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United States Nuclear Regulatory Commission
Protecting People and the Environment

NUREG-1910
Supplement 4, Vol. 1

Environmental Impact Statement for the Dewey-Burdock Project in Custer and Fall River Counties, South Dakota

Supplement to the Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities

Final Report

Chapters 1 to 5

Office of Federal and State Materials and
Environmental Management Programs

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ABSTRACT

The U.S. Nuclear Regulatory Commission (NRC) issues licenses for the possession and use of source material provided that proposed facilities meet NRC regulatory requirements and will be operated in a manner that is protective of public health and safety and the environment. Under the NRC environmental protection regulations in 10 CFR Part 51, which implement the National Environmental Policy Act of 1969 (NEPA), issuance of a license to possess and use source material for uranium milling, as defined in 10 CFR Part 40, requires an environmental impact statement (EIS) or a supplement to an EIS.

In May 2009, NRC issued NUREG–1910, the Generic Environmental Impact Statement for *In-Situ* Leach Uranium Facilities (GEIS) (NRC, 2009). In the GEIS, NRC assessed the potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of an *in-situ* leach uranium recovery facility [also known as an *in-situ* recovery (ISR) facility] located in four specified geographic regions of the western United States. As part of this assessment, NRC determined which potential impacts will be essentially the same for all ISR facilities and which will result in varying levels of impact for different facilities, thus requiring further site-specific information to determine potential impacts. The GEIS provides a starting point for NRC NEPA analyses for site-specific license applications for new ISR facilities, as well as for applications to amend or renew existing ISR licenses.

By letter dated August 10, 2009, Powertech (USA), Inc. (Powertech, referred to herein as the applicant) submitted a license application to NRC for a new source material license for the Dewey-Burdock ISR Project. The proposed Dewey-Burdock ISR Project will be located in Fall River and Custer Counties, South Dakota, which is in the Nebraska-South Dakota-Wyoming Uranium Milling Region identified in the GEIS. The NRC staff prepared this Supplemental Environmental Impact Statement (SEIS) to evaluate the potential environmental impacts from the applicant's proposal to construct, operate, conduct aquifer restoration, and decommission an ISR uranium facility at the proposed Dewey-Burdock ISR Project. This SEIS describes the environment potentially affected by the proposed site activities, presents the potential environmental impacts resulting from reasonable alternatives to the proposed action, and describes the applicant's environmental monitoring program and proposed mitigation measures. In conducting its analysis in this SEIS, the NRC staff evaluated site-specific data and information to determine whether the applicant's proposed activities and site characteristics were consistent with those evaluated in the GEIS. NRC staff then determined relevant sections, findings, and conclusions in the GEIS that could be incorporated by reference and areas that required additional analysis. Based on its environmental review, the NRC staff recommendation is that a source material license for the proposed action be issued as requested, unless safety issues mandate otherwise.

Paperwork Reduction Act Statement

This NUREG contains and references information collection requirements that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). These information collections were approved by the Office of Management and Budget (OMB), approval numbers 3150-0014, 3150-0020, 3150-0021, and 3150-0008.

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References

10 CFR Part 40. Code of Federal Regulations, Title 10, *Energy*, Part 40. "*Domestic Licensing of Source Material*." Washington, DC: U.S. Government Printing Office.

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51. "*Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions*." Washington, DC: U.S. Government Printing Office.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." ML091480244, ML091480188. Washington, DC: NRC. May 2009.

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EXECUTIVE SUMMARY

BACKGROUND

By letter dated August 10, 2009, Powertech (USA), Inc. (Powertech) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) for a new source material license for the Dewey-Burdock *In-Situ* Uranium Recovery Project, located in Fall River and Custer Counties, South Dakota. The applicant is proposing to recover uranium using the *in-situ* leach (ISL) [also known as *in-situ* recovery (ISR)] process. The proposed Dewey-Burdock ISR Project will include processing facilities and sequentially developed wellfields sited in two contiguous areas, the Burdock area and the Dewey area. Proposed facilities include a central processing plant in the Burdock area, a satellite facility in the Dewey area, wellfields, Class V deep injection wells and/or land application areas for disposal of liquid wastes, and the attendant infrastructure (e.g., pipelines and surface impoundments).

The Atomic Energy Act of 1954 (AEA), as amended by the Uranium Mill Tailings Radiation Control Act of 1978, authorizes NRC to issue licenses for the possession and use of source material and byproduct material. These statutes require NRC to license facilities, including ISR operations, in accordance with NRC regulatory requirements to protect public health and safety from radiological hazards. Under the NRC environmental protection regulations in 10 CFR Part 51, which implement the National Environmental Policy Act of 1969 (NEPA), preparation of an environmental impact statement (EIS) or supplement to an EIS is required for issuance of a license to possess and use source material for uranium milling [10 CFR 51.20(b)(8)].

In May 2009, the NRC staff issued NUREG–1910, the Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities (herein referred to as the GEIS) (NRC, 2009). In the GEIS, NRC assessed potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of an ISR facility located in four specified geographic regions of the western United States. The proposed Dewey-Burdock ISR Project is located within the Nebraska-South Dakota-Wyoming Uranium Milling Region identified in the GEIS. The GEIS provides a starting point for NRC NEPA analyses for site-specific license applications for new ISR facilities, as well as for applications that amend or renew existing ISR licenses. This Supplemental EIS (SEIS) incorporates by reference information from the GEIS and also uses information from the applicant's license application and other independent sources to fulfill the requirements set forth in 10 CFR 51.20(b)(8).

This SEIS includes the NRC staff analysis that considers and weighs the environmental effects of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures to either reduce or avoid adverse effects. It also includes the NRC staff's recommendation regarding the proposed action.

This SEIS was prepared in cooperation with the U.S. Bureau of Land Management (BLM). BLM has requested to be and is acting as a cooperating agency with NRC to evaluate the impacts of Powertech's Plan of Operations in accordance with the National Memorandum of Understanding with NRC. BLM manages 97 ha [240 ac] of land within the proposed Dewey-Burdock ISR Project area. Under 43 CFR Part 3809, BLM is required to review the environmental impacts of federal actions on surface lands to assure that there is no "unnecessary or undue degradation of public lands." To fulfill this requirement, the applicant submitted a Plan of Operations to BLM for the Dewey-Burdock ISR Project on August 26, 2009. Powertech modified the Plan of Operations and resubmitted it to BLM on January 28, 2011.

PURPOSE AND NEED FOR THE PROPOSED ACTION

NRC regulates uranium milling, as defined in 10 CFR 40.4, including the ISR process, under 10 CFR Part 40, "Domestic Licensing of Source Material." The applicant is seeking an NRC source material license to authorize commercial-scale ISR uranium recovery at the proposed Dewey-Burdock ISR Project. The purpose and need for the proposed federal action is to either grant or deny the applicant a license to use ISR technology to recover uranium and produce yellowcake at the proposed project site. Yellowcake is the uranium oxide product of the ISR milling process used to produce various products including fuel for commercially operated nuclear power reactors.

This definition of purpose and need reflects the Commission's recognition that, unless there are findings in either the AEA-required safety review or in the NEPA environmental analysis that would lead NRC to reject a license application, NRC has no role in a company's business decision to submit a license application to operate an ISR facility at a particular location.

The BLM purpose and need for the proposed action is to provide for orderly, efficient, and environmentally responsible mining of the uranium resource. The uranium resource is needed to fulfill market demands for this product for power generation and other needs. These public lands are open to mineral entry, and the applicant has filed mining claims on them. Within the proposed project area, Powertech maintains the mining claims associated with 1,708 ha [4,220 ac] of federal land that the U.S. Government reserved under the Stock-Raising Homestead Act. The BLM federal decision is to either approve the Powertech-modified Plan of Operations subject to mitigation included in the license application and this SEIS, or deny approval of the Plan of Operations. BLM's responsibility to respond to the Plan of Operations establishes the need for the action. The mining claimant has the right to mine and develop the mining claims as long as it can be done without causing unnecessary or undue degradation of the public lands and follows pertinent laws and regulations under 43 CFR Part 3800.

THE PROJECT AREA

The proposed Dewey-Burdock ISR Project is located in Custer and Fall River Counties, South Dakota, within the Great Plains physiographic province on the edge of the Black Hills uplift. The proposed site is located approximately 21 km [13 mi] north-northwest of the city of Edgemont, approximately 64 km [40 mi] west of the city of Hot Springs, and approximately 80 km [50 mi] southwest of the city of Custer. The total land area of the proposed Dewey-Burdock Project is 4,282 ha [10,580 ac]. Sections within the proposed project area are split estate, in which two or more parties own the surface and subsurface mineral rights. The surface rights are both publicly and privately owned. Approximately 4,185 ha [10,340 ac] of land is privately owned, and the remaining 97 ha [240 ac] of surface rights are owned by the U.S. Government and administered by BLM. The subsurface mineral rights are owned by various private entities and federally reserved by the U.S. Government.

The proposed Dewey-Burdock ISR Project will consist of processing facilities and sequentially developed wellfields in two contiguous areas: the Burdock area and the Dewey area. Planned facilities associated with the proposed project include buildings associated with a central processing plant in the Burdock area and a satellite facility in the Dewey area; surface impoundments; wellfields and their associated infrastructure (e.g., wells, header houses, and pipelines); Class V deep injection wells and/or land application areas for disposal of liquid wastes; and access roads. The applicant estimated that the land surface area that will be affected by proposed ISR operations will be approximately 98 ha [243 ac] if Class V deep injection wells alone are used to dispose of process-related liquid wastes and approximately 566 ha [1,398 ac] if land application alone is used to dispose of liquid wastes.

IN-SITU RECOVERY PROCESS

During the ISR process, an oxidant-charged solution, called a lixiviant, is injected into the production zone aquifer (uranium orebody) through injection wells. Typically, a lixiviant uses native groundwater (from the production zone aquifer), carbon dioxide, and sodium carbonate/bicarbonate, with an oxygen or hydrogen peroxide oxidant. As the lixiviant circulates through the production zone, it oxidizes and dissolves the mineralized uranium, which is present in a reduced chemical state. The resulting uranium-rich solution is drawn to recovery wells by pumping and then transferred to a processing facility via a network of pipelines, which may be buried just below the ground surface. At the processing facility, the uranium is removed from solution (typically via ion exchange). The resulting barren solution is then recharged with the oxidant and reinjected to recover more uranium.

During production, the uranium recovery solution continually moves through the aquifer from injection wells to recovery wells. These wells can be arranged in a variety of geometric patterns depending on the location and orientation of the orebody, aquifer permeability, and operator preference. Wellfields are typically designed in a five-spot or seven-spot pattern, with each recovery (i.e., production) well located inside a ring of injection wells. Monitoring wells are installed in the production zone aquifer and surround the wellfield pattern area. Monitoring wells are screened (i.e., open to allow water to enter) in the appropriate stratigraphic horizon to detect the potential migration of lixiviant away from the production zone. Monitor wells are also installed in the overlying and underlying aquifers to detect the potential vertical migration of lixiviant outside the production zone. The uranium that is recovered from the solution is processed, dried into yellowcake, packaged into NRC- and U.S. Department of Transportation (USDOT)-approved 208-L [55-gal] steel drums, and trucked offsite to a licensed conversion facility.

An underground injection control (UIC) program regulates the design, construction, testing, operation, and closure of injection wells at ISR facilities. Before ISR operations begin, the portion of the aquifer(s) designated for uranium recovery must be exempted from the underground source of drinking water (USDW) designation, in accordance with the Safe Drinking Water Act (SDWA). Once production is complete, the production zone groundwater is restored to NRC-approved groundwater protection standards, which are protective of the surrounding groundwater. The site is decommissioned according to an NRC-approved decommissioning plan and in accordance with NRC-approved standards. Once decommissioning is approved, the site may be released for public use.

ALTERNATIVES

The NRC environmental review regulations that implement NEPA in 10 CFR Part 51 require NRC to consider reasonable alternatives, including the No-Action alternative, to a proposed action. The NRC staff considered a range of alternatives that would fulfill the underlying purpose and need for the proposed action. From this analysis, a set of reasonable alternatives was developed, and the impacts of the proposed action were compared with the impacts that would result if a given alternative was implemented. This SEIS evaluates the potential environmental impacts of the proposed action and the No-Action alternative and also considers alternative wastewater disposal options to the proposed action. Under the No-Action alternative, the applicant would not construct and operate ISR facilities at the proposed site. Other alternatives considered at the proposed Dewey-Burdock ISR Project site but eliminated from detailed analysis include conventional mining and milling, conventional mining and heap leach processing, alternative lixiviants, alternative site locations, and alternative well completion methods. These alternatives were eliminated from detailed study because they either would not meet the purpose and need of the proposed project or would cause greater environmental impacts than the proposed action. This SEIS also discusses alternative wastewater disposal options (evaporation ponds and surface water discharge) that were not included in the proposed action.

SUMMARY OF ENVIRONMENTAL IMPACTS

This SEIS includes the NRC staff analysis that considers and weighs the environmental impacts from the construction, operation, aquifer restoration, and decommissioning of ISR operations at the proposed Dewey-Burdock ISR Project site and the No-Action alternative. This SEIS also describes mitigation measures for the reduction or avoidance of potential adverse impacts that (i) the applicant has committed to in its NRC license application, (ii) will be required under other federal and state permits or processes, or (iii) are additional measures NRC staff identified as having the potential to reduce environmental impacts but that the applicant did not commit to in its application. The SEIS uses the assessments and conclusions reached in the GEIS in combination with site-specific information to assess and categorize impacts.

As discussed in the GEIS and consistent with NUREG–1748 (NRC, 2003), the significance of potential environmental impacts is categorized as follows:

SMALL: The environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

MODERATE: The environmental effects are sufficient to alter noticeably, but not destabilize, important attributes of the resource.

LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

Chapter 4 of this SEIS provides the NRC evaluation of the potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of the proposed Dewey-Burdock ISR Project. The significance of impacts from the ISR facility lifecycle is listed next, followed by a summary of impacts by environmental resource area and ISR phase for the proposed action.

Impacts by Resource Area and *In-Situ* Recovery Facility Phase

<u>Land Use</u>

<u>Construction</u>: Impacts will be SMALL. If deep well disposal via Class V injection wells alone is used to dispose of liquid wastes, approximately 98 ha [243 ac] or 2.3 percent of the proposed project area will be disturbed by the construction phase. If land application alone is used to dispose of liquid wastes, the construction phase will disturb approximately 566 ha [1,398 ac] or 13.2 percent of the proposed project area. Topsoil will be stripped and stockpiled prior to

building surface facilities, developing initial wellfields and attendant infrastructure, and constructing access roads. Livestock grazing and recreational activities will be excluded from fenced areas surrounding the central plant, satellite facility, surface impoundments, andwellfields.

Operation: Impacts will be SMALL. Land use impacts during the operations phase will be limited to the wellfields and will be similar to, or less than, those during the construction phase. Wellfields will be developed sequentially resulting in disturbance of approximately 57 ha [140ac]. Land disturbance and access restrictions will result from drilling new wells and constructing additional header houses and pipelines. Livestock grazing and recreational activities will continue to be restricted from the central plant, satellite facility, surface impoundments, and wellfields. Potential land application areas may also be fenced to control livestock access.

Aquifer Restoration: Impacts will be SMALL. Land use impacts will be similar to, or less than those described for the operations phase. Land use impacts will decrease as fewer wells and pump houses are used and overall equipment traffic and use diminish. Access to wellfields and surface facilities will continue to be restricted. No additional land will be disturbed to construct facilities.

Decommissioning: Impacts will be SMALL to MODERATE. Decommissioning the buildings, wellfields, storage ponds, and access roads and removing potentially contaminated soil will result in a temporary, short-term increase in land-disturbing activities. Upon completion of the plugging and abandonment of wells, the soil will be returned to areas in the wellfield where it had been removed and reseeded. At the end of decommissioning, because the reclaimed land will be released for other uses and no longer restricted, the land use impact in disturbed areas will be MODERATE until vegetation becomes reestablished. After vegetation is reestablished in reclaimed areas, the land will be returned to a condition that can support a variety of land uses; therefore, the impact will be SMALL.

Transportation

Construction: Impacts will be SMALL. Dewey Road, the unpaved gravel road nearest the proposed site, will experience a 42 percent increase over existing traffic considering both autos and trucks during the ISR construction phase. This increase in traffic will incrementally accelerate degradation of road surfaces, increase the generation of dust, and increase the potential for traffic accidents and wildlife or livestock kills. The well-traveled regional roads will not be impacted significantly by construction traffic.

Operation: Impacts will be SMALL. Dewey Road, the road nearest the proposed site, will experience a 24 percent increase in daily vehicle traffic during the ISR operations phase. This increase in traffic will incrementally accelerate degradation of road surfaces, increase the generation of dust, and increase the potential for traffic accidents and wildlife or livestock kills. Additionally, the transport of yellowcake product, hazardous materials, uranium-loaded resins from the Dewey Unit to the Burdock Unit, and wastes could result in spills or leakage if an accident occurred; however, this risk was determined to be low and will be further limited by compliance with existing NRC and USDOT transportation regulations and the implementation of best management practices (BMPs) for containing leakage and spills.

Aquifer Restoration: Impacts will be SMALL. Transportation impacts will be less than those estimated for the construction and operation phases because the need to transport yellowcake product, hazardous materials, and uranium-loaded resins between units will decrease as aquifer restoration progresses. The decrease in supply shipments, waste shipments, and employee commuting (because fewer workers will be involved) will reduce the potential for accidents and therefore for any spills or leakage.

Decommissioning: Impacts will be SMALL. Transportation impacts will be less than those during the construction and operation phases because the transport of yellowcake product and processing chemicals will end during decommissioning. Access roads will either be reclaimed or left in place for future use. Waste shipments will increase temporarily, but will still represent a small contribution to daily traffic. Fewer workers will be employed, further reducing the potential transportation impact during this phase.

Geology and Soils

Construction: Impacts will be SMALL. Earthmoving activities associated with construction of the Burdock central plant and Dewey satellite plant facilities, access roads, wellfields, pipelines, and surface impoundments will include topsoil clearing and land grading. Topsoil removed during these activities will be stored and reused later to restore disturbed areas. The limited areal extent of the construction area, the soil stockpiling procedures, the implementation of BMPs, the short duration of the construction phase, and mitigative measures such as reestablishment of native vegetation will further minimize the potential impact on soils.

Operation: Impacts will be SMALL. The uranium mobilization and recovery process will not remove rock matrix from production zone sandstones and will not dewater production zone aquifers. Therefore, no significant matrix compression or ground subsidence is expected. The occurrence of potential spills during transfer of uranium-bearing lixiviant to and from the Burdock central plant and Dewey satellite facility will be mitigated by implementing onsite standard procedures and by complying with NRC requirements for spill response and reporting of surface releases and cleanup of any contaminated soils. The U.S. Environmental Protection Agency (EPA) will determine the suitability of deep geologic formations for deep Class V disposal of liquid waste before issuing an UIC permit for Class V injection wells. Treated wastewater disposed of in Class V injection wells will be required to meet release standards as referenced in 10 CFR Part 20, Subparts D and K and Appendix B, Table 2, Column 2. Potential soil contamination in proposed land application areas will be monitored by implementing soil collection and sampling procedures. Treated wastewater applied to land application areas will be required to meet NRC release limit criteria, as referenced in 10 CFR Part 20, Appendix B, and applicable state groundwater quality standards under a Groundwater Discharge Plan (GDP) approved by South Dakota Department of Environment and Natural Resources (SDDENR).

Aquifer Restoration: Impacts will be SMALL. During aquifer restoration, the processes of groundwater sweep and groundwater transfer will not remove rock matrix from production zone sandstones. The formation groundwater pressure within the extraction zone will be decreased during restoration as groundwater is removed to ensure the direction of groundwater flow is into the wellfields to reduce the potential for offsite migration of constituents. However, the change in groundwater pressure will not result in collapse of overlying rock strata as it is supported by the rock matrix of the formation. The potential impact to soils from spills, leaks, and land application of treated wastewater will be comparable to that described for the operations phase.

The NRC requirements for spill response and recovery and routine monitoring programs will also apply.

Decommissioning: Impacts will be SMALL. Disruption or displacement of soils will occur during dismantling of the facilities and reclamation of the land; however, the disturbed lands will be restored to their preextraction land use. Topsoil will be reclaimed and the surface regraded to the original topography.

Surface Waters and Wetlands

Construction: Impacts will be SMALL. The occurrence of surface water at the proposed Dewey-Burdock site is limited, and surface water flow in channels is ephemeral except for perennial Beaver Creek. The applicant will construct ISR processing and support facilities on level areas and outside the 100-year floodplain. National Pollutant Discharge Elimination System (NPDES) permits issued by SDDENR will set limits to control the amount of pollutants that can enter surface water bodies. Implementation of a stormwater pollution management plan (SWMP) will control stormwater runoff during construction and ensure that surface water runoff from disturbed areas meets NPDES permit limits. U.S. Army Corps of Engineers permits under Section 404 of the Clean Water Act will be required before conducting work in jurisdictional wetlands identified in the project area.

Operation: Impacts will be SMALL. The applicant's SDDENR-approved NPDES permit and SWMP will be in place to mitigate impacts to surface water from erosion, runoff, and sedimentation. The applicant will implement an emergency response plan to identify and clean up accidental spills and leaks. Processing facilities and chemical and fuel storage tanks will have secondary containment to contain potential spills. Operations will create liquid wastes that will be contained in radium-settling and storage ponds for eventual Class V injection well disposal and/or land application. Radium settling ponds will be constructed with liners, underdrains, and leak detection systems and storage ponds that contain treated wastewater will be constructed with geosynthetic and clay liners. Liquid waste applied to land application areas will be required to meet NRC release limit criteria for radiological contaminants, as referenced in 10 CFR Part 20, Appendix B. SDDENR will require liquid waste applied to land application areas to meet applicable state discharge requirements under a GDP.

Aquifer Restoration: Impacts will be SMALL. Impacts will be similar to those during the operations phase because the same infrastructure will be used and the same activities will be conducted. The applicant's SDDENR-approved NPDES permit and SWMP will be in place to mitigate impacts to surface water from erosion, runoff, and sedimentation. Restoration of groundwater aquifers will create wastewater that will be contained in radium settling and storage ponds for eventual Class V injection well disposal and/or land application. Radium settling ponds will be constructed with liners, underdrains, and leak detection systems and storage ponds that contain treated wastewater will be constructed with geosynthetic and clay liners. Treated wastewater applied to land application areas will be required to meet NRC release limit criteria for radiological contaminants, as referenced in 10 CFR Part 20, Appendix B. SDDENR will require wastewater applied to land application areas to meet applicable state discharge requirements under a GDP.

Decommissioning: Impacts will be SMALL. The impacts will be similar to those during the construction phase. Activities to clean up, recontour, and reclaim the land surface during decommissioning will mitigate long-term impacts to surface water. The applicant's

SDDENR-approved NPDES permit and SWMP will be in place to mitigate impacts to surface water from erosion, runoff, and sedimentation.

Groundwater

Construction: Impacts will be SMALL. The primary impact to groundwater during the construction phase will be from the consumptive use of groundwater, introduction of drilling fluids into the environment during well installation, and from surface spills of fuels and lubricants. The applicant is required to obtain water appropriation use permits from SDDENR prior to withdrawing water from aquifers. During well installation, drilling fluids (mud) will have the potential to impact surficial aquifers; however, all wells will undergo mechanical integrity tests of the casing and therefore ensure against well leakage prior to entering service. Impacts to groundwater from surface spills of fuels and lubricants will be mitigated by the applicant's implementation of BMPs and by following a spill prevention program that will require an immediate cleanup response to prevent soil contamination or infiltration to groundwater.

Operation: Impacts will be SMALL. The operations phase may impact near-surface (alluvial) aquifers, production zone aquifers containing the orebodies and surrounding aquifers, and deep aquifers below the ore production zone used for the disposal of liquid wastes.

Alluvial aquifers are separated from production zone and surrounding aquifers by thick aquitards (confining units) and, therefore, are not hydraulically connected to production zone and surrounding aquifers. In addition, alluvial aquifers do not serve as a water supply for domestic use or livestock. The impacts from spills and leaks will be SMALL. The applicant's leak detection and cleanup program will include rapid response and remediation to minimize impacts to soils and groundwater. Liquid waste applied to land application areas will be required to meet NRC release limit criteria for radiological contaminants, as referenced in 10 CFR Part 20, Appendix B and applicable state discharge requirements under a GDP issued by SDDENR.

The applicant has committed to removing and replacing existing domestic wells drawing water from production zone aquifers within the project area from private use prior to ISR operations. In addition, the applicant will monitor all domestic wells within 2 km [1.2 mi] of the wellfields during operations and replace these wells in the event of significant drawdown or degradation of water quality. Water levels in affected wells will recover with time after ISR operations and aquifer restoration activities are complete.

The establishment of an inward hydraulic gradient during wellfield operations along with the applicant-installed groundwater monitoring network to detect potential vertical and horizontal excursions will limit the potential for undetected lixiviant excursions that could degrade groundwater quality. Because the ore production zones are overlain and underlain by impermeable shale layers, this further ensures the hydraulic isolation of the ore production zones, which helps to limit potential groundwater contamination in surrounding aquifers.

Liquid wastes generated from operation of the proposed Dewey-Burdock ISR Project will be disposed of via Class V deep well injection, land application, or a combination of Class V deep well injection and land application. The groundwater in deep formations targeted for Class V deep well injection must not be a potential underground source of drinking water. Class V injection wells will be permitted in accordance with the EPA Underground Injection Control Program. Liquid wastes injected into Class V injection wells may not be classified as hazardous under the Resource Conservation and Recovery Act. NRC will require the liquid waste pumped into Class V injection wells to be treated and monitored to verify it meets NRC release standards in 10 CFR Part 20, Subparts D and K and Appendix B, Table 2, Column 2.

Aquifer Restoration: Impacts will be SMALL. Groundwater restoration will be initiated once a wellfield is no longer being used to produce uranium. Larger withdrawals will produce larger drawdowns in production aquifers during aquifer restoration, resulting in a greater impact on yields of nearby wells. As with operations, the applicant will monitor all domestic wells within 2 km [1.2 mi] of the wellfields during aquifer restoration and replace these wells in the event of significant drawdown or degradation of water quality. Water levels in affected wells will recover with time after ISR operations and aquifer restoration activities are complete. Natural recovery and the well monitoring measures established by the applicant will reduce impacts to nearby wells, ensuring the long-term environmental impact from consumptive use will be SMALL.

During aquifer restoration, hydraulic control for the former production zone will be maintained; this will be accomplished by maintaining an inward hydraulic gradient through a production bleed. During aquifer restoration activities, water will be pumped from the wellfield (without reinjection), resulting in an influx of “fresh” groundwater into the affected (mined) portion of the aquifer. Disposal of liquid wastes via Class V injection wells, land application, or a combination of Class V injection wells and land application will occur as described for ISR operations. The goal of aquifer restoration will be to restore groundwater quality in the ore production zone to Commission-approved background conditions under 10 CFR Part 40, Appendix A, Criterion 5B(5). If the aquifer cannot be restored to background conditions, then NRC will require that either the production zone be returned to maximum contaminant levels in 10 CFR Part 40, Appendix A, Table 5C or to NRC-approved alternate concentration limits. Post-restoration groundwater quality will be protective of public health and the environment.

Decommissioning: Impacts will be SMALL. The potential impact to groundwater quality during decommissioning and reclamation is comparable to that described in the construction phase. Groundwater consumptive use will be less than that of the operation and restoration phases. All monitoring, injection, and production wells will be plugged and abandoned in accordance with UIC program requirements. Wells will be filled with cement and clay to ensure groundwater does not flow through the abandoned wells. Abandoned wells will be properly isolated from the flow domain. NRC will review and approve the wellfield restoration efforts to ensure that restoration standards were followed and public health and safety is protected.

Ecological Resources

Construction: Impacts will be SMALL to MODERATE. Construction disturbance under current development plans, which require vegetative removal, will affect approximately 98 ha [243 ac] if deep well injection is used to dispose of treated wastewater or approximately 566 ha [1,398 ac] if land application or a combination of deep well injection and land application is used to dispose of treated wastewater. Some habitat loss or alteration, displacement of wildlife, and mortality due to encounters with vehicles or heavy equipment will occur, though wildlife species will likely disperse from the area once construction commences. Following recommended fencing and power line construction designs will minimize impediments to game and avian movement. Mitigation will control the introduction and spread of undesirable and invasive, nonnative plants; reduce the likelihood of injury or mortality to wildlife; and ensure no loss of aquatic habitat. Impacts to wildlife and habitat will be minimized with mitigation measures and the timely reseeding of disturbed areas following construction. Any trees with raptor nests will not be removed, and following U.S. Fish and Wildlife Service (FWS) and South Dakota Game, Fish, and Parks (SDGFP) seasonal noise, vehicular traffic, and human proximity guidelines will help to ensure the continued nesting success of area raptors. No federally threatened or endangered species are known to occur within the proposed project area. Impacts to state-protected species will not noticeably affect species' populations within the vicinity of the proposed project site.

Operation: Impacts will be SMALL to MODERATE. Ecological impacts due to noise, vehicles, structures, and the presence of humans will be similar to, but less than, those experienced during construction for either disposal option because fewer earthmoving activities will occur. However, larger areas of habitat will be converted to crops and animals will be disturbed with irrigation activities during the land application disposal option. Wastewater solutions include levels of chemical constituents that are potentially harmful to wildlife; however, proposed practices and state regulatory controls including permit conditions, monitoring requirements, and action levels would limit direct contact and potential impacts. Monitoring and action levels for environmental concentrations of wastewater constituents in land application areas will allow regulators to impose mitigations if constituents accumulate above levels of concern. The applicant will reseed disturbed areas with SDDENR- or BLM-approved seed mixtures to restore habitat. Spill detection and response plans will reduce the potential impact to terrestrial and aquatic species. Fencing would further limit wildlife access to liquid waste holding ponds. Potential conflicts between active raptor nest sites and project-related activities will continue to be mitigated by annual raptor monitoring and mitigation plans.

Aquifer Restoration: Impacts will be SMALL to MODERATE. Impacts will be similar to those experienced during the operations phase with no major differences in type or degree of impact. The existing infrastructure will be used during this phase, and mitigation measures will continue to apply from the construction and operations phases.

Decommissioning: Impacts will be SMALL to MODERATE. Temporary disturbances to land and soils during decommissioning could displace vegetation and wildlife species that had recolonized the proposed project area since initiation of ISR activities. Shrubland vegetative communities will be more difficult to reestablish and achieve full site recovery. The applicant commits to vegetation reestablishment efforts to be ongoing throughout the ISR facility life cycle. However, new vegetative growth could be affected by future grazing, droughts, or intense winters, thus reducing the rate of plant productivity and delaying full recovery, Revegetation and recontouring will restore habitat previously altered during construction and operations.

Air Quality

Construction: Impacts will be SMALL to MODERATE. The proposed Dewey-Burdock ISR Project is located in the Black Hills-Rapid City Intrastate Air Quality Control Region, which is classified as being in attainment for all National Ambient Air Quality Standards (NAAQS) primary pollutants. Air emissions during the construction phase of the proposed project will consist primarily of combustion emissions from drill rigs and fugitive road dust. The magnitude of the pollutant concentrations from the construction phase combustion emissions are below NAAQS and Prevention of Significant Deterioration (PSD) Class II regulatory thresholds except for the particulate matter PM_{10} 24-hour PSD Class II allowable increment. This also holds true for the peak year pollutant emission levels. The peak year refers to periods during which all four phases occur simultaneously and represents the highest level of emissions the proposed action will generate in any one project year. Fugitive dust emissions, the primary source for the particulate matter PM_{10}, are spread out over a large area and tend to generate emissions sporadically. Due to the level and nature of these fugitive emissions, there is potential for short-term, intermittent impacts to localized areas in and around the site particularly when vehicles travel on unpaved roads. Wind Cave National Park, a Class I area located about 47 km [29 mi] northeast of the proposed project area, has experienced visibility impacts from air pollution. However, project specific modeling results for the Wind Cave National Park (e.g., Class I PSD, visibility, and acid deposition) are below applicable thresholds.

The deep Class V injection well disposal option has more combustion emissions than the land application option due to the contribution of the deep well drill rig. The land application option has more fugitive emissions due to the greater area of land disturbed. However, these differences are relatively small and appreciable differences in the overall air emission levels between the two disposal options are not expected. Therefore, the impact magnitudes are expected to be similar.

Operation: Impacts will be SMALL. Fugitive dust emission pollutant levels will be less than those experienced during construction. ISR facilities are not major point source emitters of regulated pollutants. Combustion emissions in this phase are basically evenly divided between light duty vehicles and construction and field equipment. The combustion and fugitive dust emissions will be below NAAQS and PSD Class II regulatory thresholds. Project specific modeling results for the Wind Cave National Park (e.g., Class I PSD, visibility, and acid deposition) are below applicable thresholds.

The land application disposal option has more fugitive emissions than the Class V injection well option due to the greater area of land disturbed. However, this difference is relatively small and appreciable differences in the overall air emission levels between the two disposal options are not expected. Therefore, the impact magnitudes are expected to be similar.

Aquifer Restoration: Impacts will be SMALL. Combustion emission and fugitive emission levels for the aquifer restoration phases are the lowest relative to the other three phases. For the aquifer restoration phase, combustion emissions are primarily from light duty vehicles; wind erosion can generate more fugitive emissions than travel on unpaved roads. The combustion and fugitive dust emissions will be below NAAQS and PSD Class II regulatory thresholds. Project specific modeling results for the Wind Cave National Park (e.g., Class I PSD, visibility, and acid deposition) are below applicable thresholds. The proposed project can contribute to visibility impacts at Wind Cave National Park, but the impact magnitude will be minimal.

The land application disposal option can generate up to approximately two times the amount of fugitive emissions compared to the Class V injection well disposal option. Although there is some difference in the overall fugitive dust emissions levels between the two disposal options, the impact magnitude is expected to be similar.

Decommissioning: Impacts will be SMALL. The decommissioning phase pollutant sources and emission levels closely match those from the operation phase. Therefore, the decommissioning phase will produce a similar impact magnitude as the operation phase. As in the operation phase described previously, appreciable differences in the overall decommissioning phase air emission levels between the Class V injection well and land application disposal options are not expected.

Noise

Construction: Impacts will be SMALL. Increased traffic, as well as use of drill rigs, heavy trucks, bulldozers, and other equipment to construct and operate the wellfields, drill wells, access roads, and build the central plant and satellite facility, will generate noise audible above ambient (background) levels. The sound from construction activities will be indistinguishable from background levels at a distance of approximately 305 m [1,000 ft]. Two onsite dwellings will be impacted by noise above background levels from heavy equipment use. The Daniel residence is within 305 m [1,000 ft] of wellfields B-WF6 and B-WF7 in the Burdock area, and the Beaver Creek Ranch Headquarters is within 305 m [1,000 ft] of land application areas in the Dewey area. Increased noise levels at these residences during construction will be short term (1 to 2 years) and mitigated by using sound abatement controls on operating equipment. Administrative and engineering controls will be expected to maintain noise levels in work areas below Occupational Safety and Health Administration (OSHA) regulatory limits and be mitigated by use of personal hearing protection. Noise impacts to raptors will be mitigated by adhering to timing and spatial restrictions within specified distances of active raptor nests as determined by appropriate regulatory agencies (e.g., FWS, SDGFP, and BLM).

Operation: Impacts will be SMALL. Impacts from traffic-related noise will be similar to those during construction. Because wellfields will be developed and operated sequentially, potential noise impacts at the Daniels residence will be short term (1 to 2 years each for wellfields B-WF6 and B-WF7). In addition, the Daniel residence will not be occupied year round. Residents at the Beaver Creek Ranch Headquarters will only be exposed to noise from nearby land application areas during the growing season (May 11 to September 24). Noise impacts will be mitigated by using sound abatement controls on operating equipment. The central plant and satellite facility will generate indoor noise audible to workers. OSHA regulatory limits will be maintained and mitigated by use of personal hearing protection. Potential noise-related impacts to active raptor nest sites will continue to be mitigated by adherence to timing and spatial restrictions within specified distances of active raptor nests as determined by appropriate regulatory agencies (e.g., FWS, SDGFP, and BLM).

Aquifer Restoration: Impacts will be SMALL. Noise impacts will be similar to, or less than, those experienced during the operations phase. Pumps and other wellfield equipment contained in buildings would reduce the potential sound impact to an offsite individual. Because the aquifers in wellfields will be restored sequentially, potential noise impacts at the Daniel residence will be short term (1 to 2 years each for wellfields B-WF6 and B-WF7). In addition, the Daniel residence will not be occupied year round. During aquifer restoration, residents at the Beaver Creek Ranch Headquarters will only be exposed to noise from nearby land application areas during the growing season (May 11 to September 24). Noise impacts will be mitigated by using sound abatement controls on operating equipment. Noise impacts from traffic will be SMALL because there will be fewer vehicular trips than during the operations phase. Potential noise-related impacts to active raptor nest sites will continue to be mitigated by adherence to timing and spatial restrictions within specified distances of active raptor nests as determined by appropriate regulatory agencies (e.g., FWS, SDGFP, and BLM).

Decommissioning: Impacts will be SMALL. Noise impacts will either be similar to, or less than, those experienced during the construction phase. Noise during this phase will be temporary, and when decommissioning and reclamation activities are complete, the noise levels will return to baseline. Noise impacts from traffic will be SMALL because there will be fewer shipments to and from the proposed site as decommissioning progresses. Potential noise-related impacts to active raptor nest sites will continue to be mitigated by adherence to timing and spatial restrictions within specified distances of active raptor nests as determined by appropriate regulatory agencies (e.g., FWS, SDGFP, and BLM).

<u>Historic and Cultural Resources</u>

<u>Construction</u>: Impacts will be SMALL to LARGE. Archaeological and historic sites have the potential to be disturbed during construction of ISR facilities and infrastructure. NRC's environmental review of historic and cultural resources included evaluating the results of (i) archaeological field investigations, (ii) tribal cultural surveys, and (iii) visual and auditory impacts assessments.

Archaeological field investigations identified 18 historic sites that are listed in the National Register of Historic Places (NRHP) or are eligible for listing in the NRHP. Six of these sites could experience LARGE potential impacts due to their location within the area of potential effect (APE) for facility construction and operations. Avoidance and mitigation measures, such as data recovery excavations and fencing, are recommended for these six NRHP-eligible sites. Avoidance of the remaining 12 sites during the construction phase is anticipated and for this reason no impacts are expected. Avoidance is also recommended for 15 unevaluated historic sites within or in close proximity to the APE for facility construction and operations, pending NRHP eligibility determination.

Tribal cultural surveys recommended 17 known archaeological sites as eligible for listing in the NRHP. Three of these sites could experience LARGE potential impacts due to their location within the APE for facility construction and operations. Avoidance is recommended for these three known archaeological sites. Avoidance of the remaining 14 sites during the construction phase is anticipated and for this reason no impacts are expected. Tribal cultural surveys recommended 12 newly discovered sites as eligible for listing in the NRHP. Four of these new discoveries could experience LARGE potential impacts due to their location within the APE for facility construction and operations. Avoidance of the remaining 8 new tribal sites during the construction phase is anticipated and therefore no impacts are expected.

NRC staff compiled a list of 31 historic properties that are either listed on the NRHP or considered eligible for listing on the NRHP under criteria A and/or C due in part to their integrity of setting. These sites are located within a 4.8-km [3-mi] radius of the Dewey satellite facility or the Burdock central processing plant. Based on a line-of-sight analysis which considered the site's significance and existing environmental factors and conditions, NRC determined that 19 historic properties could experience MODERATE potential visual impacts. All of the 31 historic properties are located more than 640 m [2,100 ft] from the nearest processing facility, which exceeds the estimated 305 m [1,000 ft] zone for potential auditory impacts. Therefore, NRC staff conclude that potential auditory impacts on historic properties during the construction phase will be SMALL.

Prior to construction, an agreement between NRC, South Dakota State Historic Preservation Office (SD SHPO), BLM, interested Native American tribes, the applicant, and other interested parties will be established outlining the mitigation process for each affected resource. By NRC license condition, the applicant is required to stop any work if historical or cultural resources are encountered during construction activities. All newly discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and BLM to proceed.

Operation: Impacts will be SMALL to MODERATE. Minimal impacts will result during the operations phase because impacts to cultural resources will have been mitigated before facility construction and identified resources will be avoided. Potential visual and auditory impacts on historic properties will be the same as described for the construction phase (potential visual impacts will range from SMALL to MODERATE and potential auditory impacts will be SMALL). If historical or cultural resources are encountered during operations, the applicant is required by license condition to stop work. The discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and BLM to proceed.

Aquifer Restoration: Impacts will be SMALL to MODERATE. Impacts to historical and cultural resources during the aquifer restoration phase will be similar to operational impacts. Potential impacts to identified historic and cultural resources will have been mitigated prior to facility construction. Potential visual and auditory impacts on historic properties will be the same as described for the construction and operations phases (potential visual impacts will range from SMALL to MODERATE and potential auditory impacts will be SMALL). If historical or cultural resources are encountered during operations, the applicant is required by license condition to stop work. The discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and BLM to proceed.

Decommissioning: Impacts will be SMALL. Minimal impacts are expected during the decommissioning phase because impacts to cultural resources will have been mitigated prior to facility construction. Potential visual impacts will be reduced to SMALL after processing facilities are dismantled and removed. If historical or cultural resources are encountered during operations, the applicant is required by license condition to stop work. The discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and BLM to proceed.

Visual/Scenic Resources

Construction: Impacts will be SMALL. During facilities construction, short-term (1 to 2 years) visual and scenic impacts will result from construction equipment and fugitive dust emissions. Temporary and short-term visual impacts during the construction period in each wellfield will result from header house construction, well drilling, and construction of access roads and electrical distribution lines. Dust suppression and selecting building materials and paint that complement the natural environment will reduce overall visual and scenic impacts of project construction. Center pivot irrigation systems in proposed land application areas in the Dewey area will be visible to travelers on Dewey Road; however, Dewey Road is a lightly traveled county road with few residences. Proposed activities at the project will be consistent with the BLM visual classification of this area.

Operation: Impacts will be SMALL. Visual impacts will be similar to, or less than, those experienced during construction. Less heavy machinery will be used, and standard dust control measures (e.g., water application and speed limits) will be implemented to reduce visual impacts from fugitive dust. Wellfields will be developed sequentially, and there will be no large expanse of land undergoing development at one time. Buildings and other structures will be painted so they blend in to the natural landscape, and power lines and pipelines will be buried where appropriate. Center pivot irrigation systems in proposed land application areas in the Dewey area will be visible to travelers on Dewey Road; however, Dewey Road is a lightly traveled county road with few residences. Proposed activities at the project will be consistent with the BLM visual classification of this area.

Aquifer Restoration: Impacts will be SMALL. Visual impacts will be similar to, or less than, those experienced during the operations phase. Aquifer restoration activities will use in-place infrastructure; therefore, no modifications to either scenery or topography will occur. There will be less vehicular traffic, creating less of a visual impact. The applicant identified mitigation measures, such as dust suppression, which will be used to further reduce visual impacts.

Decommissioning: Impacts will be SMALL. Temporary impacts to the visual landscape will be comparable to those during the construction phase. Reclamation will return the visual landscape to baseline contours and will reduce the visual impact by removing buildings and the associated infrastructure. Implementation of mitigation measures (e.g., dust suppression) will further reduce the visual impacts from decommissioning.

Socioeconomics

Construction: Impacts will be SMALL. Because of the small size of the construction workforce (86 workers) and because of the short duration of the ISR construction phase (1 to 2 years), the overall potential socioeconomic impact, including the effects of ISR facility construction on demographic conditions, income, housing, employment rate, local finance, education, and health and social services, will be SMALL.

Operation: Impacts will be SMALL. Because of the small size of the operations workforce (84 workers), the migration of workers and their families to nearby towns will have a SMALL impact on demographics. Although wage rates will be higher for Dewey-Burdock employees than for workers in similar skilled positions in Fall River, Custer, and Weston Counties, the operations workforce will be small in comparison to the combined labor force in the counties; therefore, income impacts will be SMALL. The impact on housing will be SMALL because of available housing in the immediate area surrounding the proposed ISR facility. Operation of the proposed Dewey-Burdock ISR Project will create new jobs, but because of the small workforce size and because most skilled workers will be drawn from areas outside of the region of influence, impacts on employment will not be noticeable. The local economy will experience a SMALL to MODERATE beneficial impact from the purchasing of local goods and services and an increase in sales and income tax revenues. An increased demand for schools will have a SMALL impact on education because the current school systems are not at full capacity and can accommodate more students. Increased demand for health and social services will have a SMALL impact.

Aquifer Restoration: Impacts will be SMALL. Impacts will be less than those experienced during the operations phase. Fewer workers will be required, which will reduce pressure on housing, education, and health and social services.

Decommissioning: Impacts will be SMALL. Impacts will be less than those during the construction and operations phases because fewer workers will be required. Demand for housing, education, and health and social services will also be reduced.

Environmental Justice

All Phases: The percentage of minority populations living in affected block groups in the vicinity of the proposed Dewey-Burdock ISR Project site in Custer and Fall River Counties in South Dakota and Weston County in Wyoming does not significantly exceed the percentage of minority populations recorded at the state and county level and is well below the national level. Furthermore, the percentage of low-income populations living in affected census tracts in the vicinity of the proposed project site in Custer, Fall River, and Weston Counties does not significantly exceed the percentage of low-income populations recorded at the state or county level. Therefore, there will be no disproportionately high and adverse impacts to minority and low-income populations from the construction, operation, aquifer restoration, and decommissioning of the proposed Dewey-Burdock ISR facility.

The population closest to the proposed Dewey-Burdock ISR Project that could be impacted by environmental justice concerns is the Pine Ridge Indian Reservation located approximately 80 km [50 mi] east in Shannon County, South Dakota. Based on 2010 United States Census Bureau data, this reservation has both minority {greater than 95 percent Native American (Oglala Sioux Tribe)} and low-income populations. Environmental justice impacts to Native American tribes living in the vicinity of the proposed project are not expected to differ from those experienced by other populations. The proposed action has the potential to affect certain sites of religious and cultural significance to Native American tribes; however, the impacts to such sites are expected to be reduced through mitigation strategies developed through the National Historic Preservation Act Section 106 consultation process.

Public and Occupational Health

Construction: Impacts will be SMALL. Construction activities, including the use of construction equipment and vehicles, will disturb the topsoil and create fugitive dust emissions. Fugitive dust generated from construction activities will be short term (1 to 2 years), and the levels of radioactivity in soils at the proposed project site are low; therefore direct exposure, inhalation, and ingestion of fugitive dust will not result in a radiological dose to workers and the public. Construction equipment will be diesel powered and will exhaust particulate diesel emissions. The potential impacts and potential human exposures from these emissions will be SMALL, because of the short duration of the release and because the emissions will be readily dispersed into the atmosphere.

Operation: The radiological impacts from normal operations will be SMALL. Public and occupational exposure rates at ISR facilities during normal operations have historically been well below regulatory limits. Dose assessments using the MILDOS computer code indicate that the 10 CFR Part 20 public dose limit of 1 mSv/yr [100 mrem/yr] will not be exceeded at any property boundary. The remote location of the proposed Dewey-Burdock site and the use of the proposed ISR technology coupled with the applicant procedures to minimize exposure demonstrate that the potential impact on public and occupational health and safety from facility operation will be SMALL. The radiological impacts from accidents will be SMALL for workers (if the applicant's radiation safety and incident response procedures in an NRC-approved radiation protection plan are followed) and SMALL for the public because of the facility's remote location. The nonradiological public and occupational health and safety impacts from normal operations and accidents, due primarily to risk of chemical exposure, will be SMALL if handling and storage procedures are followed.

Aquifer Restoration: Impacts will be SMALL. Impacts will be similar to, but less than, those during the operations phase. The reduction or elimination of some operational activities will further reduce the magnitude of potential worker and public health impacts and safety hazards.

Decommissioning: Impacts will be SMALL. Impacts will be similar to those experienced during construction. Soil and facility structures will be decontaminated, and lands will be restored to preoperational conditions.

Waste Management

Construction: Impacts will be SMALL. Small-scale and incremental wellfield development will generate small volumes of construction waste. Waste will primarily consist of building materials, piping, and other solid wastes. No byproduct material will be generated during construction. Nonhazardous solid waste will be disposed of at a nearby municipal solid waste landfill with available capacity to accommodate estimated construction-phase waste volumes.

Operation: Impacts will be SMALL. Liquid byproduct material, including production bleed, waste brine streams from elution and precipitation, resin transfer wash, laundry water, plant wash-down water, and laboratory chemicals will be treated and disposed using Class V injection wells. If a permit cannot be obtained from EPA for Class V injection, the applicant would pursue land application of treated liquid effluent. If the capacity of either method is limited, the applicant will pursue a combination of both Class V injection and land application. Deep well injection in a Class V well requires an EPA permit, and wastes will have to meet EPA permit conditions and NRC effluent discharge limits in 10 CFR Part 20, Appendix B (both would limit potential impacts). Land application will require SDDENR-permitting of discharge water, and the land application area would be monitored to assess compliance with NRC and SDDENR requirements that would limit impacts. Solids classified as byproduct material will be sent to a licensed facility for disposal. A preoperational agreement with a licensed facility to accept wastes the proposed action generates will avoid capacity impacts. Capacity is available for disposal of nonradiological, nonhazardous wastes at regional municipal landfills. Capacity will be sufficient for disposal of low volumes of generated hazardous wastes.

Aquifer Restoration: Impacts will be SMALL based on the type and quantity of waste expected to be generated and the available capacity for disposal. Waste disposal procedures will be the same as those during the operations phase, resulting in similar impacts. One exception is the addition of reverse osmosis treatment of aquifer restoration water if a Class V deep disposal well is used. The applicant proposal includes adequate disposal capacity, and the applicant is required to comply with EPA Class V disposal permit conditions, NRC effluent limits, and other NRC safety regulations. Although the wastewater volume could increase during aquifer restoration activities, this will be offset by the reduction in production capacity from completion of wellfield production and removal from service.

Decommissioning: Impacts will be SMALL to MODERATE. Safe handling, storage, and disposal of decommissioning wastes will be described in a required decommissioning plan for NRC review before decommissioning activities begin. A preoperational agreement with a licensed disposal facility to accept solid byproduct material will ensure that sufficient disposal capacity will be available at the time of decommissioning. Equipment and building materials that meet release criteria will be reused, recycled, or disposed as construction waste at a landfill. The available local landfill capacity may be insufficient to accommodate all decommissioning nonhazardous solid waste from the proposed Dewey Burdock ISR Project.

The potential impacts on waste management resources will depend on the long-term status of the existing local landfill resources. If the capacity of the Newcastle or Custer-Fall River landfills is expanded prior to project decommissioning, the impacts to local landfills will be SMALL. If capacity at either landfill is not expanded prior to the Dewey-Burdock decommissioning, the NRC staff conclude the Newcastle landfill will have no disposal capacity at the time of decommissioning. Impacts to the Custer-Fall River landfill are expected to be MODERATE because the increase in solid waste disposal will more rapidly consume storage capacity during the last years of the landfill's projected operational life. The disposal of any waste from the Dewey-Burdock facility in the Rapid City landfill will have a SMALL impact due to the projected operational life and available capacity of that landfill.

CUMULATIVE IMPACTS

Chapter 5 of this SEIS provides the NRC evaluation of potential cumulative impacts from the construction, operations, aquifer restoration, and decommissioning of the proposed Dewey-Burdock ISR Project considering other past, present, and reasonably foreseeable future actions. Cumulative impacts from past, present, and reasonably foreseeable future actions were considered and evaluated in this SEIS, regardless of what agency (federal or nonfederal) or person undertook the action. The NRC staff determined that the SMALL to MODERATE impacts from the proposed Dewey-Burdock ISR Project are not expected to contribute perceptible increases to the SMALL to LARGE cumulative impacts, due primarily to ongoing uranium and oil and gas exploration activities, potential wind energy projects, and proposed infrastructure and transportation projects.

SUMMARY OF COSTS AND BENEFITS OF THE PROPOSED ACTION

The implementation of the proposed action will generate primarily regional and local costs and benefits. The regional benefits of building the proposed project will be increased employment, economic activity, and tax revenues in the region around the proposed site. Costs associated with the proposed Dewey-Burdock ISR Project are, for the most part, limited to the immediate area surrounding the site. The NRC staff determined the benefit from constructing and operating the facility will outweigh the economic, environmental, and social costs.

COMPARISON OF ALTERNATIVES

For the No-Action alternative, the applicant will not construct or operate ISR facilities at the proposed Dewey-Burdock ISR Project site. As a result, no uranium ore will be recovered from the proposed site. This alternative will result in neither positive nor negative impacts to any resource area.

FINAL RECOMMENDATION

After weighing the impacts of the proposed action and comparing the alternatives, the NRC staff, in accordance with 10 CFR 51.91(d), sets forth its NEPA recommendation regarding the proposed action (issuing a source material license for the proposed Dewey-Burdock ISR Project). Unless safety issues mandate otherwise, the NRC staff recommendation to the Commission related to the environmental aspects of the proposed action is that a source material license for the proposed action be issued as requested. This recommendation is based on (i) the license application, including the ER and supplemental documents the applicant submitted and responses to NRC staff requests for additional information; (ii) consultation with federal, state, tribal, and local agencies; (iii) NRC staff independent review; (iv) NRC staff consideration of comments received on the draft SEIS; and (v) the assessments summarized in this SEIS.

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ABBREVIATIONS/ACRONYMS

ACHP	Advisory Council on Historic Preservation
ACL	alternate concentration limit
ADAMS	Agencywide Documents Access and Management System
AEA	Atomic Energy Act
AET, Inc.	American Engineering Testing, Inc.
ALAC	Archaeology Laboratory Augustana College
ALARA	as low as is reasonably achievable
APE	area of potential effect
ARC	Archaeological Research Center
ARPA	Archaeological Resources Protection Act
ARSD	Administrative Rules of South Dakota
ASLBP	Atomic Safety and Licensing Board Panel
AUM	animal unit month
AWEA	American Wind Energy Association
BGEPA	Bald and Golden Eagle Protection Act
bgs	below ground surface
BHAD	Black Hills Army Depot
BHNF	Black Hills National Forest
BLM	U.S. Bureau of Land Management
BMP	best management practice
BNSF	Burlington Northern Santa Fe
CAA	Clean Air Act
CAB	Commission-approved background
CCSDWPC	Custer County, South Dakota, Weed and Pest Control
CFR	*U.S. Code of Federal Regulations*
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESQC	conditionally exempt small quantity generator
CNWRA	Center for Nuclear Waste Regulatory Analyses
CO	carbon monoxide
cpm	counts per minute
CPP	central processing plant
CWA	Clean Water Act
dBA	decibels
DM&E	Dakota Minnesota and Eastern (Railroad)
DOE	U.S. Department of Energy
Eco SSL	ecological soil screening levels
EFRC	Energy Fuels Resources Corporation
EIA	Energy Information Administration
EIS	environmental impact statement
E.O.	Executive Order
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESRI	Environmental Systems Research Institute

FACU	facultative upland
FACW	facultative wet
FHWA	Federal Highway Administration
FR	*Federal Register*
FRA	Federal Railroad Administration
FWS	U.S. Fish and Wildlife Service
GCRP	U.S. Global Change Research Program
GDP	Groundwater Discharge Plan
GEIS	generic environmental impact statement
GHG	greenhouse gas
GIS	Geographic Information System
GPS	global positioning system
HABS	Historic American Buildings Survey
HDPE	high-density polyethylene
ID	well identification
IML	Inter-Mountain Laboratories, Inc.
IQR	interquartile range
ISL	*in-situ* leach
ISR	i*n-situ* recovery
IX	ion exchange
KLJ	Kadramas, Lee, & Jackson
LA	Land Application
LOS	Line-of-Sight Analysis
MBTA	Migratory Bird Treaty Act
MCL	maximum contaminant level
MILDOS	computer code
MIT	mechanical integrity test
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MW	megawatts
mya	million years ago
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAU	Rapid City Campus of the National American University
NCRP	National Council for Radiation Protection and Measurements
NEPA	National Environmental Policy Act
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act of 1966, as amended
NOGCC	Nebraska Oil and Gas Conservation Commission
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NPDES	national pollutant discharge elimination system

NPWRC	Northern Prairie Wildlife Research Center
NRC	U.S. Nuclear Regulatory Commission
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
OBL	obligate
OMB	Office of Management and Budget
OSHA	Occupational Safety and Health Administration
OTGR	Office of Tribal Government Relations
OW	Open Water
PA	Programmatic Agreement
PABJh	Palustrine Aquatic Bed Intermittently Flooded Diked
PEM	Palustrine Emergent
PEMC	Seasonally Flooded
POP	Perimeter of Operational Pollution
Powertech	Powertech (USA) Inc.
PRB	Powder River Basin
PSD	Prevention of Significant Deterioration
PUB	Palustrine Unconsolidated Bottom
PUS	Palustrine Unconsolidated Shore
PUSA	Palustrine Unconsolidated Shore Temporarily Flooded
R2EM	Riverine Lower Perennial Emergent
R4SB7	Riverine Intermittent Streambed Vegetated
R4US	Riverine Intermittent Unconsolidated Streambed
RCRA	Resource Conservation and Recovery Act
RMP	resource management plan
RO	reverse osmosis
ROI	region of influence
ROW	right of way
SARA	Superfund Amendments and Reauthorization Act
SDCL	South Dakota Codified Law
SDDA	South Dakota Department of Agriculture
SDDENR	South Dakota Department of Environment and Natural Resources
SDDLR	South Dakota Department of Labor and Regulation
SDDOE	South Dakota Department of Education
SDDOH	South Dakota Department of Health
SDDOL	South Dakota Department of Labor
SDDOT	South Dakota Department of Transportation
SDDRR	South Dakota Department of Revenue and Regulation
SDGFP	South Dakota Game, Fish, and Parks
SDGS	South Dakota Geological Survey
SDNHP	South Dakota Natural Heritage Program
SDRMP	South Dakota Resource Management Plan
SD SHPO	South Dakota State Historic Preservation Office
SDSMT	South Dakota School of Mines and Technology
SDSU	South Dakota State University

SDWA	Safe Drinking Water Act
SEA	U.S. Department of Transportation Section of Environmental Analysis
SEIS	supplemental environmental impact statement
SER	safety evaluation report
SERP	safety and environmental review panel
SF	satellite facility
SHPO	State Historic Preservation Officer
SMCL	secondary maximum contaminant level
SNAP	Supplemental Nutrition Assistance Program
SO_2	sulfur dioxide
SOW	statement of work
SPAW	soil-plant-atmosphere-water
SQR	scenic quality rating
SRI	SRI Foundation
STB	Surface Transportation Board
SUNSI	sensitive unclassified non-safeguards information
SWMP	stormwater pollution management plan
TANF	Temporary Assistance for Needy Families
TCP	traditional cultural property
TDS	total dissolved solids
TEDE	total effective dose equivalent
THPO	Tribal Historic Preservation Office
TLD	thermoluminescent dosimeter
TVA	Tennessee Valley Authority
UCL	upper control limit
UDEQ	Utah Department of Environmental Quality
UIC	underground injection control
UMTRCA	Uranium Mill Tailings Radiation Control Act
UPL	upland
USACE	U.S. Army Corps of Engineers
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USDW	underground source of drinking water
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
UXC	The Ux Consulting Company
VOC	volatile organic compound
VRM	Visual Resource Management
WDAI	Wyoming Department of Administration and Information
WDEQ	Wyoming Department of Environmental Quality
WDTI	Western Dakota Technical Institute
WDWS	Wyoming Department of Workforce Services
WGFD	Wyoming Game and Fish Department
WIA	walk-in hunting area

WIC	Supplemental Nutrition Program for Women, Infants, and Children
WSDOT	Washington State Department of Transportation
WUS	waters of the United States
WYOGCC	Wyoming Oil and Gas Conservation Commission
WY SHPO	Wyoming State Historic Preservation Office

SI* (MODERN METRIC) CONVERSION FACTORS

Approximate Conversions From SI Units				
Symbol	**When You Know**	**Multiply By**	**To Find**	**Symbol**
Length				
cm	centimeters	0.39	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
Area				
mm^2	square millimeters	0.0016	square inches	in^2
cm^2	square centimeters	0.155	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
Volume				
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
m^3	cubic meters	0.0008107	acre-feet	ac-ft
ha-m	hectare-meters	8.107	acre-feet	ac-ft
Mass				
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
t	metric ton	1.103	short tons (2000 lb)	T
Radiological Units				
Bq	becquerels	27.03	picocuries	pCi
GBq	gigabecquerels	0.027	curies	Ci
Sv	sieverts	100	rems	rem
mSv	millisieverts	100	millirems	mrem
Temperature (Exact Degrees)				
ºC	Celsius	1.8C + 32	Fahrenheit	°F

*SI is the symbol for the International System of Units. Appropriate rounding should be performed to comply with Section 4 of ASTM E380 (ASTM International. "Standard for Metric Practice Guide." West Conshohocken, Pennsylvania: ASTM International. Revised 2003).

1 INTRODUCTION

1.1 Background

The U.S. Nuclear Regulatory Commission (NRC) and U.S. Bureau of Land Management (BLM) as a cooperating agency prepared this Supplemental Environmental Impact Statement (SEIS) in response to an application Powertech (USA) Inc. (Powertech, or the applicant) submitted on August 10, 2009, to develop and operate the Dewey Burdock Uranium *In-Situ* Recovery (ISR) Project (herein referred to as the Dewey-Burdock ISR Project), located in Custer and Fall River Counties, South Dakota (Powertech, 2009a–c). Figure 1.1-1 shows the geographic location of the proposed project. This site-specific SEIS is a supplement to the Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities (herein referred to as the GEIS) prepared in accordance with the process described in GEIS Section 1.8 (NRC, 2009a) and as detailed in Section 1.4.1 of this chapter. The NRC's Office of Federal and State Materials and Environmental Management Programs prepared this SEIS as required by Title 10, Energy, of the *U.S. Code of Federal Regulations* (10 CFR), Part 51. These regulations implement the requirements of the *National Environmental Policy Act of 1969* (NEPA), as amended (Public Law 91-190), which requires the Federal Government to assess the potential environmental impacts of major federal actions that may significantly affect the human environment.

BLM has requested to be and is acting as a cooperating agency with NRC to evaluate the impacts of the Plan of Operations for the proposed Dewey-Burdock ISR Project in accordance with the National Memorandum of Understanding between the two agencies. BLM manages 97 ha [240 ac] of land within the proposed Dewey-Burdock ISR Project area. The applicant controls the locatable mineral rights on this land through Federal Lode Claims and secures access to mineral rights through the terms of the 1872 Mining Law. Under 43 CFR Part 3800, Mining Claims Under the General Mining Laws, BLM is required to review the environmental impacts of federal actions on surface lands to assure that there is no "unnecessary or undue degradation of public lands." To fulfill this requirement, the applicant submitted a Plan of Operations to BLM for the Dewey-Burdock ISR Project on August 26, 2009. The Plan of Operations was modified and resubmitted to BLM on January 28, 2011.

The GEIS (NRC, 2009a) used the terms "*in-situ* leach (ISL) process" and "11e.(2) byproduct material" to describe the uranium milling technology and waste stream generated by the uranium recovery process. For the purposes of this SEIS, "*in-situ* recovery" or ISR is synonymous with ISL. This SEIS also uses the term "byproduct material" instead of "11e.(2) byproduct material" to describe the waste stream generated by this milling process to be consistent with the definition in 10 CFR 40.4.

1.2 Proposed Action

On August 10, 2009, the applicant initiated the proposed action by submitting an application for an NRC source material license to construct and operate an ISR facility at the proposed Dewey-Burdock ISR Project site and to conduct aquifer restoration, site decommissioning, and reclamation activities. Based on the application, the NRC's federal decision is to either grant or deny the license. The applicant's proposal is discussed in detail in SEIS Section 2.1.1.

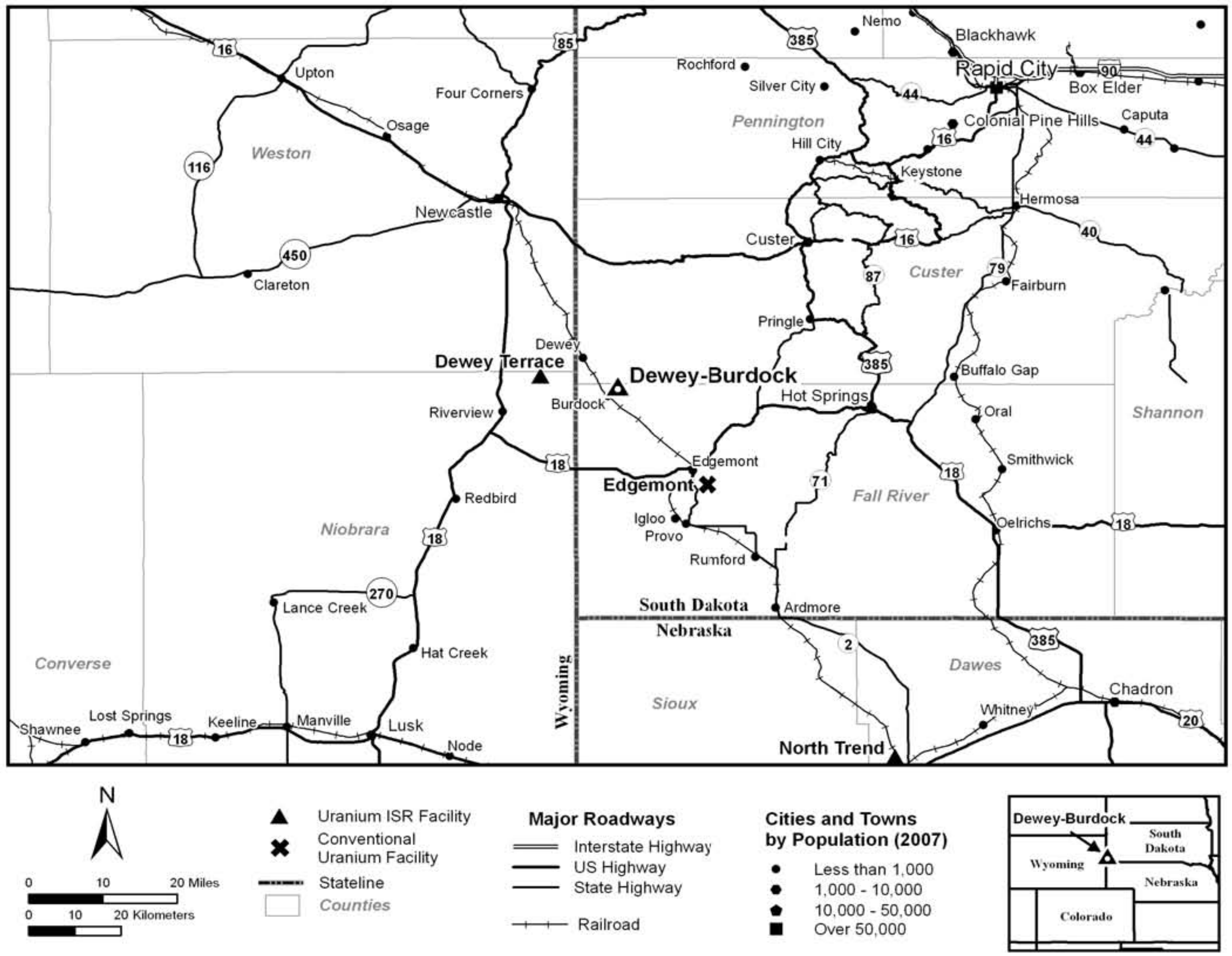

Figure 1.1-1. Geographic Location of the Proposed Dewey-Burdock *In-Situ* Recovery Project. Note That Uranium *In-Situ* Recovery Sites Depicted in This Figure (i.e., Dewey Terrace and North Trend) Are Potential Future Sites
Sources: Environmental Systems Research Institute (2008); Powertech (2009b)

1.2.1 U.S. Bureau of Land Management's Proposed Action

The BLM's federal decision is to either approve the applicant's Plan of Operations (submitted August 26, 2009, modified and resubmitted January 28, 2011) subject to mitigation included in the license application and this SEIS or deny approval of the Plan of Operations if it is found that the applicant's proposal would result in unnecessary or undue degradation of the public lands. The total amount of BLM managed land expected to be disturbed by the applicant over the life of the proposed project is 4.7 ha [11.63 ac]. This disturbance includes an access road, overhead power lines, operational wellfields, groundwater monitoring wells, and underground pipeline installations.

1.3 Purpose of and Need for the Proposed Action

NRC regulates uranium milling, including the ISR process, under 10 CFR Part 40, Domestic Licensing of Source Material. The applicant is seeking an NRC source material license to authorize commercial-scale *in-situ* uranium recovery at the proposed Dewey-Burdock ISR Project site. The purpose and need for the proposed federal action is to provide an option that allows the applicant to recover uranium and produce yellowcake at the proposed project site. Yellowcake is the uranium oxide product of the ISR milling process that is used to produce various products including fuel for commercially operated nuclear power reactors.

This definition of purpose and need reflects the Commission's recognition that, unless there are findings in the safety review required by the *Atomic Energy Act of 1954* (AEA), as amended, or findings in the NEPA environmental analysis that would lead NRC to reject a license application, NRC has no role in a company's business decision to submit a license application to operate an ISR facility at a particular location.

1.3.1 U.S. Bureau of Land Management's Purpose and Need

The BLM purpose and need for the proposed action is to provide for orderly, efficient, and environmentally responsible mining of the uranium resource. The uranium resource is needed to fulfill market demands for this product for power generation and other needs. The proposed Dewey-Burdock ISR Project area contains BLM-administered public lands open to mineral entry, and the applicant has filed mining claims on them. In addition, the applicant maintains the unpatented mining claims associated with 1,708 ha [4,220 ac] of federal minerals that the U.S. Government reserved under the Stock-Raising Homestead Act. The BLM federal decision is either to approve the revised applicant Plan of Operations subject to mitigation included in the license application and this SEIS, or deny approval of the Plan of Operations. BLM's responsibility to respond to the applicant's Plan of Operations establishes the need for the action. The mining claimant (Powertech) has the right to mine and develop the mining claims as long as it can be done without causing unnecessary or undue degradation and is in accordance with pertinent laws and regulations under 43 CFR Part 3800.

1.4 Scope of the Supplemental Environmental Impact Statement

NRC staff prepared this SEIS to analyze the potential environmental impacts (i.e., direct, indirect, and cumulative impacts) of the proposed action and of reasonable alternatives to the proposed action. The scope of this SEIS considers both radiological and nonradiological (including chemical) impacts associated with the proposed action and its alternatives. This SEIS also considers unavoidable adverse environmental impacts, the relationship between short-term uses of the environment and long-term productivity, and irreversible and irretrievable commitments of resources.

1.4.1 Relationship to the Generic Environmental Impact Statement

As discussed in Section 1.1, this SEIS is a supplement to the GEIS published as a final report in May 2009. The final GEIS assessed the potential environmental impacts associated with the construction, operation, aquifer restoration, and decommissioning of an ISR facility that could be located in any of four specific geographic regions of the western United States. The proposed Dewey-Burdock ISR Project is located in the Nebraska-South Dakota-Wyoming Uranium Milling Region, one of the regions considered in the GEIS. Table 1.4-1 summarizes the expected environmental impacts by resource area in the Nebraska-South Dakota-Wyoming Uranium Milling Region based on the GEIS analyses (NRC, 2009a).

Table 1.4-1. *In-Situ* Leach Generic Environmental Impact Statement Range of Expected Impacts in the Nebraska-South Dakota-Wyoming Uranium Milling Region

Resource Area	Construction	Operation	Aquifer Restoration	Decommissioning
Land Use	S	S	S	S to M
Transportation	S to M	S to M	S to M	S
Geology and Soils	S	S	S	S
Surface Water	S to M	S to M	S to M	S to M
Groundwater	S	S to L	S to M	S
Terrestrial Ecology	S to M	S	S	S
Aquatic Ecology	S	S	S	S
Threatened and Endangered Species	S to L	S	S	S
Air Quality	S	S	S	S
Noise	S to M	S to M	S to M	S
Historical and Cultural Resources	S to L	S	S	S
Visual and Scenic Resources	S	S	S	S
Socioeconomics	S to M	S to M	S	S to M
Public Health and Safety	S	S to M	S	S
Waste Management	S	S	S	S

Source: NRC (2009a)
S: SMALL Impact, M: MODERATE Impact, L: LARGE Impact

Scoping provides an opportunity for the public and other stakeholders to identify key issues and concerns they believe should be addressed in an EIS. The NRC staff consider the GEIS scoping process to be sufficient for the purposes of defining the scope of this SEIS. NRC accepted public comments on the scope of the GEIS from July 24, 2007 to November 30, 2007, and held three public scoping meetings in Albuquerque and Gallup, New Mexico, and Casper, Wyoming to aid in this effort. In addition, NRC held eight public meetings to solicit comments on the draft GEIS, after its publication in July 2008. One public meeting was held in Spearfish, South Dakota, on August 25, 2008. Comments on the draft GEIS were accepted from July 28, 2008 until November 8, 2008. Public comments made during the scoping meetings and on the draft GEIS are available on the NRC website (http://www.nrc.gov/ reading-rm/adams.html). Transcripts of the scoping meetings and draft GEIS comment meeting held in South Dakota are available on the NRC web site (http://www.nrc.gov/materials/uranium-recovery/geis/pub-involve-process.html). The scoping summary report was provided in GEIS Appendix A, and GEIS Appendix G provides responses to public comments (NRC, 2009a).

This SEIS was prepared to fulfill the requirement in 10 CFR 51.20(b)(8) and 43 CFR 3809 to prepare either an Environmental Impact Statement (EIS) or supplement to an EIS for the issuance of a source material license for an ISR uranium recovery facility (NRC, 2009a) and for BLM's approval of the applicant's Plan of Operations. The GEIS provides a starting point for the NRC/BLM NEPA analyses for site-specific license applications for new ISR facilities, as well as applications to amend or renew existing ISR licenses. As discussed in the GEIS, the GEIS provides criteria for each environmental resource area to assess the significance level of impacts (i.e., SMALL, MODERATE, or LARGE).

NRC staff applied these criteria to the site-specific conditions at the proposed Dewey-Burdock ISR Project. This SEIS tiers from or incorporates by reference the relevant GEIS information, findings, and conclusions concerning environmental impacts. The extent to which NRC incorporates GEIS impact conclusions depends on the consistency between (i) the applicant's proposed facility, activities, and conditions at the proposed Dewey-Burdock ISR Project and (ii) the general ISR facility description and activities in the GEIS and information or conclusions in the GEIS. NRC determinations of potential environmental impacts and the discussion of which GEIS impact conclusions were incorporated by reference are discussed in SEIS Chapter 4. GEIS Section 1.8.3 describes the use of tiering and incorporation by reference in using the GEIS for environmental reviews of site-specific ISR license applications (NRC, 2009a).

1.4.2 Public Participation Activities

As part of the preparation of this SEIS, NRC staff met with federal, state, tribal, and local agencies and authorities over the course of an expanded visit to the proposed Dewey-Burdock ISR Project site and vicinity in November and December 2009 (NRC, 2009b). Attempts to arrange for an initial briefing meeting with the Oglala Sioux Tribe were unsuccessful at that time. The purpose of these meetings was to gather additional site-specific information to support the NRC staff's environmental review and to help the staff determine consistency between site-specific and local information and corresponding information in the GEIS. As part of information gathering, the NRC staff also contacted potentially interested Native American tribes and local authorities, entities, and public interest groups in person, by email, and by telephone. Additionally, in January and February 2010, the NRC staff published an advertisement in six newspapers circulated near the proposed project area (Rapid City Journal, Edgemont Herald

Tribune, Custer Chronicle, Hot Springs Star, Lakota Country Times, and the Native Sun) soliciting public comments on the proposed action; five comments were received from this effort.

NRC published a Notice of Opportunity for Hearing on the Dewey-Burdock ISR Project license application in the Federal Register (FR) on January 5, 2010 (75 FR 467). Hearing requests from Consolidated Petitioners and the Oglala Sioux Tribe were received on March 8, 2010, and April 6, 2010, respectively (Consolidated Petitioners, 2010; Oglala Sioux Tribe, 2010). NRC also published a Notice of Intent to prepare this SEIS on January 20, 2010 (75 FR 3261).

Another part of public participation activities for development of this SEIS includes the public scoping meetings and written public comments accepted during development of the GEIS. As described in SEIS Section 1.4.1, NRC accepted public comments on the scope of the GEIS from July 24, 2007 to November 30, 2007, and held three public scoping meetings in Albuquerque and Gallup, New Mexico, and Casper, Wyoming. In addition, NRC held eight public meetings to solicit comments on the draft GEIS, after its publication in July 2008. Written comments on the draft GEIS were accepted from July 28, 2008 until November 8, 2008.

On November 26, 2012, NRC published a Notice of Availability for the draft SEIS for the proposed Dewey-Burdock ISR Project in the FR (77 FR 70486). The Notice of Availability stated that public comments were to be submitted by January 10, 2013. Members of the public were invited and encouraged to submit comments electronically, by mail, or by facsimile. The notice for the draft SEIS also stated that comments received after the January 10, 2013, would be considered if it was practical to do so. NRC accepted all comments on the draft SEIS received on or before March 5, 2013 (99-day comment period). The period for public comments (i.e., from November 25, 2012, to March 5, 2013) exceeded the minimum 45-day comment period required under NRC regulations.

The NRC staff identified 820 comments on the Dewey-Burdock draft SEIS from 349 individuals and 31 agencies and organizations. Appendix E details how NRC staff systematically identified and responded to each comment. A response is provided in Appendix E for each comment or group of comments identified and indicates whether the SEIS was modified in response to the comment.

1.4.3 Issues Studied in Detail

To meet its NEPA obligations related to its review of the Dewey-Burdock ISR Project license application, the NRC staff conducted an independent, detailed, and comprehensive evaluation of the potential environmental impacts from construction, operation, aquifer restoration, and decommissioning of an ISR facility at the proposed site and from reasonable alternatives. As discussed in GEIS Section 1.8.3, the GEIS (i) evaluated the types of environmental impacts that may occur from ISR uranium milling facilities, (ii) identified and assessed generic impacts (the same or similar) at all ISR facilities (or those with specified facility or site characteristics), and (iii) identified the scope of environmental impacts that needed to be addressed in site-specific environmental reviews. Therefore, although all of the environmental resource areas identified in the GEIS would be addressed in site-specific reviews, certain resource areas would require a more detailed analysis, because the GEIS determined a range in the significance of impacts (e.g., SMALL to MODERATE, SMALL to LARGE) could result, depending upon site-specific conditions (see Table 1.4-1).

Based on the GEIS analysis, this SEIS provides a more detailed analysis of the following resource areas:

- Land use
- Transportation
- Surface water and wetlands
- Groundwater
- Geology and soils
- Terrestrial ecology
- Threatened and endangered species
- Noise
- Visual and scenic resources
- Historical and cultural resources
- Socioeconomics
- Public health and safety
- Waste management

In addition, site-specific analyses of cumulative impacts and environmental justice concerns that were not part of the GEIS are presented in this SEIS. NRC also considers the effects the proposed action could have on global climate; the analysis estimates the potential effect of the facility's greenhouse gas emissions based on a 10-year licensing period.

1.4.4 Issues Outside the Scope of the Supplemental Environmental Impact Statement

Some issues and concerns raised during the public scoping process on the GEIS (NRC, 2009a, Appendix A) were determined to be outside the scope of the GEIS. These issues and concerns (e.g., general support or opposition for uranium milling, impacts associated with conventional uranium milling, comments regarding the alternative sources of uranium feed material, comments regarding energy sources, requests for compensation for past mining impacts, and comments regarding the credibility of NRC) are also outside the scope of this SEIS.

1.4.5 Related *National Environmental Policy Act of 1969* Reviews and Other Related Documents

A number of NEPA documents (environmental assessments) and EISs and other documents were reviewed and used in the development of this SEIS. The related NEPA reviews are described next.

NUREG–1910, Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities, Final Report (NRC, 2009a). As previously discussed, this GEIS was prepared to assess the potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of an ISR facility located in any of four different geographic regions of the western United States, including the Nebraska-South Dakota-Wyoming Uranium Milling Region where the proposed Dewey-Burdock ISR Project would be located. The environmental analysis in this SEIS both tiers and incorporates by reference from the GEIS. [Agencywide Documents Access and Management System (ADAMS) Accession No. Volume 1, ML091480244; Volume II, ML091480188]

NUREG–0706, Final Generic Environmental Impact Statement on Uranium Milling (NRC, 1980). This EIS provided a detailed evaluation of the impacts and effects of anticipated conventional uranium milling operations in the United States through the year 2000, including analysis of tailings disposal programs. NUREG–0706 concluded the environmental impacts of underground mining and conventional milling would be more severe than using ISR technology. As described in SEIS Section 2.2.1, conventional mining and milling were considered, but eliminated from the detailed analysis at the proposed Dewey-Burdock ISR Project. (ADAMS Accession No. Volume I, ML032751663; Volume II, ML032751667; Volume III, ML032751669)

NUREG–1508, Final Environmental Impact Statement to Construct and Operate the Crownpoint Uranium Solution Mining Project, Crownpoint, New Mexico (NRC, 1997). This EIS evaluated the use of ISR technology at the Church Rock and Crownpoint sites at Crownpoint, New Mexico. Alternative uranium mining methods were not evaluated, because the uranium ore located at the proposed sites was too deep to be extracted economically and the final EIS concluded underground mining would have more significant environmental impacts than ISR recovery. (ADAMS Accession No. ML082170248)

Environmental Impact Statement for the Moore Ranch *In-Situ* Recovery Project in Campbell County, Wyoming, Supplement to the GEIS (NUREG–1910, Supplement 1), Final Report (NRC, 2010a). NRC prepared this EIS as a supplement to the GEIS based on its review of an application from Energy Metals Corporation (now Uranium One) for a source material license for the proposed Moore Ranch ISR Project, which is located in Campbell County, Wyoming. The proposed Moore Ranch ISR project would encompass 2,877 ha [7,110 ac] of privately owned and State of Wyoming lands. However, Uranium One estimates that only 61 ha [150 ac] would be disturbed as a result of the project. (ADAMS Accession No. ML102290470)

Draft Environmental Impact Statement for the Dewey Conveyor Project (BLM, 2009). BLM, in cooperation with the U.S. Forest Service (USFS), prepared this draft EIS to evaluate the environmental impacts of the proposed Dewey Conveyor Project. GCC Dacotah Inc. proposed the Dewey Conveyor Project as a means to transport limestone along a 10.6-km [6.6-mi] conveyor from a future quarry location in Custer County, South Dakota, to a rail load-out facility near Dewey, South Dakota. The proposed route of the conveyor crosses BLM-administered public lands and USFS-administered National Forest System lands north of the proposed Dewey-Burdock ISR Project. (ADAMS Accession No. ML12209A089)

South Dakota Resource Management Plan, Final Environmental Impact Statement (BLM, 1985). BLM prepared the South Dakota Resource Management Plan (SDRMP) to address future management options for 113,584 ha [280,672 ac] of public land surface and 2,142,455 ha [5,294,122 ac] of federal mineral estate BLM administers through its South Dakota Resource Area Office in Belle Fourche, South Dakota. The SDRMP focuses on alternative approaches to management of vegetation apportionment and land actions. The plan includes resource management options for lands within and in the vicinity of the proposed Dewey-Burdock ISR Project area in Fall River and Custer Counties. The proposed Dewey-Burdock ISR Project is in conformance with the SDRMP as discussed on pages 14 and 44–47 of the SDRMP (ADAMS Accession No. ML12209A099)

Newcastle Resource Management Plan (BLM, 2000). BLM prepared this resource management plan to provide management direction for approximately 118,236 ha [292,168 ac] of BLM-administered public land surface and 687,507 ha [1,698,866 ac] of federal mineral estate the Newcastle Field Office administers in Crook, Niobrara, and Weston Counties in northeast Wyoming. The plan includes resource management objectives and management actions for lands adjacent to the proposed Dewey-Burdock ISR Project in Niobrara and Weston Counties. (ADAMS Accession No. ML12209A101)

Proposed Resource Management Plan and Final Environmental Impact Statement for Public Lands Administered by the U.S. Bureau of Land Management Rawlins Field Office (BLM, 2008). BLM prepared this resource management plan to direct the management of 1.4 million ha [3.5 million ac] of BLM-administered public surface land and 1.8 million ha [4.5 million ac] of BLM-administered federal mineral estate in Albany, Carbon, Laramie, and Sweetwater Counties in southwestern Wyoming. The plan established guidance, objectives, policies, and management actions for public lands the Rawlins Field Office administers. (ADAMS Accession No. ML12209A103)

Black Hills National Forest Land and Resource Management Plan (USFS, 1997). USFS prepared this plan to provide guidance for all resource management activities in the Black Hills National Forest. The plan (i) establishes goals, objectives, standards, and guidelines for resource management and (ii) describes resource management practices, levels of resource production, people-carrying capacities, and the availability and suitability of lands for resource management. (ADAMS Accession No. ML12209A110)

Black Hills National Forest, Phase I Amendment: 1997 Land and Resource Management Plan Environmental Assessment (USFS, 2001). USFS prepared a Phase I Amendment to the Black Hills National Forest Land and Resource Management Plan to address short-term concerns with sensitive species that occur or potentially occur in the Black Hills. (ADAMS Accession No. ML12209A113)

Black Hills National Forest, Phase II Amendment: 1997 Land and Resource Management Plan Final Environmental Impact Statement (USFS, 2005). USFS prepared a Phase II Amendment to the Black Hills National Forest Land and Resource Management Plan to address long-term concerns with sensitive species that occur or potentially occur in the Black Hills. The Phase II Amendment includes provisions to conserve species and protect communities, property, and other forest values by reducing fire and insect hazards. (ADAMS Accession No. ML12209A121)

Updated Land and Resource Management Plan for the Nebraska National Forest (USFS, 2009). USFS prepared this revised management plan to provide guidance for all resource management activities in the Nebraska National Forest. The plan describes management standards and guidelines, resource management practices, levels of resource production, people-carrying capacities, and the availability and suitability of lands for resource management. The Nebraska National Forest encompasses the Buffalo Gap National Grassland of southwestern South Dakota, which is located south of the proposed Dewey-Burdock ISR Project area. (ADAMS Accession No. ML12209A127)

NRC's Safety Evaluation Report for the Dewey-Burdock Project, Fall River and Custer Counties, South Dakota. The NRC staff prepared a safety evaluation report for the Dewey-Burdock license application. In the SER, the NRC staff evaluated whether the licensee's proposed action can be accomplished in accordance with the applicable regulations in 10 CFR Part 20; 10 CFR Part 40; and 10 CFR Part 40, Appendix A. Areas of review included the applicant's proposed facility design and operations, health and environmental protection, and accident analyses. The SER also provides the staff's analysis of the applicant's initial estimate of the funding needed to complete site decommissioning and reclamation. (ADAMS Accession No. ML13052A182)

Environmental Impact Statement for the Nichols Ranch ISR Project in Campbell and Johnson Counties, Wyoming, Supplement to the GEIS (NUREG–1910, Supplement 2), Final Report (NRC, 2011a). NRC prepared this EIS as a supplement to the GEIS based on its review of an application from Uranerz Energy Corporation for a source material license for the proposed Nichols Ranch ISR Project, which is located in Campbell and Johnson Counties, Wyoming. The proposed Nichols Ranch ISR project would encompass approximately 1,251 ha [3,091 ac] of privately owned land and approximately 113 ha [280 ac] of BLM-managed land. The proposed project would consist of two noncontiguous mining units: the Nichols Ranch Unit would contain the central processing plant, and the Hank Unit would contain a satellite ion-exchange facility. (ADAMS Accession No. ML103440120)

Environmental Impact Statement for the Lost Creek ISR Project in Sweetwater County, Wyoming, Supplement to the GEIS (NUREG–1910, Supplement 3), Final Report (NRC, 2011b). NRC prepared this EIS as a supplement to the GEIS based on its review of an application from Lost Creek ISR, LLC for a source material license for the proposed Lost Creek ISR Project located in Sweetwater County, Wyoming. The proposed project site covers approximately 1,708 ha [4,220 ac] with approximately 1,450 ha [3,583 ac] of federal owned, BLM-managed land and 259 ha [640 ac] of land owned by the State of Wyoming, Office of State Lands and Investment. Planned facilities associated with the project include a well field with injection, production, and monitor wells; header houses; a central processing plant; an access road network; and pipeline system. (ADAMS Accession No. ML11125A006)

1.5 Applicable Regulatory Requirements

NEPA establishes national environmental policy and goals to protect, maintain, and enhance the environment. NEPA provides a process for implementing these specific goals for those federal agencies responsible for an action. This SEIS was prepared in accordance with NEPA requirements, NRC-implementing regulations in 10 CFR Part 51, and other regulations that were in effect at the time of writing. GEIS Appendix B summarizes other federal statutes, implementing regulations, and Executive Orders that are potentially applicable to environmental reviews for the construction, operation, decommissioning, and groundwater restoration of an ISR facility.

GEIS Sections 1.6.3.3 and 1.7.5.3 summarize the State of South Dakota's statutory authority pursuant to the ISR process, relevant state agencies that are involved in the permitting of an ISR facility, and the range of state permits that would be required (NRC, 2009a). These agencies and their permitting authority are as follows:

- Under the South Dakota Mined Land Reclamation Act (South Dakota Codified Law Chapter 45-6B), the South Dakota Board of Minerals and Environment is charged with issuing state permits and developing licensing requirements for ISR facilities.

- The South Dakota Department of Environmental and Natural Resources (SDDENR) is in charge of issuing the air quality permit through the National Ambient Air Quality Standards program as well as issuing a surface water discharge permit through the National Pollutant Discharge Elimination System (NPDES) program and a groundwater discharge plan for land application of treated wastewater. In addition, SDDENR is in charge of issuing a large scale mine permit and water rights permits needed to operate ISR projects in South Dakota.

- The South Dakota State Historical Society, within the Department of Tourism and State Development, is in charge of administering the South Dakota State Historic Preservation Office (SD SHPO), which coordinates, plans, and manages historic preservation programs across the state.

1.6 Licensing and Permitting

NRC has statutory authority through the AEA and Uranium Mill Tailings Radiation Control Act to regulate uranium ISR facilities. In addition to obtaining an NRC license, uranium ISR facilities must obtain the necessary permits from the appropriate federal, state, tribal, and local governmental agencies. The NRC licensing process for ISR facilities was described in GEIS Section 1.7.1. GEIS Sections 1.7.2 through 1.7.5 describe the role of the other federal, state, and tribal agencies in the ISR permitting process.

This section of the SEIS summarizes the status of the NRC licensing process at the proposed Dewey-Burdock ISR Project site and the status of the applicant permitting with respect to other applicable federal, tribal, and state requirements. Section 1.6.1 describes the NRC licensing process and Section 1.6.2 describes the status of other required permits.

1.6.1 U.S. Nuclear Regulatory Commission Licensing Process

By letter dated August 10, 2009, the applicant submitted a license application to NRC for the Dewey-Burdock ISR Project (Powertech, 2009a). As discussed in GEIS Section 1.7.1, NRC initially conducts an acceptance review of a license application to determine whether the application is complete enough to support a detailed technical review. The NRC staff accepted the Dewey-Burdock ISR Project license application for detailed technical review by letter dated October 2, 2009 (NRC, 2009c).

The NRC's detailed technical review of the Dewey-Burdock ISR Project license application includes both a safety review and an environmental review. These two reviews are conducted in parallel (see GEIS Figure 1.7-1). The safety review focuses on assessing compliance with the applicable regulatory requirements in 10 CFR Part 20 and 10 CFR Part 40, Appendix A. The environmental review is conducted in accordance with the regulations in 10 CFR Part 51.

The NRC hearing process (10 CFR Part 2) applies to licensing actions and offers stakeholders a separate opportunity to raise concerns associated with the proposed action. In accordance with the regulation, NRC published a Notice of Opportunity for Hearing on the Dewey-Burdock ISR Project license application in the FR on January 5, 2010 (see 75 FR 467). NRC received a request for hearing from Consolidated Petitioners (Theodore P. Ebert, David Frankel, Gary Heckenlaible, Susan Henderson, Dayton Hyde, Lilias C. Jones Jarding, Clean Water Alliance, and Aligning for Responsible Mining) on March 8, 2010 (Consolidated Petitioners, 2010). Additionally, the Oglala Sioux Tribe filed a petition to intervene on April 6, 2010 (Oglala Sioux Tribe, 2010).

Regulations in 10 CFR Part 2 specify that a petition for review and request for hearing must include a showing that the petitioner has standing and that the Atomic Safety and Licensing Board Panel (ASLBP) would rule on a petitioner's standing by considering (i) the nature of the petitioner's right under the AEA or NEPA to be made a party to the proceeding, (ii) the nature and extent of the petitioner's property, financial, or other interest in the proceeding, and (iii) the possible effect of any decision or order that may be issued in the proceeding on the petitioner's interest. All of the individual Consolidated Petitioners based their claim of standing on the possibility that contamination from the applicant's proposed ISR operation would contaminate the aquifer or surface water from which Consolidated Petitioners obtain their water (Consolidated Petitioners, 2010). The Oglala Sioux Tribe's central standing claim is interest in protecting cultural and historical resources that have been or might be found in the proposed Dewey-Burdock ISR Project site, which the Oglala Sioux Tribe claims is within the aboriginal territory of the Oglala Sioux Tribe under the 1868 Fort Laramie Treaty (Oglala Sioux Tribe, 2010). In addition, the Oglala Sioux Tribe bases its claim of standing on possible groundwater contamination from the proposed Dewey-Burdock ISR Project (Oglala Sioux Tribe, 2010).

On August 5, 2010, ASLBP ruled that three individuals (Susan Henderson, Dayton Hyde, and David Frankel) and the two organizations (Clean Water Alliance and Aligning for Responsible Mining) among the Consolidated Petitioners demonstrated standing to be parties to the licensing proceeding, and one of their contentions as pled and three of their contentions as modified by ASLBP were admissible (ASLBP, 2010). Three other members of the Consolidated Petitioners (Gary Heckenlaible, Lilias C. Jones Jarding, and Theodore P. Ebert) did not demonstrate standing and were not admitted as parties to the licensing proceeding (ASLBP, 2010). ASLBP also found that the Oglala Sioux Tribe demonstrated standing to be admitted as a party to the licensing proceeding and three of their contentions as pled and one as modified by ASLBP were admissible (ASLBP, 2010).

1.6.2 Status of Permitting With Other Federal and State Agencies

In addition to obtaining a source material license from NRC prior to conducting ISR operations at the Dewey-Burdock ISR Project, the applicant is required to obtain necessary permits and approvals from other federal and state agencies to address (i) the underground injection of solutions and liquid effluent from the ISR process, (ii) the exemption of all or a portion of the ore zone aquifer from regulation under the *Safe Drinking Water Act*, and (iii) the discharge of stormwater during construction and operation of the ISR facility. Table 1.6-1 lists the status of the required permits and approvals.

Table 1.6-1. Environmental Approvals for the Dewey-Burdock Project

Issuing Agency	Description	Status
South Dakota Department of Environment and Natural Resources (SDDENR) Joe Foss Building 523 East Capitol Pierre, SD 57501	Uranium Exploration Permit	Application submitted July 2008; approved by South Dakota Board of Minerals and Environment November 2008.
	Scenic and Unique Lands Designation	Submitted August 2008; SDDENR determined lands described by applicant do not constitute special, exceptional, critical, and unique; February 2009.
	Large-Scale Mine Permit	Application submitted September 2012; deemed procedurally complete January 2013; recommended

Table 1.6-1. Environmental Approvals for the Dewey-Burdock Project (Cont'd)

Issuing Agency	Description	Status
		for approval April 2013; hearing conducted September 2013; further hearing postponed until NRC and the U.S. Environmental Protection Agency have ruled and set the federal surety, and the state Water Management Board has decided the water rights.
	Water Appropriation Permits • Madison • Inyan Kara	Applications submitted June 2012; recommended for approval November 2012; hearing conducted October-November 2013; further hearing scheduled December 2013.
	Underground Injection Control Class III Permit	Application submitted April 2009 and deemed incomplete; revised application submitted February 2010 and deemed incomplete. Rules tolled by Senate Bill 158, March 2011.
	Air Quality Permit	Application submitted November 2012; SDDENR determined that an operating air permit will not be required, February 2013.
	Groundwater Discharge Plan	Application submitted March 2012; recommended for approval December 2012; hearing conducted October–November 2013; further hearing scheduled December 2013.
	National Pollutant Discharge Elimination System Water Discharge Permit	Application not yet submitted.
U.S. Nuclear Regulatory Commission Washington, DC 20555	Source Material License (10 CFR Part 40)	Submitted August 10, 2009. Deemed complete October 2009.
U.S. Environmental Protection Agency 1595 Wynkoop Street	Aquifer Exemption (40 CFR Parts 144 and 146) and Underground Injection Control Class III Permit	Application submitted December 2008; revised application submitted August 2012 and under review.

Table 1.6-1. Environmental Approvals for the Dewey-Burdock Project (Cont'd)

Issuing Agency	Description	Status
Denver, CO 80202-1129	Underground Injection Control Class V Permit	Application submitted March 2010 and under review.
Custer County 420 Mount Rushmore Road Custer, SD 57730-1309	Building Permits	Applications not yet submitted.
Fall River County County Courthouse Hot Springs, SD 57730-1309	Building Permits	Not required.
U.S. Bureau of Land Management South Dakota Field Office	Plan of Operations	Application submitted August 2009; revised document submitted January 2011 and under review.
Source: Powertech (2010); Revised November 2013.		

1.7 Consultation

Federal agencies are required to comply with consultation requirements in Section 7 of the *Endangered Species Act of 1973* (ESA), as amended, and Section 106 of the *National Historic Preservation Act of 1966* (NHPA), as amended. The GEIS took a programmatic look at the environmental impacts of ISR uranium milling within four distinct geographic regions and acknowledged that each site-specific review would include its own consultation process with relevant agencies. Section 7 (ESA) and Section 106 (NHPA) consultations conducted for the proposed Dewey-Burdock ISR Project are summarized in Sections 1.7.1 and 1.7.2. Copies of the consultation correspondence are provided in SEIS Appendix A. Section 1.7.3 describes NRC coordination with other federal, tribal, state, and local agencies conducted during the development of the SEIS.

Executive Order 13175 (November 27 2000), *"Consultation and Coordination with Indian Tribal Governments,"* reaffirmed the federal government's commitment to a government-to-government relationship with Native American tribes, and directed federal agencies to establish procedures to consult and collaborate with tribal governments when new agency regulations would have tribal implications. The Order excludes "independent regulatory agencies, as defined in 44 U.S.C §3502(5)" from the requirements of the Order. However, according to Section 8, "Independent regulatory agencies are encouraged to comply with the provisions of this order." Although the NRC, as an independent regulatory agency, is explicitly exempt from the Order, the Commission remains committed to its spirit. The agency has demonstrated a commitment to achieving the Order's objectives by implementing a case-by-case approach to interactions with Native American tribes. NRC's case-by-case approach allows both NRC and Native American tribes to initiate outreach and communication with one another.

1.7.1 Endangered Species Act of 1973 Consultation

The ESA was enacted to prevent the further decline of endangered and threatened species and to restore those species and their critical habitats. ESA Section 7 recommends consultation with the U.S. Fish and Wildlife Service (FWS) to ensure that actions it authorizes, permits, or otherwise carries out will not jeopardize the continued existence of any listed species or adversely modify designated critical habitats.

By letter dated March 15, 2010, NRC staff initiated consultation with FWS, requesting information on endangered or threatened species and critical habitat in the proposed Dewey-Burdock ISR Project area (NRC, 2010b). NRC received a response from the FWS South Dakota Field Office, dated March 29, 2010, that (i) listed the threatened and endangered species that may occur in the project area and (ii) provided maps showing the location of wetlands within the two proposed initial mine units at the Dewey-Burdock ISR Project (FWS, 2010).

In accordance with ESA Section 7, FWS determined that the whooping crane (*Grus americana*) and black-footed ferret (*Mustela nigripes*) are federally listed species that may occur within Custer County. The whooping crane generally migrates through the eastern portion of Custer County, and the black-footed ferret is currently only found in the Wind Cave National Park. FWS had no information to indicate that these species are located within the project boundaries. No federally listed endangered species occur in Fall River County; however, the greater sage-grouse (*Centrocercus urophasianus*) is a candidate species that historically occurred in this area and has a potential to be present within the proposed area of review of the Dewey-Burdock ISR Project. At the present time, candidate species have no legal protection under ESA. By emails dated August 27, 2012 and September 9, 2013, the FWS South Dakota Field Office confirmed that there are no additional updates or changes to these federally listed species in the proposed Dewey-Burdock ISR Project area (FWS, 2012; FWS, 2013). As discussed in SEIS Section 4.6.1.1.1.1.4, the FWS determined that no additional consultation under Section 7 is required (FWS, 2013).

In accordance with NEPA regulations and other environmental laws and rules [e.g., Fish and Wildlife Coordination Act and Executive Order 11990 (Protection of Wetlands)], FWS encouraged the following when reviewing potential impacts to wetlands at the proposed Dewey-Burdock ISR Project: (i) avoidance of wetlands, if possible; (ii) minimization of impacts to wetlands if they cannot be avoided; and (iii) replacement of wetland values that may be impacted by the project (FWS, 2010).

1.7.2 National Historic Preservation Act of 1966 Consultation

In accordance with 36 CFR Part 800.1(a), Section 106 of NHPA requires that federal agencies take into account the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on such undertakings. The Section 106 process seeks the views of consulting parties including the federal agency, the State Historic Preservation Officer (SHPO), Indian tribes and Native Hawaiian organizations, Tribal Historic Preservation Officers (THPO), local government leaders, the applicant, cooperating agencies, and the public. The goal of consultation is to identify historic properties potentially affected by the undertaking, assess the effects of the undertaking on these properties, and seek ways to avoid, minimize, or mitigate any adverse effects on historic properties. As detailed in 36 CFR Part 800.2(c)(1)(i), the role of the South Dakota State Historic Preservation Office (SD SHPO) in the Section 106 process is to advise and assist federal agencies in carrying out their Section 106 responsibilities. As part of the Section 106 consultation process for the proposed Dewey-Burdock ISR Project, NRC continues consultation with potentially affected Native American tribes and consulting parties. These interactions are detailed in SEIS Section 1.7.3.5.

NRC staff met with members of the SD SHPO office on December 2, 2009, to discuss site-specific issues, including the SD SHPO review process, cumulative impacts to historic sites, and best management practices (NRC, 2009b). NRC and SD SHPO staff also discussed the possibility of entering into a programmatic agreement or memorandum of agreement, pursuant to Section 106, with all consulting parties to set forth procedures and mitigation measures to preserve existing historic and cultural resources at the proposed Dewey-Burdock ISR Project site. The NRC staff continue to consult with the SD SHPO to evaluate the effects of the proposed project on historic and cultural resources.

1.7.3 Coordination with Other Federal, Tribal, State, and Local Agencies

The NRC staff interacted with multiple federal, tribal, state, and local agencies and/or entities during preparation of this SEIS to gather information on potential issues, concerns, and environmental impacts related to the proposed Dewey-Burdock ISR Project. The consultation and coordination process included, but was not limited to, discussions with BLM; tribal governments (see SEIS Section 1.7.3.5); SDDENR; South Dakota Game, Fish, and Parks (SDGFP); and local organizations (e.g., Custer County, Town of Edgemont).

1.7.3.1 Coordination With the U.S. Bureau of Land Management

BLM is serving as a cooperating agency in the NEPA assessment and licensing process for the proposed Dewey-Burdock ISR Project because BLM has jurisdiction over the locatable mineral rights on federal land that the applicant holds within the proposed project area. As discussed in Section 1.3, the BLM's responsibility for the proposed action is to fulfill its statutory responsibilities to regulate mining on federal lands as described in 43 CFR Part 3809.

BLM is responsible for administering the National System of Public Lands and the federal minerals underlying these lands. BLM is also responsible for managing split estate situations where federal minerals underlie a surface that is privately held or owned by state or local government. In situations where BLM administers the surface rights, operators of mining claims including ISR uranium facilities, must submit a Plan of Operations and obtain BLM approval before beginning operations beyond those for casual use. BLM also reviews and approves Plans of Operations on split estate lands patented under the Stock-Raising Homestead Act but only where the surface owners and the claimant cannot come to terms on access or surface damages. In this case there are no surface owner/mining claimant conflicts and as a result the proposed development activity on the split estate lands is not subject to BLM approval. The proposed Dewey-Burdock ISR Project site contains approximately 97 ha [240 ac] of BLM-administered surface lands.

The U.S. government reserved 1,708 ha [4,220 ac] of mineral estate under the Stock-Raising Homestead Act, when the surface was originally patented. The applicant maintains the unpatented mining claims associated with the 1,708 ha [4,220 ac] of federal minerals. In addition, the applicant maintains unpatented mining claims on the 97 ha [240 ac] of BLM-administered surface lands. The statutory responsibilities pertaining to mining claims under the General Mining Laws are described in 43 CFR Part 3800.

NRC has coordinated with BLM during preparation of this SEIS. Numerous conference calls and meetings have been held, and a Memorandum of Understanding between NRC and BLM was negotiated.

The NRC staff met with the staff of South Dakota BLM field office on December 1, 2009. BLM staff indicated that the applicant's Plan of Operations for the proposed Dewey-Burdock ISR Project had been received, but review had not been initiated at the time of the meeting. BLM staff noted that an ethnographic study was conducted prior to preparation of the draft EIS for the GCC Dacotah Inc. Dewey Conveyor Project to assess the traditional use of the area by tribes in North Dakota and South Dakota (BLM, 2009; Sprague, 2008). The proposed route of the conveyor project crosses BLM-administered public lands and USFS-administered National Forest System lands north of the proposed Dewey-Burdock ISR Project. Most of the tribal members interviewed knew their people had regular ceremonial, cultural, and religious activity in the Black Hills prior to the establishment of reservations; however, no one could pinpoint present cultural, ceremonial, or religious use in the proposed area (Sprague, 2008, p. 14). During the meeting, BLM provided NRC staff with guidance documents and with information on oil and gas leases in the proposed project area. Additionally, BLM staff expressed concerns related to water quality and hydrology, land use, and cumulative effects.

1.7.3.2 Coordination with the U.S. Army Corps of Engineers

NRC staff met with U.S. Army Corps of Engineers (USACE) staff on December 2, 2009, in Pierre, South Dakota, to discuss wetlands and surface water bodies within and in the vicinity of the proposed Dewey-Burdock ISR Project site. USACE regulates, monitors, and oversees "jurisdictional waters of the United States," which are subject to the Clean Water Act. USACE requires issuance of a Section 404 Permit prior to discharge of dredge or fill material into waters determined to be jurisdictional waters of the United States. In August 2008, the applicant requested that USACE evaluate the proposed Dewey-Burdock ISR Project site to determine whether jurisdictional waters of the United States are present. By letter dated January 14, 2009, USACE documented the presence of 20 wetlands within the project area and determined that 4 were jurisdictional waters; these are Beaver Creek, an unnamed tributary to Beaver Creek, Pass Creek, and an unnamed tributary to Pass Creek (Powertech, 2009b, Appendix 3.5–H).

1.7.3.3 Coordination with the U.S. Forest Service

NRC staff met with USFS staff on December 3, 2009, in Hot Springs, South Dakota. USFS manages wildlife habitat on and uses of USFS lands. USFS has no permitting authority for the proposed Dewey-Burdock ISR Project; however, it expressed concerns that construction and operational activities could impact the nearby Black Hills National Forest and Buffalo Gap National Grasslands. USFS staff noted a concern about the cumulative groundwater effects of the project on the USFS-managed J.H. Keith Cascade Springs recreation area where Cascade Springs is located. USFS also expressed concerns about potential effects the project could have on Craven Canyon, known to have traditional cultural significance to Native American tribes.

1.7.3.4 Coordination with the U.S. Geological Survey

NRC staff met with U.S. Geological Survey (USGS) staff on December 1, 2009, in Rapid City, South Dakota, to discuss geological and hydrological aspects of the proposed Dewey-Burdock ISR Project. USGS staff provided information on the regional hydrology of the Black Hills area, including major hydrostratigraphic units, regional hydrological gradients, and major sources of municipal drinking water in the region. With respect to the proposed Dewey-Burdock ISR Project, USGS staff expressed a concern that contaminated groundwater may travel from the project area and discharge into Beaver Creek within the proposed project area and the Cheyenne River south of the proposed project area.

1.7.3.5 Interactions With Tribal Governments

Under Section 106 of the NHPA, NRC is required to conduct consultation with Native American tribes to determine whether a proposed federal action will affect historic properties. In conjunction with the tribal government consultation process, NRC staff met with Office of Tribal Government Relations (OTGR) staff on December 2, 2009, in Pierre, South Dakota, to discuss issues and concerns that tribal governments in South Dakota may have with the proposed Dewey-Burdock ISR Project. OTGR staff noted that tribal governments would be most interested in potential harm to the environment from the proposed project. OTGR staff suggested tribal organizations should have the opportunity to express their concerns with the proposed project and should be contacted prior to NRC outreach activities associated with the project.

The SD SHPO identified 20 Native American tribes that might attach historic, cultural, and religious significance to historic properties within the proposed Dewey-Burdock ISR Project area. The NRC staff contacted the 20 tribal governments by letters dated March 19, 2010; September 10, 2010; and March 4, 2011 (NRC, 2010c, 2010d, and 2011c). The staff invited the tribes to participate as consulting parties in the NHPA Section 106 process and requested assistance in identifying tribal historic sites or cultural resources that may be affected by the proposed action. Specifically, NRC staff solicited information regarding properties of religious and cultural significance to tribes. The tribes contacted initially were:

- Cheyenne River Sioux Tribe
- Crow Creek Sioux Tribe
- Flandreau Santee Sioux Tribe
- Lower Brule Sioux Tribe
- Oglala Sioux Tribe
- Rosebud Sioux Tribe
- Sisseton Wahpeton Sioux Tribe
- Standing Rock Sioux Tribe
- Yankton Sioux
- Three Affiliated Tribes (Mandan, Hidasta, and Arikara Nation)—North Dakota
- Turtle Mountain Band of Chippewa—North Dakota
- Spirit Lake Tribe—North Dakota
- Lower Sioux Indian Community—Minnesota
- Fort Peck Assiniboine and Sioux—Montana
- Northern Cheyenne Tribe—Montana
- Northern Arapaho Tribe—Wyoming
- Eastern Shoshone Tribe—Wyoming
- Santee Sioux Tribe—Nebraska
- Ponca Tribe—Nebraska
- Crow Tribe—Montana

The staff contacted the Cheyenne and Arapaho, Pawnee, and Omaha tribes in February 2013, after it was brought to the attention of the NRC that these tribes also had historical and cultural links to the proposed project area (Consolidated Intervenors, 2013).

By letter dated April 7, 2010, the Turtle Mountain Band of Chippewa–North Dakota responded to NRC and stated that the proposed project would not have an effect on historic properties of importance to the Turtle Mountain Band of Chippewa Indians. The THPO also stated that "determination of No Historic Properties Affected is granted for the project to proceed" (Turtle Mountain Band of Chippewa Indians, 2010).

NRC staff continued its efforts to engage in consultation with tribes that might be affected by the proposed action with follow-up telephone calls and by sending emails to further gather information related to identification efforts and coordinate meetings.

On September 10, 2010, NRC staff sent another letter inviting the tribes to participate in consultation to help facilitate the identification of areas on the proposed Dewey-Burdock site that the tribes believe have traditional religious or cultural significance (NRC, 2010d). NRC staff also followed up with phone calls and emails to ensure tribal officials received this correspondence.

By letter dated September 20, 2010, Mr. Perry "No Tears" Brady of the Three Affiliated Tribes (Mandan, Hidatsa, and Arikara Nations–North Dakota) responded that the tribe had determined there would be no adverse effects on historic or cultural resources important to the Mandan, Hidasta, and Arikara Nations within the proposed project area (Three Affiliated Tribes, 2010).

The Sisseton Wahpeton Oyate, Rosebud Sioux Tribe, Lower Brule Sioux Tribe, and Yankton Sioux Tribe, responded by letters dated November 2, 2010; November 7, 2010; November 15, 2010; and December 3, 2010, respectively, expressing interest in becoming consulting parties to the proposed project (Sisseton Wahpeton Oyate, 2010; Rosebud Sioux Tribe, 2010; Lower Brule Sioux Tribe, 2010; Yankton Sioux Tribe, 2010). The Sisseton Wahpeton Oyate and Rosebud Sioux THPOs recommended that NRC undertake group consulting, whereby a number of tribal representatives would participate in a meeting, possibly hosted by the Oglala Sioux Tribe. The Yankton Sioux Tribe THPO requested face-to-face consultation and expressed concerns regarding protection of traditional cultural properties (TCPs) within the project area. While the term TCP does not appear in the NHPA or its implementing regulations, the tribes apply this term to historic properties of religious and cultural significance to Indian tribes that may be affected by an undertaking. The NRC uses the term in this context.

By letter dated January 31, 2011, the Oglala Sioux Tribe THPO accepted the invitation to participate as a consulting party and stated that the proposed Dewey-Burdock Project represents a substantial potential threat to the preservation of cultural and historic resources of the Oglala Sioux Tribe (Oglala Sioux Tribe, 2011). The THPO also stated that the proposed project site is located within an area of which Sioux Tribes, along with the Cheyenne, Arapahoe, Crow, and Arikara Tribes, possess intimate cultural knowledge (Oglala Sioux Tribe, 2011). The THPO stated that impacts resulting from the proposed project include not only site-specific physical impacts, but intangible impacts to the integrity of the area from cultural, historical, spiritual, and religious perspectives. The letter also requested NRC's assistance in facilitating a site visit and regional meeting to provide all affected tribes an opportunity to review and identify the cultural and historic resources at stake.

Mr. Hubert B. Two Leggins (Crow Tribal Cultural Resource Director/Renewable Resource Supervisor) of the Crow Tribe of Montana responded by email dated March 9, 2011, indicating that the Dewey-Burdock Project area has religious and cultural significance to the Crow Tribe (Crow Tribe, 2011). Mr. Two Leggins accepted the invitation for formal consultation and stated that the Crow Tribe wanted to be a consulting party.

By letter dated May 12, 2011, NRC staff invited THPOs and/or Cultural Resources Officers to an informal information gathering meeting on June 8, 2011, at the Prairie Winds Casino and Hotel on the Pine Ridge Reservation in South Dakota (NRC, 2011d). The purpose of the meeting was to help NRC identify tribal historic sites and cultural resources that may be affected by actions associated with the proposed Dewey-Burdock ISR Project and with the Crow Butte North Trend and Crow Butte license renewal ISR projects in Nebraska. Representatives of six tribes (Oglala Sioux, Standing Rock Sioux, Flandreau-Santee Sioux, Sisseton-Wahpeton Oyate, Cheyenne River Sioux, and Rosebud Sioux) attended. BLM and SD SHPO staff also attended.

During the June 8th meeting, tribal officials expressed concerns about the identification and preservation of historic properties of traditional religious and cultural importance to tribes at the proposed Dewey-Burdock and Crow Butte sites. Tribal officials stated that historic and cultural resource studies of the sites should be conducted with tribal involvement. The SD SHPO stated that Tribal representatives would need access to the Dewey-Burdock site to assist in identification of historic properties. A transcript of this meeting (NRC, 2011e) is available through the NRC Agencywide Documents Access and Management System database on the NRC website (http://www.nrc.gov/reading-rm/adams.html).

In conjunction with the June 8, 2011, information gathering meeting, the applicant hosted a visit to the Dewey-Burdock ISR Project site on June 9, 2011. Tribal officials, NRC staff, and BLM, SD SHPO, and South Dakota Historical Society Archaeological Research Center (ARC) staff interacted with the applicant’s personnel and archaeologists from Archaeology Laboratory of Augustana College during the site visit. The Level III cultural resource evaluations at the site were conducted by the Archaeology Laboratory of Augustana College. The Level III cultural resource evaluations are described in SEIS Section 3.9.2. The Dewey-Burdock site visits included a presentation of the proposed project identifying the location of facilities and wellfields. Augustana College staff provided an overview of the results of archaeological and cultural evaluations. At the conclusion of the presentations, participants toured the proposed Dewey-Burdock ISR Project site stopping at several locations to view and investigate cultural and historic features identified during the Level III cultural resource evaluations, including stone circles and rock alignments.

To facilitate the identification of possible historic properties of importance to Native American tribes within the area of potential effect (APE), the NRC began efforts to open the Dewey-Burdock site to tribal representatives for a survey. On August 12, 2011, NRC staff sent a letter requesting the applicant submit a written plan for acquiring information on historic properties within the APE (NRC, 2011f).

On October 28, 2011, NRC staff sent a letter to the tribes stating that the staff had requested the applicant undertake studies and surveys to provide information on properties of traditional religious and cultural importance to tribes at the proposed Dewey-Burdock site, as is permissible under 36 CFR 800.2(c)(4) (NRC, 2011g). The letter informed the tribes that the applicant had engaged the services of SRI Foundation (SRI) of Rio Rancho, New Mexico, to collect information concerning historic properties that may be located in the proposed project area. The letter also informed the tribes that NRC had authorized SRI, acting on behalf of the applicant, to contact tribes to obtain information. The letter stated further that NRC would remain legally responsible for all findings and determinations and for maintaining government-to-government relationships with the involved tribes.

By letter dated January 19, 2012, NRC staff invited the THPOs to a tribal consultation on February 14–15, 2012, at the Ramkota Best Western Hotel in Rapid City, South Dakota (NRC, 2012a). The purpose of the meeting was to hear the views of interested tribes about the general types and descriptions of historic properties of religious and cultural significance that may be affected by the proposed project and how these properties can be identified and evaluated as part of the ongoing consultations under Section 106 of NHPA. The meeting was attended by officials from 13 tribes (Cheyenne River Sioux, Crow Creek Sioux, Crow Tribe of Montana, Eastern Shoshone, Fort Peak Assiniboine Sioux, Northern Arapaho, Northern Cheyenne, Oglala Sioux, Rosebud Sioux, Yankton Sioux, Sisseton-Wahpeton Sioux, Santee Sioux Nation, and Standing Rock Sioux). In addition to applicant, SRI, and NRC staffs, BLM and U.S. Environmental Protection Agency (EPA) Region 8 staffs were also in attendance.

During the February 14–15th meeting, the tribes provided the following information to NRC and BLM staffs: (i) the tribes expressed an interest in developing a confidentiality agreement before submitting any traditional cultural studies to NRC; (ii) tribal representatives stated that the purpose of any future meetings be made clearer to ensure that tribal participants have appropriate levels of decision-making authority; (iii) tribal representatives volunteered to develop project-specific statements of work (SOWs) to conduct traditional religious and cultural properties studies for the proposed Dewey-Burdock Project; and (iv) tribal representatives requested another meeting during March 14-15, 2012 to review draft SOWs the tribes and the applicants prepared for each of the three projects.

Scheduling conflicts of many tribal representatives, led to the cancellation of the March 14–15, 2012 meeting. The NRC staff transmitted the applicant's SOW for the Dewey-Burdock project to the THPOs for review and consideration by letter dated March 9, 2012 (NRC, 2012b). The NRC staff proposed to host a conference call to discuss the proposed SOW in April 2012. On April 5, 2012, NRC staff sent a letter inviting the tribes to participate in a teleconference on April 24, 2012, to discuss the applicant's SOW to identify historic properties (NRC, 2012c).

On April 24, 2012, the NRC staff held a teleconference with staff from Powertech, Cameco, SRI, SD SHPO, EPA Region 8, BLM, and the Northern Cheyenne, Oglala Sioux, Rosebud Sioux, Northern Arapaho, Sisseton-Wahpeton, Standing Rock Sioux, Yankton Sioux, and Cheyenne and Arapaho tribes. The consulting parties discussed the following aspects of the applicant's SOW: (i) adequacy of compensation for tribal officials conducting the field work, (ii) confidentiality of information gathered by the tribes, (iii) amount of acreage to be covered during fieldwork, and (iv) tribal involvement in making eligibility determinations.

A plan for accomplishing the tribal survey was discussed at the April 24, 2012, teleconference: (i) tribal representatives would continue to develop a draft tribal SOW; (ii) tribes would hold an intertribal teleconference to discuss a draft tribal SOW; (iii) tribes would provide a copy of a draft SOW to the NRC, once it was approved by all tribal officials; (iv) NRC would distribute a draft tribal SOW to consulting parties (applicant, BLM, EPA, SD SHPO); (v) NRC would arrange another meeting with consulting parties to finalize an SOW, agreeable to the parties, for the identification of potential historic properties; (vi) the applicant would schedule fieldwork for a historic property survey at the proposed Dewey-Burdock site; (vii) tribes would write preliminary and final reports for submission to the NRC to provide tribal views on effects of the undertaking on such properties; and (viii) NRC would assess effects on properties under NHPA and develop an impact determination pursuant to NEPA based on information provided by the tribes. The tribes also requested that two tribal representatives be provided access to conduct a reconnaissance visit to the Dewey-Burdock license area, for the purpose of securing information that would enable the tribes to complete a detailed proposed SOW for the project area. The applicant agreed to the request, and the Dewey-Burdock Project tribal reconnaissance visit took place on Saturday, May 26, 2012.

On June 19, 2012, the tribes provided NRC staff with a preliminary tribal SOW for identifying properties of religious and cultural significance at the Dewey-Burdock ISR Project site. Subsequently, NRC staff held teleconferences on August 9, 2012, and August 21, 2012, to solicit additional details on the SOWs prepared by the applicant and tribes. Representatives of the tribes and staff from the NRC, Powertech, SRI, SD SHPO, EPA Region 8, and BLM attended these teleconferences. Discussions centered on (i) defining the areas of potential effects (direct and indirect) that would be included in the proposed surveys, (ii) the need to provide survey cost estimates, and (iii) the need to provide a survey schedule that met the NRC licensing review schedule and completion of its scheduled NEPA review. The participating tribes requested an opportunity to revise the applicant's proposed SOW for completing a tribal survey for the Dewey-Burdock ISR Project. During the August 21, 2012, teleconference, NRC staff agreed to meet with tribal representatives in Bismarck, North Dakota on September 5, 2012 to develop a revised SOW for completion of a field survey in the fall of 2012.

The applicant informed NRC by letter dated August 29, 2012, that it was unable to reach an agreement with the tribes on a SOW and it would be unable to provide information to the NRC on properties of religious and cultural significance to the tribes that may be affected by the proposed Dewey-Burdock ISR Project (Powertech, 2012). The applicant indicated that additional efforts on its part to negotiate a mutually acceptable SOW are unlikely to be productive. The applicant, however, committed to support efforts to complete identification of historic properties by offering financial assistance to tribal representatives to carry out fieldwork and reporting activities. The applicant committed to working with NRC and BLM to provide access for tribal representatives to the project area to carry out work agreed to by the tribes.

On September 5, 2012, NRC staff met with representatives of the Yankton Sioux, Sisseton-Wahpeton Oyate Sioux, Rosebud Sioux, Standing Rock Sioux, Northern Cheyenne, Oglala Sioux, and Crow Nation tribes at the Kelly Inn in Bismarck, North Dakota. During this meeting, participants discussed how to proceed with development of a SOW to identify religious and cultural properties within the APE. The APE is the area in which properties of cultural significance may be affected by the undertaking, including direct effects (such as destruction, damage, or alteration of all or part of a property) and indirect effects (such as visual, audible, and atmospheric changes that affect the character or setting of a property). All parties agreed a survey was necessary for historic property identification. All parties also agreed further consultation was needed to develop a SOW that focused survey efforts on the identification of properties directly and indirectly affected by the proposed project. The area of potential indirect effect could include properties that are well beyond the proposed license area. In addition, the parties acknowledged the need for a Programmatic Agreement for any future disturbances outside of areas directly affected by the proposed project.

By letter dated September 18, 2012, NRC staff asked participants in the September 5, 2012, meeting in Bismarck, North Dakota to designate a preferred contractor to submit a proposal for a survey on their behalf. The NRC staff requested that a cost estimate based on the area of direct effect that may be disturbed during the initial phase of the Dewey-Burdock ISR Project be included in the proposal (NRC, 2012d). The letter included the NRC staff response to four NHPA-related concerns the tribes raised at the September 5, 2012, meeting in Bismarck, North Dakota. The letter stated (i) the NRC agrees that a Programmatic Agreement will need to be developed to address the phased identification and evaluation of historic properties; (ii) the NRC will continue to consult with BLM, SD SHPO, and the tribes on all issues arising under Section 106 of the NHPA, including potential indirect effects; and (iii) the NRC intends to keep survey information confidential to the fullest extent allowed by law.

On September 27, 2012, NRC received a proposal and cost estimate from the tribes for a traditional cultural properties survey for the proposed Dewey-Burdock Project. The proposal and cost estimate were prepared by Makoche Wowapi/Mentz-Wilson Consultants, LLP, the contractor selected by tribes to complete the cultural resources survey of the proposed project. By letter dated October 4, 2012, NRC transmitted the tribe's proposal and cost estimate to the applicant for review and comment (NRC, 2012e).

NRC informed the tribes by letter dated October 12, 2012 of the significant differences between the Makoche Wowapi/Mentz-Wilson Consultants, LLP proposal and the applicant's proposal set out in its letter dated August 29, 2012 (NRC, 2012f; Powertech, 2012). NRC indicated that resolving these differences would not support completion of a field survey at the Dewey-Burdock site in the fall 2012. NRC requested that the tribes provide their ideas on alternative methods for identifying potential properties of traditional religious and cultural importance to the tribes. NRC suggested that alternative methods might include opening the site to interested tribal specialists over a period of several weeks with payment for survey costs made to individual tribes or seeking ethnohistoric and ethnographic information from tribal specialists in interviews at tribal headquarters.

From October 15 to October 20, 2012, the NRC staff received letters and email from the Standing Rock Sioux Tribe, the Sisseton-Wahpeton Oyate, the Rosebud Sioux Tribe, and the Yankton Sioux Tribe opposing the NRC's request for alternative survey approaches (Standing Rock Sioux Tribe, 2012; Sisseton-Wahpeton Oyate, 2012; Rosebud Sioux Tribe, 2012; Yankton Sioux Tribe, 2012). These tribes maintained that the only level of effort sufficient for identifying historic properties would be an on-the-ground, 100% survey of the entire license boundary by tribal personnel from participating tribes.

On October 19, 2012, NRC received a response from the Three Affiliated Tribes and the Turtle Mountain Band of Chippawa Indians Tribe who in collaboration with Kadramas, Lee, & Jackson (KLJ), a private consulting firm from North Dakota, proposed to complete an alternative field survey of the project's 1,067-ha [2,637-ac] APE for ground disturbance. The proposal included investigation of previously recorded archaeological sites, use of light detection and ranging mapping technology to locate potential rock alignments, cairns, and other stone features, and systematic pedestrian survey of the project area. The level of effort presented in the KLJ proposal was reasonable and appropriate to the project area and estimated costs were in line with the range of survey costs obtained for other tribal surveys identified by the staff for other projects.

NRC staff confirmed that the proposed KLJ survey effort would be led by two THPOs and one former THPO employed by KLJ. In addition, the KLJ survey effort welcomed participation of other tribes. For these reasons, NRC endorsed the level of effort represented by the KLJ proposal and recommended that the applicant consider contracting with KLJ to lead the survey effort at the Dewey-Burdock site. To ensure all interested tribes would have the opportunity to participate in the survey, NRC staff requested that the applicant provide additional financial support for representatives from other tribes. The applicant agreed to provide financial support for one representative for each interested tribe. Additional tribal representatives would also be allowed to participate, but without compensation.

On October 31, 2012, NRC sent a letter to the THPOs endorsing the KLJ survey approach (NRC, 2012g). The letter invited all consulting tribes to participate in the survey with paid compensation for one representative per tribe. The KLJ survey proposal provided each participating tribe an independent opportunity to identify historic properties, to gather relevant information, and to provide independent recommendations regarding the NRHP eligibility of properties of traditional religious and cultural importance to the tribes.

NRC staff received written responses from the Standing Rock Sioux Tribe, Rosebud Sioux Tribe, Oglala Sioux Tribe, Sisseton-Wahpeton Oyate, and Yankton Sioux Tribe objecting to the proposed survey. The tribes stated that the NRC's endorsement of the KLJ proposal ignored information previously provided by the tribes. Specifically, the tribes argued that (i) the field survey must include the entire project area, not just the area directly affected by the proposed project; (ii) the field survey must be conducted by qualified tribal representatives, not archaeologists; and (iii) survey approaches based on predictive modeling are not appropriate for identifying tribal sites. The tribes further asserted that the NRC was not consulting in good faith because it was ignoring information provided by consulting tribes, and because the Three Affiliated Tribes and the Turtle Mountain Band of Chippewa Indians had advised the NRC the project was unlikely to affect places of significance to them (Three Affiliated Tribes, 2010; Turtle Mountain Band of Chippewa Indians, 2010).

On December 6, 2012, the KLJ withdrew its survey proposal by telephone. On December 17, 2012, KLJ withdrew its TCP survey proposal in writing (KLJ, 2012).

On December 14, 2012, NRC staff responded to the objections raised by the tribes to the KLJ survey proposal in a letter (NRC, 2012h). The letter informed all consulting parties that KLJ would not conduct the survey and that the NRC intended to move forward with an alternative field survey approach. The NRC postponed further efforts to undertake a field survey until Spring 2013. NRC reiterated its intention to develop a Programmatic Agreement and invited all interested consulting parties to provide information relevant to the development of a Programmatic Agreement.

On February 8, 2013, NRC staff invited 23 tribes, including the Cheyenne and Arapaho, Pawnee, and Omaha, to participate in a field survey in the Spring of 2013 (NRC, 2013a). The letter proposed April 1 to May 1, 2013, as dates for the survey, described procedures for site access, and identified the compensation for survey participation. Tribal representatives were encouraged to focus survey efforts on portions of the proposed license area that would be physically disturbed by the project; participants were permitted access to the entire project boundary within the allowable time. The applicant would provide compensation for per diem and mileage expenses for a maximum of three tribal representatives from each participating tribe. In addition, an unconditional grant of $10,000 for each participating tribe was to be provided. At the completion of the field survey a field survey report would be submitted to the NRC. The report would include: (i) a discussion of the areas examined; (ii) a description of each individual property examined; (iii) a NRHP evaluation of each individual property examined; (iv) any recommendation concerning criteria of eligibility for previously reported archaeological site within the license area visited during the field survey; and (v) recommendations for appropriate avoidance buffers or possible mitigation measures should any of the properties recommended as eligible be adversely affected by the proposed project. Tribes interested in participating in the survey were advised to respond by March 12, 2013.

On February 20, 2013, NRC staff received a letter from the Standing Rock Sioux Tribe in response to the NRC letter of February 8, 2013 (Standing Rock Sioux Tribe, 2013). The

Standing Rock Sioux Tribe objected to the survey approach and asserted that the NRC was not consulting in good faith because it was ignoring information provided by consulting tribes. In its letter, the tribe offered comments regarding the Section 106 process being conducted for the proposed Dewey-Burdock ISR Project.

On March 22, 2013, the Oglala Sioux Tribe responded by letter to the NRC letter of February 8, 2013 (Oglala Sioux Tribe, 2013). The Oglala Sioux Tribe objected to the terms of the survey proposal and indicated the proposed April 1, 2013, date for the start of the field survey did not allow sufficient time for formal authorization from its Tribal Council and constituents. The tribe expressed its concerns over the scope of the work methodology, its view that the funds allocated for the survey were insufficient, that the NRC lacked cultural sensitivity on these issues, and that the NRC was not addressing fully the direct and indirect effects on cultural resources and burial grounds, and the protection of intellectual property generated during the survey. The Oglala Sioux tribe also demanded that formal government-to-government consultation be conducted rather than the existing NHPA Section 106 consultation.

On April 1, 2013, survey work to identify traditional properties of religious and cultural significance to the tribes at the Dewey-Burdock site began. Seven tribes participated in the field survey; these were the Northern Cheyenne, Northern Arapaho, Crow Nation, Crow Creek Sioux, Cheyenne and Arapaho of Oklahoma, Santee Sioux, and Turtle Mountain Band of Chippawa Indians. Survey work was suspended on April 9, 2013, due to inclement weather. Survey work resumed on April 29, 2013, and was extended through May 24, 2013, for a total survey period spanning 36 calendar days.

On April 24, 2013, NRC staff formally invited the ACHP to become an active consulting party in the Section 106 process for the proposed Dewey-Burdock ISR Project (NRC, 2013b). NRC provided ACHP with a summary and chronology of the Section 106 consultation efforts for the proposed project.

On May 23, 2013, NRC staff hosted a government-to-government meeting concerning licensing actions associated with proposed uranium recovery projects under NRC licensing review. The NRC invited over 30 tribes currently in consultation on uranium recovery projects to this meeting with NRC management (NRC, 2013c,d). The government-to-government meeting sought the input of tribal leaders, or a designee on issues of mutual interest concerning uranium recovery projects. The NRC organized the meeting in response to the requests for a formal government-to-government meeting made by many THPOs. THPO's from the Cheyenne River Sioux, Northern Cheyenne, Yankton Sioux, Standing Rock Sioux, and Sisseton Wahpeton tribes attending this meeting. The meeting was held at the Ramkota Hotel and Conference Center in Rapid City, South Dakota.

Between June 24 and July 25, 2013, the Cheyenne and Arapaho, Northern Arapaho, and Northern Cheyenne tribes submitted survey reports to the NRC. The NRC staff also received field notes from the Crow Tribe, although the reports did not contain eligibility recommendations for identified sites. The Cheyenne and Arapaho Tribes survey report, dated June 24, 2013, documented sites of religious and cultural significance identified during site surveys conducted by tribal representatives on April 23 to 25, 2013, and April 30 to May 2, 2013. The report included NRHP eligibility recommendations and recommended mitigation measures for each identified site. The Northern Arapaho survey report documented sites identified during surveys conducted on April 29 to May 9, 2013. The report included NRHP eligibility recommendations and recommended mitigation measures, including area of importance, no surface activity, areas to remain accessible to the Northern Arapaho Tribe, and areas to be avoided by equipment disturbance and pedestrian traffic. The Northern Cheyenne Tribe report, dated July 25, 2013, summarized survey methods and provided survey results and NHPA-eligibility recommendations. Tribal Cultural Heritage Forms for ten cultural properties identified or investigated during the survey were included. The forms provide specific NHPA-eligibility recommendations and identify the eligibility criteria on which the Tribe relies. The results of the tribal surveys and the NRC assessment of the tribal survey results are discussed in SEIS Sections 3.9 and 4.9.

The Section 106 consultation process is ongoing. NRC informed the tribes by letter dated November 6, 2013 and the ACHP by letter dated November 13, 2013, that it has separated its Section 106 activities from its NEPA review (NRC, 2013e,f). The NRC staff will continue to consult with BLM, SD SHPO, and the tribes on all issues arising under Section 106 of the NHPA. The staff will also consult with ACHP as necessary.

1.7.3.6 Coordination With South Dakota Department of Environment and Natural Resources

NRC staff met with SDDENR in Pierre, South Dakota, on December 2, 2009, to discuss SDDENR's role in NRC's environmental review process for the proposed Dewey-Burdock ISR Project. SDDENR, the primary state permitting agency, will make determinations on issuance of the following state permits for the proposed Dewey-Burdock ISR Project: (i) mining permit, (ii) NPDES surface water discharge permit, (iii) air quality permit, (iv) water appropriation permit, and (v) groundwater discharge plan for land application of treated wastewater.

Discussions between NRC and SDDENR staffs focused on geological and hydrological issues with the proposed Dewey-Burdock site, including (i) the adequacy of subsurface characterization, (ii) groundwater flow rates within and in the vicinity of the project area, (iii) potential complications in hydrology caused by past exploratory drill holes, (iv) potential hydrologic connection of production zones and abandoned onsite surface mines, and (v) the effectiveness of confining layers in isolating ore-bearing aquifers. NRC and SDDENR staffs also discussed the applicant's Class III UIC permit application (Powertech, 2010) and the water appropriation and waste management permitting processes for the proposed project. Potential risks to wildlife from wastewater surface impoundments associated with the proposed project were also discussed. SDDENR would coordinate with SDGFP to mitigate the potential effects of surface impoundments on wildlife; mitigation measures discussed included the use of netting and fencing to protect wildlife and implementing protocols to assess the effects of wastewater constituents on wildlife.

1.7.3.7 Coordination With South Dakota Game Fish and Parks

NRC staff met with SDGFP staff on November 30, 2009, to discuss potential impacts on ecological resources at the proposed Dewey-Burdock ISR Project. SDGFP manages South Dakota's wildlife resources, parks, and outdoor recreational areas. SDGFP does not issue permits related to the proposed project; however, it oversees the management of state-listed threatened species and species of local concern. In addition, SDGFP consults closely with SDDENR on activities that could affect ecological resources within the proposed project area. Conversations between NRC and SDGFP staffs focused primarily on threatened or potentially threatened and endangered species (e.g., the plains topminnow, sage-grouse, and black-footed ferret) and species of local concern (e.g., raptors). SDGFP expressed a major concern: the potential effects on birds flying through the proposed project area and drinking at exposed wastewater evaporation ponds. SDGFP suggested two measures to mitigate effects on bird populations: (i) testing to determine the toxicity of constituents in the evaporation ponds and (ii) using netting and fencing to restrict wildlife access to exposed ponds. SDGFP also noted the need for testing and monitoring of soils at the proposed site to identify any buildup of salts and metals that could result from proposed land application of treated wastewater.

1.7.3.8 Coordination With South Dakota State Historical Society Archaeological Research Center

NRC staff met with ARC staff on November 30, 2009, to discuss historic and cultural resources at the proposed Dewey-Burdock Project. ARC is the lead agency for archaeological investigations pertaining to mineral exploration and mining in South Dakota. ARC described the results of a Level III Cultural Resources Evaluation conducted by the Archaeology Laboratory of Augustana College within the proposed project area. ARC also described stipulations of a Memorandum of Agreement executed between the applicant and ARC concerning avoidance and mitigation measures, which the applicant had committed to performing if historic or archaeological sites are encountered during ISR activities at the proposed site (Powertech, 2009b, Appendix 4.10–B). ARC's evaluation of the applicant's request for determination of the proposed project area as special, exceptional, critical, or unique lands was also discussed.

NRC staff returned on June 7, 2011, to meet with the Assistant State Archaeologist to review and gather additional information on cultural and historic resources related to the proposed Dewey-Burdock ISR Project site. During this visit, the results of the Level III Cultural Resources Evaluation conducted by archaeologists from the Archaeology Laboratory of Augustana College were discussed in more detail. Discussions focused on the recorded occurrence of cairn features at several identified archaeological sites at the proposed site and the potential for these types of features to contain human burials. A cairn is a manmade pile of rocks or stones often erected as a marker. NRC staff and the Assistant State Archaeologist also discussed the potential for historic properties of religious and cultural importance to Native American tribes to be present on or adjacent to the proposed project site.

1.7.3.9 Coordination With Localities

The NRC staff held meetings with the Edgemont Area Chamber of Commerce in Edgemont, South Dakota, and Custer County Planning and Economic Development in Custer, South Dakota, on December 3, 2009, to discuss site-specific issues related to the proposed Dewey-Burdock ISR Project. Meetings with these entities focused on local economics, housing availability, and community services. Members of the Edgemont Area Chamber of Commerce described current infrastructure projects that would support growth and economic development in Edgemont and the surrounding area. Discussions with Custer County Planning and Economic Development staff focused on available housing, land, and medical services to handle the anticipated population increase from the proposed project.

1.8 Structure of the Supplemental Environmental Impact Statement

As noted in Section 1.4.1 of this document, the GEIS (NRC, 2009a) evaluated the broad impacts of ISR projects in a four-state region where such projects are anticipated, but did not reach site-specific decisions for new ISR projects. The NRC staff evaluated the extent to which information and conclusions in the GEIS could be incorporated by reference into this SEIS. The NRC staff also determined whether any new and significant information existed that would change the expected environmental impact beyond what was evaluated in the GEIS.

Chapter 2 of this SEIS describes the proposed action and reasonable alternatives considered for the proposed Dewey-Burdock ISR Project, Chapter 3 describes the affected environment, and Chapter 4 evaluates the environmental impacts of implementing the proposed action and alternatives. Cumulative impacts are discussed in Chapter 5, while Chapter 6 summarizes mitigation measures to reduce adverse environmental impacts at the proposed project. Chapter 7 describes the environmental measurement and monitoring programs proposed for the Dewey-Burdock ISR Project. A cost-benefit analysis is provided in Chapter 8, and environmental consequences from the proposed action and alternatives are summarized in Chapter 9.

1.9 References

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2 *IN-SITU* URANIUM RECOVERY AND ALTERNATIVES

This chapter describes the proposed federal action, which is to issue a U.S. Nuclear Regulatory Commission (NRC) source material license to Powertech (USA) Inc. (Powertech), herein referred to as the applicant. The applicant will use its NRC license in connection with the construction, operation, aquifer restoration, and decommissioning of the Dewey-Burdock *In-Situ* Recovery (ISR) Project. In addition, the U.S. Bureau of Land Management (BLM) will utilize this analysis in its determination of whether or not to approve the applicant's modified Plan of Operations. This chapter also discusses alternatives to the proposed action. The alternatives analyzed in this Supplemental Environmental Impact Statement (SEIS) include consideration of the No-Action alternative as required under the *National Environmental Policy Act of 1969* (NEPA). Under the No-Action alternative, NRC will not issue a license to the applicant. The No-Action alternative is included to provide a basis for comparing and evaluating the potential impact of the proposed action and alternatives.

Section 2.1 of this SEIS describes the alternatives considered for detailed analysis, including the proposed action. Section 2.2 describes those alternatives that were considered but eliminated from detailed analysis. Section 2.3 compares the predicted environmental impacts of the proposed action and other alternatives. Section 2.4 sets forth the preliminary NRC staff recommendation on the proposed federal action. Section 2.5 provides the references cited for this chapter.

2.1 Alternatives Considered for Detailed Analysis

NRC staff used a variety of sources to determine a range of alternatives for detailed analysis in this SEIS. These sources include (i) the application's environmental report (Powertech, 2009a), technical report (Powertech, 2009b), and a supplemental report to the application (Powertech, 2009c); (ii) the applicant's responses to NRC staff requests for additional information (Powertech, 2010a–c, 2011); (iii) the scoping and draft comments on NUREG–1910, Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities (GEIS) (NRC, 2009a); (iv) the information gathered during the NRC staff site visits in November and December 2009 (NRC, 2009b); (v) comments on the draft SEIS; and (vi) multidisciplinary discussions held among NRC staff and various stakeholders. This SEIS evaluates the potential environmental impacts from two alternatives: the Proposed Action (Alternative 1) and the No-Action alternative (Alternative 2).

2.1.1 The Proposed Action (Alternative 1)

Under the proposed action, NRC will issue the applicant a source material license. The applicant will use its NRC license in connection with the construction, operation, aquifer restoration, and decommissioning of an ISR facility at the Dewey-Burdock ISR Project site. The project site is in Fall River and Custer Counties, South Dakota, as described in the license application. The applicant also is seeking BLM approval of its modified Plan of Operations subject to mitigation included in the license application and this SEIS. The applicant's proposed project will include processing facilities and sequentially developed wellfields sited in two contiguous areas: the Burdock area and the Dewey area. As uranium recovery activities cease at a wellfield, the area will be restored and reclaimed while a new wellfield and its supporting infrastructure is developed. Under the applicant's proposal, ISR methods will be used to extract uranium from sandstone-hosted uranium orebodies in the Fall River Formation and the Chilson Member of the Lakota Formation that make up the Inyan Kara Group. The extracted uranium will be loaded onto ion exchange (IX) resin at a central processing plant in the Burdock area and a satellite facility in the Dewey area. All processing of the uranium-loaded IX resin, including elution (stripping uranium off the resin), precipitation, drying, and packaging of the final “yellowcake” product, will take place at the Burdock central processing plant. The applicant proposes the following options (discussed in SEIS Section 2.1.1.1.6.2) for the disposal of liquid wastewater generated during uranium recovery: deep well disposal via Class V injection wells, land application, or a combination of deep well disposal via Class V injection wells and land application. Alternative wastewater disposal options for the proposed action are evaporation ponds and surface water discharge, and these are discussed in SEIS Section 2.1.1.2.

2.1.1.1 Proposed *In-Situ* Recovery Facility and Waste Disposal Options

The proposed Dewey-Burdock ISR Project includes buildings, infrastructure, wellfields, and options for waste disposal, which are described in the following sections. The general ISR process was detailed in GEIS Chapter 2 (NRC, 2009a) and will not be repeated here. The projected schedule for the proposed action is shown in Figure 2.1-1.

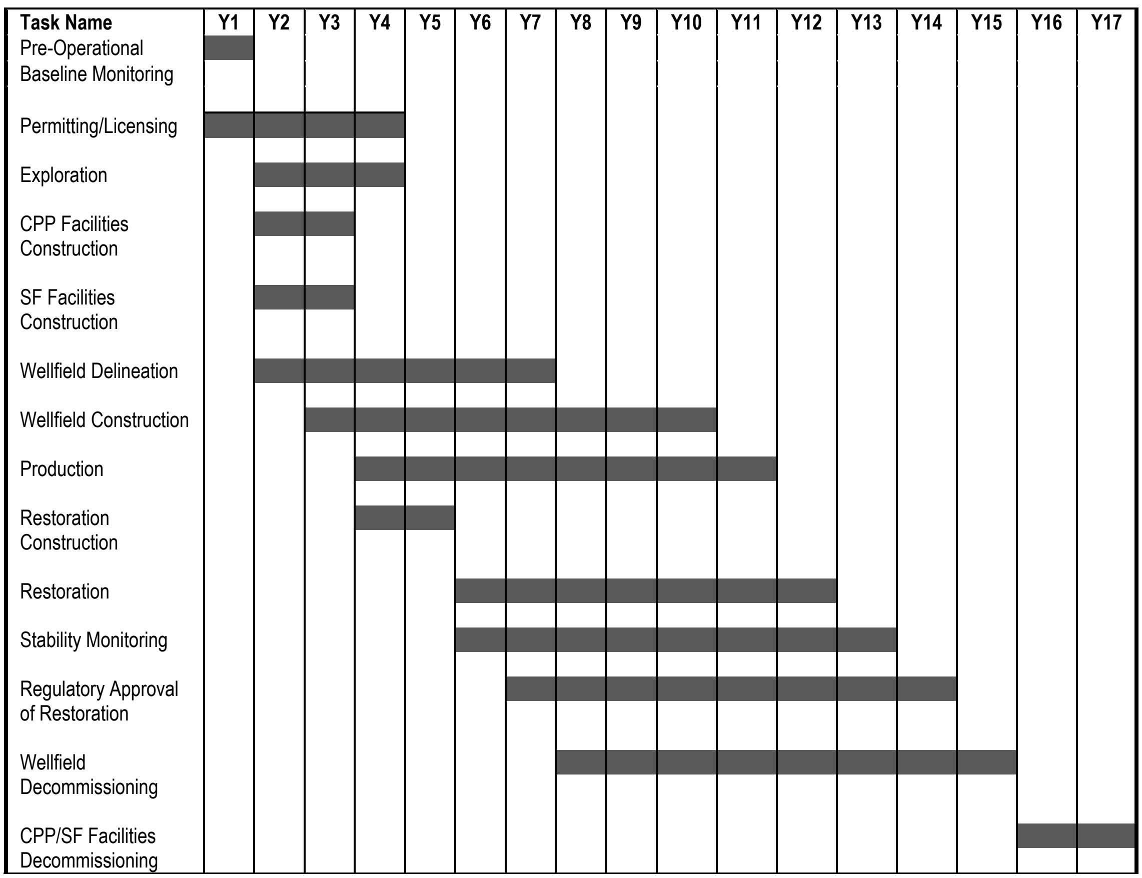


Figure 2.1-1. Projected Schedule for Construction, Operation, Aquifer Restoration, and Decommissioning Activities for the Proposed Dewey-Burdock *In-Situ* Recovery Project
Source: Modified From Powertech (2009a, 2011)

2.1.1.1.1 Site Description

The proposed Dewey-Burdock ISR Project is approximately 21 km [13 mi] north-northwest of Edgemont, South Dakota, in northern Fall River and southern Custer Counties, South Dakota (Figure 2.1-2). The project area is within the Nebraska-South Dakota-Wyoming Uranium Milling Region, described in the GEIS (NRC, 2009a). The proposed license area encompasses 4,282 ha [10,580 ac] of mostly privately owned land and is contained within two contiguous areas: the Burdock area and the Dewey area (Figure 2.1-3). The Burdock area (Township 7 South, Range 1 East, all or portions of Sections 1–3, 10–12, and 14–15; Township 6 South, Range 1 East, all or portions of Sections 27 and 34–35) will occupy the eastern part of the overall project area. The Dewey area (Township 7 South, Range 1 East, all or portions of Sections 4–5; Township 6 South, Range 1 East, all or portions of Sections 20–21 and 28–33) will occupy the western part of the overall project area. BLM manages approximately 97.1 ha [240 ac] of the permit area located in Township 7 South, Range 1 East, portions of Sections 3, 10, 11, and 12 (Figure 2.1-3). The U.S. Forest Service manages parcels of the Black Hills National Forest that lie adjacent to the eastern and northern boundaries of the proposed project area.

The proposed Dewey-Burdock ISR Project area is located within the Great Plains physiographic province on the southwestern edge of the Black Hills Uplift (Powertech, 2009a). The vegetation is a mix of short grasses and shrubs typical of semiarid steppe land along with ponderosa pine forest toward the Black Hills. The elevation within the project area ranges from approximately 1,097 to 1,189 m [3,600 to 3,900 ft] above mean sea level, with the highest elevations along the pine breaks that overlap the project area's eastern boundary. Topography in the project area and surrounding lands is primarily gently rolling in the western quarter, with more varied terrain in the pine breaks and dissected hills in the rest of the area. Two main streams pass through the proposed project area: Beaver Creek (perennial) and Pass Creek (ephemeral) (Figure 2.1-3). Pass Creek joins Beaver Creek southwest of the proposed project area. Approximately 4 km [2.5 mi] south of the confluence of Beaver and Pass Creeks, Beaver Creek flows into the Cheyenne River. The primary land use within and surrounding the project area is cattle grazing (Powertech, 2009a).

Material shipment and employee commutes to and from the proposed Dewey-Burdock ISR Project area will be primarily from Edgemont, Hot Springs, and Custer in South Dakota and Newcastle in Wyoming (Figure 2.1-2). The main highways that will be used to access the proposed project site are U.S. Highway 18, which connects Edgemont with Hot Springs, and State Highway 89, which connects Edgemont via U.S. Highway 18 with Custer (see Figure 2.1-2). Most traffic will travel to the proposed site via Fall River County Road 6463 (referred to herein as Dewey Road), which extends northwestward from Edgemont to the abandoned community of Burdock, located in the southwest corner of the Burdock area (Powertech, 2009a). This road is a two-lane, all-weather gravel road.

Dewey Road continues north from Burdock to the Fall River-Custer County line where it becomes Custer County Road 769 and continues on to the community of Dewey, a total distance of about 37 km [23 mi] from Edgemont. Dewey Road closely follows the tracks of the Burlington Northern Santa Fe Railroad (see Figure 2.1-3), which runs northward from Edgemont to Newcastle, Wyoming. The community of Dewey is about 3.2 km [2 mi] from the northwest corner of the proposed Dewey-Burdock ISR Project boundary. Some traffic is expected to

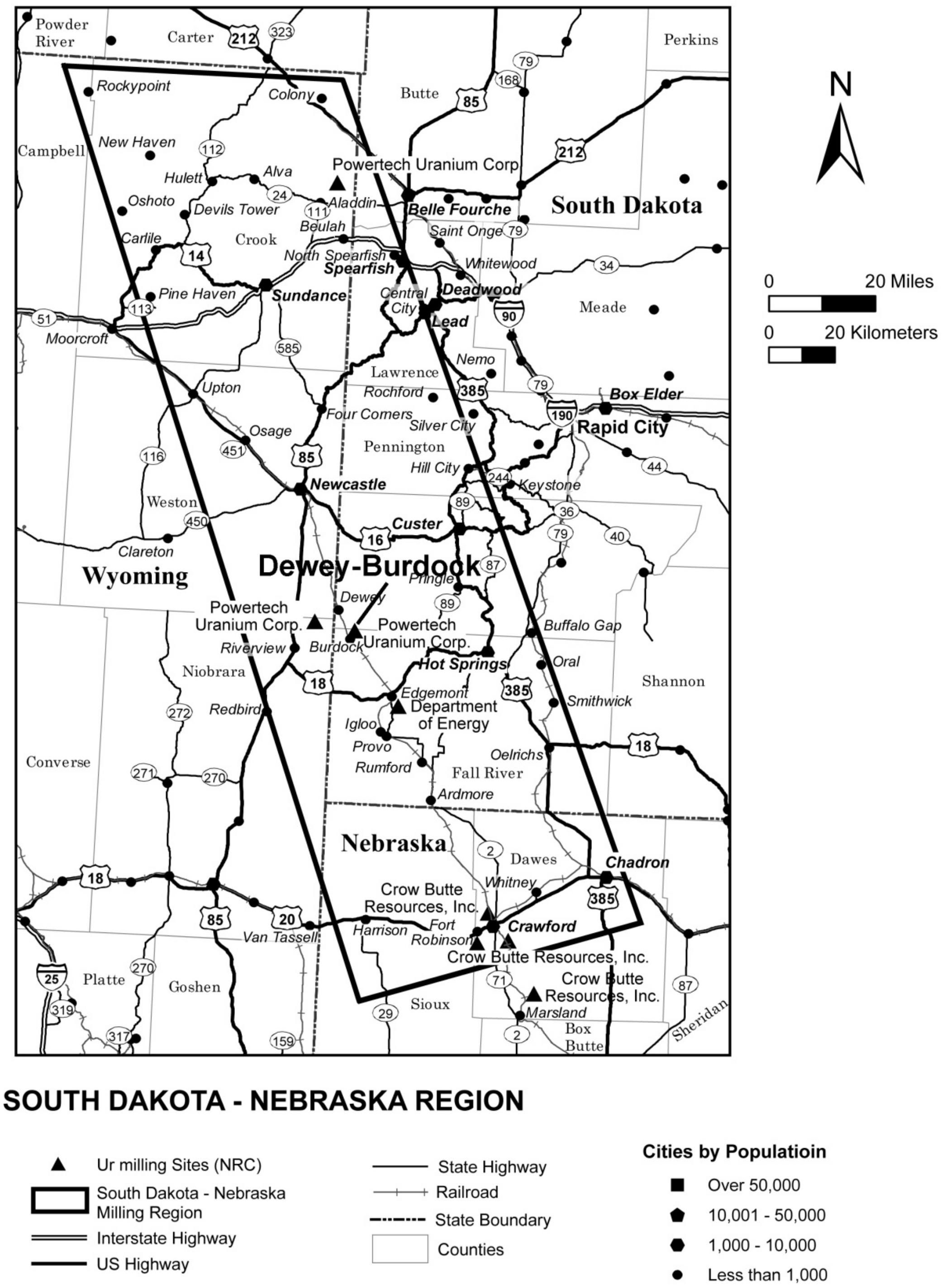


Figure 2.1-2. Map Showing Location of the Dewey-Burdock *In-Situ* Recovery Project Within the Nebraska-South Dakota-Wyoming Uranium Milling Region Source: Modified From NRC (2009a)

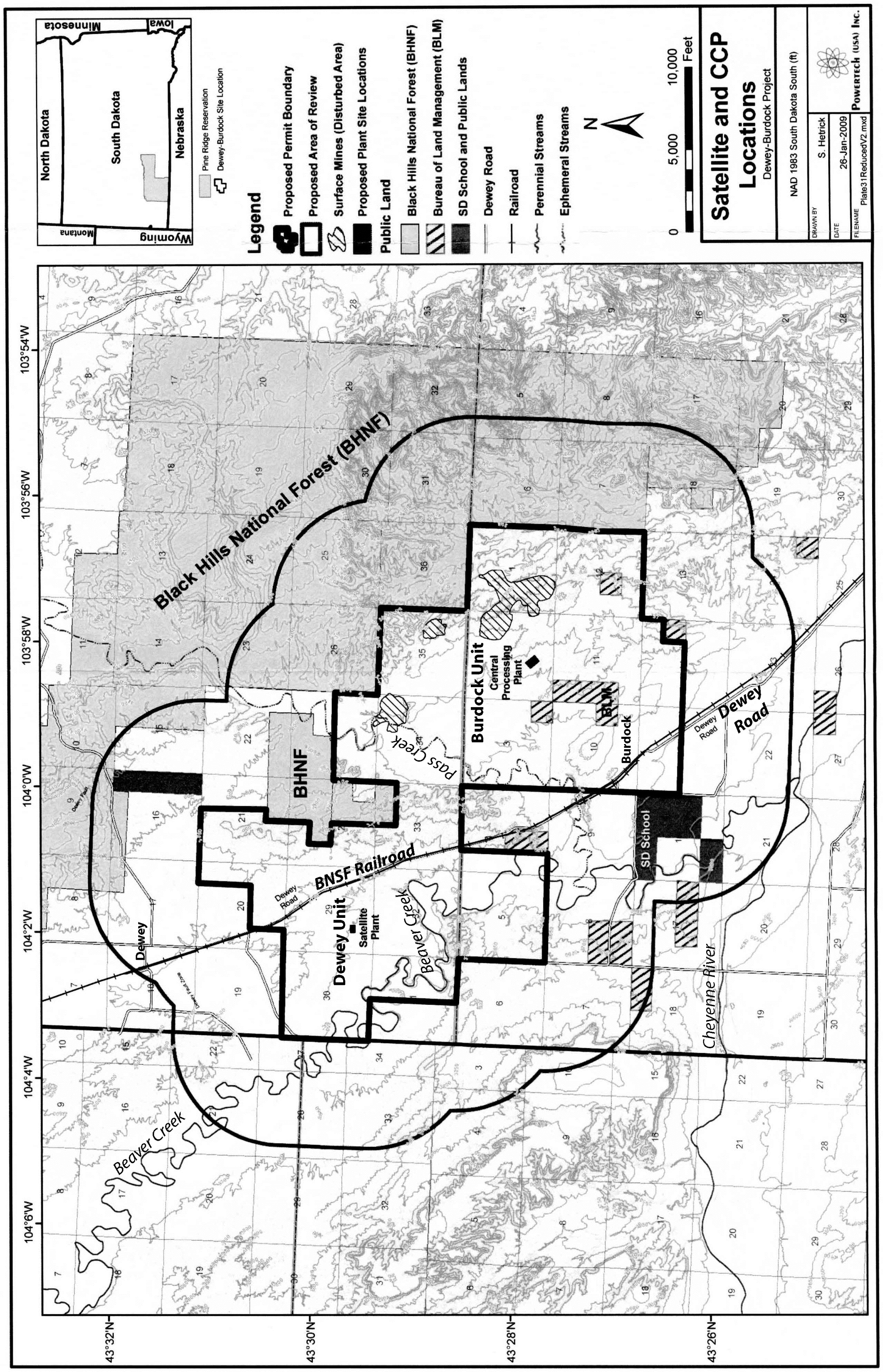


Figure 2.1-3. Dewey-Burdock *In-Situ* Recovery Project Permit Boundary Showing Dewey Area and Burdock Area, Location of U.S. Bureau of Land Management-Managed Land Within Burdock Area, and Position of Parcels of the Black Hills National Forest Bordering the Permit Area Source: Modified From Powertech (2009a)

access the site by traveling south from Newcastle along U.S. Highway 85, Old Highway 85, and Dewey Road (Powertech, 2010a). In addition, commuters who reside in the vicinity of Custer could use Pleasant Valley Road to access the proposed site from the north (Powertech, 2010a); however, this route will require much longer commute times than using the paved highways (State Highway 89 and U.S. Highway 18) to reach Edgemont, and then Dewey Road to access the proposed site from the south.

2.1.1.1.2 Construction Activities

As described in GEIS Section 2.3, the general construction activities associated with ISR facilities are drilling wells; clearing and grading associated with road construction; excavating and building foundations and surface impoundments; assembling buildings; trenching; and laying pipelines (NRC, 2009a). The facilities to be constructed as part of the proposed Dewey-Burdock ISR Project are the central processing plant, satellite facility, and associated infrastructure, such as wellfields, pipelines, power lines, header houses, ponds, center pivot circles (land application), and access roads (Powertech, 2009a). Surface facilities, underground infrastructure, and access roads at the proposed Dewey-Burdock site will be designed and built using standard construction techniques. Construction vehicles will include bulldozers, drilling rigs, water trucks, forklifts, pump hoist trucks, pickup and flatbed trucks, and other support vehicles. Construction-related activities at the proposed project will continue throughout much of the life of the project, as wellfields are sequentially developed and additional wells, underground piping, and surface structures are added and then subsequently decommissioned.

The applicant is proposing deep well injection via Class V injection wells, land application, or a combination of both methods as options for liquid waste disposal (Powertech, 2009a, 2011). The proposed Dewey-Burdock ISR Project area encompasses 4,282 ha [10,580 ac]. The applicant estimates that the land disturbed by the proposed project, excluding wellfields, will be approximately 42 ha [103 ac] if deep well injection alone is used to dispose of liquid waste and approximately 509 ha [1,258 ac] if land application alone is used to dispose of liquid waste (Powertech, 2010a). These estimates include site facilities, pipeline installation, access roads, impoundments, and center pivot circles for land application. As wellfields and supporting infrastructure are developed and constructed over the life of the project, the total disturbed area is estimated to increase to a maximum of 98 ha [243 ac] for the deep well disposal option with eight Class V injection wells and to a maximum of 566 ha [1,398 ac] for the land application option (Powertech, 2010a).

The applicant intends to salvage and manage topsoil from building sites, permanent storage areas, access roads, and chemical storage areas prior to construction, in accordance with South Dakota Department of Environment and Natural Resources (SDDENR) requirements under Administrative Rules of South Dakota (ARSD) 74:29:07:07 and South Dakota Codified Law (SDCL) 45-6B-40. For topsoil stripping, earthmoving equipment, such as rubber-tired scrapers and front-end loaders, will be used. In the wellfields, topsoil removal will be limited to header house locations and access roads. Over the life of the project, the applicant estimates that the area of topsoil to be stripped, stockpiled, and replaced will be up to 98 ha [243 ac] for the deep well disposal option and up to 175 ha [433 ac] for the land application option (Powertech, 2012b). Stockpiles for salvaged topsoil will be situated to minimize losses from wind and water erosion. To minimize sediment runoff, berms will be constructed around the perimeter of stockpiles, and the stockpiles will be vegetated with an approved seed mix. All stockpiles of topsoil will be identified with visible signs per SDDENR requirements under ARSD 74:29:07:07 (Powertech, 2009b).

2.1.1.1.2.1 Buildings

The Dewey-Burdock ISR Project will consist of a central processing plant in the Burdock area and a satellite facility in the Dewey area (Figure 2.1-3). The Burdock central plant will fully process pregnant lixiviant (i.e., uranium-bearing solution) and will process uranium-loaded resin from the Dewey satellite facility. Major process equipment housed in the Burdock central plant will include the IX system; an elution, precipitation, and thickening circuit; a chemical addition system; a filtration system for the liquid waste stream circuit; and the yellowcake filtering, drying, and packaging system. The Dewey satellite facility will house an IX system; a lixiviant (leaching solution) make-up circuit; and a treatment circuit for the liquid waste stream. Uranium-loaded resin from the Dewey satellite facility will be transported to the Burdock central plant in tanker trucks for final processing and packaging. Both the central processing plant and satellite facility will have a resin transfer system and loading area. (Powertech, 2009a)

The general layout of the Burdock central plant is shown in Figure 2.1-4 and includes the placement of an office building, maintenance shop and warehouse, and central processing plant.

These facilities will be located on approximately 2.7 ha [6.7 ac] within Section 2, Township 7 South, Range 1 East and will be surrounded by a controlled access area fence. The central processing plant will be within an approximately 32-m × 114-m [105-ft × 375-ft], pre-engineered, metal building that will house the major process equipment. The entire perimeter of the central processing plant floor will be surrounded by 15.2-cm [6-in] containment curbs and sloped toward trench drains and sumps to contain spilled and leaked fluids. Spilled and leaked fluids will be removed from the sumps by pumps and transported to the appropriate liquid waste treatment and disposal system or recycled back to the appropriate uranium recovery process component. Bulk storage tanks for the processing chemicals, such as sulfuric and/or hydrochloric acid, sodium hydroxide, and hydrogen peroxide, will be located outside the central processing plant. The storage tanks will be placed in concrete secondary containment basins, designed to contain 110 percent of the tank volume, and will be designed to withstand a 25-year, 24-hour storm event. The secondary containment basins will be separated physically from the containment basins for all other chemical systems. Carbon dioxide will be stored outside the central plant. Oxygen will be stored either near the central plant or within wellfields. Because oxygen is combustible, it will be stored at a safe distance from the central plant and other chemical storage areas. (Powertech, 2009a)

Other substances stored at the Burdock central plant will include petroleum products (gasoline, diesel) and propane. Due to the flammable and/or combustible nature of these materials, all bulk quantities of these substances will be stored outside of the central processing plant. All gasoline and diesel storage tanks will be located aboveground and within secondary containment structures, designed and constructed to meet U.S. Environmental Protection Agency (EPA) requirements. In addition, gasoline and diesel storage tanks used at the site must comply with SDDENR's tank rules found in ARSD 74:56:01 and 74:56:03.

The general layout of the Dewey satellite facility is shown in Figure 2.1-5, which shows the placement of the IX processing facility. This facility will be located on an estimated 1.2-ha [2.9-ac] area within Section 29, Township 6 South, Range 1 East and will be surrounded by a controlled access area fence. The IX processing facility will be within an approximately

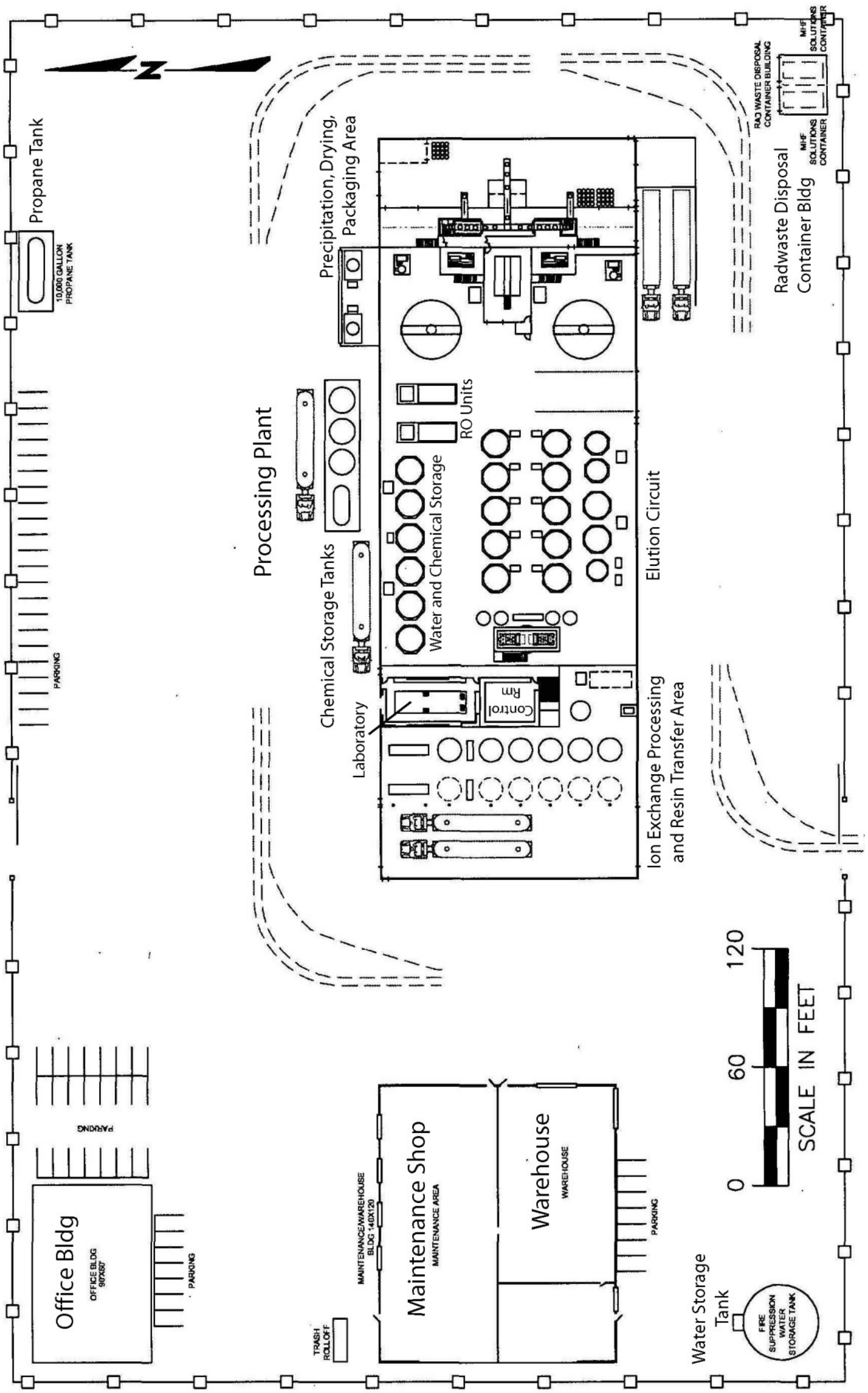


Figure 2.1-4. General Site Plan for the Budock Central Processing Plant Source: Modified From Powertech (2009b)

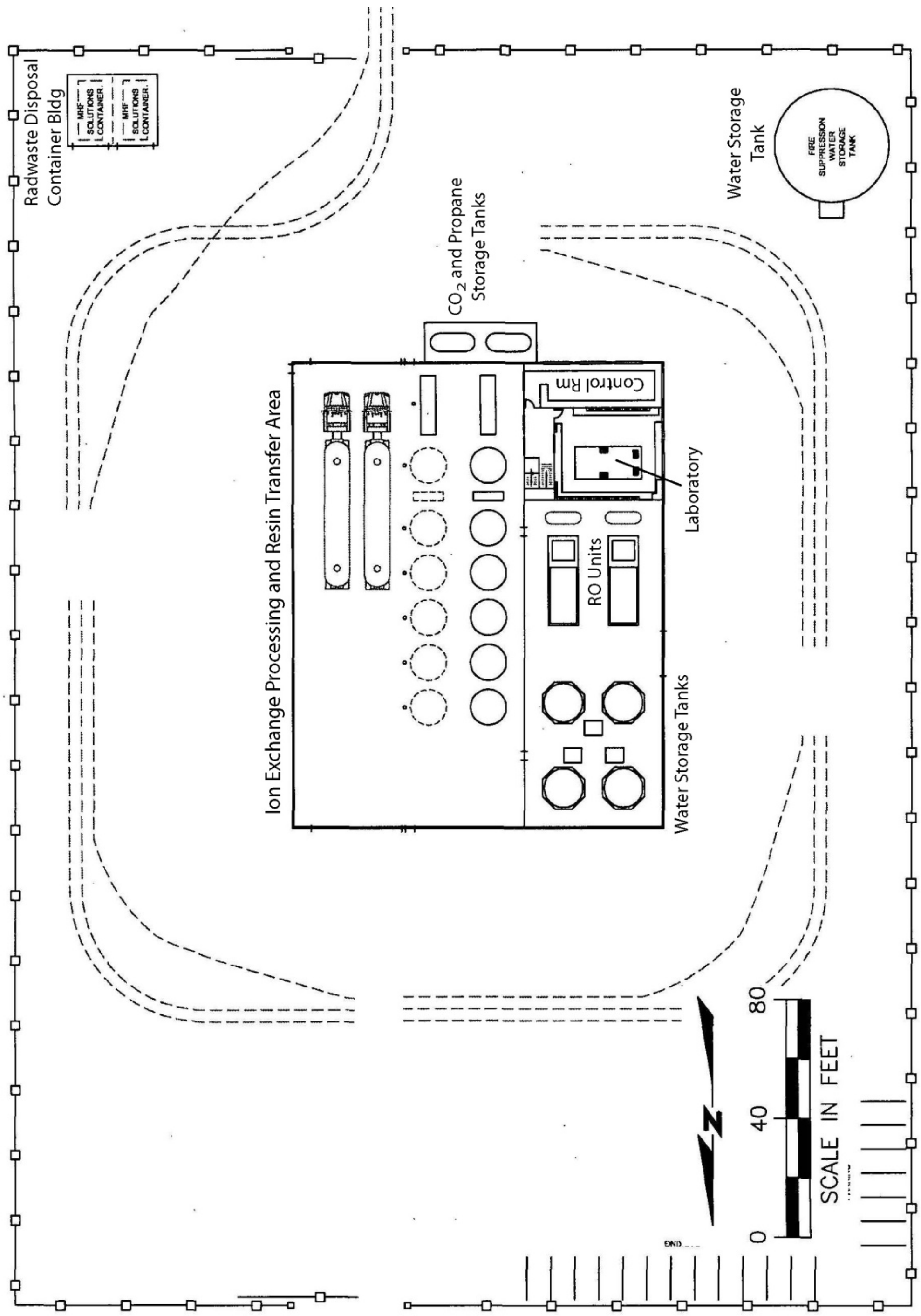


Figure 2.1-5. General Site Plan for the Dewey Satellite Facility
Source: Modified From Powertech (2009b)

38-m × 43-m [125-ft × 140-ft], pre-engineered, metal building. A 15.2-cm [6-in]-high containment curb will be constructed around the perimeter wall of the processing building slab. The satellite facility floor will be sloped toward trench drains and sumps to contain spilled and leaked fluids. Spilled and leaked fluids will be removed from the sumps by pumps and transported to the appropriate liquid waste treatment and disposal system or recycled back to the appropriate process component. Bulk storage tanks for oxygen and carbon dioxide will be located outside the IX processing building in concrete secondary containment basins designed to contain 110 percent of the tank volume plus withstand a 25-year, 24-hour storm event. (Powertech, 2009a)

Byproduct material, consisting of contaminated used equipment parts, personal protective equipment, and wastes from cleanup of spills or other housekeeping activities, will be stored in designated byproduct storage buildings. The Burdock central plant site and the Dewey satellite facility site will each have one byproduct storage building (Figures 2.1-4 and 2.1-5). These buildings will consist of a concrete slab with a containment curb surrounding the perimeter. Byproduct material will be stored in rolloff containers (bins), which will be both liquid tight and fully enclosed. The storage buildings will accommodate two 15-m^3 [20-yd^3] bins. The concrete slabs will be designed so the rolloff bins could be externally decontaminated before being transported from the proposed facility. (Powertech, 2009b)

2.1.1.1.2.2 Access Roads

As described in SEIS Section 2.1.1.1.1, the main highway that will be used to access the proposed Dewey-Burdock ISR Project is U.S. Highway 18, which connects Edgemont with Hot Springs to the east of the proposed site. Material shipment and employee commutes to and from the project area will be primarily via Dewey Road (Fall River County Road 6463 and Custer County Road 769), which extends northwestward from Edgemont to the community of Dewey, which is about 3.2 km [2 mi] from the northwest corner of the Dewey-Burdock ISR Project boundary.

The proposed Dewey-Burdock ISR Project will utilize existing roads to the greatest degree possible. However, the construction of additional access roads will be required. A main access road to the proposed central processing plant in the Burdock area will be constructed off Dewey Road in Township 7 South, Range 1 East, Section 10, near the abandoned community of Burdock (see figures in Sections 2.1.1.1.2.4.1 and 2.1.1.1.2.4.2). This access road will join with several preexisting roads that traverse the Burdock area. A main access road to the proposed satellite facility in the Dewey area will be constructed farther to the north, off Dewey Road in Township 6 South, Range 1 East, Section 20 (see figures in Sections 2.1.1.1.2.4.1 and 2.1.1.1.2.4.2). This access road will connect with several preexisting roads that traverse the Dewey area. The preexisting roads within the Burdock and Dewey areas will be used to the fullest extent possible to provide access to the proposed facility structures and wellfields and to limit the construction of new roads. Secondary roads will be constructed to provide access to other proposed facilities (such as header houses) and wellfields not currently accessible by existing roads. The applicant will secure approvals from private landowners and BLM, as well as required county permits, prior to constructing any access roads within the proposed project area (Powertech, 2009a). Construction of access roads within the proposed project area will be kept to a minimum.

2.1.1.1.2.3 Wellfields

The proposed locations of wellfields in the Dewey and Burdock areas are shown in Figure 2.1-6. Exploratory drilling, conducted by the applicant and the Tennessee Valley Authority (TVA), has demonstrated that commercially extractable uranium orebodies at the proposed site are located in sandstones in the Fall River Formation and the Chilson Member of the Lakota Formation that make up the Inyan Kara Group. The uranium mineralization occurs along a large U-shaped trend that is 8 km [5 mi] long and 5 to 6 km [3 to 4 mi] wide (Figure 2.1-6). Mineralized sands within the project area occur at depths of less than 30 m [100 ft] in the outcrop area of the Fall River Formation in the eastern portion of the Burdock area and at depths of up to 244 m [800 ft] in the Chilson Member of the Lakota Formation in the northwestern portion of the Dewey area (Powertech, 2009c, 2011). The geology, hydrology, and characteristics of the uranium mineralization at the Dewey-Burdock site are detailed in SEIS Sections 3.4 and 3.5. The estimated mineable resource within the proposed project area is 5.08 million kg [11.2 million lb] of U_3O_8 with an average grade of 0.198 percent (SRK Consulting, 2012). At an estimated recovery rate of 75 percent, the estimated recoverable uranium is 3.8 million kg [8.4 million lb] U_3O_8.

Extraction is proposed at 10 wellfields in the Burdock area and at 4 wellfields in the Dewey area, as shown in Figure 2.1-6 (Powertech, 2011). The initial Burdock wellfield (B-WF1) will be located over mapped orebodies within the Chilson Member of the Lakota Formation; the initial Dewey wellfield (D-WF1) will be located over mapped orebodies within the Fall River Formation (Powertech, 2011). Wellfield construction will affect an area of 15.9 ha [39.3 ac] in D-WF1 and an area of 7.1 ha [17.6 ac] in B-WF1 (Powertech, 2010c). Prior to finalizing the design of wellfields, the applicant will conduct closely spaced and localized delineation drilling to refine information on the location, grade, thickness, and production capability of the ore. The applicant estimated that 248 delineation holes (77 holes at B-WF1 and 171 holes at D-WF1) will be drilled during the construction phase of the proposed project (Powertech, 2010c). To estimate and manage ore production, geologic and geophysical data from the drill holes will be analyzed to determine the depth of the mineralized zone and confining units, identify and locate potential barriers to groundwater flow caused by clay stringers, and determine the thickness and grade of ore deposits. After field data are collected, delineation drill holes will be plugged and abandoned, according to SDDENR regulations under ARSD 74:11:08 (Powertech, 2009a). The applicant will design the production well spacing and the size and depth of the well screen intervals for each well based on the results of the delineation drilling data. The wellfields will be located over the delineated mineralization zones, to facilitate extraction of 0.45 million kg [1 million lb] of U_3O_8 per year, which is the design capacity of the facilities (Powertech, 2009a).

Two types of wells will be installed as part of the operations at the proposed Dewey-Burdock ISR Project: dual-purpose injection/production wells and monitoring wells. Injection wells will be used to introduce lixiviant into the uranium mineralization; production wells will be used to extract uranium-bearing solutions; and monitoring wells will be used to identify and assess impacts of ongoing operations and detect groundwater excursions.

2.1.1.1.2.3.1 Injection and Production Wells

The applicant plans to construct wellfields consisting of a series of injection and production wells laid out in geometric-shaped patterns across target uranium mineralization zones (Powertech, 2009a). The applicant estimated 100 production wells and 194 injection wells will be installed at

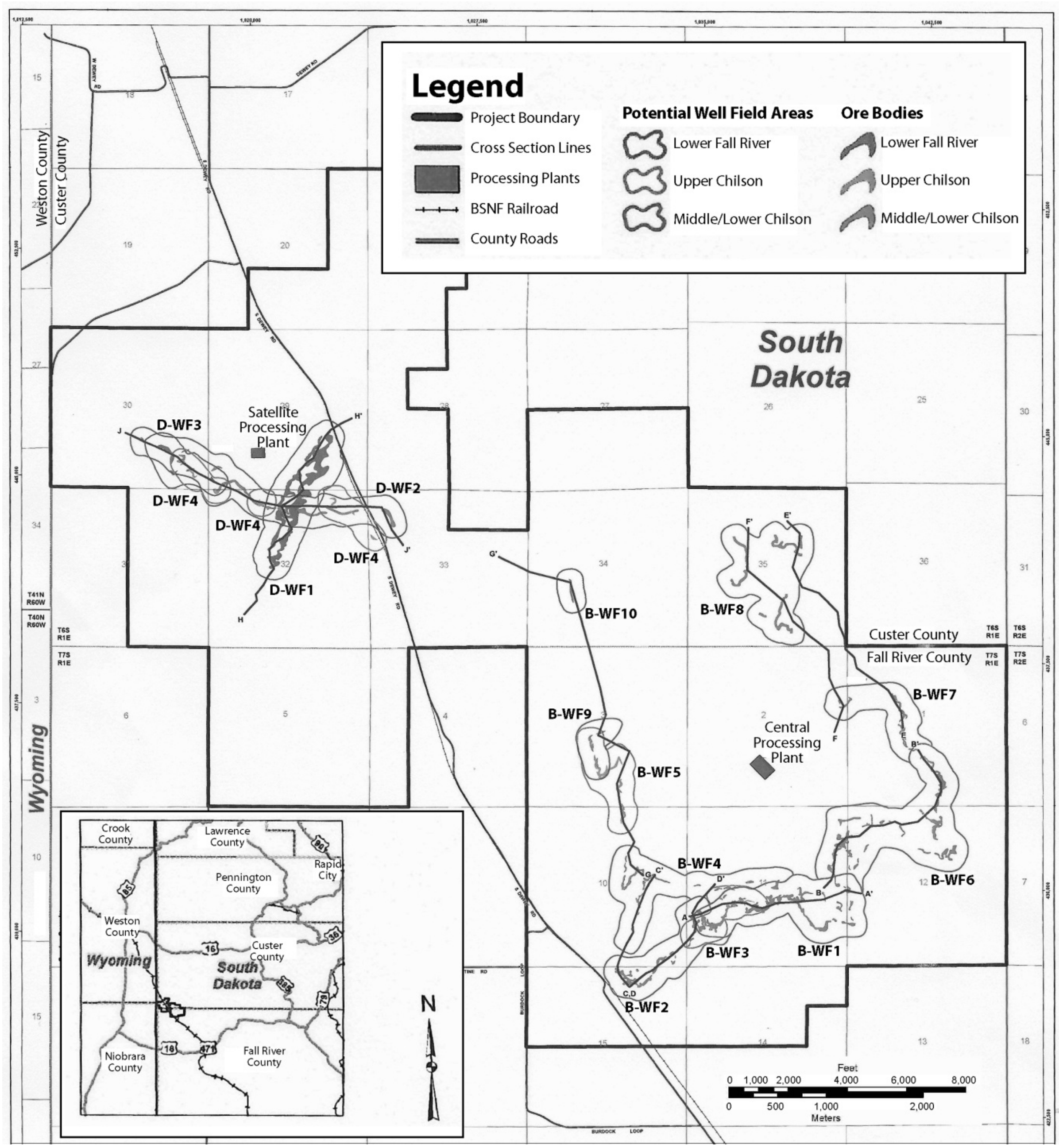


Figure 2.1-6. Map of Dewey-Burdock *In-Situ* Recovery Project Area Showing Locations of the Dewey Satellite Facility, Burdock Central Plant, Mapped Orebodies, and Proposed Wellfields
Source: Modified From Powertech (2011)

the initial wellfields during the construction phase of the proposed project (Powertech, 2010c). The wells will be "cased" by lowering a pipe into the borehole either during or after drilling to prevent the sides of the borehole from caving, prevent loss of drilling fluids into porous formations, and prevent unwanted fluids from entering the borehole. The base of the well casing at all injection and production wells will extend to or below the confining unit overlying the mineralized zone. The screened interval of injection and production wells will be completed only across the targeted ore zone (Figure 2.1-7). Wells will be designed and constructed so they can be used as either injection or production wells. The dual use of wells allows wellfield flow patterns to be changed to improve uranium production at the proposed project. Dual-use wells also result in more effective restoration of groundwater quality during the aquifer restoration phase of the ISR process (see SEIS Section 2.1.1.1.4).

Wellfield patterns and well spacing at the proposed Dewey-Burdock ISR Project site may vary at each wellfield due to variations in the lateral distribution and ore grade within the mineralized zone (Powertech, 2009a). The applicant plans to utilize a five-spot square pattern where injection wells will be at the corners of a 30-m [100-ft] wide square and a production well will be placed in the center of the square (Figure 2.1-8). Rectangular, hexagonal, or triangular configurations may be used depending on the geometry and characteristics of the orebody as it is mapped during delineation drilling and prior to final wellfield design.

The applicant may elect to space the injection wells as close as 15 m [50 ft] apart for efficient uranium recovery based on the results of delineation drilling, thus increasing the overall number of wells needed for this process (Powertech, 2009c).

Production and injection wells will be connected to manifolds in a wellfield header house; header houses distribute injection fluid to injection wells and collect production solution from recovery wells. The header house will include manifolds, valves, flow meters, pressure meters, and booster pumps. Oxygen will be incorporated into the lixiviant at the header house before it is injected into the production formation. Typically, one header house will serve up to

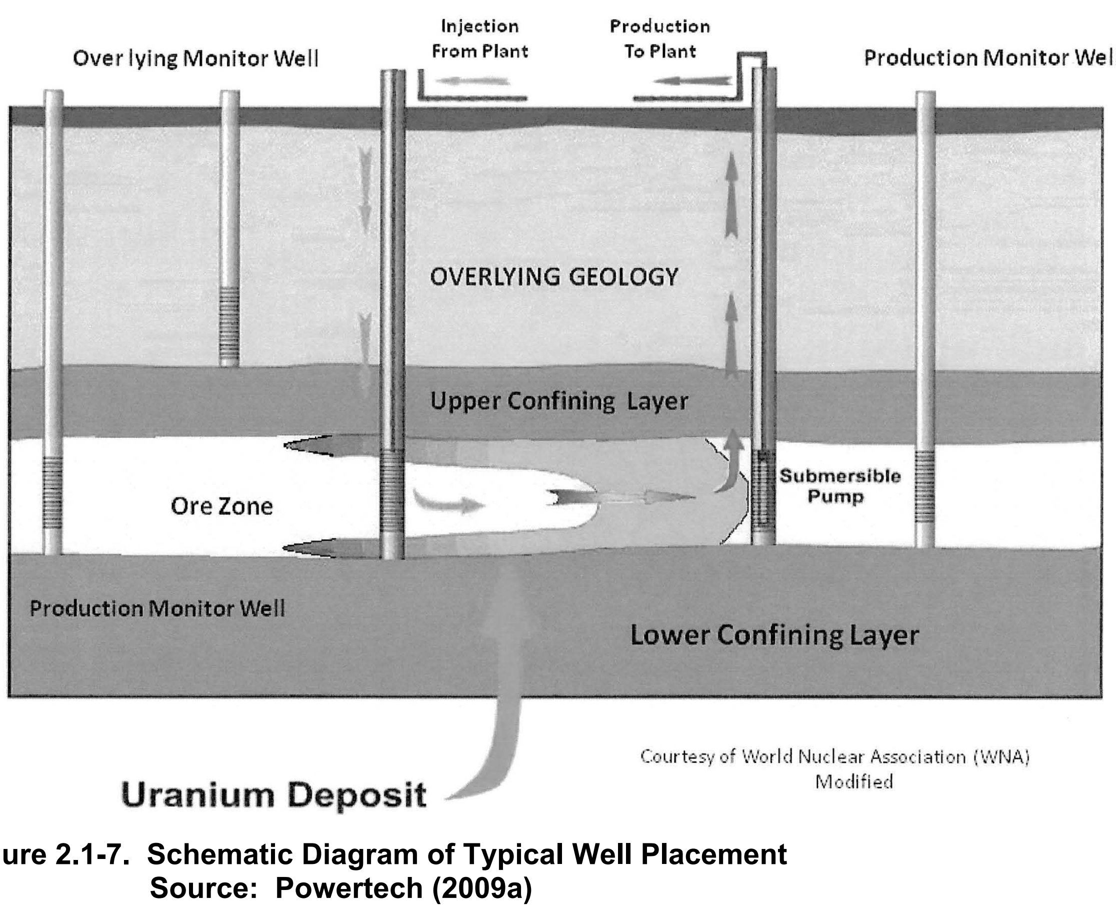


Figure 2.1-7. Schematic Diagram of Typical Well Placement
Source: Powertech (2009a)

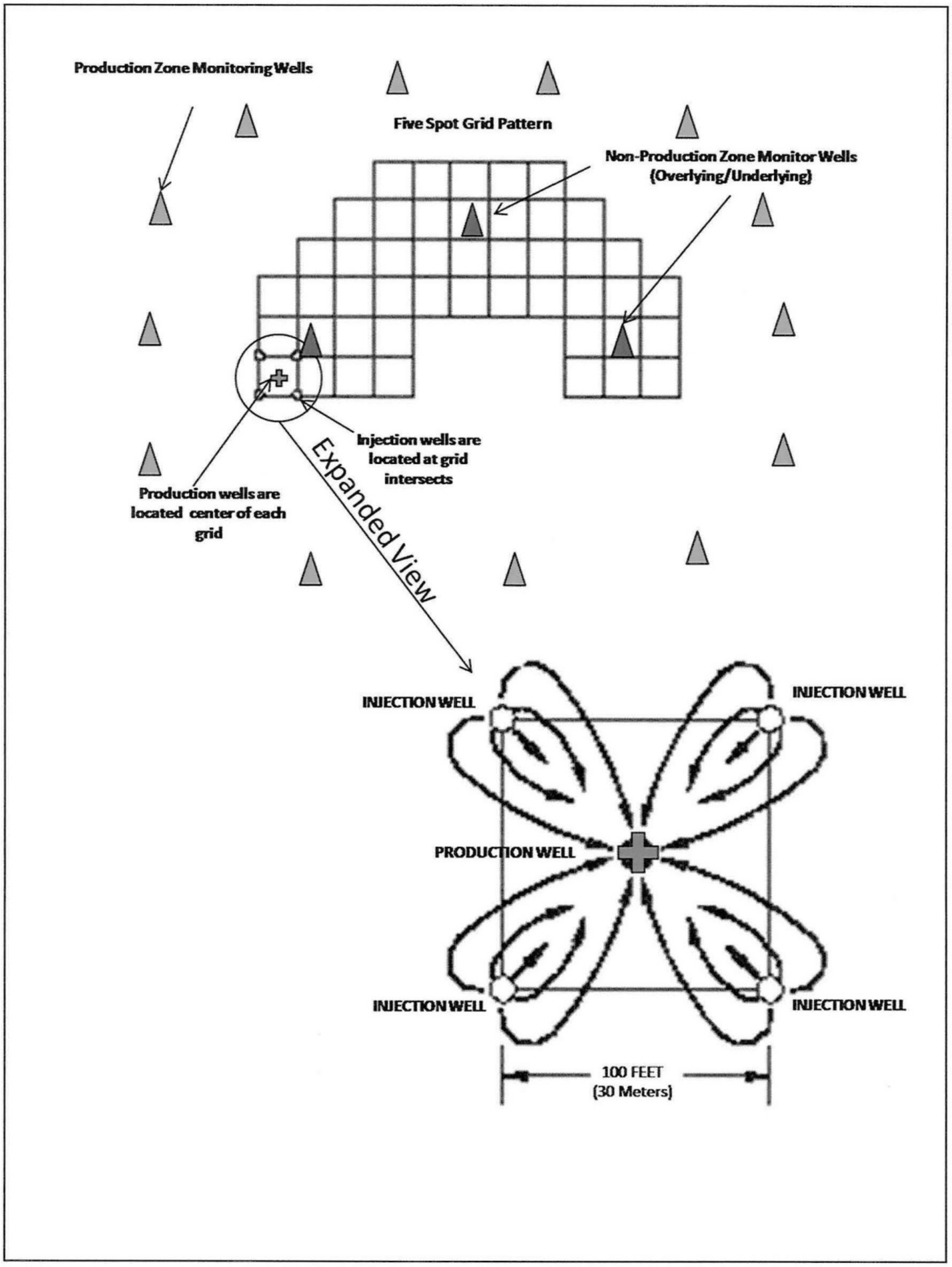


Figure 2.1-8. Schematic Diagram of Typical Five-Spot Wellfield Pattern
Source: Modified From Powertech (2009a)

20 production wells and 80 injection wells. Additional header houses will be constructed as the wellfield expands (Powertech, 2009a).

The applicant estimates that, at full production, wellfields in the proposed Dewey and Burdock areas will operate at an average production flow rate of 15,140 Lpm [4,000 gpm] (Powertech, 2011). The typical production flow rate will be approximately 9,084 Lpm [2,400 gpm] from the Burdock wellfields and approximately 6,056 Lpm [1,600 gpm] from the Dewey wellfields (Powertech, 2011). To create an overall hydraulic cone of depression, more water will be withdrawn than injected into each wellfield. Under this pressure gradient, the groundwater movement will flow toward the center of the production zone and control the movement of production solution. The difference between the amount of water withdrawn and injected is referred to as the wellfield "bleed." The applicant's projected production bleed for the proposed Dewey-Burdock ISR Project will be approximately 0.875 percent of the total production flow rate, or approximately 79.5 Lpm [21 gpm] at the Burdock wellfields and approximately 53 Lpm [14 gpm] at the Dewey wellfields (Powertech, 2011). The bleed rate will be adjusted, as necessary, during production to maintain the wellfield cone of depression.

An EPA-administered underground injection control (UIC) program regulates the design, construction, testing, operation, and closure of injection wells. Injection wells for uranium extraction are classified under UIC as Class III wells; these wells are located in the aquifer(s) containing the uranium that will be recovered. The proposed operation requires the applicant to obtain a UIC permit from EPA to use Class III injection wells. Before ISR operations begin, the portion of the aquifer(s) designated for uranium recovery must be exempted from the underground source of drinking water (USDW) designation, in accordance with the Safe Drinking Water Act (SDWA) and pursuant to 40 CFR Part 146. A USDW is defined as an aquifer or its portion that (1)(i) supplies any public water system or (ii) that contains a sufficient quantity of groundwater to supply a public water system, and (a) currently supplies drinking water for human consumption or (b) contains fewer than 10,000 mg/L (10,000 ppm) total dissolved solids; and that (2) is not an exempted aquifer. An aquifer or aquifer portion that meets the criteria for a USDW may be determined to be an "exempted aquifer" if (i)(a) it does not currently serve as a source of drinking water and (b) it cannot now and will not in the future serve as a source of drinking water because it is mineral, hydrocarbon, or geothermal energy producing, or (ii) can be demonstrated by a permit applicant as part of a permit application for a Class III operation to contain minerals that, considering their quantity and location, are expected to be commercially producible. The applicant, therefore, must obtain an aquifer exemption from EPA before initiating ISR operations.

The EPA Underground Injection Control (UIC) Program is responsible for regulating construction, operation, permitting, and closure of injection wells that place fluids underground. The types of injection wells regulated by the EPA UIC Program are defined below:

Class I (Industrial and Municipal Waste Disposal Wells) are used to inject hazardous and nonhazardous wastes into deep, isolated rock formations that are thousands of meters [feet] below the lowermost USDW.

Class II (Oil- and Gas-Related Injection Wells) are used to inject fluids associated with oil and natural gas production.

Class III (Mining Wells) are used to inject fluids to dissolve and extract minerals such as uranium, salt, copper, and sulfur.

Class IV (Shallow Hazardous and Radioactive Injection Wells) are shallow wells used to inject hazardous and nonhazardous or radioactive wastes into or above a geologic formation that contains a USDW.

Class V wells are used to inject nonhazardous fluids underground. Most are used to dispose of wastes into or above USDWs.

Class VI (CO_2 Geosequestration Wells) are deep wells used to inject carbon dioxide into deep geologic formations for long- term storage.

Once exempted, the defined aquifer(s) or its portion will no longer be protected as a USDW under SDWA. For example, at the proposed Dewey-Burdock ISR Project, portions of the Fall River and Chilson aquifers could potentially be exempted in defined areas related to commercial mineral production uranium recovery operations. The remaining portion of the Fall River and Chilson aquifers, beyond the designated exempted area, will still be considered a USDW and continue to be protected under the SDWA.

2.1.1.1.2.3.2 Monitoring Wells

The applicant has proposed installing production zone monitoring wells at the periphery of each production area (Figure 2.1-8). This perimeter monitoring well "ring" will be utilized for early detection of horizontal excursions from within the sand unit or aquifer where production is occurring. An excursion at a monitoring well is declared when the concentrations of certain indicator parameters exceed upper control limits established by the license and verified by NRC and EPA or the state. The purpose of the monitoring well ring is to ensure that groundwater quality in aquifers outside exempted zones is not impacted by ISR operations.

In some areas of the proposed Dewey-Burdock ISR Project site, multiple orebodies are vertically stacked within the Fall River Formation or the Chilson Member of the Lakota Formation with no substantial confining layers between the orebodies. In these areas, the perimeter production zone monitor wells will be screened across the full thickness of the stacked orebodies and the orebodies treated as a single production zone (Powertech, 2011). In other areas of the project site, stacked orebodies within the Fall River and Chilson Member are separated by low permeability units that may act as localized confining units (Powertech, 2011). If delineation drilling and pump testing demonstrate that localized confining units provide hydraulic separation between orebodies within one of the primary production units (e.g., the Fall River or Chilson), then monitor wells could be located and screened only within the portion of the unit in which the orebody is located (Powertech, 2011).

Production zone monitor wells will be located at a maximum of 122 m [400 ft] from the production area (Powertech, 2009a, 2009c, 2011). The spacing between monitor wells will also be 122 m [400 ft] (Powertech, 2009a). To support the proposed spacing of monitor wells, the applicant conducted numerical simulations using site-specific hydrogeologic data and proposed production flow rates to evaluate groundwater conditions related to ISR at the proposed Dewey-Burdock ISR Project (Powertech, 2011). Results of the simulations indicated that the proposed maximum monitor well spacing of 122 m [400 ft] will be adequate to detect a potential excursion (Powertech, 2011).

Production zone monitoring wells will be installed before production activities begin; required groundwater sampling and hydrologic tests will be conducted on samples taken from the monitoring wells. The applicant estimates that approximately 100 monitoring wells will be installed in the initial wellfields during the construction phase of the proposed project (Powertech, 2010c).

The applicant plans to design and install two types of nonproduction zone monitoring wells; these wells are labeled "overlying" and "underlying." Placement of overlying and underlying monitor wells is designed to correspond to the site-specific lithology and the hydrologic characteristics within the production zone(s) of each wellfield. The screened intervals of overlying wells will be located in the sand unit or aquifer immediately above the ore-bearing sandstone (Figure 2.1-7). The overlying nonproduction monitoring wells are designed to monitor any upward movement of leach fluids away from the production zone and identify leakage from production and injection well casings before fluids could enter the overlying aquifer. In the sand unit or aquifer immediately above the ore-bearing sandstone, overlying nonproduction zone monitoring wells will be evenly distributed with a minimum placement of one well for every 1.6 ha [4 ac] of production area in accordance with guidance in NUREG–1569 (NRC, 2003a). When additional aquifers exist above the first sand unit or aquifer above the ore-bearing sandstone, additional monitoring wells will be located in these aquifers, with a minimum placement of one well for every 3.2 ha [8 ac] of production area in accordance with guidance in NUREG–1569 (Powertech, 2011, Figure TR RAI 5.7.8-12-2).

The applicant will complete underlying nonproduction monitor wells in the first sand unit or aquifer underlying the ore-bearing sandstone. Where the production zone in the Chilson Member of the Lakota Formation is bounded below by the Morrison Formation, no underlying nonproduction monitor wells will be installed. In this case, the thickness {approximately 30 m [100 ft]} and relatively impermeable nature of the Morrison Formation minimize concerns about vertical excursion of lixiviant (Powertech, 2011). The underlying nonproduction monitoring wells are designed to monitor any downward movement of leach fluids from the production zone and to identify leakage from production and injection well casings before fluids could enter the underlying aquifer. Underlying nonproduction monitoring wells will be evenly distributed through the production area with a minimum placement of one well for every 1.6 ha [4 ac] of production area (Powertech, 2009a, 2011).

The production zone monitor ring and overlying and underlying monitor wells will be designed for each wellfield based on (i) production and injection well locations and (ii) site-specific lithologic and hydrologic characteristics of production zones and overlying and underlying hydrogeologic units gathered during delineation drilling. The location and/or number of monitoring wells will be determined after pump testing is complete to demonstrate that monitoring wells are hydrologically connected to injection and production wells (see following section). The applicant must present each monitoring well program to EPA for administrative approval before installing proposed wells. In addition, wells completed in overlying and underlying aquifers are subject to sampling procedures, remedial actions, and reporting requirements prescribed in NRC and EPA rules and regulations. (Powertech, 2009b)

2.1.1.1.2.3.3 Pumping Tests

Prior to operation of each wellfield, the applicant will design and implement pumping tests to establish that the production and injection wells are hydraulically connected to the perimeter production zone monitor wells and hydraulically isolated from nonproduction zone monitor wells in underlying and overlying sand units (Powertech, 2011). The pumping test system for each wellfield will include production zone pumping wells and monitor wells. Monitor wells will include (i) perimeter production zone monitor wells; (ii) monitor wells within the production zone (used for background characterization and later converted to production wells) at a minimum density of one per 1.6 ha [4 ac]; (iii) monitor wells in the immediately overlying and underlying nonproduction zone sand unit at a minimum density of one per 1.6 ha [4 ac]; (iv) monitor wells in the subsequently overlying nonproduction sand unit at a minimum density of one per 3.2 ha [8 ac]; and (v) monitor wells in alluvium, if present, at a minimum density of one per 3.2 ha [8 ac] (Powertech, 2011). As described in SEIS Section 2.1.1.1.2.3, delineation drilling data will provide detailed lithologic information to map production zones targeted for ISR operations and define the overlying and underlying sand units and confining layers to be monitored. The delineation drilling data will be used to determine the location and screened intervals of pumping and monitor wells for each wellfield during pumping tests.

The pumping test data will be used to evaluate and confirm hydraulic connection between the production zone and perimeter production zone monitor wells and hydraulic isolation (i.e., confinement) between the production zone and overlying and underlying sand units. In addition, the pumping test data will be used to demonstrate that solutions can be controlled with typical wellfield bleed rates and to detect and identify leakage due to anomalies such as improperly plugged wells and exploration boreholes (Powertech, 2011).

2.1.1.1.2.3.4 Wellfield Hydrogeologic Data Packages

The applicant's delineation drilling results and pumping test data will be included in wellfield hydrogeologic data packages, which will be submitted for review and evaluation to the Safety and Environmental Review Panel (SERP), which is established by NRC requirements (Powertech, 2011). The wellfield hydrogeologic data package will describe the wellfield, including (i) production and injection well patterns and location of monitor wells; (ii) documentation of wellfield geology (e.g., geologic cross sections and isopach maps of production zone sand and overlying and underlying confining units); (iii) pumping test results; (iv) sufficient information to demonstrate that perimeter production zone monitor wells adequately communicate with the production zone; and (v) data and statistical methods used to compute Commission-approved background water quality (Powertech, 2011).

The SERP will review the wellfield hydrogeologic test results and documentation to determine whether monitoring wells are hydrologically connected to the injection and production wells. The wellfield hydrogeologic data package and written SERP evaluation will be maintained on site and be available for NRC review. By license condition, all wellfield hydrogeologic data packages must be submitted to NRC for review prior to operating each wellfield (NRC, 2013b). The hydrogeologic test packages for the initial Burdock and Dewey area wellfields (i.e., B-WF1 and D-WF1) will be submitted to NRC for review and written verification. In addition, wellfields in the partially saturated portion of the Dewey-Burdock Project area, specifically wellfields B-WF6, B-WF7, and B-WF8 (see Figure 2.1-6), will be prohibited from operating until NRC staff have reviewed and approved the hydrogeologic data packages for those wellfields (NRC, 2013b).

2.1.1.1.2.3.5 Well Construction, Development, and Testing

The applicant intends to use standard mud rotary drilling techniques and equipment to construct production, injection, and monitor wells. Wells will be drilled to the bottom of the target completion interval with a small rotary drilling unit, using bentonite or polymer drilling mud with pH adjusted water and mixed to control viscosity (Powertech, 2008). A temporary mud pit, to contain the drilling mud, will be excavated adjacent to the drill site. During excavation of mud pits, topsoil will be separated from the subsoil with a backhoe. The subsoil will be deposited next to the mud pit, and the topsoil will be stored at a separate location until the well site is restored. Residual cuttings and drilling fluids are typically held in the mud pit after drilling and construction activities are completed (NRC, 2009a). Depending on state and local regulations, such mud pits are backfilled and graded or are alternatively emptied and cleaned, and residual solids and liquids transported and disposed of offsite (NRC, 2006). State of South Dakota rules governing disposal of drill cuttings are stipulated in ARSD 74:29:11:15. After well drilling is completed at the proposed project, the applicant proposes to redeposit the excavated subsoil in the mud pit followed by topsoil application and grading, usually within 30 days of the initial excavation of the mud pit (Powertech, 2009a).

All production, injection, and monitoring wells will be cased and cemented to prevent fluids migrating into or between USDWs in accordance with EPA requirements in 40 CFR 146.32. A schematic for a completed well is shown in Figure 2.1-9. Before an injection, production, or monitoring well enters service, the applicant proposes to perform mechanical integrity tests (MITs) using pressure-packer tests (Powertech, 2009a). The mechanical integrity of wells is tested to verify that the well casing will not fail, which could cause water loss and fluid migration across confining units during injection, recovery, and monitoring operations (NRC, 2009a).

MITs are performed by sealing a casing bottom with a plug, a downhole packer, or other suitable sealing device. The casing is then filled with water, and the top of the casing is sealed with a threaded cap or mechanical seal. The well casing is then pressurized with water and air, and a calibrated pressure gauge monitors the mechanical integrity of the well casing. Internal casing pressure is increased to 125 percent of the maximum operating pressure of the well, 125 percent of the maximum operating pressure rating of the well casing, or 90 percent of the formation fracture pressure, whichever is less (Powertech, 2009a). If obvious leaks are present or the pressure drops by more than 10 percent during a 10-minute period, the seals and fittings on the packer system must be checked and reset and another test is conducted. A well casing that maintains a high level of pressure demonstrates acceptable mechanical integrity, and the well will be qualified for service at the facility.

To ensure the continued integrity of the wellfields, the applicant will test the mechanical integrity of all active wells at least once every 5 years or after any rework that may need to be performed on the well. The applicant will document the details of the MITs (specifically, the well designation, date of test, test duration, and beginning and ending pressures), and the individual conducting the test will sign the test report. MIT results will be maintained onsite and will be available for NRC inspection. MIT results will also be reported quarterly to EPA, in accordance with the EPA UIC regulations in 40 CFR 146.33.

In addition to conducting pressure tests on new wells to establish mechanical integrity, the applicant will conduct an MIT following any repair to a well that involves the use of a downhole tool or underreaming tool (Powertech, 2009a). Downhole and underreaming tools will be used to repair or replace the well casing, screen assembly, or the gravel/sand pack. A well that shows evidence of subsurface damage will be subjected to an MIT before being returned to service. If, following repair, a well does not demonstrate acceptable MIT mechanical integrity, the well will be plugged and abandoned. The applicant must plug wells in accordance with EPA regulations and SDDENR requirements under ARSD 74:02:04 (Powertech, 2012c). The applicant’s commitment to MIT procedures and frequencies, as described previously, is included as a standard license condition for the proposed action (NRC, 2013b).

2.1.1.1.2.3.6 Pipelines

As part of the underground infrastructure at ISR facilities, a network of process pipelines and cables are typically installed connecting (i) the central uranium processing facility or the satellite facility and the header houses for transferring lixiviant; (ii) the header houses and wellfields for injecting and recovering lixiviant; and (iii) the central plant and wastewater disposal facilities (e.g., deep injection wells or land application areas) (NRC, 2009a). The piping and metering system for production and injection solutions at the proposed Dewey-Burdock ISR Project will require buried trunk lines to connect the Dewey satellite facility and its related operating wellfield areas and the Burdock central processing plant and its related wellfields to the

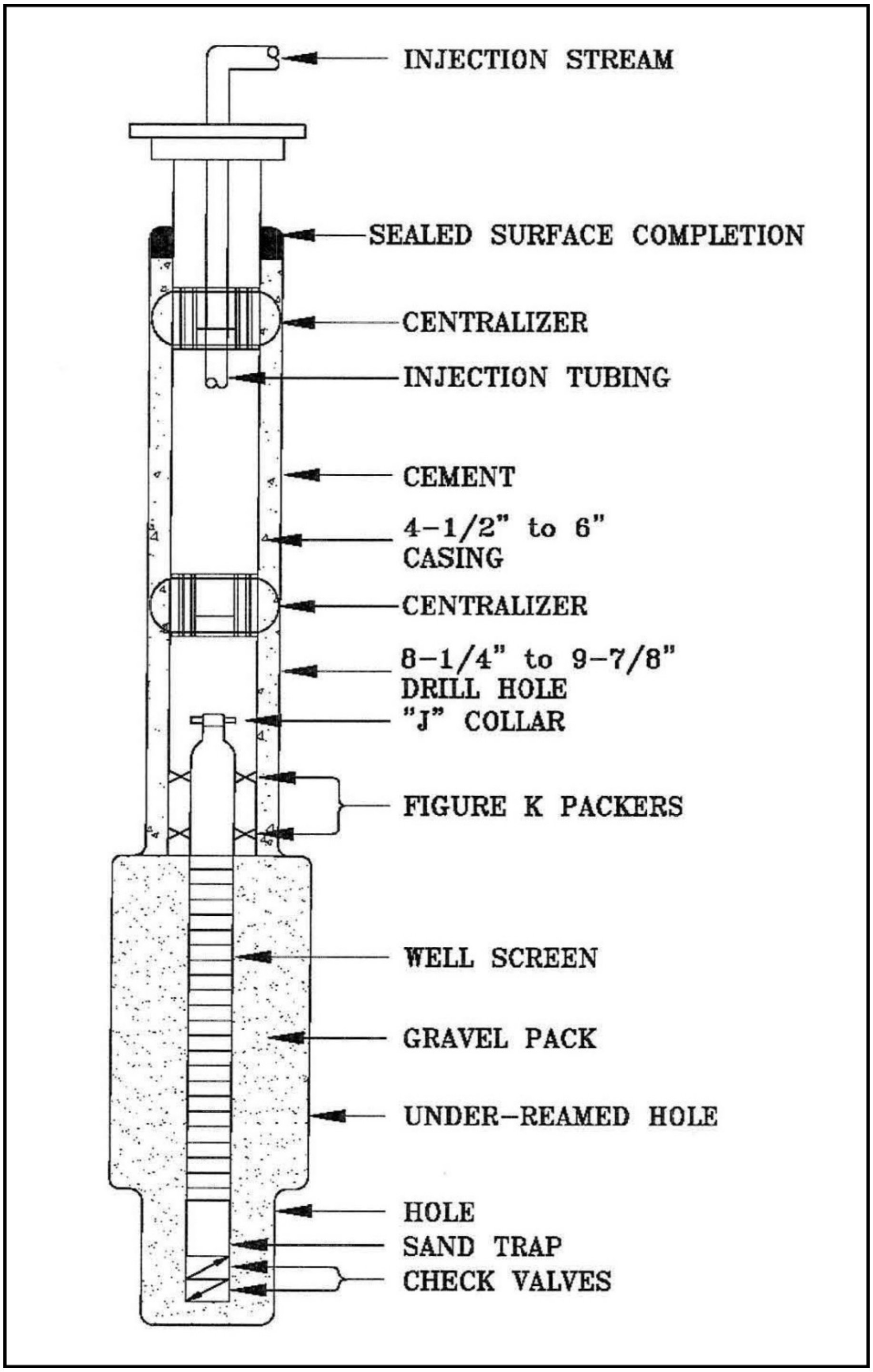


Figure 2.1-9. Schematic of Typical Injection Well Construction (the Design of a Typical Production and Monitor Well Will Be Identical Except for the Addition of a Submersible Pump in the Production Well) Source: Powertech (2009a)

metering and flow distribution headers inside the header houses. Piping will also be installed to transport liquid waste streams from the Burdock central processing plant and Dewey satellite facility to their respective wastewater disposal facilities (i.e., deep injection wells and/or land application areas).

The applicant proposes to install up to eight underground pipelines between the Burdock central processing plant and the Dewey satellite facility to transport various fluids used during ISR operations (Powertech, 2011). Conduits for electronic communication and control purposes will also be installed between the central plant and satellite facility. The plant-to-plant pipelines will transport fluids including but not limited to (i) barren and pregnant lixiviant, (ii) restoration water, (iii) reverse osmosis reject brines, (iv) wastewater from well drilling and maintenance operations, and (v) supply water from the Madison Formation or other aquifers.

High density polyethylene (HDPE) pipe with heat-welded joints is used to connect the wells, header houses, and processing facilities; the piping is buried approximately 1.5 m [5 ft] below grade to prevent freezing (Powertech, 2009b). Trenches containing pipelines are typically backfilled with native soil and graded to surrounding ground topography (Powertech, 2009b). The same procedure used in mud pit excavation during well construction will be used to preserve topsoil; topsoil is stored separately from subsoil and replaced on the subsoil after the pipeline ditch is backfilled.

HDPE piping to be used at the proposed project is designed to withstand operating pressures of 1135–2169 kPa {150–300 pounds per square inch [psig]}, although the applicant expects actual operating pressures to be less than 790 kPa [100 psig] (Powertech, 2009b). At the header house, the piping will be connected to manifolds equipped with control valves, flow meters, check valves, pressure sensors, oxygen and carbon dioxide feed systems (injection only), and programmable logic controllers. Sensors will measure and record pipeline pressures to monitor for potential leaks and spills resulting from failure of fittings and valves. Electrical power to the header houses will be delivered by overhead power lines and buried cable. Electrical power to individual wells will be delivered by buried cable from the header house. As the wellfield expands, additional header houses will be constructed and connected to one another via buried header piping. The header piping is designed to accommodate injection and production flow rates of 7,570 Lpm [2,000 gpm] and operating pressures of 1135–2169 kPa [150–300 psig]. The only exposed pipes at the proposed project site will be at the central plant, satellite facility, wellheads, and wellfield header houses.

2.1.1.1.2.3.7 Power Lines

The applicant plans to use existing power line corridors wherever possible when constructing new power lines. However, a new power line corridor will be constructed alongside Dewey Road between the Dewey and Burdock areas to connect the Dewey satellite facility and the Burdock central processing plant. This proposed corridor will be approximately 9 m [30 feet] in width; the poles will be approximately 0.3 m [1.0 ft] in diameter and will be placed every 30–91 m [100–300 ft]. No access roads will be built during construction of the power lines and minimal disturbance to the ground surface is anticipated.

2.1.1.1.2.4 Liquid Waste Disposal Systems

The applicant plans to dispose of liquid wastes generated during uranium recovery operations through deep injection wells, land application, or a combination of both methods.

Project-generated liquid wastes will include bleed water from the production wells, groundwater generated during aquifer restoration, process solutions (e.g., resin transfer water and brine generated from the elution and precipitation circuits), affected well development water, laboratory wastewater, laundry water, and plant washdown water. The applicant's preferred option for disposal is deep injection using Class V wells (Powertech, 2009c, 2011). Liquid waste injected into potential Class V injection wells at the proposed Dewey-Burdock ISR Project site must not be hazardous or radioactive, as defined at 40 CFR 144.3. SDDENR regulates land application under a Groundwater Discharge Plan (GDP). SDDENR will permit land application only if the applicant demonstrates insufficient Class V disposal capacity. If a permit is granted, it would limit wastes discharged through the land application system to those wastewaters that Powertech identified in their GDP (SDDENR, 2013a). Additionally, the use of small, onsite wastewater systems (e.g., a septic field) must be approved by SDDENR. Details about the permitting process and applicable requirements for the deep Class V injection well and land application disposal options are presented in SEIS Section 2.1.1.1.6.2.

2.1.1.1.2.4.1 Deep Class V Injection Well Option

The applicant proposes to inject up to 1,135 Lpm [300 gpm] of liquid waste into the Minnelusa and/or Deadwood Formations using a maximum of eight deep Class V injection wells (Powertech, 2011). The proposed locations of the first four Class V injection wells (two near the Burdock central plant and two near the Dewey satellite facility) are shown in Figure 2.1-10.

Deep injection well design and construction must meet EPA requirements (Powertech, 2009c). The proposed deep injection well disposal design is shown in Figure 2.1-11; in this design a cemented steel casing extends from the base of the well to the surface, an internal tubing string is fit with the casing, and a packer seals the casing, just above the point of injection. Fluid is injected through the tubing and through the packer and exits into the injection zone by perforations in the casing (see Figure 2.1-11). Pressure on the fluid-filled annulus between the tubing and well casing must be continuously maintained and monitored to detect leakage of the injection tubing or well casing. The constant pressure on the annulus will be maintained at a minimum of 100 psi above the injection tubing pressure to prevent injected waste fluid from migrating into overlying formations. Operational procedures include MIT of the casing to ensure against well leakage and reporting of MIT test results to EPA as described in SEIS Section 2.1.1.1.2.3.5. The applicant's Class V injection well monitoring program is described in detail in SEIS Section 7.6.

The Class V injection well disposal option requires surface impoundments or ponds for storage and settling of radium before injection into deep disposal wells (Powertech, 2009c, 2011). As described in SEIS Section 2.1.1.2.1, these ponds are designed following NRC requirements (NRC, 2003a, 2008; 10 CFR Part 40, Appendix A, Criterion 5). Deep injection well pond design for the proposed project will include the following:

- Two 0.93-ha [2.3-ac] radium settling ponds, one each in the Dewey and Burdock areas, each with a storage capacity of 1.96 ha-m [15.9 ac-ft]. These ponds will contain production bleed and restoration water and allow radium to settle out of solution.
- Two 0.4-ha [1.0-ac] outlet ponds, one each in the Dewey and Burdock areas, each with a storage capacity of 0.63 ha-m [5.1 ac-ft]. These ponds will intercept treated water from the radium settling ponds and store stormwater falling on the radium settling ponds.

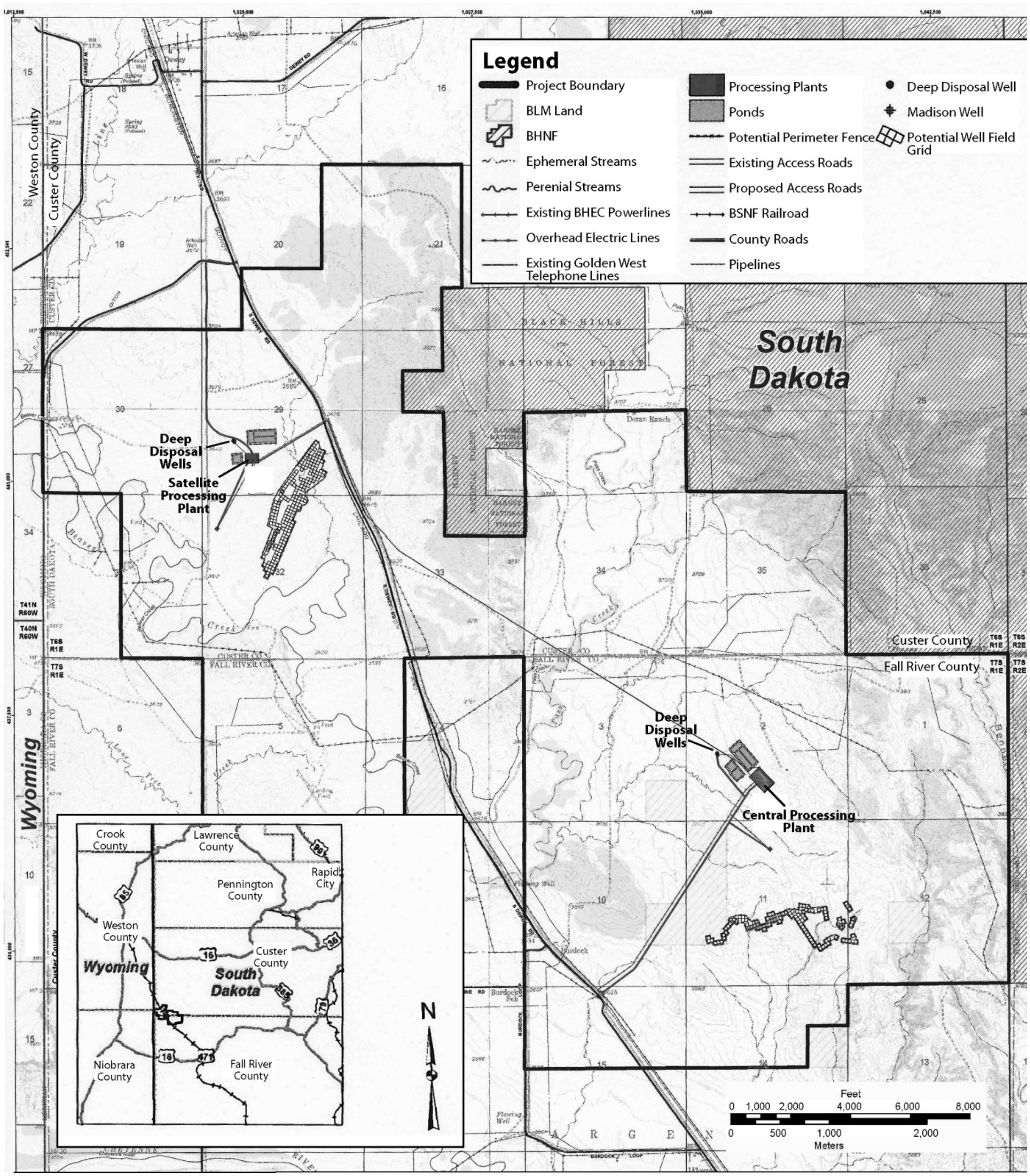


Figure 2.1-10. Location of Deep Injection Wells and Ponds for the Deep Injection Well Disposal Option
Source: Modified From Powertech (2011)

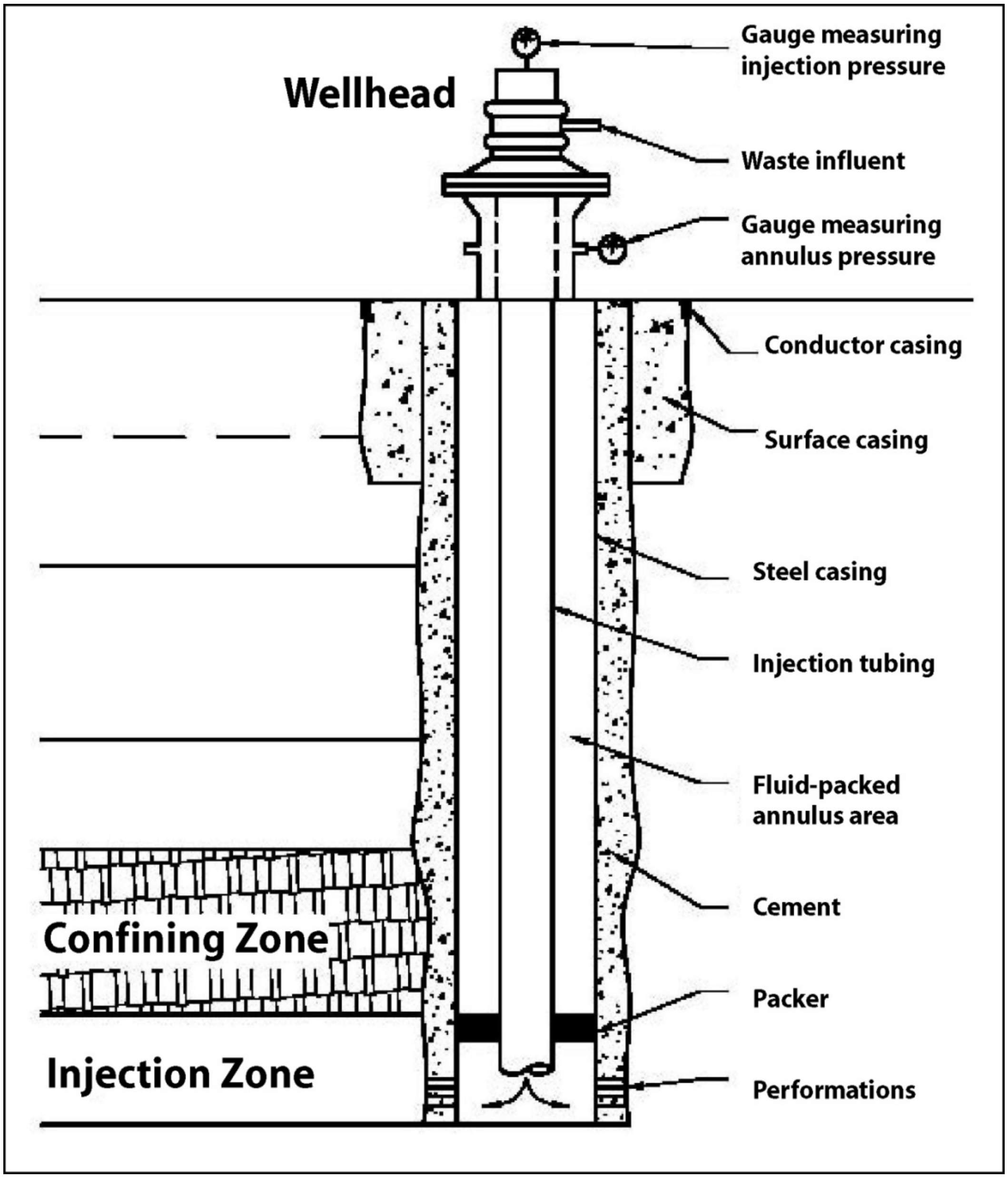


Figure 2.1-11. Schematic of the Design of Deep Injection Well
Source: Powertech (2009c)

- Two 0.45-ha [1.1-ac] surge ponds, one each in the Dewey and Burdock areas, each with a storage capacity of 1.04 ha-m [8.4 ac-ft]. These ponds will contain treated water that is pumped to the disposal wells.

- A 0.61-ha [1.5-ac] central plant pond in the Burdock area with a capacity of 1.96 ha-m [15.9 ac-ft]. This pond will contain brine produced at the Burdock central plant.

- Two 0.93-ha [2.3-ac] spare ponds, one each in the Dewey and Burdock areas, each having a capacity of 1.96 ha-m [15.9 ac-ft]. These ponds will be used for emergency containment should a pond liner fail.

Under these design conditions, ponds for Class V injection well disposal will occupy a total of 2.75 ha [6.8 ac] in the Dewey area and a total of 3.36 ha [8.3 ac] in the Burdock area (Powertech, 2010a). Siting and design of retention ponds at ISR facilities should also consider the requirements of EPA's national emission regulations under 40 CFR Part 61, Subpart W (NRC, 2008). Based on the design for the Class V injection well disposal option, the applicant may need to acquire an approval from EPA prior to commencing operations in any wellfield to ensure compliance with 40 CFR Part 61, Subpart W (NRC, 2013b).

All ponds will be designed to store the amount of water discharged to them while maintaining 0.9 m [3 ft] of freeboard (i.e., distance from the water level to the top of the embankment). Control structures, such as collector ditches and berms, will be used to prevent surface runoff for events up to and including a 100-year, 24-hour rainfall event from entering the ponds (Powertech, 2011). The radium settling, spare, and central plant ponds will be constructed with a lining system consisting of the following: (i) an 80-mil HDPE primary liner; (ii) a 60-mil HDPE secondary liner; (iii) a 0.3-m [1-ft]-thick clay liner below the secondary liner; (iv) a geonet drainage layer sandwiched between the primary and secondary HDPE liners; and (v) a leak detection sump and access port system (Powertech, 2009c). All other ponds will contain treated water for deep Class V well injection. These ponds will include a single 40-mil HDPE liner underlain by a 0.3-m [1-ft]-thick clay liner. NRC reviewed the pond design and determined the design meets the criteria in 10 CFR Part 40, Appendix A and conforms to the generally applicable standards in 40 CFR Part 192, Subpart D, for example, requiring double liners for ponds utilized for recovery operations. All ponds will be fenced to restrict and control access.

An inspection program for all ponds will be implemented in accordance with Regulatory Guide 3.11 (NRC, 2008). Inspections will include (i) daily inspections of the liner, liner slopes, and other earthwork features; (ii) daily inspections of pond freeboard; (iii) monthly inspections of leak detection systems or daily checks for water accumulation in leak detection systems; and (iv) quarterly inspections of embankment settlement and slope stability (Powertech, 2011). If inspections reveal damage or defects that could result in leakage, this information will be reported to NRC within 24 hours, and appropriate repairs will be implemented. Significant water found in the standpipes of the leak detection system will be sampled immediately for chloride and conductivity to determine whether the water in the detection system is from the pond. If analysis confirms a leak, a second sample will be collected and analyzed within 24 hours. If the second analysis confirms a leak, the pond will be taken out of service and the leak reported to NRC within 24 hours. SDDENR must be also notified of any pond leakage or releases within 24 hours, in accordance with ARSD 74:34:01:04. The pond taken out of service because of a leak will be drained by transferring its contents to a spare pond until repaired.

2.1.1.1.2.4.2 Land Application Option

For the land application option, liquid waste will be treated in lined settling ponds followed by seasonal application of the treated waste through center pivot irrigation sprinklers (Powertech, 2009c, 2011). The applicant will treat all land application water to meet the requirements of 10 CFR Part 20, Appendix B, Table 2, Column 2, which are the established limits for discharge of radionuclides to the environment and include limits for natural uranium, Ra-226, Pb-210, and Th-230 (Powertech, 2011, 2012a). This will be accomplished by IX for uranium removal followed by radium removal through co-precipitation with barium sulfate in radium settling ponds. It is not anticipated that Th-230 and Pb-210 will be present at concentrations above the limits (Powertech, 2012a). SDDENR is also proposing effluent water quality limits as part of the GDP (SDDENR, 2013a).

Two land application (irrigation) areas, one in the Dewey area and one in the Burdock area, are proposed for the land application option (Figure 2.1-12). The applicant estimates that the maximum area for land application of treated wastewater will be 426 ha [1,052 ac], including all normally operating irrigation pivots, standby irrigation pivots, and areas constructed to contain surface runoff (Powertech, 2010a). The total area under irrigation at any given time in the Dewey area will be 127.5 ha [315 ac] and will consist of five 20.23-ha [50-ac] pivots, two 10.12-ha [25-ac] pivots, and one 6.1-ha [15-ac] pivot (Powertech, 2012a). In addition, two 10.12-ha [25-ac] pivots and one 6.1-ha [15-ac] pivot will be on standby. The total irrigated area at any given time in the Burdock area will also be 127.5 ha [315 ac], but will consist of six 20.23-ha [50-ac] pivots and one 6.1-ha [15-ac] pivot. In addition, two 10.12-ha [25-ac] pivots and one 6.1-ha [15-ac] pivot will be on standby. Runoff from precipitation events or snowmelt on land application areas will be conveyed to catchment areas downgradient of land application areas and allowed to evaporate or infiltrate (Powertech, 2012a).

Potential wellfield areas at the proposed Dewey-Burdock site (see Figure 2.1-6) overlap with portions of proposed land application areas illustrated in Figure 2.1-12 (Powertech, 2011). In the Dewey area, only land application areas designated for standby operation overlap with potential wellfields. Standby land application areas will serve as contingency areas and generally will not be used at the same time as the wellfields (Powertech, 2011). In the Burdock area, there is limited potential overlap between proposed land application areas and proposed wellfields. Overlap in the Burdock area is expected to be limited to areas where perimeter monitor wells are located (Powertech, 2011).

The center pivot irrigation systems will typically operate 24 hours per day during the growing season, which is approximately April through October (Powertech, 2011). SDDENR GDP would restrict land application of liquid wastewater during periods when soils are frozen or snow-covered, rather than specific months of the year (SDDENR, 2013a). The applicant used the SPAW (Soil-Plant-Atmosphere-Water) model to estimate the disposal capacity for the land application option (Powertech, 2011). The model predicted that each land application area will be able to dispose of approximately 1,124 Lpm [297 gpm] from March 29 to May 10; approximately 2,472 Lpm [653 gpm] from May 11 to September 24; and approximately 1,124 Lpm [297 gpm] from September 25 to October 31. The applicant's design average annual application rate (i.e., annual average capacity) is 1,173 Lpm [310 gpm] for each of the proposed land application areas (Powertech, 2012a), or 2,347 Lpm [620 gpm] for the combined (Dewey and Burdock) land application areas. During periods when soils are frozen or snow-covered (most likely from November through March), when land application will not be used, treated liquid waste will be stored temporarily in ponds located near the Burdock central plant and Dewey satellite facility (Powertech, 2011). The available liquid waste storage capacity is far greater than the maximum storage capacity applicant estimated to be required during nonirrigation periods. For example, the SPAW model estimates that approximately 26.6 ha-m [216 ac-ft] of liquid waste storage capacity is needed during winter months, while 62.9 ha-m [510 ac-ft] of storage pond capacity will be available (Powertech, 2011).

In addition to ponds for storage during nonirrigation periods, the land application option requires ponds to allow radium to settle out to levels allowable for land application (Figure 2.1-12). As

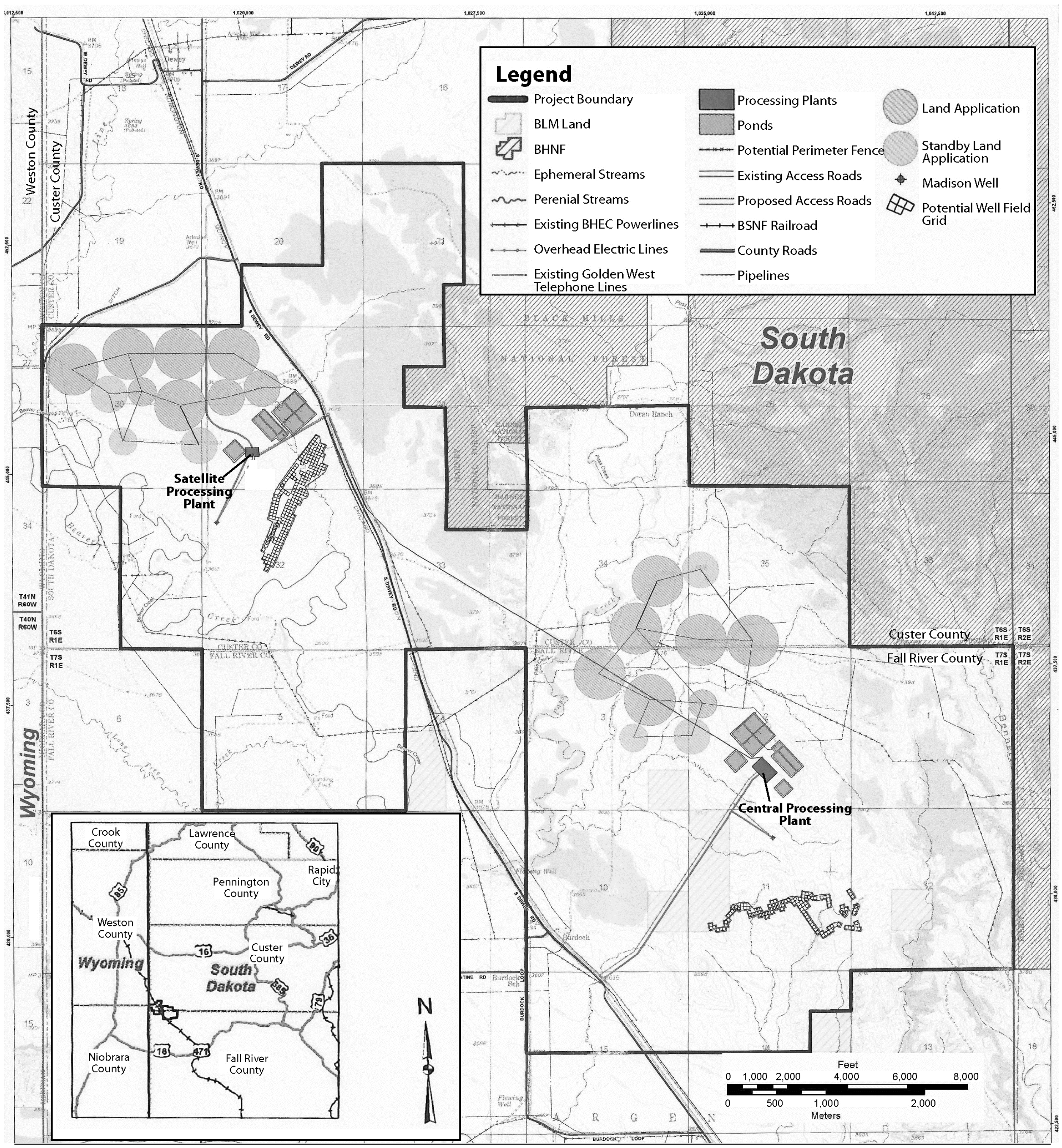


Figure 2.1-12. Location of Land Application Irrigation Areas and Ponds for the Land Application Liquid Waste Disposal Option
Source: Modified from Powertech (2011)

with the Class V injection well disposal option, pond design will comply with NRC requirements (NRC, 2003a, 2008; 10 CFR Part 40, Appendix A, Criterion 5). Land application pond design for the proposed project will include the following (Powertech, 2009c, 2011):

- Two 1.62-ha [4.0-ac] radium settling ponds, one each in the Dewey and Burdock areas, each with a storage capacity of 4.86 ha-m [39.4 ac-ft]. These ponds will contain production bleed and restoration water and settle radium out of solution.

- Two 0.32-ha [0.8-ac] outlet ponds, one each in the Dewey and Burdock areas, each with a storage capacity of 0.60 [4.9 ac ft]. These ponds will intercept treated water from the radium settling ponds and store stormwater falling on the radium settling ponds.

- Two sets of storage ponds will be used to store treated water during the nonirrigation season:

    — A system of four 1.78-ha [4.4-ac] ponds constructed in the Dewey area, each having a capacity of 7.87 ha-m [63.8 ac-ft].

    — A system of four 1.78-ha [4.4-ac] ponds constructed in the Burdock area, each having a capacity of 7.87 ha-m [63.8 ac-ft].

- Two 1.78-ha [4.4-ac] spare storage ponds, one each in the Dewey and Burdock areas, each having a storage capacity of 7.87 ha-m [63.8 ac-ft]. These ponds will be used for emergency containment should any of the storage ponds fail or portions of the land application system become temporarily inoperable.

- A 1.09-ha [2.7-ac] central plant pond in the Burdock area having a capacity of 4.46 ha-m [36.2 ac-ft]. This pond will contain brine produced at the Burdock central plant.

- Two 1.62-ha [4.0-ac] spare ponds, one each in the Dewey and Burdock areas, each having a capacity of 4.86 ha-m [39.4 ac-ft]. These ponds will be used for emergency containment should a liner on the radium settling ponds fail.

Under these design conditions, land application ponds will occupy 12.5 ha [30.8 ac] in the Dewey area and 13.6 ha [33.5 ac] in the Burdock area (Powertech, 2010a). As described previously, siting and design of retention ponds at ISR facilities should also consider the requirements of EPA’s national emission regulations under 40 CFR Part 61, Subpart W (NRC, 2008). Based on the design for the land application option, the applicant may need to acquire approval from EPA prior to commencing operations in any wellfield, to ensure compliance with 40 CFR Part 61, Subpart W (NRC, 2013b).

All ponds will be designed to store the amount of water discharged to them while maintaining 0.9 m [3 ft] of freeboard. Control structures, such as collector ditches and berms, will be used to prevent surface runoff for events up to and including a 100-year, 24-hour rainfall event from entering the ponds (Powertech, 2011). As with the Class V injection well option, the radium settling, spare, and central plant ponds will be constructed with a lining system consisting of the following: (i) an 80-mil HDPE primary liner; (ii) a 60-mil HDPE secondary liner; (iii) a 0.3-m [1-ft]-thick clay liner below the secondary liner; (iv) a geonet drainage layer sandwiched between the primary and secondary HDPE liners; and (v) a leak detection sump and access port system (Powertech, 2009c). All other ponds will be constructed with a lining system consisting of a 40-mil HDPE liner underlain by a 0.3-m [1-ft]-thick clay liner. NRC reviewed the pond design and determined the design meets the criteria of 10 CFR Part 40, Appendix A criteria and conforms to generally applicable standards in 40 CFR Part 192, Subpart D, for example, requiring double liners for ponds utilized for recovery operations). All ponds will be fenced to restrict and control access.

As described in SEIS Section 2.1.1.1.2.4.1 for the deep Class V injection well option, an inspection and reporting program for land application ponds will be implemented in accordance with Regulatory Guide 3.11 (NRC, 2008). Inspections will include (i) daily inspections of the liner, liner slopes, and other earthwork features; (ii) daily inspections of pond freeboard; (iii) monthly inspections of leak detection systems or daily checks for water accumulation in leak detection systems; and (iv) quarterly inspections of embankment settlement and slope stability (Powertech, 2011).

2.1.1.1.2.4.3 Combined Deep Class V Injection Well and Land Application Option

If Class V injection wells are permitted and constructed but lack sufficient capacity to dispose of the entire waste stream, the applicant will combine the use of Class V injection wells and land application for liquid waste disposal (Powertech, 2011). For the combined waste disposal option, land application facilities and infrastructure (e.g., irrigation areas, storage ponds, center pivot irrigation systems) will be constructed and operated on an as-needed basis depending on the capacity of the Class V injection wells to dispose of the liquid waste stream. As described in the previous section, SDDENR will regulate land application under a GDP. In addition, pond design for the combined Class V injection well and land application option will be completed following NRC regulations and requirements (NRC, 2003a, 2008; 10 CFR Part 40, Appendix A, Criterion 5).

2.1.1.1.2.5 Schedule

The applicant estimates that constructing the buildings, initial wellfields, and waste disposal systems for the proposed Dewey-Burdock ISR Project will take approximately 2 years (Figure 2.1-1). Wellfields will be developed sequentially along with supporting infrastructure, including header houses and pipelines. The construction of subsequent wellfields will begin during the operational stage of the initial wellfields in the Dewey and Burdock areas.

The applicant estimates that 86 workers will be directly involved in the construction phase of the proposed project (Powertech, 2009a). Workers are expected to come from the nearby towns of Edgemont, Hot Springs, and Custer, South Dakota, and Newcastle, Wyoming. These towns are 21 to 80 km [13 to 50 mi] from the proposed project site.

2.1.1.1.3 Operation Activities

As discussed in GEIS Section 2.4, uranium extraction by the ISR process involves two primary operations. First, uranium mobilization occurs in underground aquifers when lixiviant (leaching solution) is injected into the orebody and uranium-laden solutions are recovered (NRC, 2009a). The uranium-laden solutions, referred to as pregnant lixiviant, are then pumped from the production wells into IX systems within surface facilities, where uranium is recovered and prepared for shipment (NRC, 2009a). The applicant proposes to conduct operations at the proposed Dewey-Burdock ISR Project consistent with those activities described in the GEIS (Powertech, 2009a). These activities are described in the following sections.

2.1.1.1.3.1 Uranium Mobilization

Uranium mobilization will consist of the following steps: (i) injection of lixiviant into the production zone, (ii) oxidation and formation of uranium-bearing aqueous complexes underground, and (iii) extraction (production) and transport of the pregnant lixiviant to the processing facility. The uranium mobilization steps and excursion monitoring of lixiviant are described in the following sections.

2.1.1.1.3.1.1 Lixiviant Chemistry

The applicant proposes to add lixiviant, consisting of varying concentrations of oxygen and carbon dioxide, to the groundwater acquired from onsite wells to promote the dissolution and mobilization of uranium (Powertech, 2009a). The oxygen in the lixiviant oxidizes the uranium from the relatively insoluble, reduced tetravalent state (U^{4+}) to the more soluble, oxidized hexavalent state (U^{6+}). The carbon dioxide in the lixiviant provides a source of carbonate and bicarbonate ions that react with the oxidized uranium to form either dissolved uranyl tricarbonate complexes [$UO_2(CO_3)_3^{-4}$] or uranyl dicarbonate complexes [$UO_2(CO_3)_2^{-2}$]. The relative abundance of each dissolved uranyl carbonate complex is a function of pH and total carbonate strength. GEIS Table 2.4-1 summarizes typical lixiviant chemistry (NRC, 2009a). As noted in GEIS Section 2.4.1.1, the principal geochemical reactions caused by the lixiviant are (i) oxidation and subsequent dissolution of uranium and other metals from the orebody and (ii) their subsequent extraction (NRC, 2009a).

2.1.1.1.3.1.2 Lixiviant Injection and Production

Lixiviant is pumped down injection wells to the mineralized zones hosted in sandstones in the Fall River and Chilson Member of the Lakota Formations, where it will oxidize and dissolve uranium from the formations. The uranium-bearing solution migrates through the pore spaces in the sandstone and is recovered by production wells. The applicant has estimated that approximately 191 production wells and approximately 406 injections wells will be installed annually over the 8-year operational life of the proposed project (Powertech, 2010c). The applicant estimates production flow rates of 9,084 Lpm [2,400 gpm] in the Burdock area and 6,056 Lpm [1,600 gpm] in the Dewey area (Powertech, 2011). Uranium-enriched pregnant lixiviant will be pumped from production wells to the Burdock central plant or the Dewey satellite facility for uranium extraction by IX. The resulting barren lixiviant will then be refortified with oxygen and carbon dioxide and reinjected into the wellfield to dissolve additional uranium. This process will continue until further uranium recovery is uneconomical.

Production wells are normally positioned to pump pregnant lixiviant from a number of injection wells. As described in SEIS Section 2.1.1.1.2.3.1, square well patterns and sometimes hexagons or triangles will be utilized to access all economically recoverable portions of the uranium orebody. As described in GEIS Section 2.4.3, the production wells at an ISR facility extract slightly more water than is reinjected into the host aquifer to create a net inward flow of groundwater into the wellfield, which minimizes the potential movement of lixiviant and its associated contaminants out of the wellfield. This excess water, referred to as production bleed, is byproduct material that must be properly managed (NRC, 2009a). The applicant proposes to withdraw 0.5 to 3 percent more groundwater than is reinjected (Powertech, 2009a). The typical production bleed will be approximately 0.875 percent and will be adjusted as necessary to maintain the wellfield cone of depression (i.e., a net inward flow of groundwater into the wellfield) (Powertech, 2011). Production bleed rates will be controlled by withdrawing a small portion of the barren solution from the IX circuit, which will then be disposed of via Class V deep well injection and/or land application in both the Dewey and Burdock areas. Production bleed is detailed in SEIS Section 2.1.1.1.3.3.

2.1.1.1.3.1.3 Excursion Monitoring

GEIS Section 2.4.1.4 describes how ISR operations potentially affect the groundwater quality near a site, if lixiviant moves from the production zone resulting in either a vertical or lateral excursion (NRC, 2009a). The applicant proposes to implement an operational groundwater monitoring program that meets the requirements of 10 CFR Part 40, Appendix A, Criteria 7 and 7A. This program will be designed to detect and correct any condition that could lead to the unintended spread of lixiviant either horizontally or vertically outside of the production zone, which could lead to an excursion (Powertech, 2009a). As described in GEIS Section 2.4.3, excursions may be caused by improper water balance between injection and recovery rates, undetected high permeability strata or geological faults, improperly abandoned exploration drill holes, discontinuities within the confining layers, poor well integrity, or unintentional disruption (fracturing) of the ore zone or confining units (NRC, 2009a). The applicant's proposed excursion monitoring program includes monitoring (i) flow rates, (ii) operating pressures of injection, production, and monitoring wells, and (iii) the flow rates and operating pressures of the main pipelines leading to and from the Burdock central plant and the Dewey satellite facility.

The applicant estimated that approximately 57 monitoring wells will be installed annually over the 8-year operational life of the project (Powertech, 2010c). The applicant proposes to sample the monitoring wells in the ore zone and overlying and underlying aquifers at approximately 2-week intervals (Powertech, 2009a). Samples from these wells will be analyzed for chloride, conductivity, and total alkalinity, and the data will be compared to the upper control limits (UCLs) for these constituents (Powertech, 2011). The applicant will establish UCLs after background water quality is established for the monitor wells in a particular wellfield, as described in SEIS Section 7.3.1.2. The water level in each monitor well will also be measured and recorded prior to each sampling event. Water level and analytical monitoring data for the UCL parameters will be retained onsite for NRC review.

An excursion occurs when two or more excursion indicators in a monitoring well exceed their UCLs (NRC, 2003b). If the concentration of two or three excursion indicators exceeds established UCL concentrations during a sampling event, a second sample will be taken within 48 hours after results of the first analysis are received and analyzed (Powertech, 2011). If an excursion is not confirmed by a second sample, a third sample will be taken within 48 hours after the second set of sampling data are received. If the second or third samples produce results where two or more excursion indicators exceed the UCL concentrations, the well producing these results will be placed on excursion status and corrective action will be required. The first sample results will be considered in error if the second and third samples do not confirm the results from the first sample.

If an excursion is detected, the applicant will be required to notify NRC within 24 hours by telephone or email, and in writing within 7 days; corrective actions should begin immediately. Corrective actions will include increasing sampling frequency to weekly, increasing the pumping rates of production wells in the area of the excursion to increase the net bleed, and pumping individual wells to enhance recovery of solutions. If these actions do not retrieve the excursion within 60 days, the applicant will suspend injection of lixiviant into the production zone adjacent to the excursion until the excursion is retrieved and the UCL parameters are no longer exceeded. Within 60 days of a confirmed excursion, the applicant will be required to file a written report to NRC describing the event and the corrective action taken (NRC, 2003b).

2.1.1.1.3.2 Uranium Processing

Uranium will be recovered from the pregnant lixiviant and processed into yellowcake in a multistep process (NRC, 2009a). The steps include (i) loading of uranium complexes onto IX resin, (ii) eluting (recovering) uranium complexes from the resin, and (iii) precipitating, drying, and packaging of uranium. Figure 2.1-13 shows the general flow of the uranium processing steps for the proposed Dewey-Burdock Project.

2.1.1.1.3.2.1 Ion Exchange

Recovery of uranium from the pregnant lixiviant solution will be accomplished via an IX process. Pregnant lixiviant will be pumped from the wellfields into the IX columns, which contain uranium-specific IX resin beads (Dowex 21K XLT or equivalent) (Powertech, 2009a). As the lixiviant flows through the resin beads, the dissolved uranium complexes in the solution will attach to the resin beads by displacing a chloride ion or bicarbonate ion. The resin will be considered loaded when uranium complexes occupy most of the available sites on the resin beads.

The proposed IX systems at both the Dewey satellite facility and Burdock central plant consist of eight fixed-bed IX columns (Powertech, 2009a). The columns will be operated as four sets of two vessels in series (Figure 2.1-13). The IX vessels are designed to operate in pressurized downflow mode, and each will contain approximately 14.15 m^3 [500 ft^3] of IX resin. The barren lixiviant leaving the IX system will normally contain less than 2 mg/L [2 ppm] uranium (NRC, 2009a).

After the barren lixiviant leaves the IX vessels, the production bleed will be removed and routed to the liquid waste system for deep well injection and/or land application. Carbon dioxide will then be added to the barren lixiviant to return the carbonate/bicarbonate concentration to the desired level. The lixiviant solution will then be pumped back to the wellfield, where oxygen will be added prior to reinjection into the wellfields to repeat the leaching cycle.

2.1.1.1.3.2.2 Elution

GEIS Section 2.4.2.2 describes the elution circuit at ISR facilities (NRC, 2009a). The proposed elution circuit at the Burdock central plant is designed to accept and elute uranium-loaded resin from the Burdock central plant and the Dewey satellite facility (Powertech, 2009a).

At the Burdock central plant, resin transfer out of the IX vessels into the elution circuit will be accomplished via resin-transfer piping. Transfer of loaded resin from the Dewey satellite facility to the elution circuit at the Burdock central plant will be accomplished via resin-transfer trucks. Resin-transfer trucks will have one or more compartments with minimum capacities of 14.15 m^3 [500 ft^3] per compartment (Powertech, 2009a). The resin will be hydraulically removed from the compartments and screened for debris and other particulates before transfer into the elution vessels.

An elution process removes the uranyl dicarbonate and uranyl tricarbonate ions from the resin and restores the resin to its chloride form for reuse. Fresh eluant will be prepared by combining

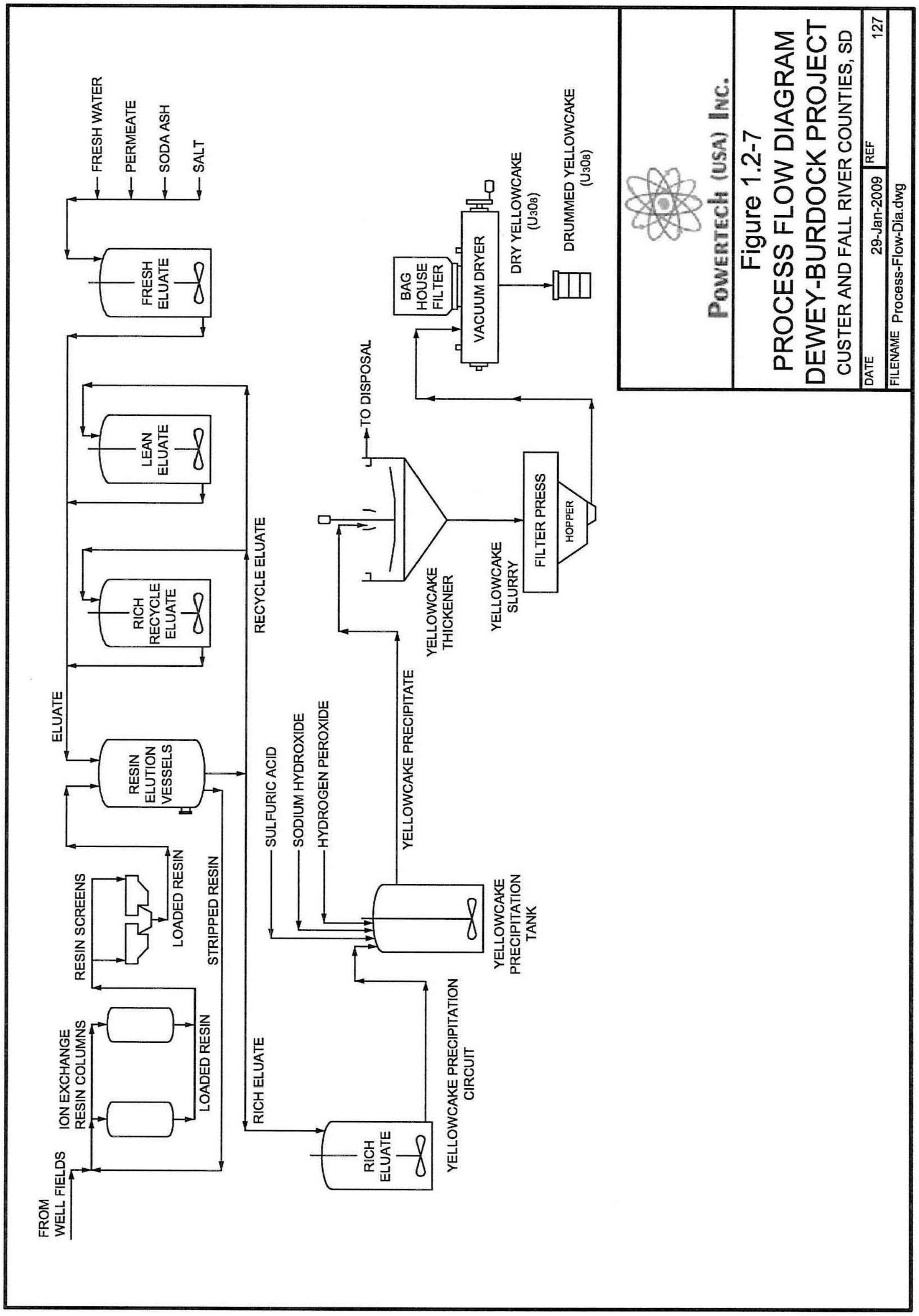


Figure 2.1-13. Overall Process Flow Diagram
Source: Powertech (2009a)

saturated chloride (salt) solution and saturated sodium carbonate (soda ash) solution with water, forming a solution that is approximately 10 percent sodium chloride and 2 percent sodium carbonate. The elution circuit proposed for use at the Dewey-Burdock ISR Project is illustrated in Figure 2.1-13. The elution process involves recycling eluant passing through the resin elution vessel to maximize the removal of uranium from the uranium-loaded resins. The applicant estimates the proposed process will remove more than 95 percent of the uranyl carbonate complexes from the resin (Powertech, 2009a).

2.1.1.1.3.2.3 Precipitation, Drying, and Packaging

GEIS Section 2.4.2.3 describes precipitation, drying, and packaging at ISR facilities (NRC, 2009a). The proposed precipitation and drying process at the Burdock central plant uses rich eluate, which has been transferred from the rich eluate tank to a precipitation tank (Figure 2.1-13). Precipitation and drying will be initiated by adding sulfuric or hydrochloric acid to the rich eluate in the precipitation tank to breakdown the carbonate portion of the dissolved uranyl carbonate complex. The proposed process uses hydrogen peroxide to precipitate out the uranium as uranium peroxide (UO_4). Next, sodium hydroxide is added to adjust the pH before the precipitated uranyl peroxide or yellowcake slurry settles. After settling, the yellowcake slurry is pumped to a gravity thickener (Figure 2.1-13). The thickened slurry is pumped to a filter press to remove excess water. The yellowcake slurry is washed with fresh water to remove impurities, especially chloride, and air dried to further reduce the moisture content.

After air drying is complete, the next step of the proposed process moves the filtered yellowcake to a rotary vacuum dryer housed in a separate room of the central plant. The dryer operates at a temperature of approximately 121 °C [250 °F] at full vacuum and has a production rate of 998 dry kg [2,200 dry lb] per day (Powertech, 2009b). The dryer will be operated under a vacuum to reduce the ability of water-soluble uranium oxides and other compounds to form and to pull solids and water vapor toward the center of the system, which helps to prevent unwanted releases. Vapor is pulled from the dryers by sealed liquid ring vacuum pumps and filtered through baghouse filters located on the tops of the dryers; this removes particles larger than 1 micron [3.9×10^{-5} in] in size. The vapor exiting the baghouses will be cooled using condensers to remove water vapor and any remaining smaller sized particulates. Any water in the condensers will be collected and pumped to the solids removal tank in the wastewater system.

Following the drying stage, the yellowcake will be packaged in approved 208-L [55-gal] steel drums and stored within a restricted storage area until shipment offsite (Powertech, 2009a). Onsite inventory of drummed yellowcake typically will not exceed 90,718 kg [200,000 lb]. Packaged yellowcake will be shipped offsite via truck to licensed uranium conversion facilities for further processing. Conversion facilities are currently located in Metropolis, Illinois, and Port Hope, Ontario, Canada. The applicant projects an annual production of 453,600 kg/yr [1 million lb/yr] of yellowcake (as U_3O_8) over the 8-year projected operational life of the proposed Dewey-Burdock ISR Project (Powertech, 2009a).

2.1.1.1.3.3 Management of Production Bleed and Water Balance

As stated in GEIS Section 2.4.3, uranium mobilization will produce excess water that must be properly managed (NRC, 2009a). The production wells at any ISR facility extract slightly more water than is reinjected into the host aquifer, which creates a net inward flow of groundwater into the wellfield. This excess water, referred to as production bleed, is byproduct material that must be properly managed. At the proposed Dewey-Burdock ISR Project, the applicant proposes to use the process described in SEIS Section 2.1.1.1.3.2.1. As part of normal operations, the production bleed is diverted from the IX circuit after the uranium is recovered, but before the lixiviant is recharged.

Estimated water balances presented as flow rates for the operations and aquifer restoration phases of the proposed project are illustrated and summarized in Figure 2.1-14. Water balances are presented for each liquid waste disposal option that could be implemented in the Dewey and Burdock areas. Aquifer restoration flow rates presented in Figure 2.1-14 are discussed in SEIS Section 2.1.1.1.4.1.

The applicant estimates that, at full production, wellfields in the proposed Dewey and Burdock areas will operate at an average production flow rate of 15,140 Lpm [4,000 gpm] (Powertech, 2011). The production bleed will be approximately 0.5 to 3.0 percent of the production flow rate of 9,084 Lpm [2,400 gpm] in the Burdock area and 6,056 Lpm [1,600 gpm] in the Dewey area (Powertech, 2011). The typical production bleed will be approximately 0.875 percent of the production flow rate, or approximately 79.5 Lpm [21 gpm] in the Burdock area and approximately 53 Lpm [14 gpm] in the Dewey area (Powertech, 2011). The bleed rate will be adjusted as necessary to maintain the wellfield cone of depression. The applicant proposes to dispose of production bleed from the Burdock and Dewey areas by deep Class V well injection and/or land application (see SEIS Section 2.1.1.1.6.2).

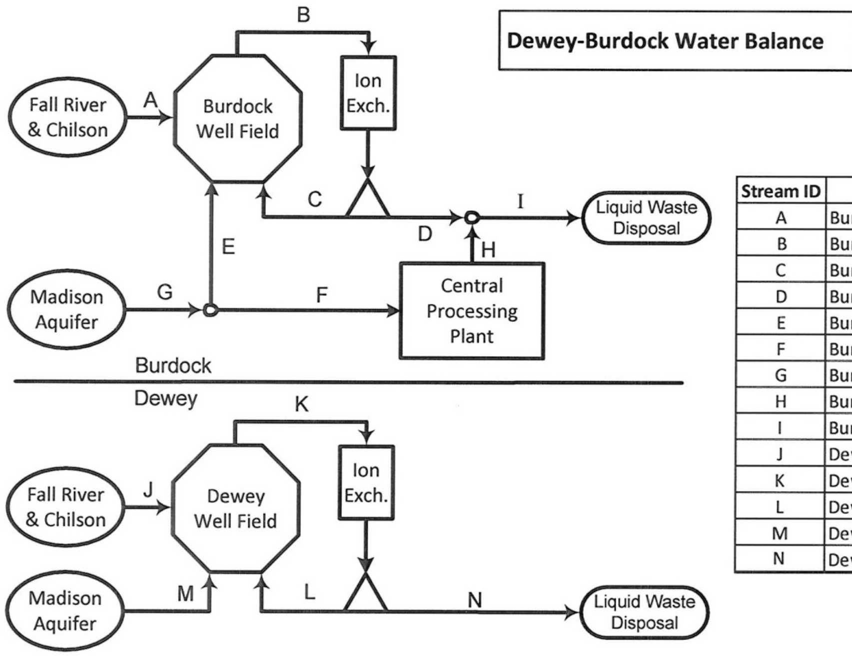
Other liquid waste streams, including spent elution circuit bleed, liquids from process drains, groundwater generated during aquifer restoration, and washdown water, will be produced as part of the proposed Dewey-Burdock ISR Project. As described in SEIS Section 2.1.1.1.6.2, these waste streams will be handled in the same manner as the production bleed.

2.1.1.1.3.4 Schedule

The applicant currently plans to develop 10 wellfields in the Burdock area and 4 wellfields in the Dewey area (Figure 2.1-6). The applicant anticipates that production activities in the initial wellfields will commence 2 years after construction begins (Figure 2.1-1). Wellfield operations will continue for 8 years as additional wellfields are completed along the uranium roll fronts in both the Burdock and Dewey areas. The applicant estimated that 84 workers will be directly involved in the operations phase of the proposed Dewey-Burdock ISR Project (Powertech, 2009a). As during the construction phase, some workers will come from the towns of Edgemont, Hot Springs, and Custer, South Dakota, and Newcastle, Wyoming, each of which is 21 to 80 km [13 to 50 mi] away from the proposed project site.

2.1.1.1.4 Aquifer Restoration Activities

GEIS Section 2.5 described aquifer restoration activities within wellfields that ensure water quality in surrounding aquifers will not be adversely affected by the uranium recovery operations (NRC, 2009a). At the end of the uranium recovery process, constituents that were mobilized by the lixiviant remain in the production aquifer. The primary goal of aquifer restoration is to return groundwater quality within the production zone of wellfields to the preoperational water quality conditions or to standards consistent with NRC requirements at 10 CFR Part 40, Appendix A, Criterion 5B(5) (Powertech, 2009b, 2011). 10 CFR Part 40, Appendix A, Criterion 5B(5) requires that groundwater quality in the exempted ore-bearing aquifer be restored to (i) a Commission-approved background (CAB) concentration; (ii) the maximum contaminant levels



Stream ID	Description
A	Burdock Aquifer Bleed
B	Burdock Extraction Composite
C	Burdock Reinjection
D	Burdock Well Field Bleed
E	Burdock Madison Make-up
F	Burdock Fresh Brine Make-up
G	Burdock Madison, Total
H	Burdock CPP Brine
I	Burdock Liquid Waste
J	Dewey Aquifer Bleed
K	Dewey Extraction Composite
L	Dewey Reinjection
M	Dewey Madison Make-up
N	Dewey Liquid Waste

Operation Phase Water Balance Flow Rates (gpm)

Project Area	Bleed Option	Disposal Option	A	B	C	D	E	F	G	H	I
Burdock	0.875%	Class V Well Injection	21	2400	2379	21	0	12	12	12	33
		Land Application	21	2400	2379	21	0	12	12	12	33
			J	**K**	**L**		**M**				**N**
Dewey	0.875%	Class V Well Injection	14	1600	1586		0				14
		Land Application	14	1600	1586		0				14

Aquifer Restoration Phase Water Balance Flow Rates (gpm)

Project Area	Bleed Option	Disposal Option	A	B	C	D	E	F	G	H	I
Burdock	W/O Groundwater Sweep (1% bleed)	Class V Well Injection	2.5	250	175	75	73	0	73	0	75
		Land Application	2.5	250	0	250	248	0	248	0	250
	With Groundwater Sweep (17% bleed)	Class V Well Injection	42	250	175	75	33	0	33	0	75
		Land Application	42	250	0	250	208	0	208	0	250
			J	**K**	**L**		**M**				**N**
Dewey	W/O Groundwater Sweep (1% bleed)	Class V Well Injection	2.5	250	175		73				75
		Land Application	2.5	250	0		248				250
	With Groundwater Sweep (17% bleed)	Class V Well Injection	42	250	175		33				75
		Land Application	42	250	0		208				250

Figure 2.1-14. Typical Project-Wide Flow Rates
Source: Modified From Powertech (2011)

(MCLs) listed in 10 CFR Part 40, Appendix A, Table 5C, for constituents listed in Table 5C and if the background level of the constituents fall below the listed value; or (iii) an alternate concentration limit (ACL) established by the Commission, if the constituent background level and the values listed in Table 5C are not reasonably achievable. The ACL development is described in SEIS Appendix B. These groundwater quality standards will be implemented, as part of the aquifer restoration phase, to ensure public health and safety. The applicant will also be required to provide financial sureties to cover the costs of both planned and delayed restoration programs, in accordance with 10 CFR Part 40, Appendix A, Criterion 9. NRC reviews financial sureties annually.

Under the Federal UIC program (40 CFR Parts 144 to 146), the exempted production aquifer(s) will no longer be protected under the SDWA as a source of drinking water. In compliance with 40 CFR 146.4, the exempted aquifer(s) does not currently serve as a source of drinking water and cannot now and will not in the future serve as a source of drinking water. Hence, groundwater in exempted aquifers cannot be considered as a source of drinking water after restoration. However, outside of the aquifer exemption boundary, the aquifer is still protected as a source of drinking water, and UIC regulation 40 CFR 144.12 prohibits the movement of any contaminant into the underground source of drinking water located outside the aquifer exemption boundary. Contaminant is defined broadly in the UIC regulations (40 CFR 144.3) to include "any physical, chemical, biological, or radiological substance or matter in water." Therefore, groundwater at the aquifer exemption boundary must meet 10 CFR Part 40, Appendix A, Criterion 5B(5) water quality requirements.

In addition to NRC requirements at 10 CFR Part 40, Appendix A, Criterion 5B(B), groundwater in the production zone aquifer will have to be restored to State of South Dakota standards. In accordance with ARSD 74:54:01:04, groundwater in the production zones must be restored to established ambient concentrations or South Dakota groundwater quality standards.

Before beginning wellfield operations, the applicant must determine background water quality by sampling and analysis of water quality indicator constituents in the mineralized zone(s) and underlying and overlying aquifers across each wellfield (Powertech, 2009b). The applicant will establish target restoration goals [CAB concentrations per 10 CFR Part 40, Appendix A, Criterion 5B(5)] as a function of the average background water quality and the variability in each parameter based on statistical methods (Powertech, 2011). SEIS Section 7.3.1.1 describes these background water quality parameters and methods to be used to establish groundwater restoration targets for the proposed Dewey-Burdock ISR Project.

Background water quality samples obtained from monitoring wells placed in the ore-bearing aquifers, as well as the underlying and overlying aquifers (where present), will be used to define excursion parameters and UCLs. UCLs must be established before ISR operations begin because they are used to control and manage any excursions that may occur during the ISR operation and restoration phases. Groundwater monitoring for selected constituents, throughout the life of the proposed project, is discussed in SEIS Section 7.3.1.2.

2.1.1.1.4.1 Groundwater Restoration Methods

The applicant proposes to begin restoring the initial wellfields in the Burdock and Dewey areas as soon as reasonably practicable after production activities are terminated (Powertech, 2009a). As new wellfields are opened, the applicant plans to restore each wellfield as soon as reasonably practicable following production (Powertech, 2011). The methods selected for groundwater restoration will depend on the liquid waste disposal option (see SEIS Section 2.1.1.1.2.4). For the Class V injection well option, groundwater treatment using reverse osmosis (RO) with permeate injection will be the primary restoration method (Powertech, 2011). If land application is used for liquid waste disposal, then groundwater sweep with injection of clean makeup water from the Madison Formation will be used to restore the aquifer. In either case, the applicant proposes to remove at least six pore volumes during aquifer restoration. A pore volume is the volume of water required to replace the water in the volume of aquifer in the production zone.

The applicant estimates that the pore volume affected in the first year of production will be approximately 49.2 million L [13 million gal], assuming an active wellfield area of approximately 8.1 ha [20 ac] (Powertech, 2011). The total volume of groundwater to be extracted during groundwater restoration (i.e., 6 pore volumes), is estimated to be approximately 295 million L [78 million gal]. The typical restoration extraction flow rate from the Dewey and Burdock wellfields will be approximately 946 Lpm [250 gpm] each for a total of 1,892 Lpm [500 gpm] (see Figure 2.1-14). At a restoration flow rate of 1,892 Lpm [500 gpm], the applicant estimated that approximately 0.3 years will be required to restore an 8.1-ha [20-ac] wellfield area (i.e., remove 6 pore volumes) (Powertech, 2011). Restoration monitoring and stabilization will also be part of the overall restoration program. The groundwater restoration methods and the monitoring and stabilization program proposed for the proposed Dewey-Burdock ISR Project are described in the following sections.

2.1.1.1.4.1.1 Deep Class V Injection Well Option

For the deep Class V injection well disposal option, the primary method of aquifer restoration will be RO treatment with permeate injection. In this method, water will be pumped from the wellfields to the Burdock central processing plant or the Dewey satellite facility for treatment. The water will be treated in IX columns to remove uranium and other dissolved ions and then passed through high pressure RO membranes, which will remove more than 90 percent of the remaining dissolved constituents. The treated effluent, or permeate, will be returned to the wellfields for injection. The RO reject, or brine, will undergo radium removal in the radium settling ponds and then will be disposed of in one or more deep Class V injection wells. The total liquid waste flow rate will be approximately 746 Lpm [197 gpm] during concurrent uranium production and aquifer restoration and approximately 568 Lpm [150 gpm] during aquifer restoration alone (see Figure 2.1-14) (Powertech, 2011). These liquid waste flow rates are lower than the proposed disposal capacity of up to 1,135 Lpm [300 gpm] for the Class V injection well disposal option (see SEIS Section 2.1.1.1.2.4.1).

About 70 percent of the water withdrawn from the wellfields and passed through the RO membranes will be recovered as permeates. Before reinjection into the wellfields, the permeate will be supplemented with makeup water from wells in the Madison Formation and injected into the wellfields at an amount slightly less than the amount withdrawn to maintain a slight restoration bleed. The restoration bleed will maintain hydraulic control of the wellfields during aquifer restoration and will typically be 1 percent of the restoration flow, unless groundwater sweep is used in conjunction with RO treatment with permeate injection. In the latter case, the restoration bleed will average approximately 17 percent, as described in SEIS Section 2.1.1.1.4.1.3.

2.1.1.1.4.1.2 Land Application Option

For the land application disposal option, the primary method of aquifer restoration will be groundwater sweep with Madison Formation water injection (Powertech, 2011). In this method, water will be pumped to the Burdock central processing plant or Dewey satellite facility for removal of uranium and other dissolved species in IX columns. The partially treated water will undergo radium removal in the radium settling ponds and then will be disposed of in land application areas. RO treatment will not be used if there are no deep Class V injection wells available to accept the RO brine.

The typical liquid waste flow rates for the land application option will be approximately 2,070 Lpm [547 gpm] during concurrent uranium production and aquifer restoration and approximately 1,892 Lpm [500 gpm] during aquifer restoration alone (see Figure 2.1-14). The combined disposal capacities of the Burdock and Dewey land application areas will be sufficient to dispose of the liquid waste streams during the spring, summer, and fall months (see SEIS Section 2.1.1.1.2.4.2). In addition, excess capacity will be present during these months to dispose of stored liquid waste from the winter months. None of the water recovered from the wellfields in the Fall River and Chilson will be reinjected back into the wellfields. Instead, makeup water from the Madison Formation will be injected into the wellfields at a flow rate sufficient to maintain the restoration bleed, which will typically be 1 percent of the restoration flow rate, unless the optional groundwater sweep method is used as described next (Powertech, 2011).

2.1.1.1.4.1.3 Optional Groundwater Sweep

Although a 1 percent restoration bleed will typically be used to maintain hydraulic control of wellfields, higher bleed rates may be required to recover flare (i.e., outward spreading) of lixiviant from the wellfield pattern areas during aquifer restoration. If necessary, the applicant has proposed to increase the restoration bleed by withdrawing up to one pore volume of water through groundwater sweep over the course of aquifer restoration. This will result in an average restoration bleed of approximately 17 percent or approximately 159 Lpm [42 gpm] of water being removed from the production aquifer in each of the Dewey and Burdock areas under both disposal options (see Figure 2.1-14) (Powertech, 2011).

2.1.1.1.4.2 Restoration Monitoring and Stabilization

During aquifer restoration, lixiviant injection stops and groundwater transfer, sweep, and/or treatment are used to attempt to restore the production aquifer groundwater quality to original background levels. Stopping lixiviant injection reduces the potential for an excursion and reduces the frequency of sampling the monitoring wells. The applicant's restoration monitoring program for the proposed project will include taking samples from monitoring wells, overlying aquifer wells, and underlying aquifer wells every 60 days during the restoration phase of operations (Powertech, 2009b). The samples will be analyzed to determine whether water quality has been restored consistent with 10 CFR Part 40, Appendix A, Criterion 5B(5). Water levels in wells will be measured prior to sampling. If unforeseen conditions, such as snowstorms, flooding, or equipment malfunctions, make monitoring impossible for 65 days, the applicant will be required to report this condition to NRC (Powertech, 2009b).

The applicant will maintain hydraulic control of each wellfield through the end of aquifer restoration. Verification of hydraulic control will be performed through water level measurements in perimeter monitor wells (Powertech, 2011). Water levels in the perimeter monitor wells will be measured continuously using pressure transducers to confirm hydraulic wellfield control. Aquifer restoration will be complete when the applicant demonstrates that water quality conditions have been restored in accordance with 10 CFR Part 40, Appendix A, Criterion 5B(5) requirements. These standards are either CAB water quality; water quality equivalent to the MCLs provided in the table in 10 CFR Part 40, Appendix A, Criterion 5C; or an ACL NRC established in accordance with Criterion 5B(6). The NRC process for reviewing and approving ACLs is found in SEIS Appendix B.

After NRC determines the production area is restored, the applicant will implement a groundwater stability monitoring program for a minimum of 12 months. The results of the monitoring program determine whether the approved standards for each constituent have been met and whether any adjacent nonexempt aquifers are affected (Powertech, 2009b, 2011). Over the 12-month minimum stability monitoring period, there will be an initial sampling event at the beginning of the stability monitoring period followed by the sampling events described next (Powertech, 2011):

- Perimeter monitor wells in the production zone and monitor wells in the overlying and underlying aquifers will continue to be sampled once every 60 days for the UCL indicator excursion parameters of chloride, total alkalinity, and conductivity. The applicant will contact NRC if any of the wells cannot be monitored within 65 days of the last sampling event due to unforeseen conditions, such as snowstorms, flooding, and equipment malfunctions.

- Quarterly, the production zone wells will be sampled and analyzed for the water quality parameters listed in SEIS Table 7.3-1. The criteria to establish successful stability are as follows: for each sampling event, the mean concentration of each water quality parameter must meet the target restoration goal established for that parameter.

If the analytical results from the stability monitoring program meet the target restoration goals and do not exhibit significant increasing trends, the applicant will (i) submit supporting documentation to NRC showing that the restoration parameters have remained at to below the restoration standards and (ii) request that the wellfield be declared restored (Powertech, 2011).

2.1.1.1.4.3 Schedule

The applicant estimates that wellfield restoration in the Burdock and Dewey areas will commence immediately after production activities in the wellfields end. The applicant projected that restoration of the first wellfields will begin 2 years after production activities commence and will continue for 9 years (see Figure 2.1-1). As additional wellfields are brought into production in the Burdock and Dewey areas, the applicant will restore each wellfield as soon as reasonably practicable following production (Powertech, 2011). The applicant estimates nine workers will be directly involved in aquifer restoration activities (Powertech, 2009a). Most workers will come from Edgemont, Hot Springs, and Custer, South Dakota, and Newcastle, Wyoming, which are 21 to 80 km [13 to 50 mi] from the proposed project site.

2.1.1.1.5 Decontamination, Decommissioning, and Reclamation Activities

Decommissioning of the proposed Dewey-Burdock ISR Project will require an NRC-approved decommissioning plan. All decommissioning activities will be carried out in accordance with

10 CFR Part 40 and other applicable regulatory standards (Powertech, 2009b). GEIS Section 2.6 (NRC, 2009a) describes the general processes for the decontamination, decommissioning, and reclamation of an ISR facility. NRC regulations require a licensee to submit a detailed decommissioning plan for NRC review and approval at least 12 months before final decommissioning is planned. NRC evaluates a proposed decommissioning plan, and if approved, the plan becomes an amendment to the license. Only after receiving NRC approval of a plan may a licensee initiate the decommissioning process. Unless the Commission approves an alternative schedule for completion of decommissioning, pursuant to 10 CFR 40.42(i), the licensee will be required by 10 CFR 40.42(h)(1) to complete decommissioning as soon as practicable but no later than 2 years after approval of the decommissioning plan.

Before the property is released for unrestricted use, the licensee will conduct a comprehensive radiation survey to establish that the levels of various constituents are within limits identified in 10 CFR Part 40, Appendix A. The applicant will be required to return all lands to their previous land use, unless the landowner justified an alternative and the state approved the alternative. For example, a landowner could decide to retain access roads. The goal of the decommissioning and reclamation process will be to return disturbed lands to a production use equal to or better than that which existed prior to uranium recovery. As part of the decommissioning and reclamation process, the applicant will (i) plug and abandon wells, (ii) reclaim disturbed lands, (iii) remove contaminated equipment and materials, (iv) establish appropriate cleanup criteria for structures, (v) decontaminate to NRC requirements items to be released for unrestricted use, and (vi) survey soils and structures to identify residual contamination.

On BLM-administered land, the licensee must comply with reclamation requirements in 43 CFR Part 3800 to assure that there is no unnecessary or undue degradation of public surface lands. These reclamation requirements include standards for (i) plugging and abandoning wells, (ii) removing pipelines, (iii) replacing topsoil, (iv) controlling weeds, (v) restoring acceptable physical and chemical properties to affected soils, (vi) restoring land to blend with adjoining topography, and (vii) seeding and restoring native vegetation.

The following sections describe the general decommissioning activities proposed for the Dewey-Burdock ISR Project.

2.1.1.1.5.1 Radiological Surveys and Contamination Control

The applicant proposes to conduct pre-decommissioning radiological surveys of the Dewey-Burdock ISR Project to identify areas that will need to be cleaned to applicable regulatory limits (NRC, 2009a). Decommissioning surveys of soils, structures, and equipment will be required. The results of these surveys will be used to determine how best to handle contaminated soils, structures, or other materials.

The applicant has committed to conducting land cleanup in accordance with 10 CFR Part 40, Appendix A, Criterion 6(6) and SDDENR regulations (Powertech, 2011). Radiation surveys will be conducted to determine whether any contaminated areas exist. The most likely areas of contaminated soils will be wellfield surfaces and mud pits, surface impoundment bottoms and berms, process building areas, storage yards, transportation routes for uranium recovery products or contaminated materials, and pipeline runs. Areas near deep Class V disposal wells and areas used for land application of treated water will also be surveyed and decontaminated as necessary. NRC will review and approve survey and sampling results. Contaminated soil will be removed and disposed, as byproduct material, at a licensed disposal facility. Pond liners and leak detection systems will also be surveyed. If radiological contamination is found, the liners and detection systems will be removed and disposed of in a licensed disposal facility.

2.1.1.1.5.2 Wellfields

Wellfield decommissioning and surface reclamation will be initiated when NRC determines that the groundwater in a wellfield has been adequately restored and that the water quality is stable (NRC, 2009a). Decommissioning and decontamination of wellfields will include well abandonment; the removal of piping, tanks, ancillary buildings, and equipment; cleaning surface soils to the radiological standards provided in 10 CFR Part 40, Appendix A, Criterion 6; and revegetation of disturbed areas (Powertech, 2009b). To prevent adverse impacts to groundwater quality, all production, injection, and monitoring wells, as well as all drill holes, will be abandoned in place according to SDDENR regulations established in ARSD 74:02:04:67 and 74:11:08 (Powertech, 2009a, 2012c). Well abandonment will require plugging wells with bentonite or cement grout (Powertech, 2009b, 2011). Prior to abandonment wells must be opened to remove debris and equipment (e.g., tubing, pumps, and screens) to prevent obstacles from interfering with plugging operations. Wellhead casing will be removed to a depth of 1 m [3 ft] below the ground surface and set in a cement plug 2 m [6 ft] below ground surface on each well or borehole plugged and abandoned (Powertech, 2009b, 2011).

Wellfield reclamation will involve removing surface and subsurface equipment including injection and production feed lines, header houses, electrical and control distribution systems, well boxes and wellhead equipment, and buried piping. NRC decommissioning guidelines require surveying all piping, equipment, buildings, and wellhead machinery for contamination prior to release. If still usable, wellfield piping, well heads, and associated equipment will be moved to new production areas. When the final production area is reclaimed, all contaminated piping, well heads, and associated equipment that is not salvageable will be removed to an NRC-approved disposal facility. A final background gamma survey will identify contaminated earthen materials requiring removal (Powertech, 2009b). As final steps, the wellfield surface will be recontoured where necessary and revegetated (Powertech, 2009b).

The applicant will be required to provide a land reclamation plan to NRC for review and approval within 12 months before wellfield reclamation begins. The plan will include descriptions of the areas to be reclaimed, the planned reclamation activities, methods to protect workers and the environment against radiation hazards, and a cost estimate for reclamation (Powertech, 2009b).

2.1.1.1.5.3 Process Buildings and Equipment and Other Structures

After groundwater is restored in the final production area, the Burdock central plant, the Dewey satellite facility, and auxiliary facilities associated with both areas will be decommissioned. All processing equipment associated with the central plant and the satellite facility will be dismantled and either sold to another NRC-licensed facility or decontaminated in accordance with NRC regulations and guidance documents. Materials that cannot be decontaminated will be disposed of at an NRC-approved facility. Decontaminated materials will be reused, sold, or removed and disposed of offsite. After the dismantling and removal of buildings is completed, the former building sites will be contoured to blend in with the surrounding terrain. Gamma surveys will be conducted to verify that radiation levels are within acceptable limits (Powertech, 2009b).

2.1.1.1.5.4 Engineered Structures and Access Roads

After final site decontamination and decommissioning are complete, site access and wellfield access roads will be reclaimed. If landowners prefer, the roads may be left in place for their private use. BLM, however, requires complete reclamation of roads on BLM-managed lands. Where the access roads are reclaimed, they will be ripped up and/or disked to relieve compaction; gravel will be removed from road surfaces. Culverts will also be removed, and pre-mining drainage patterns will be reestablished. In addition to being graded, all roads and ditches will be recontoured to blend in with the surrounding terrain; topsoil will be reapplied uniformly onto road surfaces prior to revegetation (Powertech, 2009b).

2.1.1.1.5.5 Final Contouring and Revegetation

Once the proposed Dewey-Burdock Project is complete, all disturbed lands will be returned to their preproduction uses for livestock grazing and as wildlife habitat. Surface reclamation and decommissioning efforts will be conducted to return the disturbed lands to their original or better condition. Disturbed lands will be restored to blend with the contour of adjoining topography. Topsoil removed and stored during construction will be reapplied during the reclamation process. Soil amendments, which may include chemical amendments, may be necessary to restore acceptable physical and chemical properties to any soils exhibiting salinity and/or sodium accumulations or other obstacles to reclamation. Revegetation of the project area is the final state of reclamation and will involve seeding the area with a seed mixture approved by SDDENR, the local conservation district, BLM, and landowners. SDDENR will determine when revegetation is complete and when the conditions for bond release have been met (Powertech, 2009b).

2.1.1.1.5.6 Schedule

The applicant estimates that decommissioning of the Burdock central plant and Dewey satellite facility will take 2 years to complete. There will be some overlap between wellfield decommissioning and the groundwater restoration activities as shown in Figure 2.1-1. Wellfield decommissioning is estimated to continue for 8 years and will proceed sequentially as production and restoration activities are completed in each wellfield. The applicant estimates that nine workers will be directly involved in the reclamation and decommissioning phases of the proposed project (Powertech, 2009a). The majority of these workers will come from towns such as Edgemont, Hot Springs, and Custer, South Dakota, and Newcastle, Wyoming, each of which is 21 to 80 km [13 to 50 mi] from the proposed project site.

2.1.1.1.6 Effluents and Waste Management

All phases of the proposed action, construction, operation, aquifer restoration, and decommissioning will generate effluents and waste streams that must be handled and disposed of properly. This section describes the types and volumes of effluents or wastes the applicant estimates will be generated during the life of the proposed Dewey-Burdock ISR Project. Definitions of the liquid and solid wastes that will be generated are found in the text box in SEIS Section 2.1.1.1.6.2. The proposed disposal methods and locations for liquid and solid wastes are described in SEIS Section 3.13. The potential impacts of generating and disposing of these types of waste are detailed in SEIS Section 4.14. Air quality and air emission impacts are provided in SEIS Sections 3.7 and 4.7. Transportation of waste materials for offsite disposal is described in SEIS Section 2.1.1.1.7. Regional transportation conditions are found in SEIS Section 3.3, and the potential impacts on transportation are detailed in SEIS Section 4.3.

2.1.1.1.6.1 Gaseous or Airborne Particulate Emissions

Gaseous or airborne particulate emissions generated during the life of the proposed Dewey-Burdock ISR Project will primarily consist of fugitive dusts, combustion engine exhaust, radon gas emissions from various stages of the processing system, and uranium particulate emissions from yellowcake drying (Powertech, 2009a). Appendix C presents nonradiological air emissions information for the proposed project including emission inventories and air dispersion modeling.

2.1.1.1.6.1.1 Nonradiological Emissions

Fugitive dust and engine exhaust emissions will be generated primarily from (i) vehicle traffic; (ii) ground-surface-disturbing construction and decommissioning activities; and (iii) diesel construction equipment including well drill rigs and water trucks (Powertech, 2009a). Combustion emissions include greenhouse gases and National Ambient Air Quality Standards (NAAQS)-regulated pollutants. Fugitive dust sources include vehicular travel on unpaved roads and land disturbance associated with the construction of wellfields, roads, and support facilities. The applicant proposes imposing speed limits on unpaved roads, encouraging carpooling, and promptly restoring disturbed areas to limit dust generation, traffic, and erosion (Powertech, 2009a). Combustion emission sources from onsite and offsite sources will include construction equipment and trucks transporting materials and product. Point or stationary source emissions will be limited to equipment like propane heaters, fire suppression pumps, and emergency generators. These stationary emissions will represent a small portion of the overall emissions. As discussed in SEIS Section 3.7.1.2, the prevailing wind direction is from the northwest, which will result in dust being moved southeast. All four phases of the proposed action are expected to produce nonradiological emissions.

Combustion exhaust emission estimates for non-greenhouse gases will be produced by (i) stationary sources, (ii) mobile construction and drilling field equipment, and (iii) other mobile sources. Table 2.1-1 presents estimates for combustion emission mass flow rates (i.e., mass of pollutant generated annually) from stationary sources. Stationary emissions are assumed to be constant over the project life span except for project year one, in which no stationary emissions are assumed to be generated. Table C–1 in Appendix C details these stationary source estimates. Table 2.1-2 presents estimates for combustion emission mass flow rates from mobile sources for each phase, as well as the peak year estimate when all four phases occur simultaneously.

Construction phase emission estimates are provided in Table 2.1-2. The construction phase in project year one consists of two main activities: facilities construction and wellfield construction. Therefore, one emission estimate includes both activities. Facilities construction will be completed at the end of project year one. The construction phase associated with the remaining life of the project is limited to wellfield construction. Therefore, the other emission estimate is for wellfield construction only. Table C–2 in Appendix C details the mobile source estimates. Commuter traffic was included in the combustion emission estimates for mobile sources. The calculation of the mobile emission inventory in Table 2.1-2 incorporates some of the mitigation that the applicant has committed to perform.

Table 2.1-1. Nonradiological Combustion Emission Estimated Mass Flow Rates (Metric Tons* Per Year) From Stationary Sources for the Proposed Action†

Emission Source	Emissions (Metric Tons/Year)					
	NO_X‡	CO‡	PM10‡	PM2.5‡	SO_2‡	TOC‡
Space Heater	0.67	0.39	0.036	0.036	0.0009	0.054
Dryer Thermal Fluid Heater	0.83	0.47	0.044	0.044	0.0009	0.063
Emergency Generator	0.00	0.00	0.000	0.000	0.000	0.00
Fire Suppression Pump	0.036	0.009	0.0027	0.0027	0.0027	0.00
Total	1.54	0.87	0.83	0.83	0.0045	0.12

Source: Modified from IML (2013).
*To convert metric tons to short tons, multiply by 1.10231.
†Except for project year 1, stationary emissions are assumed to be constant over the project lifespan.
‡NO_X = nitrogen oxides, CO = carbon monoxide, PM10 = particulate matter 10 micrometers, PM2.5 = particulate matter 2.5 micrometers, SO_2 = sulfur dioxide, TOC = total organic carbon.

Table 2.1-2. Nonradiological Combustion Emission Mass Flow Rate Estimates (Metric Tons* Per Year) From Mobile Sources for Various Phases of the Proposed Action

Pollutant	Phase					Total or Peak Year‡
	Construction†		Operation	Aquifer Restoration	Decommissioning	
	Facilities and Wellfields	Wellfields Only				
Particulate Matter PM10	2.69	2.14	0.73	0.07	0.56	3.51
Particulate Matter PM2.5	2.61	2.07	0.72	0.07	0.54	3.40
Sulfur Dioxide	7.78	6.40	1.80	0.05	2.00	10.26
Nitrogen Oxides	46.34	37.12	12.6	1.12	11.26	62.11
Carbon Monoxide	44.50	37.8	8.45	0.71	6.45	53.43
Total Hydrocarbon	16.58	12.3	15.75	2.23	5.39	35.71
Formaldehyde	1.89	1.53	0.63	0.05	0.50	2.71

Source: Modified from IML (2013).
*To convert metric tons to short tons, multiply by 1.10231.
†Two types of construction phase emission estimates were provided. Construction (facilities and wellfields) only occurs in project year 1 (i.e., facility construction complete after project year 1). In subsequent project years, construction (wellfield only) occurs.
‡Total accounts for when all four phases occur simultaneously and represents the highest amount of mobile source emissions the proposed action will generate in any one project year. Project year 1 only includes the construction phase (i.e., no overlap with other phases), and facilities construction only occurs in project year 1. Therefore, the construction—wellfield only—is used when calculating the total.

These mitigation commitments are described in SEIS Section 4.7, and the manner in which the mitigation was incorporated into the calculation of the emission inventory is provided in Appendix C Section C2.1.

Fugitive dust emissions will be produced mainly by vehicle travel on unpaved roads and wind erosion to disturbed land. Table 2.1-3 contains the fugitive emission mass flow rate estimates from travel on unpaved roads. This table provides emission estimates for both the onsite and offsite project related vehicle traffic. The offsite project fugitive emissions are mostly from commuter vehicles. The onsite emissions include the commuter vehicles and the various construction and drill field equipment. This table also provides a peak year estimate when all four phases occur simultaneously. As done for the combustion emissions, two types of construction phase estimates are provided. The calculation of the fugitive emission inventory in Table 2.1-3 incorporates mitigation that the applicant has committed to perform. The mitigation commitment is described in SEIS Section 4.7, and the manner in which the mitigation was incorporated into the calculation of the emission inventory is provided in Appendix C Section C4. Table 2.1-4 contains the fugitive mass flow rate emissions from wind erosion. The annual wind erosion estimates levels do not vary much over the span of the project. The amount of fugitive emissions from wind erosion is a function of the amount of disturbed land. The two liquid waste disposal options, deep Class V well disposal and land application, vary in the amount of land disturbed. Therefore, the information in Table 2.1-4 is provided for each liquid waste disposal option.

Table 2.1-3. Total* (Peak Year) Fugitive Dust Mass Flow Rate (Metric Tons† per Year) Estimates for All Phases and Sources‡

Source	Phase	Particulate Matter PM10	Particulate Matter PM2.5
On-Site Fugitive Emission from Vehicle Travel	Construction—Facilities and Wellfield	176.69	17.669
	Construction—Wellfield Only	138.48	13.848
	Operation	91.50	9.1499
	Aquifer Restoration	7.00	0.700
	Decommissioning	54.53	5.453
Off-Site Fugitive Emissions from Vehicle Travel	Construction—Facilities and Wellfield	51.63	5.163
	Construction—Wellfield Only	24.77	2.477
	Operation	37.98	3.798
	Aquifer Restoration	5.67	0.567
	Decommissioning	25.74	2.574
Wind Erosion§	Not applicable	29.76	4.4
Total		415.43	43.01

Source: Modified from IML (2013).
*Total accounts for when all four phases occur simultaneously and represents the highest amount of emissions the proposed action will generate in any one project year. Project year 1 only includes the construction phase (i.e., no overlap with other phases), and facilities construction only occurs in project year 1. Therefore, the construction—wellfield only—is used when calculating the total.
†To convert metric tons to short tons, multiply by 1.10231.
‡Fugitive dust sources include on-site road, off-site road, and wind erosion (land application disposal)
§Annual values varied slightly over the project lifetime. Reported values are maximums. Minimum values could be as much as 2.5 metric tons lower for PM10 and 0.4 metric tons lower for PM2.5

Table 2.1-4. Onsite Fugitive Emission Mass Flow Rate Estimates (Metric Tons* per Year) from Wind Erosion for the Deep Class V Well and Land Application Disposal Options

Pollutant	Deep Class V Well Disposal	Land Application Disposal
Particulate Matter PM_{10}†	10.1	29.7
Particulate Matter $PM_{2.5}$‡	1.5	4.4

Source: Modified from Powertech (2012b) and IML (2012)
*To convert metric tons to short tons, multiply by 1.10231.
†Annual values varied slightly over the project lifetime. Reported values are maximums. Minimum values could be as much as 2.5 metric tons lower.
‡Annual values varied slightly over the project lifetime. Reported values are maximums. Minimum values could be as much as 0.4 metric tons lower.

ISR phases may occur simultaneously. To account for overlapping phases, a total emission estimate was calculated by adding together the annual emissions from all four phases. This total or peak year estimate represents the highest amount of emissions the proposed action will generate in any one project year. Table 2.1-5 contains the peak year estimate when the stationary (see Table 2.1-1), mobile (see Table 2.1-2), and fugitive source (see Table 2.1-3) emissions are combined. The values in Table 2.1-5 reveal that certain source categories generate the majority of emissions for certain pollutants. Table C–8 in Appendix C identifies the contribution (i.e., percent) of the various emission source categories to the various pollutants. For example, fugitive dust sources generate 99.1 percent of the total PM_{10} particulate matter emissions and 92.5 percent of the $PM_{2.5}$ particulate matter emissions. The mobile combustion emission sources generate the majority of the sulfur dioxide (99.9 percent), nitrogen dioxide (97.6 percent), and carbon monoxide (98.4 percent) emissions. The highest level of emissions that the stationary sources contribute to any single pollutant is for nitrogen oxide, at 2.4 percent.

The air impact analysis for the proposed project includes two types of air modeling. The AERMOD dispersion model was used to predict NAAQS and Prevention of Significant Deterioration (PSD) pollutant concentrations, and the CALPUFF model was used to generate Air Quality Related Values (i.e., visibility and acid deposition) for Wind Cave National Park. Expressing the proposed project's emissions in concentrations can help characterize the magnitude of the emission levels because regulatory standards, such as NAAQS and PSD, are also expressed in concentrations. The AERMOD dispersion model was used to predict pollutant concentrations at 4,220 locations that extend in all directions from the project site and fully encompass Wind Cave National Park. These concentrations were calculated for the construction, operation, aquifer restoration, and decommissioning phases and they were based on the emission estimates from stationary, mobile, and fugitive sources. SEIS Figures 4.7-1 and 4.7-2 identify the receptor locations for the AERMOD modeling, while SEIS Figures 4.7-3 and 4.7-4 identify the receptor locations for the CALPUFF modeling.

SEIS Table 4.7-1 presents the AERMOD modeling results with respect to the NAAQS, while SEIS Table 4.7-2 presents the results with respect to the PSD-allowable increments. The NAAQS and PSD-allowable increments are described in SEIS Section 3.7.2. Tables 2.1-1 to 2.1-5 and SEIS Tables 4.7-1 and 4.7-2 summarize the detailed emission estimates presented in Appendix C. SEIS Table 4.7-3 presents the visibility analysis results and Table 4.7-4 presents the acid deposition results.

Combustion exhaust estimates for greenhouse gas emissions fall into three source categories. The first category consists of facility sources, which is further categorized into stationary

Table 2.1-5. Total* (Peak Year) Nonradiological Emission Mass Flow Rate (Metric Tons† Per Year) Estimates for All Phases and Sources

Pollutant	Stationary Sources	Mobile Emission Sources	Fugitive Dust Sources‡	Peak Year Total
Particulate Matter PM10	0.083	3.51	415.43	419.0
Particulate Matter PM2.5	0.083	3.40	43.01	46.5
Sulfur Dioxide	0.0045	10.26	0	10.265
Nitrogen Oxides	1.54	62.11	0	63.65
Carbon Monoxide	0.87	53.43	0	54.30

Source: Modified from IML (2013).
*Total accounts for when all four phases occur simultaneously and represents the highest amount of emissions the proposed action will generate in any one project year. Project year 1 only includes the construction phase (i.e., no overlap with other phases), and facilities construction only occurs in project year 1. Therefore, the construction—wellfield only—is used when calculating the total.
†To convert metric tons to short tons, multiply by 1.10231.
‡Fugitive dust sources include on-site road, offsite road, and wind erosion (land application disposal).

sources and facility fugitive emissions from the uranium recovery process. The second category consists of mobile sources, which include construction and drilling equipment and other mobile sources, including commuter vehicles. The third category consists of indirect emissions from electricity consumption (i.e., emissions associated with the production of the electricity that the proposed project consumes). Table 2.1-6 presents the carbon dioxide gas emission estimates for the proposed action. Emission estimates are provided for each of the three source categories for each of the four phases of the proposed action. Carbon dioxide constitutes the majority of greenhouse gas emissions. Some methane and nitrous oxide emissions will occur. Chlorofluorocarbon and hydrochlorofluorocarbon greenhouse gas emissions are not expected from the proposed project.

Table 2.1-6. Annual Carbon Dioxide Estimates in Metric Tons/Year * for the Proposed Action

Phase	Facility		Mobile Sources	Electrical Consumption	Total
	Stationary Sources†	Fugitive from Uranium Recovery Process			
Construction	1,439	0	3,990	542	5,970
Operation	1,439	440	1,490	22,097	25,466
Aquifer Restoration	1,439	0	110	6,685	8,234
Decommissioning	1,439	0	1,286	542	3,267
Peak Year‡	1,439	440	6,876	29,865	38,621§

Source: Modified from IML (2013).
*To convert metric tons to short tons, multiple by 1.10231.
†Except for project year one, stationary emission are assumed to be constant over the project lifespan. Therefore the peak year calculation would only need to include the stationary source emission value one time rather than for each phase.
‡Peak year accounts for when all four phases occur simultaneously and represents the highest amount of emissions the proposed action will generate in any one project year.
§This value is for the peak year total which only includes the stationary source emission value of 1,586 once (Note †). This value is not the total of the individual phase totals in the column because each phase totals includes the stationary source emission value.

NRC staff believes that any emissions of volatile organic compounds from the potential land application of liquid byproduct material described in SEIS Section 2.1.1.1.6.2 will be negligible. The ISR process as described in SEIS Section 2.1.1.1.3.2 does not introduce or utilize volatile organic compounds. Furthermore, the list of constituents in the example ISR liquid waste stream from the GEIS does not include any volatile organic compounds (NRC, 2009a, Table 2.7-3). As described in Table 2.1-8, both NRC and SDDENR regulate land application of this liquid waste stream.

GEIS Section 1.7.2 describes air permitting. Briefly, the Clean Air Act permitting process is divided into two programs: the New Source Review program (preconstruction) and the Title V program (operation). The New Source Review requires stationary air pollution sources to obtain permits prior to construction. Three types of New Source Review permits exist: (i) PSD, (ii) nonattainment New Source Review, and (iii) minor New Source Review. In attainment areas (i.e., those areas where air quality meets the NAAQS), PSD permits are required for major stationary pollutant sources that are new or making major modifications. Classification as a major source in an attainment area is based on the potential to emit more than 90.7 or 227 metric tons [100 or 250 short tons] of a regulated pollutant, depending on the source. In nonattainment areas, the nonattainment New Source Review permits are required for major stationary pollutant sources that are new or making major modifications. Classification as a major source in a nonattainment area is generally based on the potential to emit more than 90.7 metric tons [100 short tons] of a regulated pollutant. This threshold can be lower for areas with more serious nonattainment problems. A minor New Source Review permit supplements the PSD and nonattainment New Source Review programs. The New Source Review permit provides regulators (i.e., SDDENR for the Dewey-Burdock project) a method to implement permit conditions as needed to limit emissions from sources not covered by those two programs. Title V permits are required for stationary sources that, during operation, have the potential to emit more than 90.7 metric tons [100 short tons] of any air permit (lower thresholds for areas that are in nonattainment) (NRC, 2009a).

The applicant submitted an air quality application to SDDENR in November, 2012 (see Table 1.6-1). Based on the information in the application, SDDENR determined that an air permit will not be required and the proposed project will not be subject to PSD requirements (SDDENR, 2013b). Information concerning the relationship between the SDDENR regulatory determination and the NRC's SEIS analyses is provided in SEIS Section 4.7.1 and Appendix C, Section C1.

2.1.1.1.6.1.2 Radioactive Emissions

Radon gas emissions are most likely to occur during the operation and aquifer restoration stages of the proposed action, as detailed in SEIS Section 4.13. Radon releases may occur in the wellfield when the pregnant lixiviant is brought to the surface from the ore zone aquifer. Radon will also be released to air from radium settling ponds (Sections 2.1.1.1.2.4.1 and 2.1.1.1.2.4.2). Radon gas release could also occur when the downflow IX columns are taken offline for resin transfer and are opened to the atmosphere. Radon gas will disperse quickly into the air. The use of general area and local ventilation systems will control radon buildup within the onsite facilities. General area ventilation could involve forced air ventilation of work areas in process buildings. Local ventilation for process vessels, where radon releases are more likely, may involve ducting or piping radon from the point of release through fans that exhaust to the outside, where the radon will disperse quickly into the air.

The applicant estimates an annual release of 34,077 GBq [921 curies] of Rn-222 from the proposed Dewey-Burdock ISR Project (Powertech, 2011). Wellfield operations will account for 52 percent of the released radon, 47 percent will be the result of processing activities, and land application activities will produce the remainder. Potential dose impacts from radon releases were calculated at the site boundary in 16 compass directions each from the Burdock central plant and the Dewey satellite facility (Powertech, 2011). Results indicated that the 10 CFR Part 20 public dose limit of 1 mSV/yr [100 mrem/yr] is not exceeded at any property boundary. The applicant's calculations are discussed in SEIS Section 4.13.

An additional potential source for airborne particulate emissions is the yellowcake dryer, which will be located at the proposed Burdock central plant. The applicant proposes to use vacuum dryer technology for yellowcake drying operations at the Burdock central plant (Powertech, 2009a). NUREG–1569 (NRC, 2003a) provides guidance for evaluating air emissions at *in-situ* leach (ISL) facilities; dust emissions produced in the drying stage are negligible, where a vacuum dryer is used to dry yellowcake. A vacuum dryer utilizes a heat source contained in a separate, isolated system, which ensures no radioactive materials are trapped in the heating system or the exhaust it generates, as detailed in NUREG/CR–6733 (Mackin, et al., 2001). The applicant's proposed dryer contains a drying chamber where yellowcake slurry is added and is subjected to vacuum pressure (Powertech, 2009a). The dryer will retain all yellowcake dusts that could be produced during loading and unloading operations. The proposed dryer is designed so that moisture from the yellowcake is the only source of vapor in the system. Vapor exiting the dryer is filtered through a baghouse filter above the dryer, which removes particulates down to a size of approximately 1 micron [3.9×10^{-5} in]. Vapor exiting the baghouse filter is then cooled using a condenser to remove water vapor and remaining small particulates (Powertech, 2009a). Water from the condenser will be collected and pumped to the solids removal tank in the wastewater disposal system. The overhead baghouse system collects dust in the baghouse filter and returns it to the drying chamber. The applicant proposes routine monitoring and analysis of the drying system exhaust to detect the presence of natural uranium, Th-230, Ra-226, and Pb-210 (Powertech, 2009a). The proposed monitoring ensures releases of Th-230, Ra-226, and Pb-210 are (detected and kept) as low as is reasonably achievable. The monitoring system will be instrumented to operate automatically and to shut down if malfunctions such as heating or vacuum system failures occur. Monitoring results must be submitted to NRC in semiannual reports.

These terms define the various types of solid and liquid wastes generated at the Dewey-Burdock ISR Project:

Liquid wastes

<u>Liquid byproduct material</u>: All liquid wastes resulting from the proposed action, except for sanitary wastewater and well development and testing wastewater.

<u>Sanitary wastewater</u>: Ordinary sanitary septic system wastewater; this wastewater is not hazardous waste and not byproduct material wastewater.

<u>Well development and testing wastewaters</u>: Wastewater produced during well development and pumping tests; this water is not hazardous waste or byproduct material and will not require treatment before disposal.

Solid wastes

<u>Solid byproduct material</u>: All solid wastes resulting from the proposed action that satisfy the 10 CFR 40.4 definition of byproduct material.

<u>Nonhazardous solid waste</u>: Solid waste that is not hazardous waste, including domestic/municipal wastes (trash), construction/demolition debris, septic solids, and radioactive facilities and equipment resulting from the proposed action that meet the criteria for unrestricted release specified in the NRC license (see NRC, 1993).

<u>Hazardous waste</u>: Resource Conservation and Recovery Act or state-defined hazardous waste that is not byproduct material and includes universal hazardous wastes.

2.1.1.1.6.2 Liquid Wastes

The applicant expects to generate liquid wastes during all phases of uranium recovery at the proposed Dewey-Burdock ISR Project. These wastes include well development and well test waters, stormwater runoff, waste petroleum products and chemicals, sanitary wastewater, production bleed, process solutions and laboratory chemicals, plant washdown water, and restoration water. Process solutions include process bleed, elution and precipitation brines, and resin transfer wash. NRC classifies wastewater generated during or after the uranium extraction phase of site operations as byproduct material; however, stormwater runoff, domestic sewage, waste petroleum, and hazardous waste are not byproduct material. Byproduct material does not meet the definition of solid waste in 40 CFR 261.4(a)(4) and therefore is not regulated as hazardous waste under Resource Conservation and Recovery Act (RCRA) regulations.

Liquid byproduct material generated by the proposed Dewey-Burdock ISR Project will contain chemical and radiological constituents including uranium and radium. Detailed information on expected wastewater constituents and estimated concentrations are provided in license application documentation (Powertech, 2011; 2012a). Specifically, for proposed deep Class V well injection the applicant's estimated wastewater quality is documented in Table TR RAI P&R-14d-1 of their response to NRC requests for additional information (Powertech, 2011). The proposed land application wastewater quality is provided in Table 5.8-2 of the applicant's GDP (Powertech, 2012a).

The applicant proposed deep Class V well injection, land application, or a combination of these processes for managing liquid byproduct material. The particular waste management option used will affect how wastes are treated and will determine the final disposal method. As described in SEIS Chapter 1, the proposed options require the applicant to obtain all applicable federal and South Dakota permits, in addition to an NRC license, before it operates the facility. SDDENR will permit land application only if the applicant demonstrates insufficient Class V disposal capacity (SDDENR, 2013a). Alternative wastewater disposal options are described in SEIS Section 2.1.1.2. However, the applicant did not propose using these alternative methods.

The applicant's proposed deep Class V well injection disposal option involves drilling wells at the project site to dispose of liquid byproduct material. A typical deep injection well design is shown in Figure 2.1-11. The applicant submitted a permit application to EPA to construct four to eight UIC Class V deep injection wells to inject liquid byproduct material into the Minnelusa and Deadwood Formations; the application is currently under review (Powertech, 2011, Appendix 2.7-L). The first four of the proposed wells are detailed in the permit application. The depth from the ground surface to the disposal horizon for the 4 wells ranges from 492 to 1,076 m [1,615 to 3,530 ft] (Powertech, 2011, Appendix 2.7–L). For disposal using a UIC Class V well, an EPA permit, if granted, will prohibit injection of any material defined as hazardous waste as defined by RCRA regulations in 40 CFR 261.3. Additionally, if a license is granted, NRC will require the effluent pumped into deep injection wells to be treated and monitored to verify it meets NRC release standards in 10 CFR Part 20, Subparts D and K, and Appendix B.

The applicant has proposed to manage liquid byproduct material under the Class V injection well disposal option using a system of storage ponds, treatment methods, and deep injection wells. During the operations phase, the applicant proposes to combine the plant wastewater stream (including the waste brine streams from elution and precipitation, resin transfer wash, laundry water, plant washdown water, and laboratory chemicals) with the production bleed and well development wastewater. Wastewater will be redirected back to the central processing plant for ion-exchange treatment to remove uranium, the wastewater will then be mixed with barium chloride, and finally wastewater will be discharged into lined settling ponds (i.e., radium removal ponds) (Powertech, 2009b, 2010a, 2011). The barium chloride chemically binds to radium in solution and deposits as a sludge that will be removed and sent to a licensed disposal facility (Powertech, 2010a). Following radium removal processing, the applicant will then inject the combined waste streams in the Class V deep injection wells. During the aquifer restoration phase, the applicant proposes to manage aquifer restoration wastewater (i.e., liquid byproduct material) by treating the wastewater by reverse osmosis and reinjecting the treated water back into the aquifer production zone undergoing restoration (see SEIS Section 2.1.1.1.4.1.1). The applicant proposes to operate the reverse osmosis system using the necessary pretreatment, which includes multi-media or sand filters and feed conditioning (Powertech, 2009b). As described in Section 2.5.3 of the GEIS (NRC, 2009) the reverse osmosis process yields two fluid streams: approximately 70 percent will be clean water (permeate) that can be reinjected into the aquifer and approximately 30 percent of the water will contain concentrated ions (brine) that cannot be reinjected directly into Class V wells. The applicant will combine the contaminants (brine) removed from treated water with operational wastewater and the combined wastewater will be transferred to radium settling ponds for further treatment, prior to disposal in the Class V injection wells. The applicant's Class V injection well monitoring program includes monitoring of injection pressure at the wellhead, the fluid-filled annulus pressure between the casing and injection tubing string (see Figure 2.1-11), and injection zone pressure and is described in detail in SEIS Section 7.6.

The applicant's proposal includes options for managing liquid byproduct material by land application independently and in conjunction with deep Class V injection well disposal. For land application, the applicant will need to obtain an approved state GDP permit and comply with applicable state discharge requirements for land application of treated wastewater. The applicant submitted a GDP application for the proposed project in March 2012 (Powertech, 2012a). SDDENR limits wastes discharged through the land application system to those wastewaters that the applicant identified in their GDP. These wastewaters include production bleed; groundwater generated during aquifer restoration; affected groundwater generated during well development; and liquid process waste, such as resin transfer water and brine (SDDENR, 2013a). Process solutions, wastewater disposal, or surface water runoff from the site will be required to meet GDP permit requirements, South Dakota groundwater quality standards (ARSD 74:54:01) outside of EPA's approved aquifer exemption boundary, or surface water quality standards (ARSD 74:51:01).

In the land application option, the applicant will route the central plant wastewater stream, which includes waste brine streams from elution and precipitation, resin transfer wash, laundry water, plant washdown water, and laboratory chemicals, into a storage pond. Wastewater will be redirected back to the central processing plant for IX treatment to remove uranium, the wastewater will be mixed with barium chloride, and finally wastewater will be discharged into lined settling ponds (i.e., radium removal ponds). In the application, the applicant proposes to sample water from the ponds to verify it is within South Dakota and NRC discharge limits. Treated wastewater would be pumped through center pivot sprinklers during the growing season, which is approximately April through October (Powertech, 2011). The applicant anticipates that irrigated crops may include native vegetation, alfalfa, or salt-tolerant wheatgrass (Powertech, 2012a). During winter months (approximately November through March), when land application would not be used on frozen ground, treated liquid waste would be temporarily stored in ponds located near the Burdock central plant and Dewey satellite facility (Powertech, 2011, 2012a).

The applicant proposes regular monitoring of air, soil, crops and livestock, surface water, and groundwater to identify the presence of NRC- and SDDENR-regulated constituents. Monitoring results must be reported to NRC semiannually (see SEIS Chapter 7). As part of the decommissioning phase, NRC will require radiological surveys of land application areas to ensure that the soil concentration limits in 10 CFR Part 40, Appendix A, Criterion 6-(6) are met. If soil concentration limits are exceeded, NRC will require the removal of contaminated materials, which could add to the total amount of material for disposal at a licensed facility. In addition, the applicant proposes to dispose of any pond liners and precipitated solids accumulated in radon settling ponds as solid byproduct material, as described in SEIS Section 2.1.1.1.6.3.

The amount of liquid byproduct material produced by the proposed action varies by ISR lifecycle phase, disposal option, and aquifer restoration method. The applicant estimated the maximum estimated flow of produced liquid byproduct material at any time considering concurrent uranium recovery operations and aquifer restoration activities. For the Class V injection well option, the applicant's maximum calculated liquid byproduct material production is 749 L/min [197 gal/min] (Powertech, 2011). For the land application option, the applicant's maximum calculated liquid byproduct material production is 2,080 L/min [547 gal/min] (Powertech, 2011).

The applicant proposes to dispose of sanitary wastewater from restrooms and lunchrooms into onsite septic systems located near the Burdock central plant and Dewey satellite facility. The applicant is required to obtain a permit from the SDDENR to construct the onsite septic systems (Powertech, 2009b). The applicant also proposes to collect and route stormwater for discharge to surface water (Powertech, 2009a). The applicant is required to obtain a National Pollutant Discharge Elimination System (NPDES) permit to discharge stormwater to surface water from the State of South Dakota.

2.1.1.1.6.3 Solid Wastes

As described in GEIS Section 2.7.3, all phases of the operational lifecycle of an ISR facility generate solid wastes (NRC, 2009a). Solid byproduct material includes spent resin, empty chemical containers and packaging, pipes and fittings, tank or storage pond sediments, contaminated soil from leaks and spills, and contaminated construction and demolition debris. Nonhazardous solid waste includes septic solids, municipal solid waste (general trash), and other solid wastes. Solid hazardous waste includes used batteries and light bulbs.

Solid byproduct material does not meet the NRC criteria for unrestricted release and must be disposed of at a licensed disposal site, in accordance with the requirements of 10 CFR Part 40, Appendix A, Criterion 2. The applicant estimates the proposed Dewey-Burdock facility will produce 22 m^3 [29 yd^3] of solid byproduct material from radium settling ponds annually from the deep Class V injection well option and 50 m^3 [66 yd^3] of solid byproduct material from the land application option (Powertech, 2011). Assuming a 10-year operational period, the NRC staff calculated total radium settling byproduct material accumulation as 222 m^3 [290 yd^3] from the deep Class V injection well option and 500 m^3 [660 yd^3] from the land application option. The applicant plans to store these wastes temporarily onsite. The applicant proposes to transport these materials offsite to a licensed facility for disposal in accordance with U.S. Department of Transportation (USDOT) requirements using shipment capacities of 23 m^3 to 33 m^3 [30 yd^3 to 40 yd^3] (Powertech, 2010a, 2011). It is estimated that one to three shipments of operational byproduct material will occur per year.

The NRC staff calculated the amount of solid byproduct material that will be generated from decommissioning activities using the financial assurance information the applicant submitted;

the land application option estimate is 1,580 m^3 [2,067 yd^3] and the deep Class V injection well disposal option estimate is 1,419 m^3 [1,856 yd^3] (Powertech, 2011). These estimates apply to decommissioning wellfields, removal of constructed ponds, pond liners, and equipment and IX resin. The applicant anticipates that decommissioning of facilities will take 2 years; therefore, the annual byproduct waste generation estimate for decommissioning is 790 m^3 [1,034 yd^3] for the land application option and 710 m^3 [928 yd^3] for the deep Class V injection well disposal option. At this time, the applicant does not have an agreement in place with a licensed site to accept its solid byproduct material for disposal. If an NRC license is granted, an NRC license condition will require the applicant to have a byproduct material disposal agreement in place before operations begin. The applicant assumes it will obtain an agreement for disposal of byproduct material at the White Mesa site in Blanding, Utah, which is detailed in SEIS Section 3.13. SEIS Section 4.14 describes the impacts of solid byproduct material disposal.

During all phases of the proposed project, the applicant expects to produce nonhazardous solid waste. This waste could be composed of municipal waste (facility trash), septic solids, and other solid wastes, such as uncontaminated equipment, hardware, and packing materials. The applicant proposes to collect nonhazardous solid waste at designated onsite areas and dispose of this material at the Custer-Fall River Waste Management District landfill in Edgemont, South Dakota, or at the Newcastle Solid Waste Facility, if additional capacity is needed (Powertech, 2010a). SEIS Section 3.13 provides additional descriptions of the local solid waste facilities. The applicant estimates the proposed action will generate approximately 184 t [203 T] of nonhazardous solid waste annually during the construction phase (Powertech, 2010a). The NRC staff calculates the annual volume of construction debris as 144 m^3 [188 yd^3], which assumes a density of 1,281 kg/m^3 [1.08 T/yd^3]. During the operational period, the applicant estimates that less than 1.4 t [3,000 lb] per week of nonhazardous solid waste will be generated. The mass of nonhazardous solid waste is equivalent to an annual volume of 150 m^3 [196 yd^3], assuming a density of 475 kg/m^3 [800 lb/yd^3].

The NRC staff used the data in the applicant's financial assurance section of the application (Powertech, 2011) to estimate the total amount of nonhazardous solid waste that will be generated during the proposed 2-year decommissioning period; these totals are 12,496 m^3 [16,344 yd^3] for the land application option and 10,427 m^3 [13,638 yd^3] for the deep Class V injection well disposal option. The NRC staff calculates the annual decommissioning nonhazardous solid waste as 6,248 m^3 [8,172 yd^3] for the land application option and 5,213 m^3 [6,819 yd^3] for the deep Class V injection well disposal option by dividing the total estimates by the applicant's proposed 2-year decommissioning period. The applicant's nonhazardous solid waste estimates for decommissioning include plant building materials and equipment and wellfield equipment that do not contain radioactive materials or that meet NRC limits for unrestricted release.

The applicant's proposal describes hazardous waste that will be generated as waste oil, cleaning solvents, and used batteries (Powertech, 2009a). The applicant has estimated the proposed Dewey-Burdock ISR Project will generate less than 100 kg [220 lb] per month of all forms of hazardous waste, a quantity that the applicant expects will allow the facility to be classified as a Conditionally Exempt Small Quantity Generator (CESQG) under RCRA and South Dakota regulations (Powertech, 2009a). A CESQG (i) must determine whether its waste is hazardous; (ii) must not generate more than 100 kg [220 lb] per month of hazardous waste or, except with regard to spills, more than 1 kg [2.2 lb] of acutely hazardous waste; (iii) may not accumulate more than 1,000 kg [2,205 lb] of hazardous waste onsite at any time; and (iv) must treat or dispose of its hazardous waste in a treatment storage or disposal facility that meets the requirements specified in 40 CFR 261.5. If the facility fails to meet any of these four criteria, it will lose CESQG status. Without CESQG classification it will be fully regulated as either (i) a small-quantity generator of more than 100 kg [220 lb], but less than 1,000 kg [2,205 lb] of nonacute hazardous waste per calendar month or (ii) a large-quantity generator of 1,000 kg [2,205 lb] or more of nonacute hazardous waste per calendar month. Any hazardous wastes, such as organic solvents, paints, used oil and paint thinners, empty chemical containers, tank sediments/sludges, chemical wastes, or spent batteries, must be disposed of in accordance with applicable local, state, and federal regulatory requirements.

2.1.1.1.7 Transportation

The applicant proposes using trucks to transport construction equipment and materials, operational processing supplies, IX resins, yellowcake product, and waste materials. The applicant commits to complying with all applicable USDOT and NRC packaging and transportation requirements for shipments of hazardous chemicals and radioactive materials (Powertech, 2009b). During all phases of the facility lifecycle, both temporary and permanent workers will commute to and from the facility and generate additional traffic on local roads.

The applicant proposes using trucks to ship construction supplies and the vehicles used to construct facilities and wellfields at the proposed site. As stated previously, the applicant proposes phased wellfield development. After the processing facilities are constructed, the remaining wellfield construction activities and associated transportation will occur over a number of years (Figure 2.1-1). The applicant estimated 38 worker commuting round-trips will occur daily during the construction period based on a commitment to implement a carpooling policy (Powertech, 2013a,b). The applicant's estimate of construction-related traffic is presented in Table 2.1-7.

During operations, the applicant plans to use tanker trucks to transfer uranium-loaded and barren IX resins between the Burdock central processing plant and the Dewey satellite facility. The applicant estimates that each day, one uranium-loaded resin truck will travel from the satellite facility to the central processing plant and one barren resin truck will travel from the central processing plant to the satellite facility. The applicant proposes to ship yellowcake product from the central processing plant to a conversion facility located in Metropolis, Illinois, or Port Hope, Ontario, Canada. The NRC staff estimates the shipment distances from the proposed site to Metropolis, Illinois, and Port Hope, Ontario, to be approximately 2,270 km [1,410 mi] for either location (NRC, 2009a). The applicant proposes loading yellowcake into sealed 210-L [55-gal] drums and shipping by certified carrier. Assuming a proposed production rate of 0.45 million kg [1 million lb] of yellowcake per year, the applicant estimates approximately 25 yellowcake shipments annually. Proposed chemical supply shipments to the Dewey-Burdock facility include carbon dioxide, oxygen, salt, soda ash, barium chloride, hydrogen peroxide, sulfuric acid, hydrochloric acid, sodium hydroxide, and fuel. Shipments of waste products, including byproduct material, nonhazardous solid wastes, and hazardous wastes will originate at the proposed site for disposal at licensed disposal facilities during the plant operations. Estimates of traffic for all phases of the facility lifecycle are provided in Table 2.1-7. Based on the information in Table 2.1-7, the total daily operations phase truck traffic is estimated at 2 one-way trips per day for either waste disposal option.

During the decommissioning phase, the applicant proposes to decommission and dismantle structures and equipment, and to reclaim land surfaces. The applicant also proposes to ship some materials and equipment offsite for recycling or reuse. The applicant expects that waste materials, which will include byproduct material (e.g., contaminated facilities and equipment,

Table 2.1-7. Estimated Daily Vehicle Round-Trips for the Proposed Dewey-Burdock *In-Situ* Recovery Project Waste Management Options

Cargo	Land Application Option	Deep Class V Injection Well Option
Construction Equipment/Supplies	9	9
Construction/Employee Commuting	38	38
Remote Ion-Exchange Shipments	1	1
Processing Chemicals	0.92	0.92
Processing Byproduct Material	0.0085*	0.0037*
Yellowcake	0.1†	0.1†
Operations Employee Commuting	27	27
Aquifer Restoration Employee Commuting	5	5
Decommissioning Nonhazardous Solid Waste	1.0‡	0.87‡
Decommissioning Byproduct Material	0.13‡	0.12‡
Decommissioning Recycle/Reuse Equipment	0.07§<	0.07§<
Decommissioning Employee Commuting	7	7

Source: Powertech, 2009b, 2010a, 2013a,b. The applicant's reported vehicle trips from these references were not reported for each waste disposal option, and therefore the NRC staff assumed that the reported vehicle trips applied to both disposal options.
*The NRC staff divided the applicant's annual byproduct material estimate by the reported truck capacity and an assumed 260 shipping days per year.
†The NRC staff divided the applicant's annual yellowcake production rate by the reported truck capacity and an assumed 260 shipping days per year.
‡The NRC staff divided the estimated waste for each option by the proposed 2-year decommissioning period, by the proposed truck capacity, and by an assumed 260 shipping days per year.
§The NRC staff divided the applicant's estimated shipments by the proposed 2-year decommissioning period and an assumed 260 shipping days per year.

pond bottoms, and excavated soils), nonradiological and nonhazardous solid waste, and hazardous solid waste, will be shipped offsite to licensed disposal facilities. Traffic estimates for the decommissioning phase are provided in Table 2.1-7. The total daily decommissioning phase truck traffic estimates are 1.2 one-way trips per day for the land application option and 1.1 one-way trips per day for the Class V injection well disposal option.

2.1.1.1.8 Financial Assurance

NRC regulations at 10 CFR Part 40, Appendix A, Criterion (9) and SDDENR regulations under SDCL 45-6B require applicants to assure that sufficient funds will be available to carry out decommissioning, reclamation of disturbed areas, waste disposal, dismantling and disposal of all facilities including buildings and wellfields, and groundwater restoration by independent third parties (NRC, 2009a). NRC and SDDENR regulations require the applicant to establish financial surety arrangements to cover such costs before operations begin at the proposed

Dewey-Burdock ISR Project. The applicant must also maintain these surety arrangements until NRC and SDDENR determine the applicant has complied with its reclamation plan.

NRC has primacy for the proposed Dewey-Burdock site and will calculate the surety bond for the portions of the site over which it has jurisdiction, including facility decommissioning of the central processing plant, satellite plant, process and retention ponds, radioactive and byproduct storage facilities, wellfields, and land application areas, groundwater restoration, radiological surveys, and environmental monitoring. The SDDENR portion of the bond will cover costs outside NRC jurisdiction and will include reclaiming access roads and other surface areas not associated with the central processing plant, satellite plant, process ponds, and wellfields. EPA will have a separate bond covering the plugging and abandonment of all Class III and Class V injection wells.

The surety bond for the proposed Dewey-Burdock ISR Project will be independently calculated by the NRC with input from SDDENR as defined in a pending Memorandum of Understanding (MOU) between the two agencies (NRC, 2013c). The MOU will include a provision for the NRC to hold the state portion of the bond. Provisions will specify that NRC and SDDENR jointly manage and adjust the value of the bond as site conditions change over the project life and as portions of the facility are decommissioned and reclaimed.

NRC and SDDENR will require annual revisions to the applicant's surety bond to ensure that funds are available for the decommissioning of existing and planned operations and existing and planned construction. NRC reviews financial surety arrangements and decommissioning plans in detail as part of its review for the safety evaluation report (NRC, 2013a). For additional information on financial surety requirements, see 10 CFR Part 40, Appendix A, Criterion (9) and GEIS Section 2.10.

2.1.1.2 Alternative Liquid Waste Disposal Options

Liquid wastes are expected to be generated during the operations and aquifer restoration phases of the proposed Dewey-Burdock ISR Project. The applicant is required to manage and dispose of liquid byproduct material in compliance with applicable state and federal regulations, as established by license and permit. SEIS Section 2.1.1.1.6.2 describes the characteristics and quantities of the proposed liquid waste streams and the proposed approach for the applicant to apply for a permit to dispose of these waste streams using Class V deep injection wells. If EPA does not grant the applicant a UIC permit, the applicant will need to rely solely on the proposed land application or seek an NRC license amendment to approve another disposal option before it initiates operations. Historically, ISR facilities have used evaporation ponds and surface water discharge to manage and dispose of liquid wastes. Some licensed ISR facilities have used Class I deep disposal wells; however, Class I deep disposal wells are not permitted in South Dakota. For this reason, Class I deep disposal wells are not discussed as a potential option for the proposed Dewey-Burdock ISR Project.

The following subsections describe alternative wastewater disposal options. These options were mentioned in the GEIS. Table 2.1-8 compares the characteristics of several wastewater disposal options (NRC, 2009a). Potential environmental impacts of the waste management options are analyzed in SEIS Section 4.14.1.

Table 2.1-8. Comparison of Different Liquid Wastewater Disposal Options

	Class V Injection Well	**Evaporation Ponds**	**Land Application**	**Discharge to Surface Waters**
Land Size/ Footprint	13.4 ha [33 ac] Applicant estimate of proposed additional disposal option-specific land required including impoundments (e.g., radium settling, central plant pond, outlet pond, surge pond, reserve capacity)	40.5 ha [100 ac] Individual pond: 0.4 to 2.5 ha [1 to 6.25 ac], max 16.2 ha [40 ac] Pond system: about 40 ha [100 ac]	481 ha [1,188 ac] Applicant estimate of proposed additional disposal-option-specific land required including 55.1 ha [136 ac] for impoundments (e.g., radium settling, central plant pond, outlet pond, surge pond, reserve capacity) and 426 ha [1052 ac] for land application areas	13.4 ha [33 ac] Assumed by NRC to be similar to applicant estimate for Class V injection option Potential additional separate storage facilities (impoundments, tanks) to maintain separate waste streams
Relevant Regulations and Permits	10 CFR Part 20, Subparts D and K and Appendix B UIC Class V permit (EPA) NPDES permit (SDDENR) Large-Scale Mine Permit (SDDENR)	10 CFR Part 40, Appendix A Large-Scale Mine Permit (SDDENR) NESHAPS permit (40 CFR Part 61, Subpart W) Contract for byproduct material disposal (liners, sludges)	10 CFR Part 20, Subparts D and K and Appendix B 10 CFR Part 40, Appendix A, Criterion 6(6) Groundwater discharge plan (SDDENR) NESHAPS permit (40 CFR Part 61) Large-Scale Mine Permit (SDDENR)	10 CFR Part 20, Subparts D and K and Appendix B NPDES permit (SDDENR) No release to navigable waters standard in 40 CFR Part 440.34(b)(1) Large-Scale Mine Permit (SDDENR)
Construction Requirements	Land clearing and excavation equipment for pad, mud pits, radium-settling basins, treatment facilities Drilling rig	Land clearing and excavation equipment to prepare surface for pond(s) Construction equipment to construct pond liner(s)	Land clearing and excavation equipment for roads, radium settling basins, treatment facilities	Land clearing and excavation equipment for roads, radium-settling basins, treatment facilities

Table 2.1-8. Comparison of Different Liquid Wastewater Disposal Options (Cont'd)

	Class V Injection Well	Evaporation Ponds	Land Application	Discharge to Surface Waters
Is wastewater storage required prior to disposal?	Yes, storage/surge tank(s) Radium settling basins, treatment facility if needed to reduce radium, uranium, and other contaminant concentrations	No additional storage needed; evaporation pond provides necessary storage prior to disposal	Yes, storage/surge tank(s) Radium-settling basins, treatment facility if needed to reduce radium, uranium, and other contaminant concentrations	Yes, applicant may elect to maintain separate "process" and "mine" wastewater streams Radium-settling basins, treatment facility if needed to reduce radium, uranium, and other contaminant concentrations
Wastewater Treatment Issues	Decontamination through ion exchange and radium settling during operations and reverse osmosis during aquifer restoration. Effluent must meet 10 CFR Part 20, Appendix B effluent limits. May add antifouling agent to reduce scaling in well.	No additional treatment is required (optional)	Decontamination through ion exchange and radium settling during operations and aquifer restoration	Decontamination through ion exchange/reverse osmosis; additional treatment to meet conditions of NPDES discharge permit
Decommissioning Issues	Radium-settling basin liners and sludges, treatment of building debris to be disposed as byproduct material, additional transportation of wastes to licensed disposal facility Plug and abandon well in accordance with South Dakota Well Construction Standards Sections 74:02:04:67 and 74:02:04:69	Pond liners and sludges to be disposed as byproduct material; additional transportation of wastes to licensed disposal facility	Radium-settling basin liners and sludges, treatment of building debris to be disposed as byproduct material, additional transportation of wastes to licensed disposal facility Application soils to be disposed as byproduct material if limits exceeded Additional transportation of wastes to licensed disposal facility	Radium-settling basin liners and sludges, treatment of building debris to be disposed as byproduct material, additional transportation of wastes to licensed disposal facility

Table 2.1-8. Comparison of Different Liquid Wastewater Disposal Options (Cont'd)

	Class V Injection Well	Evaporation Ponds	Land Application	Discharge to Surface Waters
Environmental Benefits	Wastewater treated to 10 CFR Part 20, Appendix B effluent limits	Containment during storage, waste volume reduction, liquid waste form converted to solid prior to final disposal	Wastewater treatment to reduce uranium, radium, and other constituents Limited construction needed for land application area	Wastewater treated to meet conditions of an NPDES discharge permit
Climatic Influences	Deeper drilling requires larger rig, longer rig time, higher diesel emissions (CO_2 emission estimate for one deep well was approximately 1,000 × typical production well)* Additional equipment needed to construct wastewater storage and treatment facilities	Additional equipment needed to construct evaporation ponds	Additional equipment needed to construct wastewater storage and treatment facilities	Additional equipment needed to construct wastewater storage and treatment facilities
Health and Safety Issues	Potential leaks from wastewater storage and treatment facilities Additional waste volume during decommissioning	Potential leaks from evaporation ponds Additional waste volume during decommissioning	Potential leaks from wastewater storage and treatment facilities Additional waste volume during decommissioning	Potential leaks from wastewater storage and treatment facilities Additional waste volume during decommissioning

*Ratio of calculated CO_2 emissions for a single deep well of 308 t/yr [340 T/yr] and single production well of 0.29 t/yr [0.32 T/yr] is 1,062. Emissions estimates are from Table D.3-1 in NRC (2011). The single production well emissions estimate of 0.29 t/yr [0.32 T/yr] was calculated from the reported total wellfield drilling estimate in Table D.3-1 of 154 t/yr [170 T/yr] divided by the number of wells in the wellfield (525) that is reported in Table D.2-1 of the same reference.
Source: NRC (2009a)

2.1.1.2.1 Evaporation Ponds

One commonly used method for disposal of liquid wastes involves pumping liquids into one or more ponds and allowing natural solar radiation to reduce the volume through evaporation. The waste streams are not always treated prior to being discharged into evaporation ponds, and radionuclides and other metals are concentrated as the liquids evaporate. The basic design criteria for an evaporation pond system are contained in 10 CFR Part 40, Appendix A, Criteria 5A and 5E. NRC regulations set standards for the location of the pond(s) and the design and construction of the necessary clay or geosynthetic liner systems and embankments for the ponds (NRC, 2003a, 2008). NRC regulations also establish criteria for pond inspection and maintenance. The NRC guidance in Regulatory Guide 3.11 (NRC, 2008) recommends considering applicable EPA regulations in any impoundment design.

The effectiveness of evaporation ponds depends on evaporation rates and how quickly liquid wastes are generated. The evaporation rate varies seasonally and is dependent on temperature and relative humidity; the rate is highest during warm, dry conditions and is lower during cool, humid conditions. When the evaporation rate is low or seasonal conditions reduce evaporation, the operator can increase the size and the surface area of the evaporation ponds to augment evaporation.

Evaporation ponds are commonly used at facilities that employ a combination of waste disposal methods. Historically, the area of individual evaporation ponds at uranium ISR facilities has ranged from 0.04 to 2.5 ha [0.1 to 6.2 ac] (NRC, 1997, 1998a,b; Sanford Cohen and Associates, 2008). The total footprint of the evaporation pond system for all liquid byproduct material streams at an ISR facility has been estimated to be as high as 40 ha [100 ac] (NRC, 1997).

The applicant of an ISR facility would design, construct, and monitor a leak detection system and conduct routine inspections, with special inspections as described in NRC guidance to identify and repair leaks that might occur in the evaporation pond system (NRC, 2008). NRC guidance recommends that an applicant's design incorporate sufficient freeboard (the distance from the water level to top of the embankment) of about 1 to 2 m [3 to 6 ft], depending on the size of the individual pond, so that precipitation or wind-driven waves would not overtop the embankment (NRC, 2008). In addition, sufficient reserve capacity in the evaporation pond system must be maintained to allow the entire contents of one or more ponds to be transferred to other ponds in the event of a leak requiring corrective action and liner repair (NRC, 2009a). When necessary, an applicant would install perimeter fencing to ensure safety. These requirements would be written as conditions in an NRC license, and enforcement would be managed through the NRC inspection program.

The ISR facility applicant might need to demonstrate that radionuclides, such as radon, released to the air from ponds meet 40 CFR Part 61 requirements, in particular the provisions of Subpart W that incorporates the requirements of 40 CFR Part 192 (NRC, 2008; Sanford Cohen and Associates, 2008). In developing the impoundment design, the applicant will also need to consider EPA surface impoundment regulations for surface impoundments in 40 CFR Part 264 (NRC, 2008).

Because ponds are open to the air, dust and dirt can blow into ponds and the concentrations of dissolved solids may increase due to evaporation, resulting in the precipitation of salts from the solution. Ponds may require periodic cleaning to maintain good repair and the necessary freeboard; additionally, accumulated salts and solids may need to be disposed of as byproduct material at a licensed disposal facility. Similarly, when the operation and aquifer restoration phases end, pond liners and any accumulated materials would need to be disposed of as byproduct material. To provide an example of decommissioning waste volume, the volume of byproduct material that would be generated during decommissioning and reclamation of evaporation ponds at the Smith Ranch ISR facility in Converse County, Wyoming, was estimated in 2007 at 52 m^3 [68 yd^3] (NRC, 2009a).

During the winter months in South Dakota, during which temperatures are generally below freezing, ponds could ice over, thereby reducing evaporation to zero. To maintain year-round liquid disposal capability using evaporation ponds at the proposed Dewey-Burdock ISR Project facilities, the applicant will likely need to have either sufficient storage capacity or at least one other disposal option available. Deep Class V well injection and land application are proposed as optional methods. The applicant currently does not consider evaporation ponds a viable liquid waste disposal option at the proposed Dewey-Burdock site (Powertech, 2009b). This is due to unfavorable climatic conditions at the site; notably, the short period of high temperatures, long periods of sub-freezing temperatures, and strong winds.

2.1.1.2.2 Surface Water Discharge

Another disposal method historically used at uranium ISR facilities is treatment of liquid waste and discharge at the surface. EPA, in accordance with 40 CFR 440.34, does not allow new ISL facilities to discharge process waste water to navigable waters. For release of this effluent to non-navigable surface waters, the effluent would need to be pretreated to meet the NRC release standards in 10 CFR Part 20, Subparts D and K and Appendix B and the provisions of 10 CFR Part 40, Appendix A. The regulations at 10 CFR 20.2007 require compliance with other applicable federal, state, and local regulations. This would include EPA effluent discharge regulations for ISL facilities at 40 CFR Part 440, Subpart C, and the SDDENR requirements imposed by an NPDES water discharge permit. The NPDES permit specifies effluent limits to ensure water quality standards are maintained. Pretreatment of the liquid effluent using IX columns, reverse osmosis, and barium/radium sulfate precipitation is typically incorporated into the surface water discharge process to decrease uranium and radium levels in the wastewater below the permitted discharge limits. Like the land application wastewater disposal option, this treatment might require additional land for the construction of radium settling basins and storage reservoirs (NRC, 2003a). An applicant would need to control (i) byproduct material remaining at storage facilities and within tanks, impoundments, and radium-settling basins until the site and facilities are decommissioned (NRC, 2003a) or (ii) the radioactivity at storage facilities and within tanks, impoundments, and radium settling basins until the site and facilities are decommissioned (NRC, 2003a; Sanford Cohen and Associates, 2008).

In comments on the draft SEIS, SDDENR informed NRC that NPDES permit requirements do not allow process wastewater discharges to waters of the state. SDDENR has also informed NRC that if a permit for surface water discharge were requested for the proposed Dewey-Burdock site (e.g., because the surface drainages are connected to waters of the state), SDDENR would propose an NPDES permit that would require no discharge of process wastewater (see comment 119-000013 in Appendix E). Therefore, surface water discharge appears unlikely to be a viable option for disposal of liquid byproduct material for the proposed Dewey-Burdock ISR Project, but is retained in this analysis as a point of comparison with the other evaluated options.

2.1.2 No-Action (Alternative 2)

Under the No-Action alternative, NRC will not approve the license application for the proposed Dewey-Burdock ISR Project and BLM will not approve the applicant's modified Plan of Operations. The No-Action alternative will result in the applicant not constructing or operating the proposed Dewey-Burdock ISR Project. No buildings, access roads, wellfields, pipelines, or liquid waste disposal systems will be constructed. No uranium will be recovered from the subsurface orebodies; therefore, injection, production, and monitoring wells will not be installed to operate the facility. No lixiviant will be introduced into the subsurface, and no facilities will be constructed to process extracted uranium or store chemicals. Because no uranium will be recovered, neither aquifer restoration nor decommissioning activities will occur. No liquid effluents or solid wastes will be generated. The No-Action alternative is included to provide a basis for comparing and evaluating the potential impacts of the other alternatives, including the proposed action.

2.2 Alternatives Eliminated From Detailed Analysis

As required by NEPA regulations, the NRC staff considered alternatives to issuing the applicant a license. The range of alternatives was determined by considering the purpose and need for the proposed action and the private party's objective in extracting uranium from a particular orebody. In a site-specific environmental review the identification of reasonable alternatives depends on the proposed action, as well as site conditions. This section describes alternatives to the proposed action that were considered by the NRC, but not subjected to detailed analyses for the reasons described in the following sections. Sections 2.2.1 and 2.2.2 describe different mining techniques and associated milling alternatives for the proposed project site. Section 2.2.3 discusses the use of different lixiviant chemistry. Section 2.2.4 describes alternative site locations for the central plant and satellite facility within the proposed project area. Section 2.2.5 details the use of alternative well completion methods at the proposed project site.

2.2.1 Conventional Mining and Milling

Uranium ore deposits may be accessed either by open pit surface mining or by underground mining techniques. Open pit mining is used to extract shallow ore deposits—generally deposits less than 168 m [550 ft] below ground surface (EPA, 2008a). To access shallow deposits, the topsoil is removed and stockpiled for later site reclamation, while the overburden (the remainder of the material overlying the deposit) is removed via mechanical shovels and scrapers, via trucks or loaders, or by blasting (EPA, 1995, 2008a). The depth to which an orebody is surface mined depends on the ore grade, the nature of the overburden, and the ratio of overburden to be removed to one unit of ore extracted (EPA, 1995).

Underground mining techniques vary depending on the size, depth, orientation, and grade of the orebody; the stability of the subsurface strata; and economic factors (EPA, 1995, 2008b). In general, underground mining involves sinking a shaft near the orebody and then extending levels horizontally from the main shaft at different depths to access the ore. Ore and waste rock are removed through shafts by elevator or by using trucks to carry these materials up inclines to the surface (EPA, 2008a).

In addition, when the open pit or underground workings are established, the mine may need to be dewatered to allow the extraction of the uranium ore. Dewatering is accomplished by either pumping water directly from the open pit or pumping interceptor wells to lower the water table (EPA, 1995). The mine water usually requires treatment prior to discharge because it becomes contaminated with radioactive constituents, metals, and suspended and dissolved solids. Discharge of these mine waters may have subsequent impacts to surface water drainages and sediments, as well as to near-surface sources of groundwater (EPA, 1995).

Following the completion of mining, either by open pit or underground techniques, the mine will be reclaimed. Stockpiled overburden is reintroduced into the mined area, either during or following extraction operations, and topsoil is reapplied in an attempt to reestablish topography consistent with the surroundings. When dewatering ceases, the water table may rebound and fill portions of the open pit and underground workings. Historically, uranium mines have had negative impacts on local groundwater supplies and the waste materials from the mines have contaminated lands surrounding the mines (EPA, 2008b).

Ore extracted from an open pit or underground mine is processed in a conventional mill. As discussed in GEIS Appendix C (NRC, 2009a), ore processing at a conventional mill involves a series of steps (handling and preparation, concentration, and product recovery). While conventional milling techniques recover approximately 90 percent of the uranium content of the feed ore (NRC, 2009a), the process generates substantial wastes, known as tailings, because roughly 95 percent of the ore rock is disposed as waste (NRC, 2006). The conventional mill process also consumes large amounts of water. For example, the water usage estimate for the proposed Pinon Ridge Mill in Colorado is approximately 534 Lpm [141 gpm] (EFRC, 2009).

Tailings are disposed of in lined impoundments; NRC reviews the design and construction of impoundments to ensure safe disposal of the tailings (NRC, 2009a). Reclamation of the tailings pile generally involves evaporation of liquids in the tailings and settlement of the tailings over time. The tailings pile is then covered with a thick radon barrier and earthen material or rocks for erosion control. The area surrounding the reclaimed tailings piles would be fenced off in perpetuity and the site transferred to either a state or federal agency for long-term care (EIA, 1995). The costs associated with final mill decommissioning and tailings reclamation can run into the tens of millions of dollars (EIA, 1995).

In the final GEIS on uranium milling (NRC, 1980), NRC evaluated the potential environmental impacts of conventional uranium milling operations in a programmatic context, including the management of mill tailings. This GEIS evaluated the nature and extent of conventional uranium milling as part of the development of regulatory requirements for the management and disposal of mill tailings and for mill decommissioning. The impacts from operating a conventional mill are significantly greater than for operating an ISR facility. For example, at the proposed Dewey-Burdock ISR Project, approximately 75 ha [185 ac] will be used for uranium extraction operations. This will include wellfields, the central processing plant, a satellite facility, and pipeline infrastructure (Powertech, 2010a). A conventional mill requires much more land; approximately 300 ha [741 ac] would be affected by construction and milling operations and related activities would use approximately an additional 150 ha [370 ac] (NRC, 1980). The deposition of windblown tailings could further restrict land use near the tailings. In conventional mill modeling, levels of contamination extend several hundred meters [feet] beyond the model site boundary evaluated in the GEIS for conventional milling. Because of these factors, conventional milling was eliminated from detailed analysis in the SEIS.

2.2.2 Conventional Mining and Heap Leaching

Heap leaching is discussed in GEIS Appendix C. For low-grade ores, heap leaching is a viable alternative. Heap leaching is typically used when the orebody is small and situated far from the milling site. After extraction by conventional open pit or underground mining, the low-grade ore is crushed to approximately 2.6 cm [1 in] in size and mounded above grade on a prepared pad. A sprinkler or drip system positioned over the top continually distributes leach solution over the mound. Depending on the lime content, an acid or alkaline solution is used. The leach solution trickles through the ore and mobilizes the uranium, as well as other metals, into solution. The solution is collected at the base of the mound by a manifold and is then processed to extract the uranium. The uranium recovery from heap leaching ranges from 50 to 80 percent, resulting in a final tailings material of around 0.01 percent U_3O_8 content. When heap leaching is complete, the depleted materials are byproduct material that must be placed in a conventional mill tailings impoundment unless NRC grants an exemption for disposal in place. The impacts from heap leaching may be less than those associated with conventional milling; however, the impacts from open pit or underground mining are substantial. For these reasons, which are the same as those listed in SEIS Section 2.2.1, this alternative is not subjected to detailed analysis in this document.

2.2.3 Alternative Lixiviants

Alternative lixiviant chemistry was considered for the operations phase of the applicant's proposed project. Alternative chemistry includes acid leach solutions and ammonia-based lixiviants (Powertech, 2009a). Acid-based lixiviants, such as sulfuric acid, dissolve heavy metals and other solids associated with uranium in the host rock and other chemical constituents that require additional remediation and have greater environmental impacts. At a small-scale research facility in Wyoming, acid-based solutions were used to test their effectiveness as a lixiviant in the ISR process. During operations, significant problems developed. The mineral gypsum precipitated on the well screens and in the aquifer, which plugged the wells and reduced the efficiency of the wellfield restoration. Aquifer restoration had limited success, because of the gradual dissolution of the precipitated gypsum, which resulted in increased salinity and sulfate levels in the affected groundwater (Uranium One Americas, 2009). Because it is technically more difficult to restore acid mine sites, the use of an acid-based lixiviant was eliminated from detailed analysis in the SEIS.

Ammonia-based lixiviants have been used at ISR operations in Wyoming. However, operational experience has shown that ammonia tends to adsorb onto clay minerals in the subsurface and then slowly desorbs from the clay during restoration. This requires that a much larger volume of groundwater be removed and processed during aquifer restoration (Mudd, 2001). Because of the greater consumptive use of groundwater to meet groundwater restoration requirements, the use of an ammonia-based lixiviant was eliminated from detailed analysis.

2.2.4 Alternative Sites

Alternative sites within the proposed Dewey-Burdock ISR Project area were evaluated for the locations of the central plant and satellite facility (Powertech, 2009a). The applicant considered site-specific conditions in choosing the proposed central plant and satellite facility locations. The applicant made siting decisions to avoid proximity to historical and cultural resources, to avoid construction and operations in areas of historical environmental disturbance from past surface mining, to protect wildlife by avoidance of nesting sites for raptors, to avoid proximity to drainages, and to utilize surface and subsurface geological characteristics efficiently.

Based on the site-specific conditions used to choose the proposed locations of the Burdock central plant and Dewey satellite facility, alternative sites were not chosen for detailed analysis.

2.2.5 Alternative Well Completion Methods

Within the Dewey-Burdock ISR Project area, there is at least one area where one production zone overlies another (Powertech, 2009a). The applicant proposed the following preferred scenario for well completion for areas that contain more than one ore-bearing sand. First, the production and injection wells will be completed within the lowest ore sand. After the uranium has been recovered in the lowest sand, the production and injection wells will be completed in the next ore-bearing sand upward. After recovering the uranium from all the ore-bearing sands, restoration will begin by restoring the uppermost sandstone horizon first and working down to the lowermost sandstone horizon. The monitoring well ring design will correspond to the depth of uranium-bearing sand undergoing production or restoration.

Two alternative well completion methods were considered for areas within the project area containing more than one ore-bearing sand or production zone. The first alternative considered completion of wells across multiple sand horizons using the same wells and same monitoring ring. This alternative was not selected for detailed analysis due to the difficulties in (i) ensuring that the injection and productions fluids will be efficiently distributed through the various sands and (ii) monitoring the performance of the wellfield. The second alternative considered construction of larger wellfields and monitoring rings to encompass more reserves. Under this alternative, wells will be completed in the same manner as the applicant's preferred option. This method was considered and rejected due to (i) the increase in scale, (ii) the potential difficulties in evaluating pump tests, (iii) the increase in time and activities associated with installing and producing the wellfield, and (iv) delay in final restoration and reclamation of the wellfield. Therefore, this alternative well completion method was not selected for detailed analysis.

2.3 Comparison of the Predicted Environmental Impacts

NUREG–1748 (NRC, 2003b) categorizes the significance of potential environmental impacts as follows:

SMALL: The environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource considered.

MODERATE: The environmental effects are sufficient to alter noticeably, but not destabilize, important attributes of the resource considered.

LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource considered.

Chapter 4 presents a detailed evaluation of the environmental impacts from the proposed action and the No-Action alternative on resource areas at the proposed Dewey-Burdock ISR Project. Table 2.3-1 compares the significance level (SMALL, MODERATE, or LARGE) of potential environmental impacts of the proposed action for each proposed waste disposal option and the No-Action alternative and identifies the section in Chapter 4 where more detailed information can be found. For each resource area, the NRC staff identifies the significance level during each phase of the ISR process: construction, operation, aquifer restoration, and decommissioning. The predicted environmental impact to each resource area for the proposed action can also be found in the Executive Summary.

2.4 Final Recommendation

After weighing the impacts of the proposed action and comparing the alternatives, NRC staff, in accordance with 10 CFR 51.91(d), sets forth its NEPA recommendation regarding the proposed action. Unless safety issues mandate otherwise, the NRC staff recommendation to the Commission related to the environmental aspects of the proposed action is that a source material license for the proposed action be issued as requested. This recommendation is based

Table 2.3-1. Summary of Impacts for the Proposed Dewey-Burdock *In-Situ* Recovery Project

Section 4.2 Land Use Impacts				
	Proposed Action (Alternative 1)			No Action (Alternative 2)
	Deep Well Disposal Via Class V Injection Option	Land Application Option	Combined Disposal Via Class V Injection and Land Application Option	
Construction	SMALL 4.2.1.1.1	SMALL 4.2.1.2.1	SMALL 4.2.1.3	NONE 4.2.2
Operations	SMALL 4.2.1.1.2	SMALL 4.2.1.2.2	SMALL 4.2.1.3	NONE 4.2.2
Aquifer Restoration	SMALL 4.2.1.1.3	SMALL 4.2.1.2.3	SMALL 4.2.1.3	NONE 4.2.2
Decommissioning	SMALL to MODERATE* 4.2.1.1.4	SMALL to MODERATE* 4.2.1.2.4	SMALL to MODERATE* 4.2.1.3	NONE 4.2.2
Section 4.3 Transportation Impacts				
	Proposed Action (Alternative 1)			No Action (Alternative 2)
	Deep Well Disposal Via Class V Injection Option	Land Application Option	Combined Disposal Via Class V Injection and Land Application Option	
Construction	SMALL† 4.3.1.1.1	SMALL† 4.3.1.2.1	SMALL† 4.3.1.3	NONE 4.3.2
Operations	SMALL† 4.3.1.1.2	SMALL† 4.3.1.2.2	SMALL† 4.3.1.3	NONE 4.3.2
Aquifer Restoration	SMALL 4.3.1.1.3	SMALL 4.3.1.2.3	SMALL 4.3.1.3	NONE 4.3.2
Decommissioning	SMALL 4.3.1.1.4	SMALL 4.3.1.2.4	SMALL 4.3.1.3	NONE 4.3.2
Section 4.4 Geology and Soils Impacts				
	Proposed Action (Alternative 1)			No Action (Alternative 2)
	Deep Well Disposal Via Class V Injection Option	Land Application Option	Combined Disposal Via Class V Injection and Land Application Option	
Construction	SMALL 4.4.1.1.1	SMALL 4.4.1.2.1	SMALL 4.4.1.3	NONE 4.4.2
Operations	SMALL 4.4.1.1.2	SMALL 4.4.1.2.2	SMALL 4.4.1.3	NONE 4.4.2
Aquifer Restoration	SMALL 4.4.1.1.3	SMALL 4.4.1.2.3	SMALL 4.4.1.3	NONE 4.4.2
Decommissioning	SMALL 4.4.1.1.4	SMALL 4.4.1.2.4	SMALL 4.4.1.3	NONE 4.4.2

Table 2.3-1. Summary of Impacts for the Proposed Dewey-Burdock *In-Situ* Recovery Project (Cont'd)

Section 4.5.1 Water Resources Impacts (Surface Water and Wetlands)				
	Proposed Action (Alternative 1)			No Action (Alternative 2)
	Deep Well Disposal Via Class V Injection Option	Land Application Option	Combined Disposal Via Class V Injection and Land Application Option	
Construction	SMALL 4.5.1.1.1.1	SMALL 4.5.1.1.2.1	SMALL 4.5.1.1.3	NONE 4.5.1.2
Operations	SMALL 4.5.1.1.1.2	SMALL 4.5.1.1.2.2	SMALL 4.5.1.1.3	NONE 4.5.1.2
Aquifer Restoration	SMALL 4.5.1.1.1.3	SMALL 4.5.1.1.2.3	SMALL 4.5.1.1.3	NONE 4.5.1.2
Decommissioning	SMALL 4.5.1.1.1.4	SMALL 4.5.1.1.2.4	SMALL 4.5.1.1.3	NONE 4.5.1.2

Section 4.5.2 Water Resources Impacts (Groundwater)				
	Proposed Action (Alternative 1)			No Action (Alternative 2)
	Deep Well Disposal Via Class V Injection Option	Land Application Option	Combined Disposal Via Class V Injection and Land Application Option	
Construction	SMALL 4.5.2.1.1.1	SMALL 4.5.2.1.2.1	SMALL 4.5.2.1.3	NONE 4.5.2.2
Operations	SMALL 4.5.2.1.1.2	SMALL 4.5.2.1.2.2	SMALL 4.5.2.1.3	NONE 4.5.2.2
Aquifer Restoration	SMALL 4.5.2.1.1.3	SMALL 4.5.2.1.2.3	SMALL 4.5.2.1.3	NONE 4.5.2.2
Decommissioning	SMALL 4.5.2.1.1.4	SMALL 4.5.2.1.2.4	SMALL 4.5.2.1.3	NONE 4.5.2.2

Section 4.6 Ecological Resources Impacts				
	Proposed Action (Alternative 1)			No Action (Alternative 2)
	Deep Well Disposal Via Class V Injection Option	Land Application Option	Combined Disposal Via Class V Injection and Land Application Option	
Construction	SMALL 4.6.1.1.1	SMALL to MODERATE† 4.6.1.2.1	SMALL to MODERATE† 4.6.1.3	NONE 4.6.2
Operations	SMALL 4.6.1.1.2	SMALL to MODERATE† 4.6.1.2.2	SMALL to MODERATE† 4.6.1.3	NONE 4.6.2
Aquifer Restoration	SMALL 4.6.1.1.3	SMALL to MODERATE† 4.6.1.2.3	SMALL to MODERATE† 4.6.1.3	NONE 4.6.2
Decommissioning	SMALL to MODERATE‡ 4.6.1.1.4	SMALL to MODERATE‡ 4.6.1.2.4	SMALL to MODERATE‡ 4.6.1.3	NONE 4.6.2

Table 2.3-1. Summary of Impacts for the Proposed Dewey-Burdock *In-Situ* Recovery Project (Cont'd)

Section 4.7 Air Quality Impacts				
	Proposed Action (Alternative 1)			No Action (Alternative 2)
	Deep Well Disposal Via Class V Injection Option	Land Application Option	Combined Disposal Via Class V Injection and Land Application Option	
Construction	SMALL to MODERATE§ 4.7.1.1.1	SMALL to MODERATE§ 4.7.1.2.1	SMALL to MODERATE§ 4.7.1.3	NONE 4.7.2
Operations	SMALL 4.7.1.1.2	SMALL 4.7.1.2.2	SMALL 4.7.1.3	NONE 4.7.2
Aquifer Restoration	SMALL 4.7.1.1.3	SMALL 4.7.1.2.3	SMALL 4.7.1.3	NONE 4.7.2
Decommissioning	SMALL 4.7.1.1.4	SMALL 4.7.1.2.4	SMALL 4.7.1.3	NONE 4.7.2

Section 4.8 Noise Impacts				
	Proposed Action (Alternative 1)			No Action (Alternative 2)
	Deep Well Disposal Via Class V Injection Option	Land Application Option	Combined Disposal Via Class V Injection and Land Application Option	
Construction	SMALL 4.8.1.1.1	SMALL 4.8.1.2.1	SMALL 4.8.1.3	NONE 4.8.2
Operations	SMALL 4.8.1.1.2	SMALL 4.8.1.2.2	SMALL 4.8.1.3	NONE 4.8.2
Aquifer Restoration	SMALL 4.8.1.1.3	SMALL 4.8.1.2.3	SMALL 4.8.1.3	NONE 4.8.2
Decommissioning	SMALL 4.8.1.1.4	SMALL 4.8.1.2.4	SMALL 4.8.1.3	NONE 4.8.2

Section 4.9 Historical and Cultural Resources Impacts				
	Proposed Action (Alternative 1)			No Action (Alternative 2)
	Deep Well Disposal Via Class V Injection Option	Land Application Option	Combined Disposal Via Class V Injection and Land Application Option	
Construction	SMALL to LARGE‖ 4.9.1.1.1	SMALL to LARGE‖ 4.9.1.2.1	SMALL to LARGE‖ 4.9.1.3	NONE 4.9.2
Operations	SMALL to MODERATE╪ 4.9.1.1.2	SMALL to MODERATE╪ 4.9.1.2.2	SMALL to MODERATE╪ 4.9.1.3	NONE 4.9.2
Aquifer Restoration	SMALL to MODERATE╪ 4.9.1.1.3	SMALL to MODERATE╪ 4.9.1.2.3	SMALL to MODERATE╪ 4.9.1.3	NONE 4.9.2
Decommissioning	SMALL 4.9.1.1.4	SMALL 4.9.1.2.4	SMALL 4.9.1.3	NONE 4.9.2

Table 2.3-1. Summary of Impacts for the Proposed Dewey-Burdock *In-Situ* Recovery Project (Cont'd)

Section 4.10 Visual and Scenic Resources Impacts				
	Proposed Action (Alternative 1)			No Action (Alternative 2)
	Deep Well Disposal Via Class V Injection Option	Land Application Option	Combined Disposal Via Class V Injection and Land Application Option	
Construction	SMALL 4.10.1.1.1	SMALL 4.10.1.2.1	SMALL 4.10.1.3	NONE 4.10.2
Operations	SMALL 4.10.1.1.2	SMALL 4.10.1.2.2	SMALL 4.10.1.3	NONE 4.10.2
Aquifer Restoration	SMALL 4.10.1.1.3	SMALL 4.10.1.2.3	SMALL 4.10.1.3	NONE 4.10.2
Decommissioning	SMALL 4.10.1.1.4	SMALL 4.10.1.2.4	SMALL 4.10.1.3	NONE 4.10.2
Section 4.11 Socioeconomic Impacts (Demographics)				
	Proposed Action (Alternative 1)			No Action (Alternative 2)
Construction				NONE 4.11.2
Demographics	SMALL 4.11.1.1.1			
Income	SMALL 4.11.1.1.2			
Housing	SMALL 4.11.1.1.3			
Employment Rate	SMALL 4.11.1.1.4			
Local Finance	SMALL 4.11.1.1.5			
Education	SMALL 4.11.1.1.6			
Health and Social Services	SMALL 4.11.1.1.7			
Operations				NONE 4.11.2
Demographics	SMALL 4.11.1.2.1			
Income	SMALL 4.11.1.2.2			
Housing	SMALL 4.11.1.2.3			
Employment Rate	SMALL 4.11.1.2.4			
Local Finance	SMALL to MODERATE¶ 4.11.1.2.5			
Education	SMALL 4.11.1.2.6			
Health and Social Services	SMALL 4.11.1.2.7			
Aquifer Restoration	SMALL 4.11.1.3			NONE 4.11.2
Decommissioning	SMALL 4.11.1.4			NONE 4.11.2

Table 2.3-1. Summary of Impacts for the Proposed Dewey-Burdock *In-Situ* Recovery Project (Cont'd)

Section 4.12 Environmental Justice Impacts				
	Proposed Action (Alternative 1)			No Action (Alternative 2)
Construction	SMALL 4.12.1			NONE 4.12.2
Operations	SMALL 4.12.1			NONE 4.12.2
Aquifer Restoration	SMALL 4.12.1			NONE 4.12.2
Decommissioning	SMALL 4.12.1			NONE 4.12.2
Section 4.13 Public and Occupational Health and Safety Impacts				
	Proposed Action (Alternative 1)			No Action (Alternative 2)
	Deep Well Disposal Via Class V Injection Option	Land Application Option	Combined Disposal Via Class V Injection and Land Application Option	
Construction	SMALL 4.13.1.1.1	SMALL 4.13.1.2.1	SMALL 4.13.1.3	NONE 4.13.2
Operations	SMALL 4.13.1.1.2	SMALL 4.13.1.2.2	SMALL 4.13.1.3	NONE 4.13.2
Aquifer Restoration	SMALL 4.13.1.1.3	SMALL 4.13.1.2.3	SMALL 4.13.1.3	NONE 4.13.2
Decommissioning	SMALL 4.13.1.1.4	SMALL 4.13.1.2.4	SMALL 4.13.1.3	NONE 4.13.2
Section 4.14 Waste Management Impacts				
	Proposed Action (Alternative 1)			No Action (Alternative 2)
	Deep Well Disposal Via Class V Injection Option	Land Application Option	Combined Disposal Via Class V Injection and Land Application Option	
Construction	SMALL 4.14.1.1.1	SMALL 4.14.1.2.1	SMALL 4.14.1.3	NONE 4.14.2
Operations	SMALL 4.14.1.1.2	SMALL 4.14.1.2.2	SMALL 4.14.1.3	NONE 4.14.2
Aquifer Restoration	SMALL 4.14.1.1.3	SMALL 4.14.1.2.3	SMALL 4.14.1.3	NONE 4.14.2
Decommissioning	SMALL to MODERATE# 4.14.1.1.4	SMALL to MODERATE# 4.14.1.2.4	SMALL to MODERATE# 4.14.1.3	NONE 4.14.2

*A MODERATE impact on land use until vegetation is reestablished in seeded areas.
†A MODERATE impact on vegetation, small- to medium-sized mammals, raptors, nongame and migratory birds, and reptiles.
‡A MODERATE impact on vegetation until it is reestablished.
§A MODERATE impact on air quality from short-term, intermittent fugitive dust emissions. The peak year (i.e., when all four phases occur simultaneously) impacts will range between SMALL to MODERATE.
‖A MODERATE or LARGE impact on 13 historic properties and other unevaluated historic, cultural, and religious properties in the project area. A potential MODERATE visual impact on 19 historic properties.
╪A potential MODERATE visual impact on 19 historic properties.
¶A potential positive MODERATE impact on local finance from increased employment, economic activity, and tax revenues.
#A potential MODERATE impact on disposal of nonhazardous solid waste depending on the long-term status of existing local landfill resources.

on (i) the license application, which includes the ER and supplemental documents, and the applicant's responses to NRC staff requests for additional information; (ii) consultation with federal, state, tribal, and local agencies; (iii) independent NRC staff review; (iv) NRC staff consideration of comments received on the draft SEIS; and (v) the assessments summarized in this SEIS.

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3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1 Introduction

The proposed Dewey-Burdock *In-Situ* Recovery (ISR) Project is located in Custer and Fall River Counties, South Dakota, in the Nebraska-South Dakota-Wyoming Uranium Milling Region as defined in the generic environmental impact statement (GEIS) (NRC, 2009a). The proposed project area, which encompasses 4,282 ha [10,580 ac] of land, is in a relatively unpopulated rural area consisting of rangeland used primarily for cattle grazing. The nearest population center to the proposed Dewey-Burdock ISR Project is Edgemont, South Dakota, approximately 21 km [13 mi] to the south-southeast. The hamlet of Dewey, South Dakota, is located approximately 3.2 km [2 mi] northwest of the project. Other towns located within 80 km [50 mi] of the proposed project area include Hot Springs and Custer, South Dakota, and Newcastle, Wyoming (see Figure 1.1-1).

This chapter describes the existing site conditions of the proposed Dewey-Burdock ISR Project. The resource areas described in this chapter include land use; transportation; geology and soils; water resources; ecology; meteorology, climatology, and air quality; noise; historic and cultural resources; visual and scenic resources; socioeconomics; public and occupational health; and waste management practices. The descriptions of the affected environment are based on information provided in the Powertech (USA) Inc. (Powertech) (referred to herein as the applicant) license application documents (Powertech, 2009a–c) and responses to U.S. Nuclear Regulatory Commission (NRC) requests for additional information (Powertech, 2010a–c, 2011) and supplemented by additional information the NRC identified. The information in this chapter forms the basis for assessing the potential impacts (see Chapter 4) of the proposed action and each alternative (see Chapter 2).

3.2 Land Use

The proposed Dewey-Burdock ISR Project is located within the Great Plains physiographic province on the edge of the Black Hills uplift. The proposed project area covers 4,282 ha [10,580 ac] and is composed of two contiguous areas: the Burdock area and the Dewey area (Figure 3.2-1). The Burdock area is located in the following townships and ranges: (i) Township 7 South, Range 1 East, Sections 1, 2, 3, 10, 11, 12, and portions of Sections 14 and 15 and (ii) Township 6 South, Range 1 East, Sections 34, 35, and portions of Section 27. The Dewey area is located in the following townships and ranges: (i) Township 7 South, Range 1 East, Section 5 and portions of Section 4 and (ii) Township 6 South, Range 1 East, Sections 29, 30, and 32, and portions of Sections 20, 21, 28, 31, and 33. Approximately 4,185 ha [10,340 ac] of the proposed project area are in the hands of private landowners, while approximately 97 ha [240 ac] are U.S. Government lands managed by U.S. Bureau of Land Management (BLM) (Powertech, 2009a,b).

GEIS Section 3.1.2.2 describes the concept of split estate where different entities own the surface rights and subsurface rights (such as the rights to develop minerals) for a piece of land (NRC, 2009a). This divided ownership pattern occurs at the proposed Dewey-Burdock ISR Project site, where BLM manages federally owned subsurface mineral rights to portions of land whose surface rights are owned by private landowners. In total, the U.S. Government reserved 1,708 ha [4,220 ac] of subsurface mineral estate under the Stock-Raising Homestead Act when the surface was patented. The applicant maintains the unpatented mining claims associated

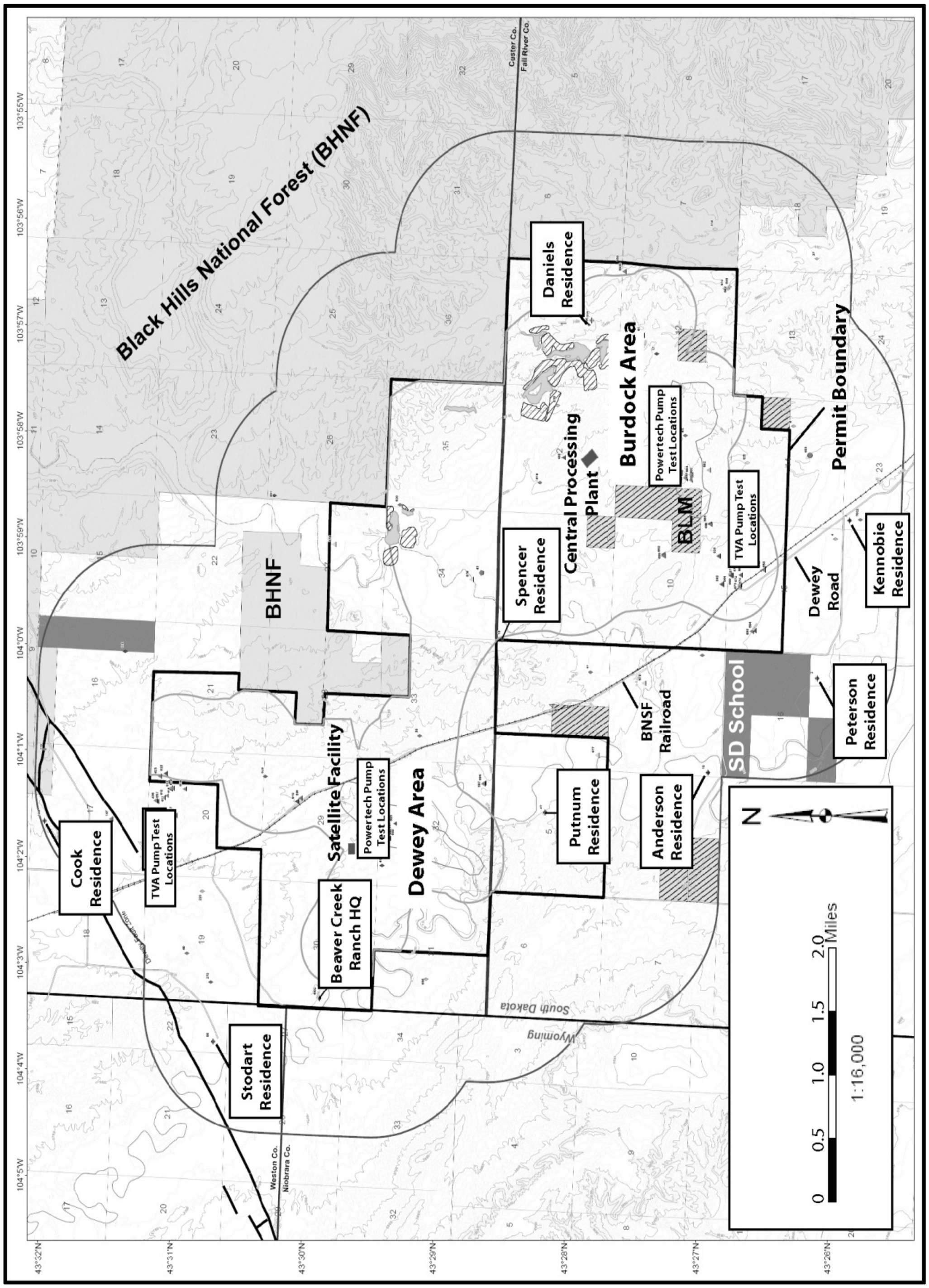

Figure 3.2-1. Map Showing Proposed Dewey-Burdock *In-Situ* Recovery Project Permit Boundary, Location of U.S. Bureau of Land Management-Managed Land, Position of Parcels of the Black Hills National Forest (BHNF) Bordering the Permit Area to the East and North, and Locations of Residences Within the Proposed Permit Area
Source: Modified From Powertech (2009c)

with the 1,780 ha [4,220 ac] of federal minerals. In addition, the applicant maintains unpatented mining claims on the 97 ha [240 ac] of BLM-managed surface lands.

The land the applicant acquired for uranium resource development within the proposed project area consists of a mixture of leases from private landowners, both surface and subsurface, as well as the mining claims on the 1,780 ha [4,220 ac] of subsurface mineral estate and 97 ha [240 ac] of BLM-managed surface lands (Powertech, 2009a). This land consists of contiguous blocks of property known to contain the majority of discovered and delineated uranium resources that would be permitted for development.

Dwellings located within a 1.6-km [1.0-mi] radius of the proposed project boundary are listed in Table 3.2-1 and mapped on Figure 3.2-1. Two permanently occupied dwellings (the Putnam residence and the Beaver Creek Ranch headquarters), the vacant Spencer residence, and the seasonally occupied Daniel dwelling are located within the proposed project area. The permanent onsite residences, the Putnam dwelling and Beaver Creek Ranch headquarters, are located approximately 1.3 km [0.8 mi] south and 0.8 km [0.5 mi] west, respectively, of proposed wellfields in the Dewey area. The closest offsite residences, the Peterson and Kennobie dwellings, are located approximately 1.3 km [0.8 mi] southwest and 1.3 km [0.8 mi] south, respectively, of proposed wellfields in the Burdock area.

The project area and surrounding region has been used as rangeland, as wildlife habitat, for recreation and hunting, in uranium exploration and mining, in oil and gas development, and for wind energy generation since historic times. SEIS Section 3.6.1 describes wildlife and vegetation in the project area. A small portion of the project area currently covered by stands of ponderosa pine has been logged selectively for pulpwood; however, timber is not currently and historically has not been a significant industry in the region surrounding the proposed project area (Powertech, 2010d).

3.2.1 Rangeland

Land use within the proposed Dewey-Burdock ISR Project area and adjacent lands is primarily agricultural (Powertech, 2009a), mainly for grazing cattle and a small number of horses. The National Agriculture Statistics Service reports 75,250 head of cattle in Fall River and

Table 3.2-1. Dwellings Within the Proposed Dewey-Burdock *In-Situ* Recovery Project Area and a 1.6-km [1.0-mi] Radius of the Proposed Permit Boundary

Dwelling Name	Status	Number of Permanent Occupants	Location*
Peterson	Occupied	9	T7S, R1E, Section 16
Kennobie	Occupied	2	T7S, R1E, Section 23
Spencer	Vacant		T7S, R1E, Section 3
Daniel	Seasonal		T7S, R1E, Section 1
Andersen	Occupied	3	T7S, R1E, Section 9
Putnam	Occupied	2	T7S, R1E, Section 5
Stodart	Vacant		T41S, R60E, Section 22
Cook	Vacant		T6S, R1E, Section 17
Beaver Creek Ranch Headquarters	Occupied	1	T6S, R1E, Section 30

Source: Powertech (2010a).
*T = Township; R = Range; S = South; E = East

Custer Counties in 2007 (USDA, 2009). No commercial crop production takes place within the permit area; however, approximately 157 ha [389 ac] of land along Beaver Creek in Section 32, Township 6 South, Range 1 East is irrigated for hay production for use by the grower (Powertech, 2009a).

The approximately 97 ha [240 ac] of BLM-managed lands within the project area are located in Fall River County entirely within the Burdock area (Figure 3.2-1); these lands are surrounded by private land and have limited public access. Additional small parcels of BLM-managed land are located outside the proposed project area in Fall River County. The majority of land under BLM management in South Dakota is grassland (BLM, 1985). The forage produced on these lands is a public resource and historically has been used for livestock grazing. Area ranchers lease grazing privileges and derive economic benefits from the public lands proportional to the amount of grassland under lease. In its current resource management plan for South Dakota, BLM has categorized most grazing allotments of BLM lands in Fall River County, including those within the proposed project area, as “custodial” (BLM, 1985). The objective of this category is to manage and protect the existing resource value of the land (BLM, 1985).

3.2.2 Hunting and Recreation

Within the proposed project area, recreational use is limited primarily to big game hunting. Pronghorn antelope, mule deer, white-tailed deer, and elk are the predominant big game species hunted (Powertech, 2009a). Hunting is currently open to the public within the project area on approximately 2,307 ha [5,700 ac] including the 97 ha [240 ac] of BLM-managed land (Powertech, 2011). In addition, South Dakota Game, Fish, and Parks (SDGFP) leases around 1,214 ha [3,000 ac] of privately owned land within the project area and designates this acreage as walk-in hunting areas (WIA) (Powertech, 2011). The amount of land designated as WIAs changes from year to year because landowners lease their lands annually to SDGFP.

Recreational lands are present in Custer, Fall River, and Pennington Counties within an 80-km [50-mi] radius of the proposed project. Major attractions include Mount Rushmore National Memorial, Wind Cave National Park, and Jewel Cave National Monument, all managed by the U.S. Department of the Interior. These attractions are within the Black Hills National Forest (BHNF) and are located approximately 71 km [44 mi] northeast, 47 km [29 mi] east, and 37 km [23 mi] north of the project area, respectively (Figure 3.2-2). BHNF borders the proposed project to the north, northeast, and east, and the Buffalo Gap National Grassland is located approximately 4.8 km [3 mi] south of the proposed project (Figure 3.2-2). The U.S. Forest Service (USFS) manages these lands, which provide a variety of recreational activities, such as sightseeing, hiking, camping, fishing, and hunting (USFS, 2009, 1997).

3.2.3 Minerals and Energy

Historically, industrial activity within and in the region surrounding the proposed Dewey-Burdock ISR Project has consisted primarily of uranium exploration and mining and oil and gas development. There are no coal mines or coal bed methane operations in Fall River and Custer Counties (NRC, 2009a). However, information gathered during a site visit meeting with the BLM staff indicated small bituminous coal deposits located east and south of the proposed project area were developed in the past (NRC, 2009b). This information is consistent with isolated coal fields located approximately 3 km [2 mi] southeast of the proposed project area and approximately 6 km [4 mi] southeast of the city of Edgemont (Figure 3.2-2).

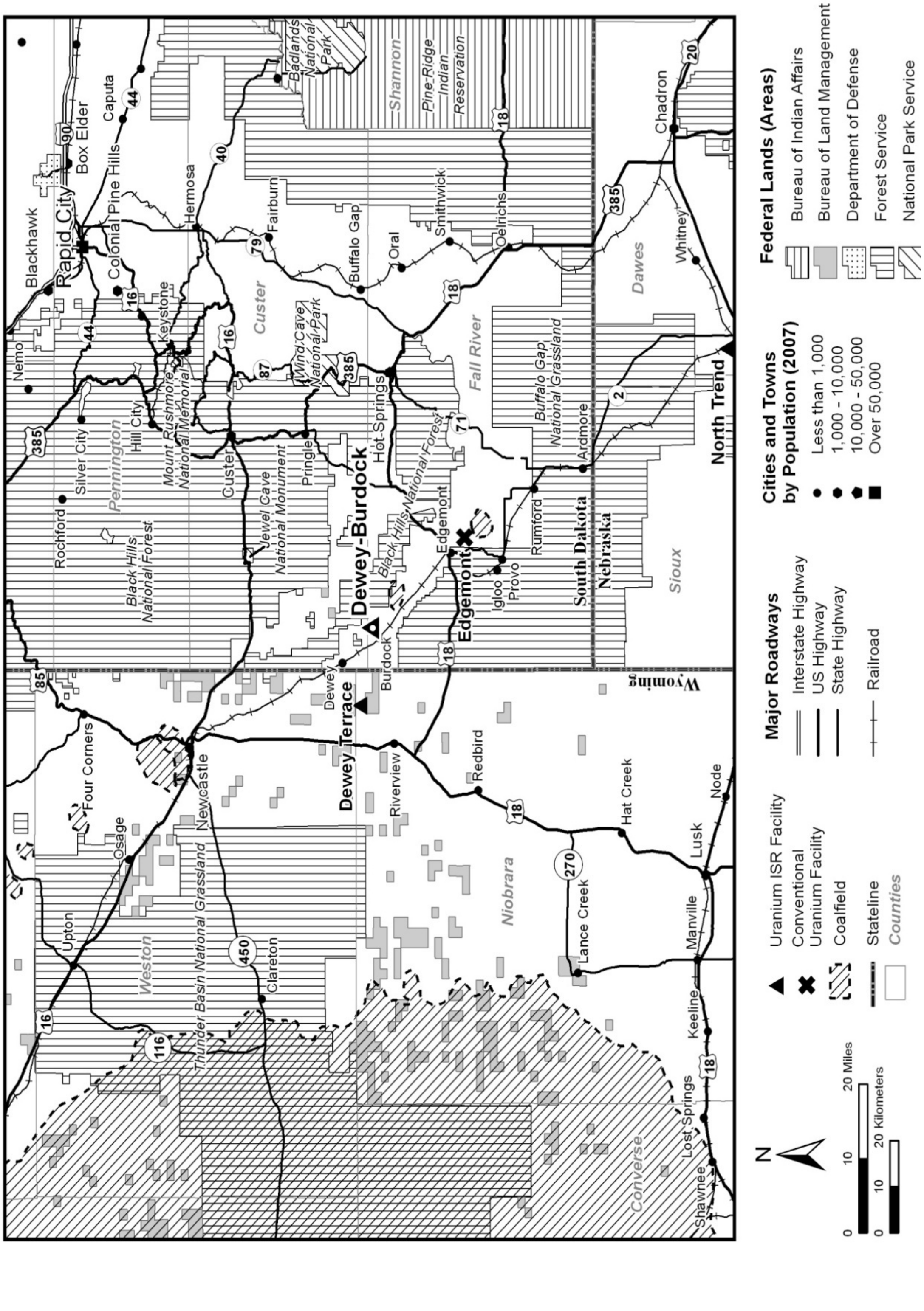

Figure 3.2-2. Recreational Areas, Federal Lands, Coal Fields, and Potential *In-Situ* Recovery Facilities Near the Proposed Dewey-Burdock ISR Project
Sources: ESRI (2008); National Atlas of the United States (2009)

The proposed project site is located within the Edgemont Uranium District in Fall River and Custer Counties, South Dakota. Uranium was first discovered in the Edgemont District in 1951, and open pit mines produced uranium until 1972 (Powertech, 2009a). Surface and underground uranium mines were operated in the Burdock area along the eastern boundary of the proposed project area (Figure 3.2-3). Surface mines consist of seven open pits: Triangle Pit, Darrow Mine, Darrow Pit 1, Darrow Pit 2, Darrow Pit 3, Darrow Pit 4, and Darrow Pit 6 (Figure 3.2-3). The underground mine workings consist of four shallow mines (Triangle Underground, Darrow Underground, Freezeout 1, and Freezeout 2 mines) and two open pit adits (tunnels) driven into the highwalls of Darrow Pit 2 (Figure 3.2-3) (Powertech, 2011). The underground mines were constructed as declines (downward sloping ramps) ranging in depth from 0 to 24.4 m [0 to 80 ft] below ground surface. Both the underground and open pit mines extracted uranium from shallow sandstone orebodies within the Fall River Formation (Powertech, 2011). Existing mine waste overburden from the underground and open pit mines remains in the eastern portions of the Burdock area (Figure 3.2-3). The Tennessee Valley Authority (TVA) acquired the land encompassing the proposed project area in 1978 and conducted uranium exploration activities until 1986. In total, TVA drilled more than 4,000 exploration drill holes within and in the vicinity of the proposed project.

Operating uranium recovery facilities are located within the broader regional area. The nearest operational ISR facility is the Crow Butte ISR facility, which is located approximately 105 km [65 mi] to the south-southeast in Dawes County, near Crawford, Nebraska (NRC, 2009a). The applicant identified uranium resources at two potential ISR projects at Dewey Terrace and Aladdin in Wyoming (Powertech, 2009b). The potential Dewey Terrace project is located 13 km [8 mi] west of the proposed Dewey-Burdock ISR Project in Weston and Niobrara Counties, Wyoming (Figure 3.2-2). The mineralized trends in the Dewey Terrace project area are a continuation of the mapped trends from the Dewey-Burdock ISR Project. The potential Aladdin project is located approximately 129 km [80 mi] to the north in Crook County, Wyoming, near the Wyoming/South Dakota border. Development of these potential ISR facilities is dependent upon further site investigations, as well as the viability of the uranium market (Powertech, 2009b). To this date, the applicant has not submitted a letter of intent for either Aladdin or Dewey Terrace.

There are no former or actively producing oil and gas wells within the proposed Dewey-Burdock ISR Project permit area or within 2 km [1.2 mi] of the proposed project boundary (Powertech, 2011). However, 3 oil and gas test wells are located in the proposed Burdock area and another 10 tests wells are within 2 km [1.2 mi] of the proposed project boundary (Figure 3.2-4) (Powertech, 2010a, 2011). A review of South Dakota Department of Environment and Natural Resources (SDDENR) permit files for each of these wells indicated that one of the oil and gas wells within the Burdock area (40 047 20065) and two of the oil and gas test wells located within 2 km [1.25 mi] of the project boundary (40 047 05090 and 40 047 05093) have been recompleted as stock watering wells (SDDENR, 2013). In Fall River County, the producing oil well nearest to the proposed project is approximately 11 km [7 mi] to the southeast in the Cheyenne Bend oilfield (SDDENR, 2012a). Other producing oil wells are located southwest of the city of Edgemont. In Custer County, producing oil wells are in the Barker Dome oilfield, approximately 6 km [4 mi] east of the project area (SDDENR, 2012b). The Powder River Basin in Wyoming, to the west of the proposed project, contains some of the largest coal bed methane and natural gas deposits in the United States. Weston and Niobrara Counties in Wyoming to the west and northwest of the proposed project contain significantly more active oil and gas production wells than Fall River and Custer Counties (Wyoming Oil and Gas Conservation Commission, 2012). The majority of oil and gas production and exploration are concentrated in

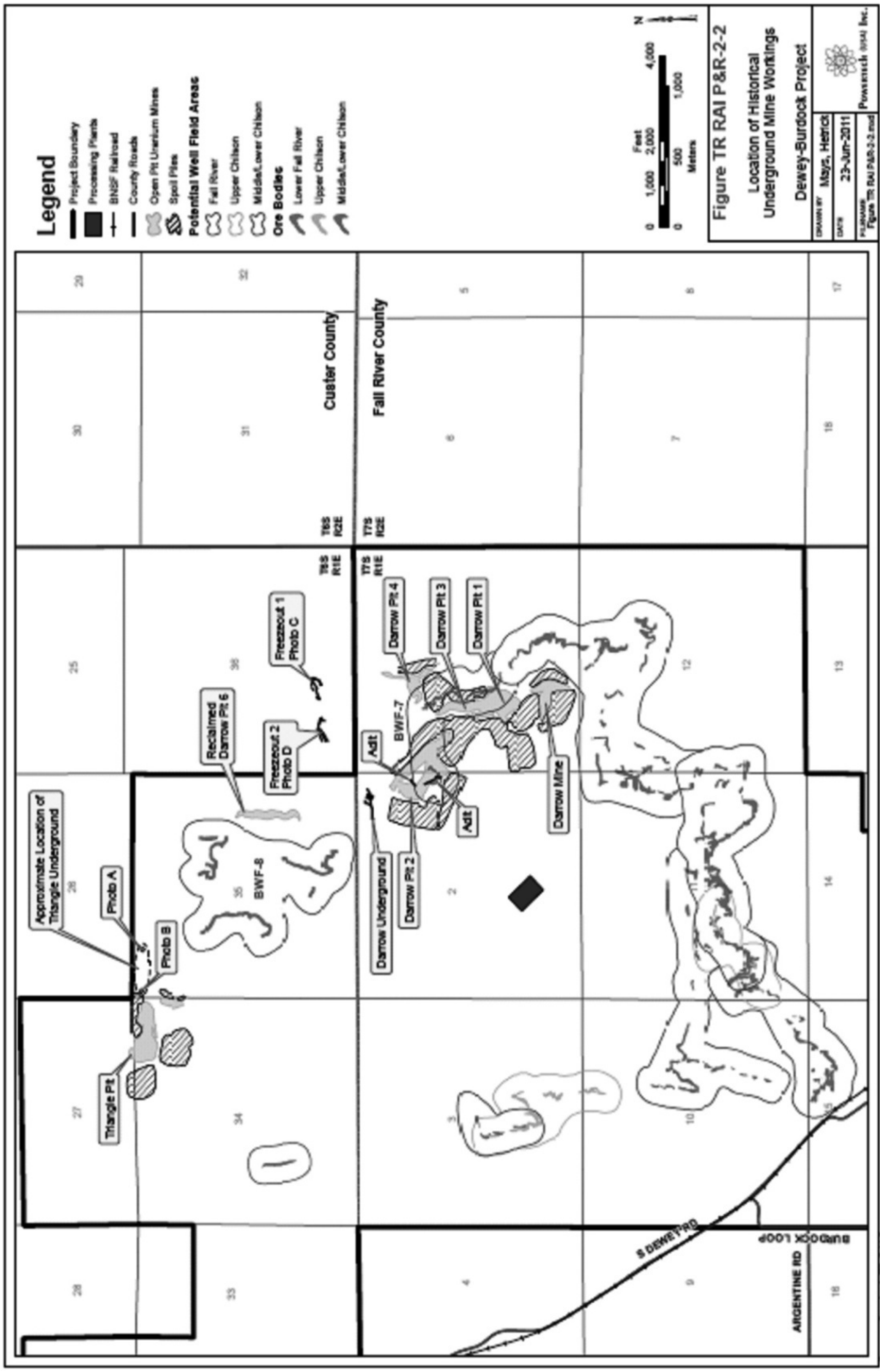

Figure 3.2-3. Map Showing Locations of Historical Underground and Open Pit Mine Workings in the Eastern Part of the Proposed Dewey-Burdock *In-Situ* Recovery Project Site
Source: Powertech (2011)

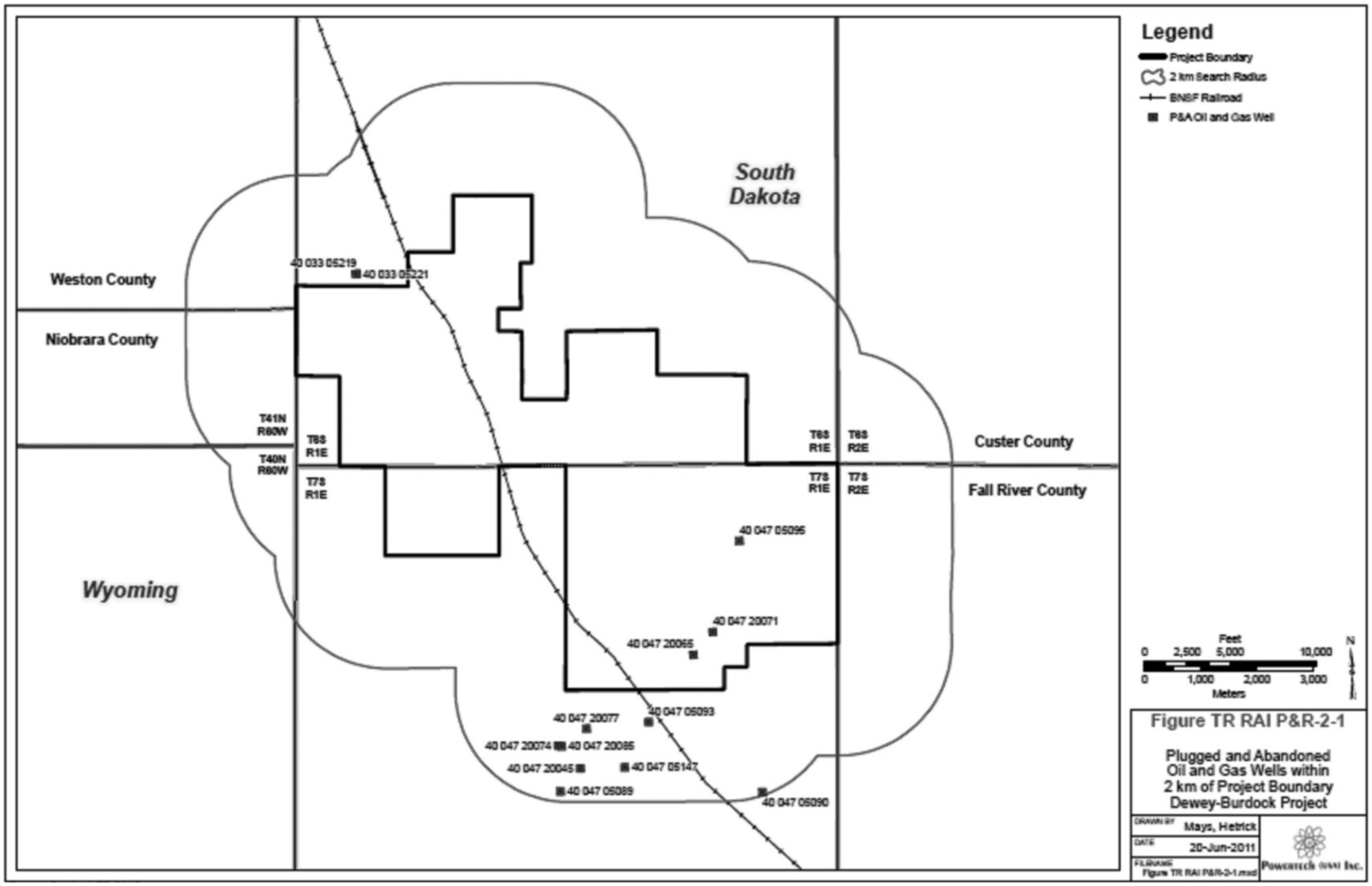

Figure 3.2-4. Map Showing Plugged and Abandoned Oil and Gas Test Wells Within 2 km [1.2 mi] of the Proposed Dewey-Burdock *In-Situ* Recovery Project Boundary
Source: Powertech (2011)

the southwestern part of Weston County and the northwestern part of Niobrara County, closer to the Powder River Basin. The producing wells nearest to the proposed project are in the Plum Canyon oilfield in Wyoming, approximately 5 km [3 mi] to the northwest in Weston County (see Figure 5.1-3 in this SEIS). At this time, no pending or potential oil and gas land leases are within the proposed project area. Furthermore, demand for oil and gas leasing on available land in the vicinity of the proposed project is low. Most active oil and gas development in the region is located on USFS-managed land, primarily in the Buffalo Gap National Grassland, located west and south of Edgemont. Sixteen oil and gas drilling permits were issued in Fall River County since 2005 (SDDENR, 2012c). In Custer County, no oil and gas drilling permits have been issued since 2005 (SDDENR, 2012c). Seven known oil and gas lease tracts are on USFS-managed land in the immediate vicinity of the proposed project area; however, these tracts are currently not available for bid (BLM, 2009a). These tracts are located in Custer County within Township 6 South, Range 1 East; two of the tracts (SDM79010BO and SDM79010BN) border the permit boundary of the proposed project (Figure 3.2-5).

At present, no wind farms are located in the vicinity of the proposed project; however, a landowner group, the Dewey-Burdock Wind Association, LLC is exploring the viability of wind power (Powertech, 2010a). The land designated as a potential wind farm includes privately owned land inside and surrounding the proposed project area. Most of the landowners involved in the potential wind farm are also involved in the proposed Dewey-Burdock ISR Project (Powertech, 2010a). The wind farm is currently in the conceptual phase.

3.3 Transportation

This section describes the transportation infrastructure and conditions in the region surrounding the proposed Dewey-Burdock ISR Project. As described in Section 2.1.1.1.7 of this SEIS, the applicant has proposed to use trucks to ship equipment, supplies, and produced materials, including wastes, during the lifecycle of the proposed action. The applicant does not anticipate using the Burlington Northern Santa Fe (BNSF) railroad as a transportation option for any of the proposed project operations. There are no navigable waterways within close proximity that provide transportation access to the proposed project.

The proposed Dewey-Burdock ISR Project site is located in Fall River and Custer Counties in a remote area of southwestern South Dakota near the eastern border of Wyoming, approximately 21 km [13 mi] northwest of Edgemont, South Dakota. Figure 3.3-1 shows the transportation corridor of the region surrounding the proposed site, and Figure 3.2-1 provides a closer view of the immediate proposed site area and the existing transportation infrastructure. Access to the proposed site from Edgemont is from the southeast on Fall River County Road 6463 (locally known as Dewey Road). Within Custer County, Dewey road is also called Custer County Road 769. Figure 3.2-1 shows Dewey Road, an unpaved, gravel-covered road that is narrower than a standard two-lane road of 6 to 7 m [20 to 24 ft] and runs adjacent to the BNSF rail line (BLM, 2009a). County records indicate repairs to Dewey Road were needed due to flooding 15 times since 1987 (BLM, 2009a). The main access road to the proposed central processing plant (CPP) facilities and well fields in the Burdock area of the proposed project will be constructed off Dewey Road in Township 7 South, Range 1 East, Section 10 (see Figure 2.1-10). The main access road to the proposed satellite facility (SF) in the Dewey area of the proposed project will be constructed off Dewey Road in Township 6 South, Range 1 East, Section 20 (see Figure 2.1-10).

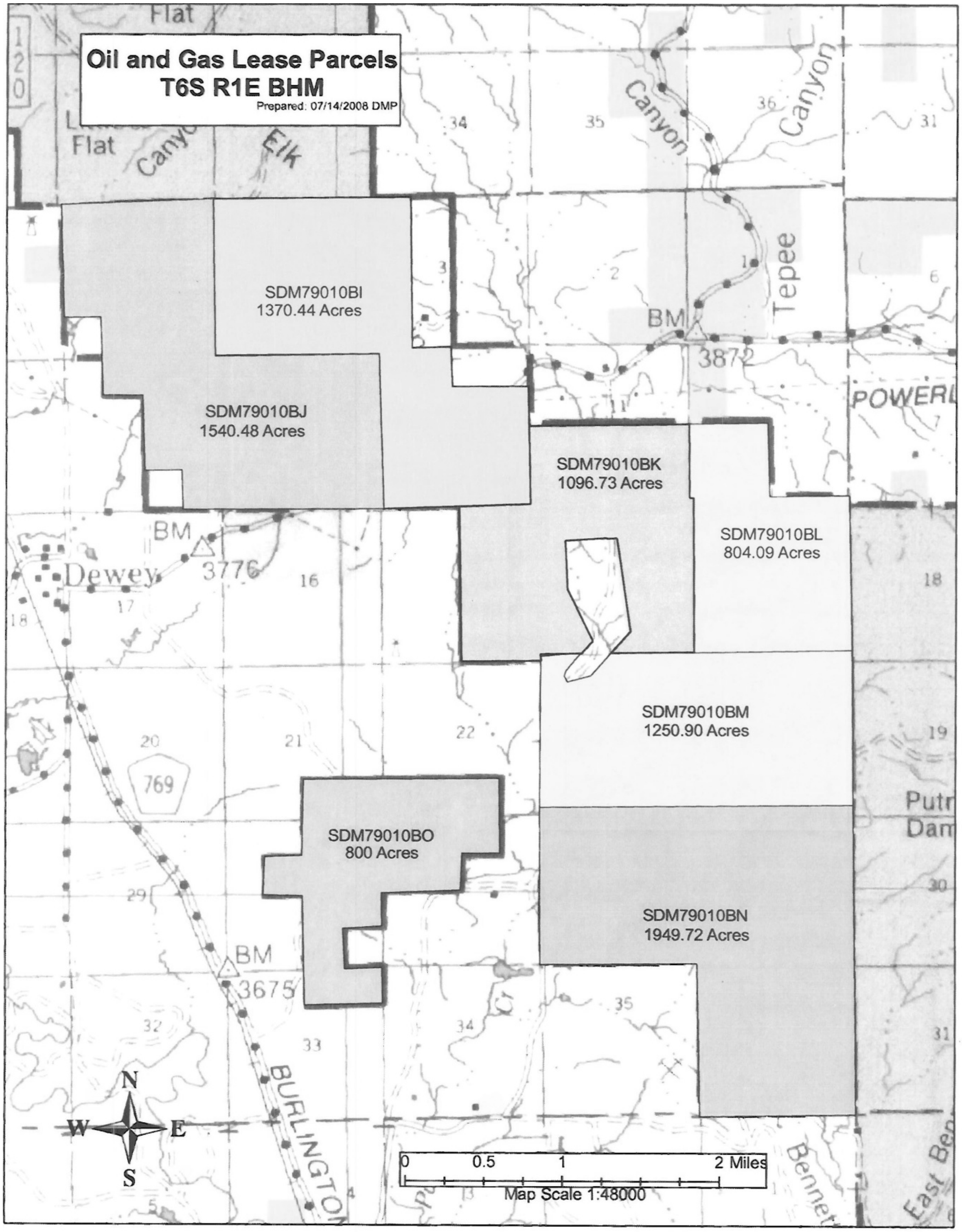

Figure 3.2-5. Pending Oil and Gas Lease Tracts in Custer County, South Dakota
Source: BLM (2009a)

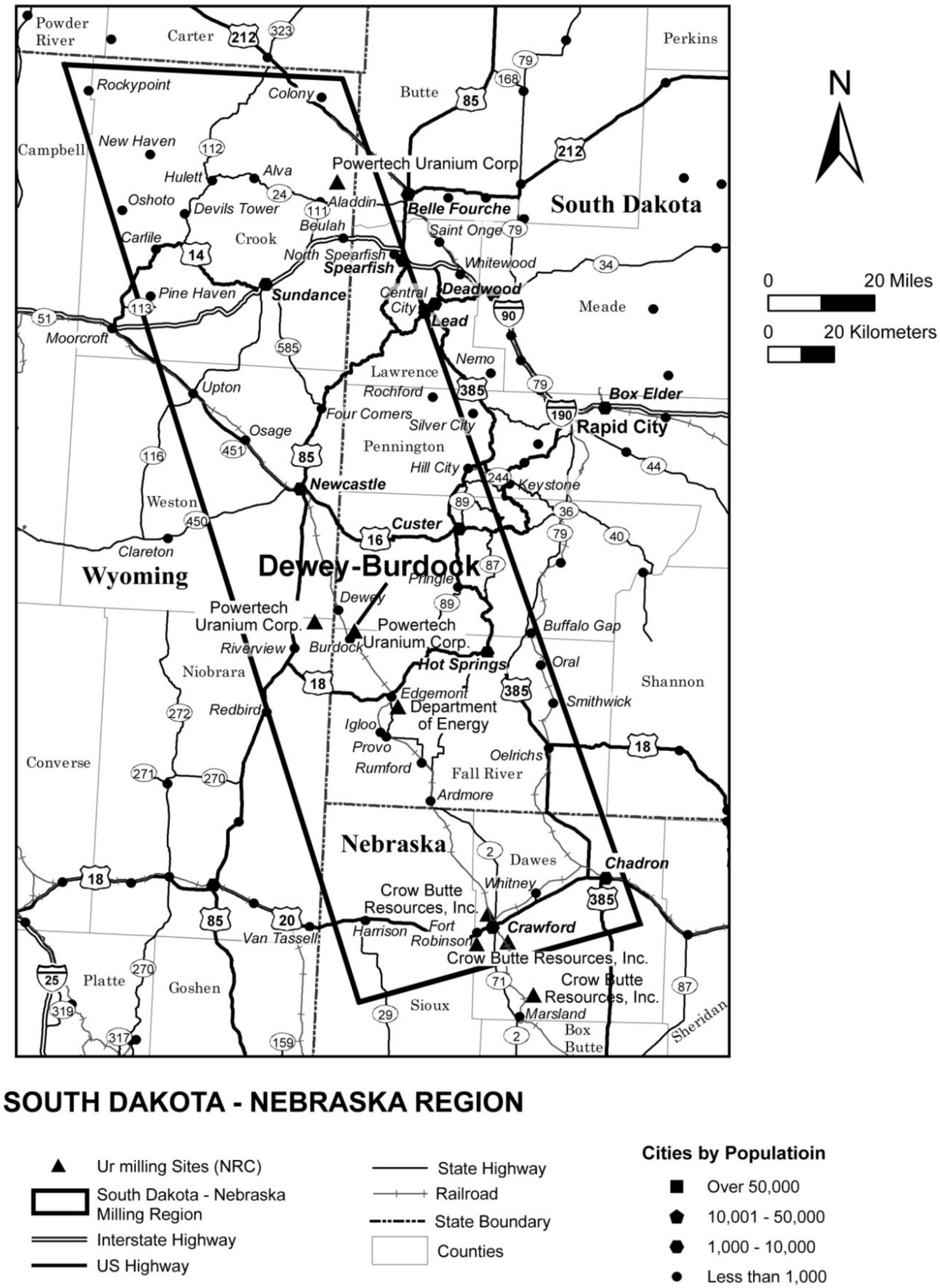

Figure 3.3-1. Transportation Corridor of the South Dakota-Nebraska-Wyoming Uranium Milling Region Surrounding the Proposed Dewey-Burdock *In-Situ* Recovery Project
Source: NRC (2009a)

U.S. Highway 18 travels northeast from Edgemont to Hot Springs, South Dakota, and to State Highway 79, which travels north to Rapid City and Interstate 90 (see Figure 3.3-1). U.S. Highway 18 also connects Edgemont to State Highway 89 that runs north to Custer, South Dakota. Table 3.3-1 presents traffic counts for regional roads based on available data. No road capacity studies of local transportation routes were identified. However, insights to rural road capacities were based on (i) published estimates for a single freeway lane capacity of 13,900 vehicles per day derived by the South Dakota Department of Transportation (SDDOT, 2000) and (ii) a rural two-lane highway hourly capacity estimate (1,375 vehicles per hour) that accounts for nonideal travel conditions (Kadrmas, et al., 2010) that the NRC staff converted to a daily value of 7,237 vehicles per day using the method and assumptions SDDOT (2000) reported and assuming equal traffic in each direction.

3.4 Geology and Soils

The proposed Dewey-Burdock Project is located in the Black Hills of southwestern South Dakota within the Nebraska-South Dakota-Wyoming Uranium Milling Region evaluated in GEIS Section 3.4.3.1 (NRC, 2009a). GEIS Section 3.4.3.1 provides a regional description of the geology and soils of the Black Hills. A summary of the geology of the Black Hills region and site-specific discussions of the geology and soils within and in the vicinity of the proposed Dewey-Burdock ISR Project are provided in the following sections.

3.4.1 Geology

3.4.1.1 The Black Hills (Western South Dakota–Northeastern Wyoming)

The Black Hills are an asymmetrical domal uplift elongated in the northwest direction (Figure 3.4-1). Economically significant uranium discoveries in the Black Hills are contained within strata of the Inyan Kara Group (Chenoweth, 1988). Prior to 1968, three uranium districts (Hulett Creek, Carlile, and Edgemont) produced the bulk of the uranium production tonnage mined from the Black Hills area in Wyoming and South Dakota (Hart, 1968). The proposed Dewey-Burdock ISR Project is located within the Edgemont uranium district in Custer and Fall River Counties, South Dakota (Figure 3.4-1).

Table 3.3-1. Annual Average Daily Traffic in the Vicinity of the Proposed Dewey-Burdock *In-Situ* Recovery Project

Road Segment	2011 Traffic Count*		
	All Vehicles	Auto	Truck
Dewey Road	225	—	—
US 18 (Edgemont to US 89)	1,782	1,361	421
US 18 (Hot Springs to SR 79)	5,075	4,725	350
SR 89 (US 385 to US 18)	659	604	55
SR 79 (at US 18)	3,172	2,569	603

Sources: BLM (2009a); SDDOT(2011)
*Traffic counts are annual average daily traffic for both directions of travel for year 2011 SDDOT (2011), except the Dewey Road count. Based on limited available information, the Dewey Road count is an average of two 24-hour counts performed by the Fall River County Highway Department in 2012 (Powertech, 2013a).
U.S. Nuclear Regulatory Commission staff calculated the auto counts as the difference between the reported all-vehicle and truck counts.

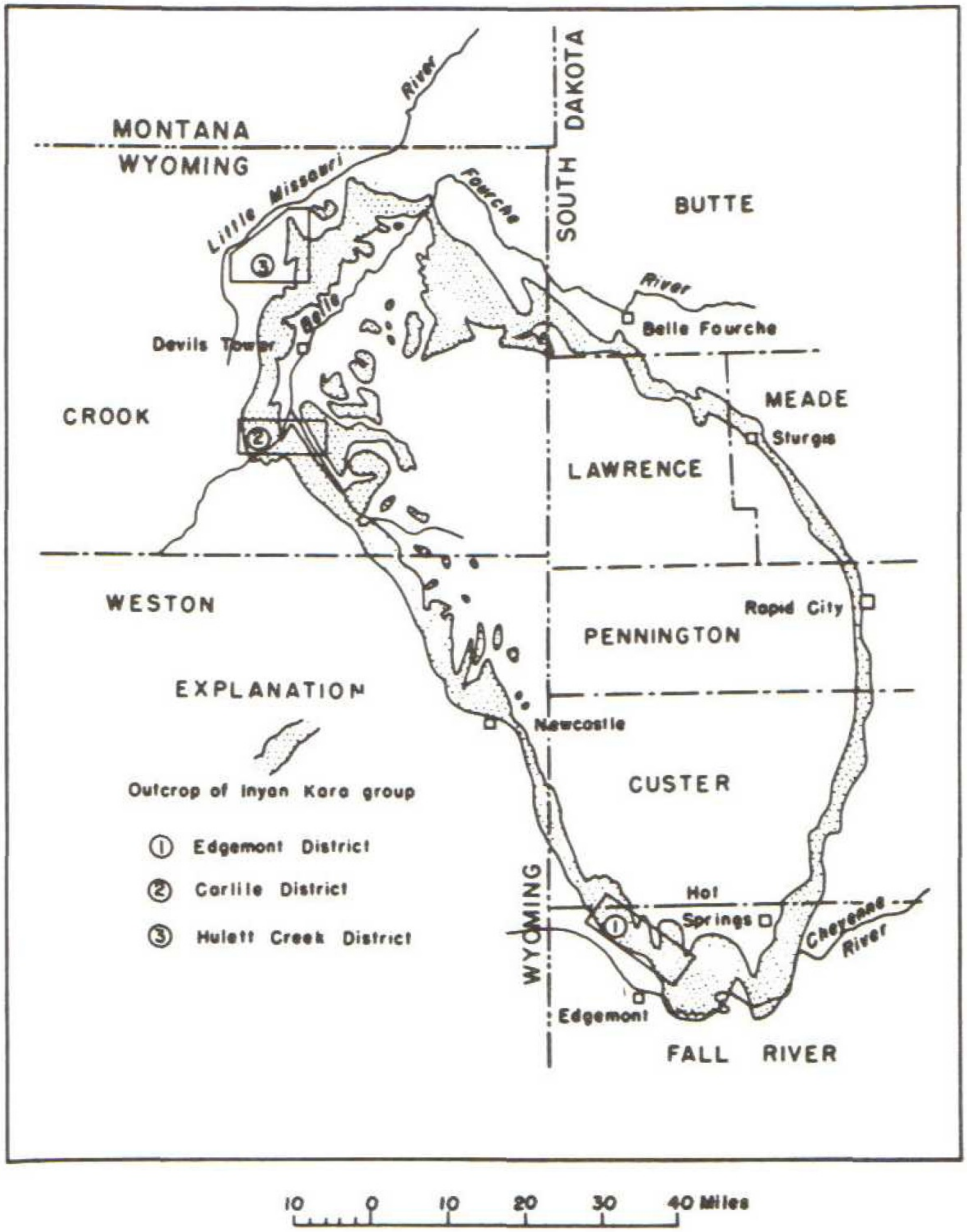

Figure 3.4-1. Outcrop Map of the Inyan Kara Group in the Black Hills of Western South Dakota and Northeastern Wyoming Showing the Locations of Principal Uranium Mining Districts
Source: Modified From NRC (2009a)

Stratigraphic units present in the Black Hills include sedimentary deposits of the Cretaceous, Jurassic, and Triassic Periods [65–145 million years ago (mya), 149–199 mya, and 200–251 mya, respectively] (Figure 3.4-2). In the Dewey-Burdock ISR Project area, the Inyan Kara Group is Lower Cretaceous (99-145 mya) in age and consists of subequal amounts of complexly interbedded sandstone and claystone (Renfro, 1969). The Inyan Kara Group is bounded below by continental Jurassic sediments of the Morrison Formation and is overlain by the marine sediments of the Graneros Group, which includes the Skull Creek Shale, the Newcastle Sandstone, the Mowry Shale, and the Belle Fourche Shale. Resistant sediments of the Inyan Kara Group form the outermost ring of hogback ridges that crop out in a roughly oval pattern around the flanks of the Black Hills (Figure 3.4-1). Major sandstone-hosted uranium deposits occur from 2 to 8 km [1 to 5 mi] downdip from the main Inyan Kara escarpment at depths ranging from 30 to 244 m [100 to 800 ft].

The Inyan Kara Group is formally subdivided into the Lakota Formation and the Fall River Formation. Source sediment for both formations is considered to include all pre-Cretaceous sediments to the south and east of the Black Hills (Renfro, 1969).

The Lakota Formation is generally accepted to be continental in origin. The Lakota Formation represents a sequence of coastal-plain deposits of fine-grained, poorly sorted sandstone and mudstone; channel-fill deposits of cross-bedded sandstone; natural levee and overbank deposits of lenticular fine-grained, carbonaceous sandstone and siltstone; and floodplain deposits of bedded siltstone, mudstone, and claystone (Maxwell, 1974). The Lakota Formation ranges in thickness from 15 to 91 m [50 to 300 ft] and thickens regionally from northwest to southeast (Chenoweth, 1988).

The Fall River Formation overlies the Lakota Formation, ranges in thickness from 30 to 46 m [100 to 150 ft], and thickens regionally from southeast to northwest (Dondanville, 1963). The Fall River Formation is divided into deltaic and marine facies. The deltaic facies consist of channel sandstone, interchannel sandstone and mudstone, and blanket sandstone. The marine and marginal marine facies consist of offshore and lagoonal mudstone and shale, and bar and spit sandstone.

Uranium deposits in the Inyan Kara Group are present as roll-front deposits. The formation and characteristics of roll-front uranium deposits in the western United States, which includes the Nebraska-South Dakota-Wyoming Uranium Milling Region, are described in GEIS Section 3.1.2.1 (NRC, 2009a). In the uranium deposits within the Inyan Kara Group, uranium minerals coat sand grains, fill interstices between grains, and are disseminated in organic matter (Renfro, 1969). The specific source of uranium is unknown. Two proposed uranium sources include uranium indigenous (i.e., native) to the Lakota and Fall River sediments (Renfro, 1969) and uranium leached by groundwater from tuffaceous beds of the Tertiary White River Group that were unconformably deposited across the eroded Black Hills uplift (Hart, 1968).

3.4.1.2 Dewey-Burdock Geology

Surface geology across the proposed Dewey-Burdock ISR Project area is shown in Figure 3.4-3. The Fall River Formation outcrops across the eastern part of the proposed project area, the Skull Creek Shale and Mowry Shale outcrop across the central part of the proposed project area, and the Belle Fourche Shale outcrops across the western part of the proposed project area. At the site the shales present are all part of the Graneros Group. Formations

Black Hills Area			
System	Series		Formation
Tertiary	Pliocene		Ogallala Formation
	Miocene		Arikaree Formation
	Oligocene		White River Formation
	Eocene		(Absent)
	Paleocene		Fort Union Formation
Cretaceous	Upper		Hell Creek Formation
			Fox Hills Sandstone
			Pierre Shale
			Niobrara Formation
			Carlile Shale
			Greenhorn Formation
		Graneros Group	Belle Fourche Shale
	Lower		Mowry Shale
			Newcastle Sandstone
			Skull Creek Shale
		Inyan Kara Group	Fall River Formation
			Lakota Formation
Jurassic			Morrison Formation
			Unkpapa Sandstone
			Sundance Formation
			Gypsum Spring Formation
Triassic			Spearfish Formation
Permian			
			Minnekahta Limestone
			Opeche Shale
			Minnelusa Formation
Pennsylvanian			
Mississippian			Madison Formation
Devonian			Englewood Formation
Ordovician			Whitewood Formation
			Winnipeg Formation
Cambrian			Deadwood Formation

Figure 3.4-2. Principal Stratigraphic Units in the Black Hills Area of Western South Dakota and Northeastern Wyoming
Sources: Modified From Driscoll, et al. (2002) and NRC (2009a)

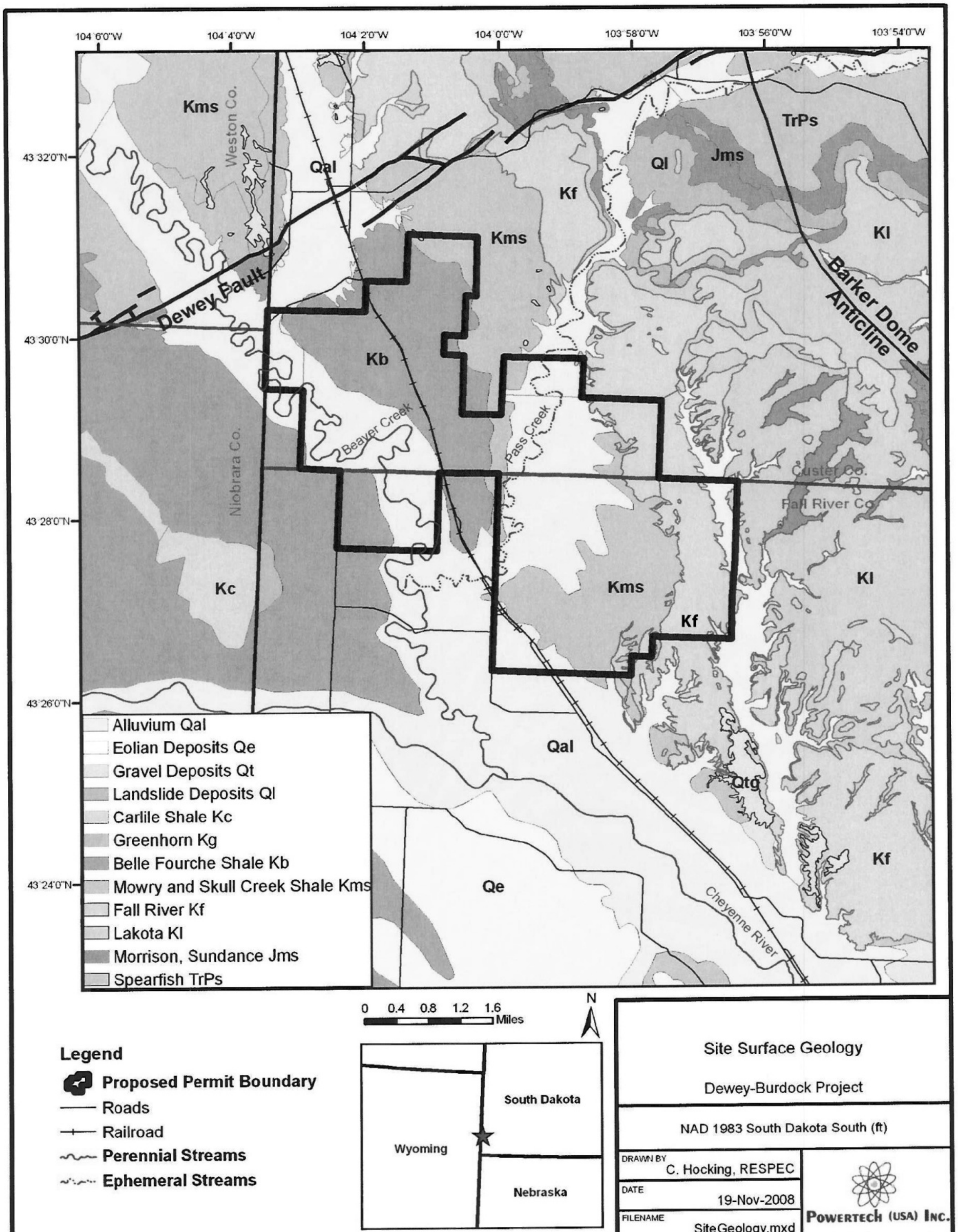

Figure 3.4-3. Map Showing Site Surface Geology Within and Surrounding the Proposed Dewey-Burdock *In-Situ* Recovery Project Area Source: Powertech (2009a)

within the project area dip gently 2 to 6 degrees to the southwest. The most recent sedimentary units deposited within the project area are Quaternary age alluvium deposits. Alluvium consisting of silt, clay, and gravel is present in the major stream drainages and their tributaries. There is faulting and folding in areas surrounding the proposed project. The Dewey Fault, a northeast-to-southwest-trending fault zone, is present approximately 1.6 km [1 mi] north and northwest of the project area. The Barker Dome, a northwest-to-southeast-trending anticline, is present east of the project area (Figure 3.4-3).

Stratigraphic units of interest for the proposed Dewey-Burdock ISR Project include the Morrison Formation, the Inyan Kara Group (Lakota and Fall River Formations), the Skull Creek Shale, the Mowry Shale, and the Belle Fourche (Figure 3.4-4). The Inyan Kara Group is host to all the uranium mineralization for the proposed project (Powertech, 2009a). The Morrison Formation and the Skull Creek Shale coupled with the Mowry and Belle Fourche Shales form the lower and upper confining units for uranium mineralization at the Dewey-Burdock site, respectively. The combined Skull Creek–Mowry–Belle Fourche Shale is often referred to as the Granerous Group. Structure contour maps and cross sections delineating the extent and character of the stratigraphic units at the proposed Dewey Burdock site were compiled with data obtained from TVA downhole electric logs of thousands of exploration drill holes and from drill cuttings data (Powertech, 2009a,c). As described in SEIS Section 3.5.3.2, aquifer pumping tests have provided data indicating a hydraulic connection between the Lakota and Fall River Formations through the intervening Fuson Shale in the Burdock area. A numerical groundwater model developed by the applicant using site-specific geologic and hydrologic information

<table>
<tr><th colspan="5">Dewey-Burdock Site Stratigraphy</th></tr>
<tr><th>System</th><th>Series</th><th colspan="3">Formation</th></tr>
<tr><td rowspan="6">Cretaceous</td><td>Upper</td><td rowspan="3">Graneros Group</td><td colspan="2">Belle Fourche Shale</td></tr>
<tr><td rowspan="5">Lower</td><td colspan="2">Mowry Shale</td></tr>
<tr><td colspan="2">Skull Creek Shale</td></tr>
<tr><td rowspan="3">Inyan Kara Group</td><td colspan="2">Fall River Formation</td></tr>
<tr><td rowspan="2">Lakota Formation</td><td>Fuson Member</td></tr>
<tr><td>Chilson Member</td></tr>
<tr><td colspan="2" rowspan="3">Jurassic</td><td colspan="3">Morrison Formation</td></tr>
<tr><td colspan="3">Unkpapa Sandstone</td></tr>
<tr><td colspan="3">Sundance Formation</td></tr>
</table>

Figure 3.4-4. Stratigraphic Units Present at the Proposed Dewey-Burdock *In-Situ* Recovery Project Site
Sources: Modified From Driscoll, et al. (2002) and NRC (2009a)

suggested that leakage through the Fuson Shale is caused by improperly installed wells or improperly abandoned exploration holes completed in the Fall River and Lakota Formations (Petrotek, 2012).

Morrison Formation

The Upper Jurassic Morrison Formation consists of floodplain deposits having an average thickness of approximately 30 m [100 ft]. This lower confining unit is composed of calcareous, noncarbonaceous massive shale with limestone lenses and a few thin fine-grained sandstones. Analyses of core samples indicate that Morrison clays have very low vertical permeabilities {on average 2.0×10^{-8} cm/s [6.0×10^{-5} ft/day]} (Powertech, 2009a).

Inyan Kara Group: Lakota Formation and Fall River Formation

The Lakota Formation consists of three members (from lower to upper): the Chilson Member, also known as the Lakota Sandstone; the Minnewasta Limestone Member; and the Fuson Member. Only the Chilson and Fuson Members are present at the proposed project site (see Figure 3.4-4).

The Chilson Member consists of two units: a basal carbonaceous mudstone and an overlying unit of channel sandstones interbedded with shale. Core sample analyses indicate the sandstones have horizontal permeabilities ranging from 2.6×10^{-3} to 4.1×10^{-3} cm/sec [7.4 to 11.6 ft/day] (Powertech, 2009a). The thickness of the Chilson Member sandstone within the proposed Dewey-Burdock ISR Project area varies from 27.4 to 73.2 m [90 to 240 ft] (Powertech, 2009a).

The Fuson Member is the uppermost member of the Lakota Formation and is used to divide the Lakota Formation and the Fall River Formation. The Fuson Member is composed of shale-siltstone with discontinuous sandstone units at the base and top of the member. The Fuson Member is estimated to have an average thickness of 30.5 m [100 ft] in the southern Black Hills (Gott, et al., 1974). The Fuson Shale, which is the shale-siltstone portion of the Fuson Member, ranges in thickness from 6 to 24 m [20 to 80 ft] within the proposed project area (Powertech, 2011). The Fuson Shale has low vertical permeability ranging from 7.9×10^{-14} to 2.3×10^{-12} cm^2 [0.008 to 0.228 millidarcies] (Powertech, 2009a).

The Fall River Formation is composed of carbonaceous interbedded siltstone and sandstone, channel sandstones, and a sequence of interbedded sandstone and shale. The Fall River Formation ranges in thickness from 37 to 49 m [120 to 160 ft] within the proposed project area (Powertech, 2009a). The Fall River Formation is exposed at the surface in the eastern half of the Burdock area at the proposed Dewey-Burdock site (Figure 3.4-3).

The sandstones of the Fall River and Lakota Formations contain the uranium deposits at the proposed project site. Mineralized sands occur at depths of less than 30 m [100 ft] in the outcrop area of the Fall River Formation in the eastern part of the Burdock area and at depths of up to 244 m [800 ft] in the Lakota Formation in the Dewey area (Powertech, 2009a). The depths of ore zones in the initial wellfields at the proposed project range from approximately 122 to 244 m [400 to 800 ft] bgs in the Dewey area and approximately 61 to 122 m [200 to 400 ft] in the Burdock area (Powertech, 2009c). The calculated average thickness of individual ore zones is 1.4 m [4.6 ft] with an average ore grade of 0.198 percent U_3O_8 (Powertech, 2011).

The primary uranium minerals in the deposits are very fine-grained pitchblende and coffinite, which coat sand grains and fill interstices between grains.

Skull Creek Shale

The Skull Creek Shale directly overlies the Fall River Formation and consists predominantly of dark-gray to black shale and organic material. The Skull Creek Shale is the basal unit of the Graneros Group, which forms the upper confinement for the uranium mineralization. The Skull Creek Shale has a thickness of approximately 61 m [200 ft]. The Skull Creek Shale has a vertical permeability of approximately 6.9×10^{-14} cm^2 [0.007 millidarcies] (Powertech, 2009a). The Skull Creek Shale has been eroded and is absent in the eastern part of the Burdock area (Figure 3.4-3).

Mowry Shale

The Mowry Shale, together with the Skull Creek Shale and Belle Fourche Shale, is also considered to be part of the upper confining unit for the target mineralization zone at the proposed Dewey-Burdock ISR Project. The Newcastle Sandstone, usually present between the Skull Creek and the Mowry Shale, is absent within the proposed project area as shown in Figure 3.4-4.

Belle Fourche Shale

The uppermost unit of the Graneros Group is the Belle Fourche Shale. This shale unit is 91-m [300-ft] thick and consists of thin-bedded gray to black soft shale containing black to reddish-brown ironstone concretions. The ironstone concretions are particularly abundant in the basal 6 to 9 m [20 to 30 ft]. There is bentonite production from the lower part of the Belle Fourche Shale, but not within the proposed project area. The combined thickness of the Skull Creek, Mowry, and Belle Fourche Shales is over 168 m [550 ft] in the southwestern part of the proposed project site (i.e., the Dewey area) (Powertech, 2011). In the eastern part of the Burdock area, the Granerous Group shale units have been eroded and are absent (Figure 3.4-3).

Breccia Pipes

Breccia pipes and collapse breccias have been studied and mapped in the southern Black Hills (Darton, 1909; Braddock, 1963; Gott, et al., 1974; Epstein, 2001). These features originate in anhydrite and gypsum sequences within the upper portion of the Minnelusa Formation (Gott, et al., 1974). Dissolution of these evaporate sequences by underlying Minnelusa and/or Madison artesian water created solution cavities into which overlying Permian sediments collapsed. The areal extent of dissolution is limited to within a few miles downgradient from the Minnelusa outcrop. The probable maximum downgradient limit of dissolution has been mapped by the U.S. Geological Survey (USGS) and is approximately 8 km [5 mi] northeast of the proposed project area (Braddock, 1963). The applicant presented further evidence against the presence of breccia pipes in the proposed project area, including field investigations for breccia pipes, evaluation of Inyan Kara water temperatures, regional pumping test results, and evaluation of color infrared imagery (Powertech, 2011).

Artificial Penetrations

According to the environmental report, there are 4,000 exploration drill holes representing historic exploration activities (Powertech, 2009a). The applicant has drilled approximately 115 exploration holes, including 20 monitoring wells in the project area. While the applicant cannot confirm that all historic borings were properly plugged and abandoned, the applicant has made commitments to ensure that unplugged drill holes will not impact human health or the environment during operations (Powertech, 2009b, 2011). Futhermore, state regulations were in place governing exploration hole plugging at the time the historical exploration occurred. In the technical report (Powertech, 2009b), the applicant stated that little evidence of unplugged boreholes has been observed given infrared photography data. However, an infrared map of a portion of the Burdock area shows an alkali pond area (Powertech, 2011). The applicant states unplugged borings appear to explain the presence of this pond area. No other pond areas or springs appear in infrared photography data of the Dewey-Burdock site. There is no other evidence indicating that previously unplugged borings are current groundwater flow pathways (Powertech, 2011).

3.4.2 Soils

GEIS Section 3.4.3.1 describes the soils of the Black Hills as a product of weathering of surficial sedimentary rocks of the Black Hills range (NRC, 2009a). To provide site-specific soil characteristics, the applicant had a soil survey conducted within the Dewey-Burdock permit area in accordance with procedures of the National Cooperative Soil Survey (Powertech, 2009a). The survey included a total of 4,272 ha [10,557 ac] (Powertech, 2009b). The soils in the proposed site are typical for semiarid grasslands and shrublands of the Western United States and are classified as Aridic Argiustolls, Aridic Ustorthents, and Aridic Haplusterts.

The soil survey results indicated that soils within the proposed permit area generally have a clayey or very fine texture with patches of sandy loam on upland areas and fine, clay-textured soils in or near drainages. Deep soils were found on level upland areas, and shallow and very shallow soils were found on hills, ridges, and breaks. Salvage depths ranged from 0 to 1.5 m [0 to 5 ft] (Powertech, 2009a). The clayey texture of the surface horizon found throughout most of the proposed project area results in soils more susceptible to erosion from water than wind (Powertech, 2009a).

3.4.3 Seismology

The Dewey Fault is located approximately 1.6 km [1 mi] north of the proposed Dewey-Burdock permit area (Figure 3.4-3). The Dewey Fault is a nearly vertical northeast-to-southwest-trending normal fault with a combined displacement and drag of approximately 152 m [500 ft] on the north side. Given the location and displacement characteristics of this fault, there will be no effect on proposed site activities. The Long Mountain Structural Zone located 11 km [7 mi] southeast of the proposed project area contains several small, shallow faults in the Inyan Kara Group. No faults have been identified within the proposed permit area (Powertech, 2009a). Additionally, according to the USGS Quaternary Fault and Fold Database, no capable faults (active faults) with surface expression occur within a 100-km [62-mi] radius from the center of the proposed site, demonstrating a historically low seismic potential (USGS, 2006a). The most significant seismic hazard within and in the vicinity of the proposed project area is a “floating” earthquake. In accordance with 10 CFR Part 40, Appendix A, a floating earthquake is one that is considered to occur randomly within a tectonic province. According to the applicant, the maximum magnitude of such an earthquake is 6.1. Within the period from 1872 to 2010, 14 earthquakes of Richter Scale magnitudes ranging from 2.3 to 4.1 were recorded in Custer and Fall River Counties (SDGS, 2010). The Modified Mercalli scale intensities for these magnitudes are II (e.g., felt by few at best) to IV (e.g., felt indoors and outdoors), respectively. Eight earthquakes had epicenters located north of Hot Springs near Wind Cave National Park in Custer County, and two earthquakes had epicenters near Hot Springs in Fall River County. The closest earthquake to the proposed Dewey-Burdock site occurred January 5, 2004, with a recorded magnitude 2.8 with an epicenter located approximately 8 km [5 mi] north of the hamlet of Dewey in Custer County. The remaining 3 of the 14 earthquakes had epicenters located in southwestern, central, and eastern Fall River County.

3.5 Water Resources

3.5.1 Surface Waters

As described in GEIS Section 3.4.4.1, uranium deposits in Fall River and Custer Counties in southwestern South Dakota are present within the Beaver Creek and Angostura Reservoir watersheds (Figure 3.5-1). The proposed Dewey-Burdock ISR Project area lies within the Beaver Creek watershed and is drained by Beaver Creek, Pass Creek, and their tributaries (Powertech, 2009a). The Beaver Creek watershed covers an area of 3,522 km^2 [1,360 mi^2], excluding the Pass Creek subwatershed and lies within Weston, Niobrara, and Crook Counties in Wyoming and within Pennington, Custer, and Fall River Counties in South Dakota. The Pass Creek subwatershed comprises most of the east-southeast portion of the Beaver Creek watershed and covers an area of 596 km^2 [230 mi^2] within Custer, Fall River, and Pennington Counties in South Dakota and a very small portion of Weston County in Wyoming.

Beaver Creek, a perennial and shallow stream with ephemeral tributaries, flows northwest to southeast through the northwestern and western portions of the Dewey area (Figure 3.5-2). The average discharge rate for Beaver Creek, measured at Newcastle, Wyoming, is 0.34 m^3/s [12 ft^3/s] (stream gage 06392950; USGS, 2010). Pass Creek, which within the proposed project area is an ephemeral stream that supports some intermittent habitat, is dry for most of the year, except for short periods of high runoff following major storms (Powertech, 2009a). Pass Creek flows southerly through the central portion of the proposed project area and joins Beaver Creek southwest of the proposed project area. No permanent stream flow gages are stationed along Pass Creek. Beaver Creek and Pass Creek were not classified as domestic water supplies in beneficial uses of surface waters categorized by the State of South Dakota near the proposed area (SDDENR, 2008), although water from Beaver Creek is used for hay irrigation. Approximately 4 km [2.5 mi] south of the confluence of Beaver and Pass Creeks, Beaver Creek flows into the Cheyenne River (Figure 3.5-2). The average flow of the Cheyenne River at Edgemont, South Dakota, is 1.1 m^3/s [39 ft^3/s] (stream gage 06395000; USGS, 2010).

There are no known natural springs within the proposed Dewey-Burdock ISR Project area (Powertech, 2011). There is one area in the southwest corner of the Burdock area, known as the “alkali flats” or the “alkali area,” where groundwater is discharging to the ground surface from the Fall River aquifer and Chilson aquifer (Chilson Member of the Lakota Formation) through improperly plugged exploratory boreholes (Powertech, 2011). Two springs are present along the Dewey Fault near the town of Dewey approximately 2 km [1.2 mi] northwest of the proposed project boundary.

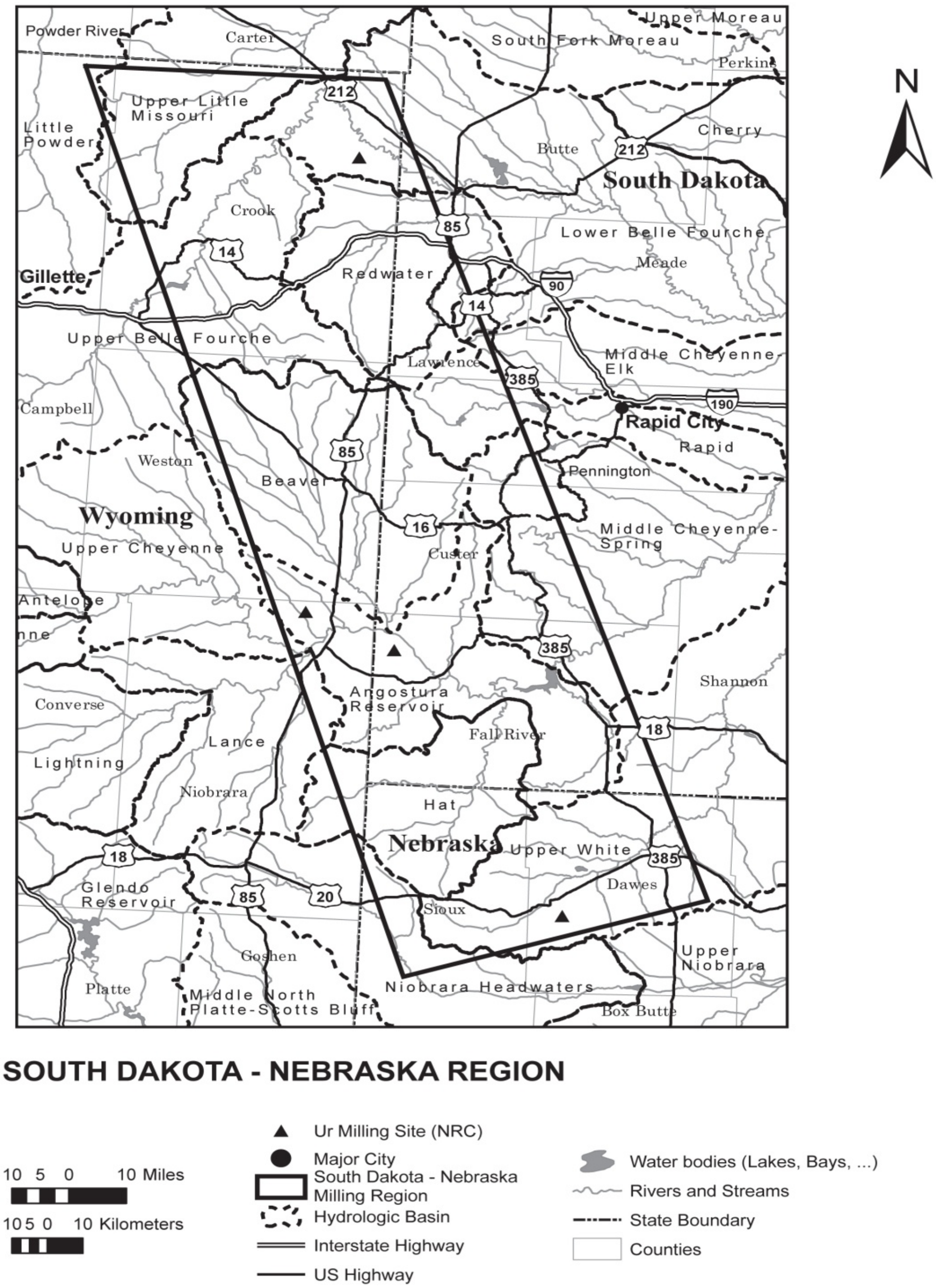

Figure 3.5-1. Watersheds Within the Nebraska-South Dakota-Wyoming Uranium Milling Region
Source: NRC (2009a)

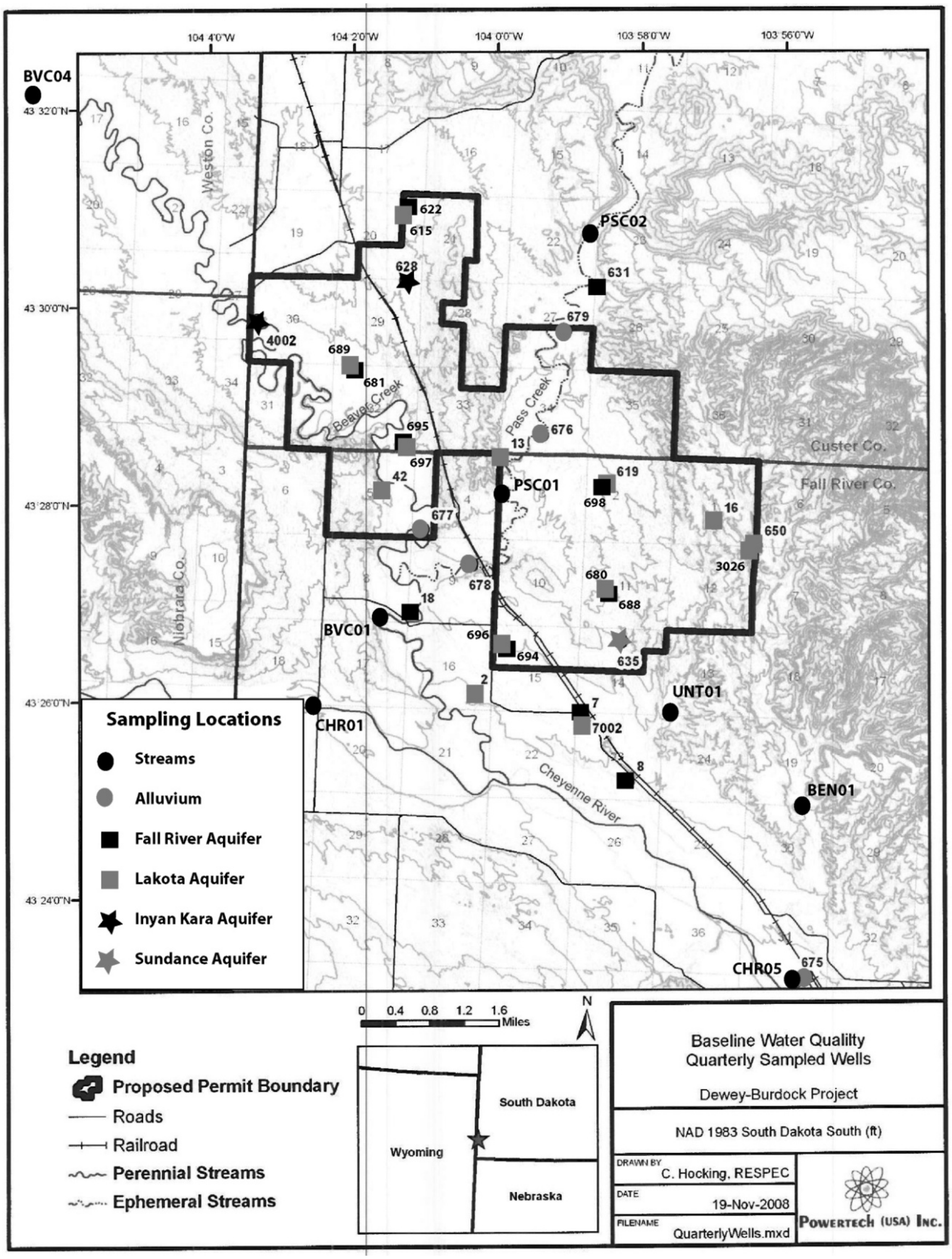

Figure 3.5-2. Map Showing Locations of Beaver Creek, Pass Creek, and the Cheyenne River in Relation to the Proposed Dewey-Burdock *In-Situ* Recovery Project and Water Quality Sampling Locations for Surface Water and Groundwater. Note That Alluvium Samples Were Collected From Wells and Are Not Surface Water Samples.
Source: Modified From Powertech (2009a)

The applicant performed floodplain modeling on the stream channels of Beaver Creek, Pass Creek, and smaller ephemeral drainages within the proposed project area to determine the extent of inundation from a simulated 100-year flood and evaluate potential adverse impacts to facilities from flooding (Powertech, 2009b, 2011). Results of the modeling showing the areal extent of a 100-year flood with respect to proposed facilities and wellfields are illustrated in Figure 3.5-3. The modeling indicates that, with the exception of the plant-to-plant pipeline and small parts of some proposed wellfields, most of the proposed facilities, infrastructure, potential land application areas, and wellfields will be located outside the 100-year flood inundation boundaries of Beaver Creek and Pass Creek. For example, the 100-year floodplain boundary of Beaver Creek will be 668 m [2,190 ft] from the proposed satellite facility in the Dewey area and 664 m [2,180 ft] from the proposed central processing plant in the Burdock area. Conversely, some wellfields and storage ponds in the Dewey area and some wellfields, the main access road, and the plant-to-plant pipeline in the Burdock area are located within the 100-year floodplain boundary of ephemeral drainages (Figure 3.5-3).

There are a number of abandoned open pit mines (depression zones) within the project area stretching from the eastern to the northern boundaries of the site in the Burdock area (see Figure 3.2-3). With the exception of Darrow Pit #2, the Darrow pits are usually dry but occasionally contain water that collects from runoff events (Powertech, 2011). The usual presence of water in Darrow Pit #2 suggests that the base of the pit may be below the potentiometric surface of the Fall River Formation. The Triangle Pit, which lies up dip of the proposed Burdock area wellfields, has permanent water storage at a depth greater than 30 m [100 ft]. The bottom of the Triangle Pit is below the potentiometric surface of the Fall River and is, therefore, hydraulically connected to the Fall River Formation.

Surface Water Quality

Water quality in Beaver Creek, Pass Creek, and the Cheyenne River varies considerably and is dependent on flow regime. These streams often experience extended periods of low or no flow. During periods of high flow, relatively high amounts of sediment and low dissolved solids occur in the streams, while less turbid waters with higher dissolved solids occur during periods of low flow. Upstream and downstream of the proposed Dewey-Burdock ISR Project in South Dakota, the Cheyenne River is classified as having the following beneficial water uses: (i) warm water semipermanent fish life propagation; (ii) limited contact recreation; (iii) fish and wildlife propagation, recreation, and stock watering; and (iv) irrigation (SDDENR, 2008). According to the State of South Dakota 2006 303(d) list, from Beaver Creek to the Angostura Reservoir, the Cheyenne River is listed as supporting the beneficial use of limited contact recreation, but is listed as impaired for the other three beneficial water uses due to high total dissolved and suspended solids, high salinity, and high conductivity. According to Administrative Rules of South Dakota (ARSD) 74:51:03:08, Beaver Creek in South Dakota is classified as suitable for the same uses as the Cheyenne River.

Both Beaver Creek and Pass Creek are classified as having the beneficial uses of fish and wildlife propagation, recreation, stock watering, and irrigation near the project site (SDDENR, 2008). These creeks, however, are not classified as having the beneficial use of domestic waters.

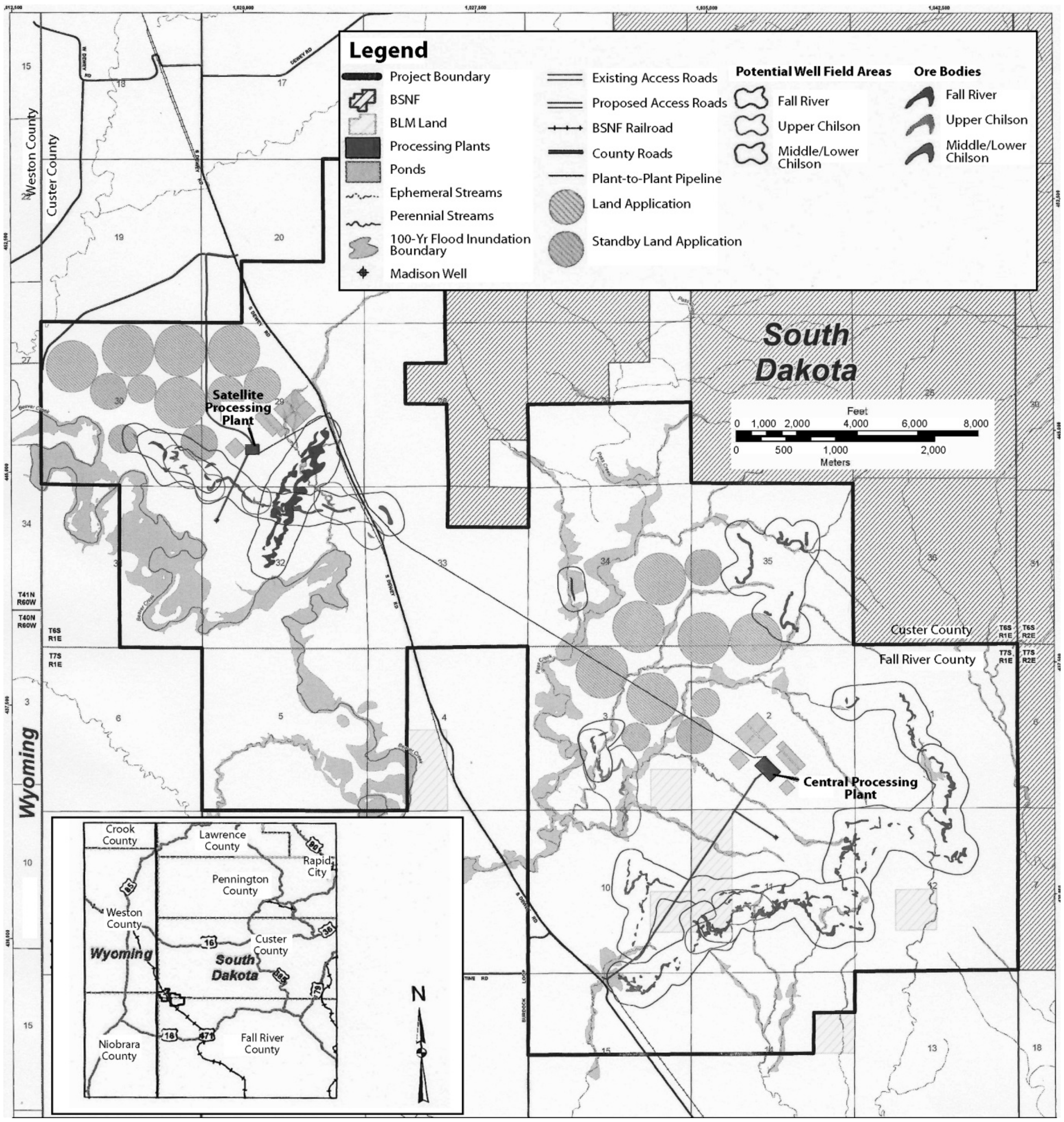

Figure 3.5-3. Map Showing Modeled 100-Year Flood Inundation Boundary of Stream Channels Within the Proposed Dewey-Burdock *In-Situ* Recovery Project Area
Source: Modified From Powertech (2011)

The applicant followed guidance in NUREG–1569 (NRC, 2003) and NRC Regulatory Guide 4.14 (NRC, 1980) to establish preoperational or baseline surface water quality conditions at the proposed site (Powertech, 2009a, 2011). The applicant collected surface water samples monthly between July 2007 and June 2008 from perennial and ephemeral streams upstream and downstream of the proposed Dewey-Burdock ISR Project (Powertech, 2009a). Figure 3.5-2 shows the locations of stream sampling locations. Perennial stream sampling locations included two sites on Beaver Creek (BVC01 and BVC04) and two sites on the Cheyenne River (CHR01 and CHR05). Ephemeral stream sampling locations included two sites on Pass Creek (PSC01 and PSC02), a site in Bennett Canyon (BEN01), and an unnamed downstream tributary (UNT01). Due to the sporadic nature of rainfall at the proposed site, passive samplers were installed at the ephemeral stream sampling sites to collect samples during flow events (Powertech, 2009a). Table 3.5-1 summarizes results for key parameters and constituents of concern in surface water at the stream sampling sites, and Table 3.5-2 summarizes results for radionuclides of concern.

Results of the stream sampling indicated exceedances of State of South Dakota surface water standards (ARSD Chapter 74:51:01) for field parameters (pH, dissolved oxygen, and specific conductance) at Beaver Creek and the Cheyenne River, while other field parameters were within State of South Dakota surface water quality limits. At Beaver Creek, pH levels were higher than the 8.8 standard in 16 percent (3 of 19) of the measurements, but were not below the 6.5 standard for warmwater semipermanent fish life propagation waters. At the Cheyenne River, pH measurements complied with state standards. Dissolved oxygen measurements were in compliance at Beaver Creek, but fell below the state standard for warm water semipermanent fish life {5 mg/L [5 ppm]} in one sample from the Cheyenne River. Specific conductance values exceeded the fish, wildlife, and stock daily maximum standard of 7,000 uS/cm in 15 percent (3 of 20) of the measurements at Beaver Creek and 5 percent (1 of 19) of the measurements at

Table 3.5-1. Summary of Key Parameters and Constituents of Concern in Surface Waters in Streams at the Proposed Dewey-Burdock *In-Situ* Recovery Project

Stream ID	pH	Dissolved Oxygen mg/L	Specific conductance uS/cm	Total Dissolved Solids mg/L	Sulfate mg/L	Chloride mg/L	Arsenic mg/L	Selenium mg/L
BVC01								
N	9	10	10	11	11	11	11	11
Mean	8.33	10.79	3680	2875	1359	500	0.0058	0.0012
Min*	7.94	6.86	860	609	317	38	<0.001	<0.001
Max†	8.91	13.57	7678	5860	2540	1370	0.048	0.003
BVC04								
N	10	10	10	11	11	11	11	11
Mean	8.07	10.64	4066	3144	1384	721	0.0041	0.0016
Min	7.52	6.54	733	516	286	9	<0.001	<0.001
Max	8.82	13.74	7186	5700	2670	1730	0.023	0.004
CHR01								
N	8	8	8	9	9	9	9	9
Mean	8.10	8.63	4522	4157	2616	129	0.0044	0.0012
Min	7.47	3.74	350	219	86	2	<0.001	<0.001
Max	8.44	13.08	7847	7040	4520	249	0.024	0.003
CHR05								
N	11	9	11	12	12	12	12	12
Mean	8.03	10.20	3863	3425	1919	376	0.004	0.0015
Min	7.42	7.63	510	365	180	17	<0.001	<0.001
Max	8.24	12.92	6986	6450	4160	912	0.029	0.003
PSC01								
N	1	1	1	2	2	2	2	2
Mean	8.12	10.26	1844	1765	1188.5	2.4	0.017	0.0013
Min	8.12	10.26	1844	1510	977	2.0	0.003	<0.001
Max	8.12	10.26	1844	2020	1400	2.8	0.031	0.002
PSC02								
N	1	1	1	2	2	2	2	2
Mean	8.1	9.51	1696	1204	777	1.8	0.0105	0.0018
Min	8.1	9.51	1696	998	645	1.6	0.003	<0.001
Max	8.1	9.51	1696	1410	909	2.0	0.018	0.003
UNT01								
N	0	0	0	1	1	1	0	1
Mean				369	278	1.0		0.03
Min				369	278	1.0		0.03
Max				369	278	1.0		0.03

*Min = minimum
†Max = maximum
Source: Powertech (2011).

Table 3.5-2. Summary of Key Radionuclides of Concern in Surface Waters in Streams at the Proposed Dewey-Burdock *In-Situ* Recovery Project

Stream ID	Gross Alpha pCi/L	U (Diss)* mg/L	U (Total) mg/L	Ra-226 (Diss) pCi/L	Ra-226 (Susp)* pCi/L	Pb-210 (Diss) pCi/L	Pb-210 (Susp) pCi/L	Po-210 (Diss) pCi/L	Po-210 (Susp) pCi/L	Th-230 (Diss) pCi/L	Th-230 (Susp) pCi/L
BVC01											
N	11	9	11	8	9	6	6	6	6	9	9
Mean	17.95	0.0124	0.0121	0.31	0.26	2.7	3.38	1.13	1.6	0.1	0.66
Min†	5.9	0.002	0.004	< 0.2	< 0.2	< 1.0	< 1.0	< 1.0	< 1.0	< 0.2	< 0.2
Max†	65.8	0.0269	0.0262	2.0	3.1	11.0	15.3	2.6	3.0	0.3	3.4
BVC04											
N	11	9	11	8	9	6	6	6	6	9	9
Mean	14.5	0.0126	0.0121	0.12	0.66	5.1	3.15	1.2	1.72	0.27	0.47
Min	2.3	0.0017	0.003	< 0.2	< 0.2	< 1.0	<1.0	< 1.0	< 1.0	< 0.2	< 0.2
Max	34.7	0.023	0.0239	0.5	2.5	26.0	8.6	3.0	3.7	1.7	2.1
CHR01											
N	9	7	9	6	7	4	4	4	4	7	7
Mean	22.56	0.0189	0.021	0.29	0.71	1.18	1.48	1.08	1.85	0.11	1.1
Min	5.1	0.0024	0.0043	< 0.2	< 0.2	< 1.0	< 1.0	< 1.0	< 1.0	< 0.2	< 0.2
Max	35.3	0.0324	0.0365	0.6	4.0	3.2	4.4	1.7	4.1	0.3	3.8
CHR05											
N	12	10	12	9	10	6	6	6	6	10	10
Mean	19.62	0.0162	0.017	0.24	0.6	2.45	6.3	0.85	1.18	0.09	0.49
Min	4.0	0.0028	0.0043	< 0.2	< 0.2	< 1.0	< 1.0	< 1.0	< 1.0	< 0.2	< 0.2
Max	29.9	0.0368	0.0378	1.4	3.8	6.6	22.0	2.4	3.8	< 0.2	2.2
PSC01											
N	2	1	2	1	1	1	1	1	1	1	1
Mean	7.65	0.005	0.0176	0.1	0.1	2.2	0.9	0.7	0.3	0.0	0.5
Min	6.5	0.005	0.01	0.1	0.1	2.2	0.9	0.7	0.3	0.0	0.5
Max	8.8	0.005	0.0252	0.1	0.1	2.2	0.9	0.7	0.3	0.0	0.5
PSC02											
N	2	1	2	1	1	1	1	1	1	1	1
Mean	3.05	0.0007	0.0035	0.0	0.0	1.7	0.0	0.2	0.3	0.0	0.2
Min	1.9	0.0007	0.0012	0.0	0.0	1.7	0.0	0.2	0.3	0.0	0.2
Max	4.2	0.0007	0.0057	0.0	0.0	1.7	0.0	0.2	0.3	0.0	0.2
UNT01											
N	1	1	1	1	1	0	0	0	0	1	1
Mean	6.1	0.0002	0.0009	0.2	0.03					0.0	0.0
Min	6.1	0.0002	0.0009	0.2	0.03					0.0	0.0
Max	6.1	0.0002	0.0009	0.2	0.03					0.0	0.0

Source: Powertech (2011).
*Diss = dissolved; Susp = suspended
†Min = minimum; Max = maximum

the Cheyenne River. Specific conductance also exceeded the irrigation daily maximum standard of 4,375 uS/cm in 50 percent (10 of 20) of the measurements at Beaver Creek and 42 percent (8 of 19) of the measurements at the Cheyenne River.

The U.S. Environmental Protection Agency (EPA) regulations in 40 CFR Part 141 (National Primary Drinking Water Regulations) establish the secondary maximum contaminant levels (SMCLs) for constituents that alter the color, taste, and odor of water (e.g., total dissolved solids, sulfate, and chloride) and the maximum contaminant levels (MCLs) for radionuclides and hazardous constituents (e.g., gross alpha, uranium, Ra-226, Pb-210, arsenic, and selenium) in drinking water. The SMCLs and MCLs established in 40 CFR Part 141 are the same as State of South Dakota drinking water standards (ARSD, Chapter 74:04:12). Results of the stream sampling indicated that almost all the samples exceeded the SMCL for total dissolved solids (TDS) {500 mg/L [500 ppm]} with values ranging from 219 to 7,040 mg/L [219 to 7,040 ppm]. Almost all samples (46 of 48) also exceeded the SMCL for sulfate {250 mg/L [250 ppm]} with values ranging from 86 to 4,520 mg/L [86 to 4,520 ppm]. About half of the samples (23 of 48) exceeded the SMCL for chloride {250 mg/L [250 ppm]} with values ranging from 1 to 1,730 mg/L

[1 to 1,730 ppm]. About 15 percent of the samples (7 of 48) exceeded the MCL for arsenic {0.01 mg/L [0.01 ppm]} with values ranging from <0.001 to 0.048 mg/L [<0.001 to 0.048 ppm]. None of the stream samples exceeded the MCL for selenium {0.05 mg/L [0.05 ppm]}. Selenium values ranged from <0.001 to 0.004 mg/L [<0.001 to 0.004 ppm].

For radionuclides, the majority of samples (26 of 48) exceeded the MCL for gross alpha {555 Bq/m^3 [15 pCi/L]}, with exceedances occurring in both Beaver Creek and the Cheyenne River. Total uranium concentrations ranged from 0.0009 to 0.0378 mg/L [0.0009 to 0.0378 ppm]; four samples from the Cheyenne River exceeded the MCL of 0.03 mg/L [0.03 ppm]. Total Ra-226 concentrations ranged from 0 to 192 Bq/m^3 [0 to 5.2 pCi/L]; one sample from Beaver Creek and one sample from the Cheyenne River exceeded the MCL of 185 Bq/m^3 [5.0 pCi/L]. Pb-210 doesn't have an approved individual MCL based on radiation exposure and is not regulated under current drinking water standards. However, EPA has proposed an MCL of 37 Bq/m^3 [1.0 pCi/L] for Pb-210 (EPA, 2000). The proposed MCL of 37 Bq/m^3 [1.0 pCi/L] for Pb-210 was exceeded in four samples from Beaver Creek, three samples from the Cheyenne River, and the two samples collected from Pass Creek.

3.5.2 Wetlands and Waters of the United States

The applicant conducted a wetland delineation survey of the proposed Dewey-Burdock ISR Project site in 2007 (Powertech, 2009a). The proposed project area is situated in the uplands areas of the two main drainages (Beaver Creek and Pass Creek) and includes several old mine pits and depressed areas. Wetlands were identified throughout the Beaver Creek drainage and near an old flowing well on Pass Creek at the southern boundary of the proposed project area. In addition, wetlands were identified in a majority of the old mine pits in the eastern portion of the Burdock area and in depressed areas throughout the project area. Table 3.5-3 summarizes the 2007 wetland delineation results. Based on the wetland delineation results, the total estimated wetland area in the proposed project area is 14.21 ha [35.11 ac] (Powertech, 2009a).

Table 3.5-3. Summary of 2007 Wetland Delineation Survey Results

Number of Features	Classification*	Ha [Ac]
2	Wetland Channel (PEM)	0.306 [0.756]
2	Wetland Channel (R2EM)	5.420 [13.393]
1	Wetland Channel (R4SB7)	0.001 [0.002]
2	Wetland Channel (R4US)	0.019 [0.048]
4	PEM Isolated Pond	0.827[2.043]
1	PEMC Isolated Pond	0.002 [0.005]
1	PABJh Isolated Pond	0.105 [0.260]
1	PUSA Isolated Pond	0.012 [0.030]
3	PUB Isolated Depression	2.124 [5.248]
3	PUS Isolated Depression	1.095 [2.706]
5	Mine Pits PUB, PEM, OW	4.300 [10.626]
	Total	**14.210 [35.114]**

Source: Powertech (2009a).
*Explanation of Classification: PEM (Palustrine Emergent); R2EM (Riverine Lower Perennial Emergent); R4SB7 (Riverine Intermittent Streambed Vegetated); R4US (Riverine Intermittent Unconsolidated Streambed); PEMC (Seasonally Flooded); PABJh (Palustrine Aquatic Bed Intermittently Flooded Diked); PUSA (Palustrine Unconsolidated Shore Temporarily Flooded); PUB (Palustrine Unconsolidated Bottom); PUS (Palustrine Unconsolidated Shore); and OW (Open Water).

The entire stretch of Beaver Creek, totaling 5.41 ha [13.38 ac] located in the northwest part of the proposed project area, was designated as a Riverine Lower Perennial Emergent (R2EM) wetland. Vegetation along the upper banks of Beaver Creek comprises mainly big sagebrush (*Artemisia tridentata*), greasewood (*Sarcobatus vermiculatus*), and western wheatgrass (*Elymus smithii*). The wetland indicator status of big sagebrush and greasewood is upland (UPL). The wetland indicator status of western wheatgrass is facultative upland (FACU).

Common vegetation identified along the drainage of Beaver Creek included prairie cordgrass (*Spartina pectinata*), Baltic rush (*Juncus balticus*), and common threesquare (*Schoenoplectus pungens*). The wetland indicator status of prairie cordgrass and Baltic rush is facultative wet (FACW). The wetland indicator status of common threesquare is obligate (OBL).

Pass Creek, which runs through the central part of the proposed project area, contains wetland areas near an old, open flowing well at the southern boundary of the project area. The wetland totals 0.20 ha [0.50 ac] and is classified as Palustrine Emergent (PEM). Common vegetation found within the wetland was prairie cordgrass and common threesquare, with a wetland indicator status of FACW and OBL, respectively.

Approximately 0.47 ha [1.17 ac] of wetlands and 3.82 ha [9.45 ac] of open water (OW) are present in the old mine pits at the eastern and northeastern edges of the Burdock area (Figure 3.2-3). Two of the Darrow pits in Section 1, Township 7 South, Range 1 East are classified as Palustrine Unconsolidated Bottom (PUB) wetland. Darrow Pit #2 in Section 2, Township 7 South, Range 1 East is classified as both PEM and OW wetland. The PEM is located along the bank of the Darrow Pit #2 and OW in other parts of the pit. The Triangle Pit located in Section 34, Township 6 South, Range 1 East was classified as OW wetland and totaled 3.09 ha [7.63 ac]. Other old mine pits in the Burdock area were classified as nonwetland due to lack of hydrophytic vegetation and/or hydrology.

The applicant has recommended all topographic depressed areas identified as wetlands in its 2007 wetland delineation survey be classed as nonjurisdictional, based on their isolated nature (Powertech, 2009a). These wetlands were primarily classified as PEM, Seasonally Flooded (PEMC), Palustrine Aquatic Bed Intermittently Flooded Diked (PABJh), Palustrine Unconsolidated Shore (PUS), Palustrine Unconsolidated Shore Temporarily Flooded (PUSA), and PUB wetlands based on hydrology conditions. Approximately 4.16 ha [10.29 ac] of wetland depressions and ponds were identified within the proposed project area.

The U.S. Army Corps of Engineers (USACE), Ohama District, completed a jurisdictional Waters of the United States determination of wetlands on the proposed Dewey-Burdock site in January 2009 (Powertech, 2009a, Appendix 3.5–H). USACE identified 20 wetland sites, and 4 of these were considered jurisdictional: Beaver Creek, Pass Creek, and an ephemeral tributary to each creek. The jurisdictional ephemeral tributary to Beaver Creek has wetlands present near its confluence with Beaver Creek; it is located in Section 32, Township 6 South, Range 1 East (see Figure 4.5-1). The jurisdictional ephemeral tributary to Pass Creek has wetlands present near its confluence with Pass Creek; it is located in Section 3, Township 7 South, Range 1 East (see Figure 4.5-1).

3.5.3 Groundwater

3.5.3.1 Regional Aquifer Systems

The geological sequence of the regional aquifers presented in the applicant's license application (Powertech, 2009a–c) is consistent with the information on the hydrologic setting of the Black Hills area by Driscoll, et al. (2002) and Fahrenbach, et al. (2009). On the regional scale, the major aquifers in the Black Hills area include (from top to bottom) the Inyan Kara Group, Minnekahta, Minnelusa, Madison, and Deadwood aquifers (Figure 3.5-4). These aquifers are separated by confining layers with low permeability except at their outcrop areas. The hydrologic setting in the Black Hills area also involves minor aquifers, which include the Sundance/Unkpapa, Newcastle, and alluvial aquifers. These minor aquifers yield small volumes of water locally for domestic and livestock uses. A hydrostratigraphic section showing aquifers present at the Dewey-Burdock site is presented in Figure 3.5.5.

Aquifer characteristics and hydraulic properties of the major aquifers, from shallow to deep, are discussed in this section. The Inyan Kara Group aquifer is the first major aquifer below the ground surface. It ranges from 76 to 152 m [250 to 500 ft] in thickness and contains two subaquifers: the Fall River aquifer and Chilson aquifer, which are separated by the Fuson Shale confining unit (see Figure 3.5-5). The Inyan Kara Group aquifers are highly heterogeneous, display transmissivities in the range of 0.1 to 557 m^2/day [1 to 6,000 ft^2/day], and are capable of yielding high volumes of water (Driscoll, et al., 2002). The effective porosity of the Inyan Kara aquifer is 0.17 and is generally the highest of the major aquifers (Rahn, 1985). Effective porosity is the porosity of the rock consisting of interconnected pores. The Inyan Kara aquifer is recharged primarily by precipitation at the outcrop.

The Inyan Kara Group aquifer is overlain by the Graneros Group (the combined Skull Creek–Mowry–Belle Fourche shales) except at outcrop areas. Within the Graneros Group, the Newcastle Sandstone contains an important minor aquifer known as the Newcastle aquifer. As noted in SEIS Section 3.4.1.2, the Newcastle Sandstone is absent within the proposed Dewey-Burdock project area. The Inyan Kara Group aquifer is separated from the underlying Minnekahta aquifer by a sequence of (from shallow to deep) Morrison Formation, Sundance/Unkpapa aquifer (minor aquifer), and the Gypsum Spring Formation.

The Minnekahta aquifer is a major aquifer in the Black Hills area and ranges in thickness from 7.6 to 19.8 m [25 to 65 ft] (Strobel, et al., 1999). The Minnekahta aquifer is a thin to medium-bedded, fine-grained laminated limestone (Driscoll, et al., 2002). Information on the hydraulic properties of the Minnekahta aquifer is limited. The Minnekahta aquifer is typically very permeable; however, due to its limited thickness, well yields can be small. In northeast Wyoming, the effective transmissivity and specific capacity of the Minnekahta aquifer were reported to be 4.2 m^2/day and 0.5 m^3/day [45 ft^2/day and 19 ft^3/day], respectively (Northeast Wyoming River Basins Water Plan, 2002).

The Minnelusa aquifer ranges in thickness from 114 to 358 m [375 to 1,175 ft] in the Black Hills area (Driscoll, et al., 2002). The Minnelusa aquifer is composed of layers of sandstone, dolomite, and anhydrite in the Minnelusa Formation. Porosity within the Minnelusa is predominantly primary porosity associated with void space present during rock formation, although secondary porosity is present in association with fractures and dissolution features after rock formation. The effective porosity of the Minnelusa is 0.05 (Rahn, 1985).

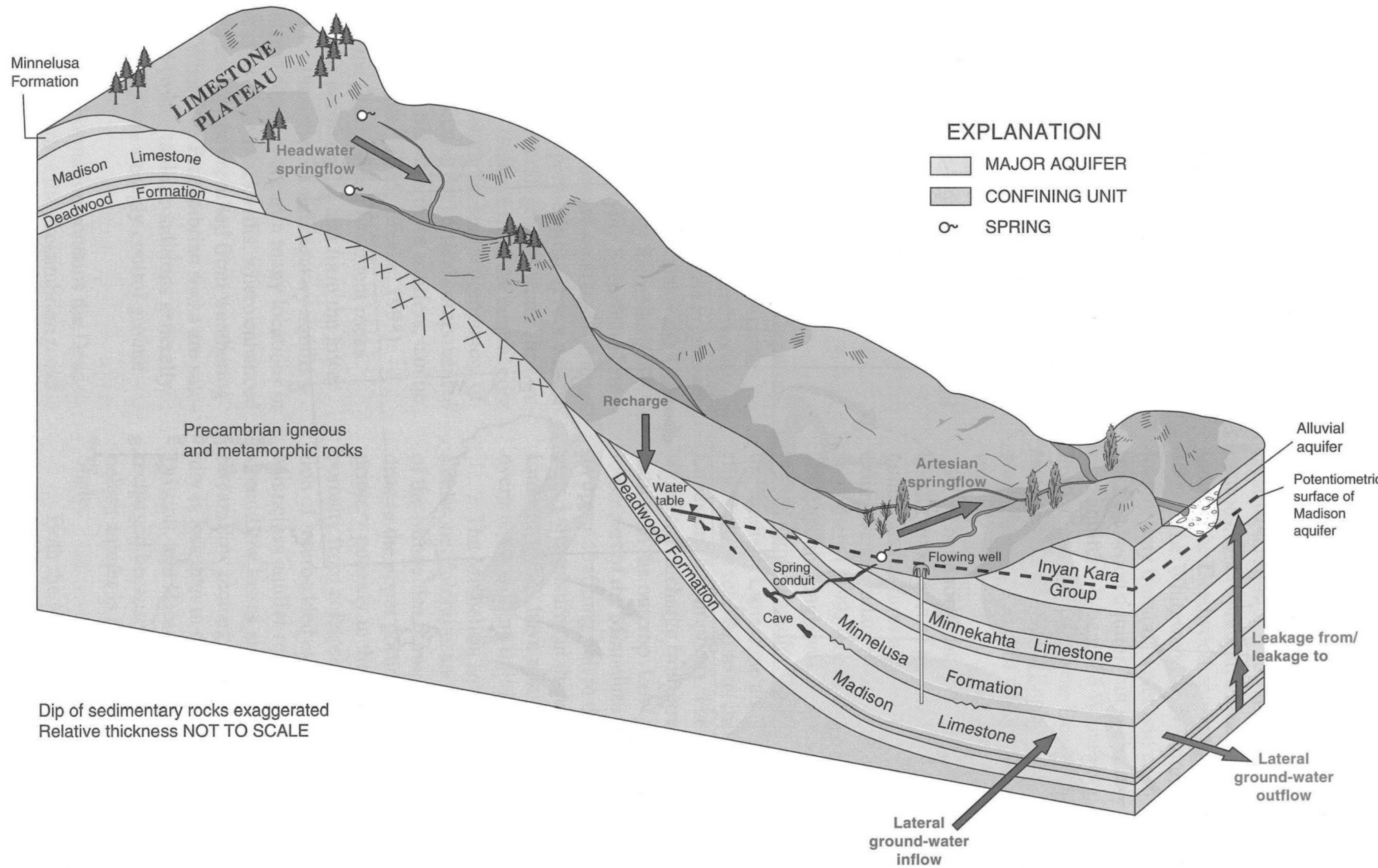

Figure 3.5-4. Schematic Diagram Showing Simplified Hydrogeologic Setting of the Black Hills Area
Source: Driscoll, et al. (2002)

Dewey-Burdock Site Hydrostratigraphy

System	Series	Formation		
Cretaceous	Upper	Graneros Group		Belle Fourche Shale
	Lower	Graneros Group		Mowry Shale
	Lower	Graneros Group		Skull Creek Shale
	Lower	Inyan Kara Aquifer		Fall River Aquifer
	Lower	Inyan Kara Aquifer	Lakota Formation	Fuson Shale
	Lower	Inyan Kara Aquifer	Lakota Formation	Chilson Aquifer
Jurassic				Morrison Formation
				Unkpapa Aquifer
				Sundance Aquifer
				Gypsum Spring Formation
Triassic / Permian				Spearfish Formation
Permian				Minnekahta Aquifer
				Opeche Shale
Permian / Pennsylvanian				Minnelusa Aquifer
Mississippian				Madison Aquifer
Devonian				Englewood Formation
Ordovician				Whitewood Formation
				Winnipeg Formation
Ordovician / Cambrian				Deadwood Aquifer

Figure 3.5-5. Hydrostratigraphic Units Present at the Proposed Dewey-Burdock *In-Situ* Recovery Project Site
Source: Modified from Driscoll, et al. (2002)

It is a heterogeneous aquifer with transmissivity in the range of 0.1 to 1,115 m^2/day [1 to 12,000 ft^2/day]. The Minnelusa is separated from the Minnekahta aquifer by the Opeche Shale, which acts as the intervening confining layer. There are confining layers at the base of the Minnelusa Formation. In some locations, these confining layers may be absent or provide ineffective confinement; this could enhance hydraulic connection between the Minnelusa aquifer and the underlying Madison aquifer (Naus, et al., 2001). However, SDDENR concluded based on water levels in the Minnelusa and Madison observation wells in the area that there is a distinct difference in the potentiometric surfaces of the two aquifers (SDDENR, 2012d). These differences suggest that the Minnelusa and Madison aquifers are hydraulically separated in the vinicity of the proposed project area (SDDENR, 2012d). The Minnelusa Formation has been considered to be in hydraulic connection with the Inyan Kara aquifer through breccia pipes (Gott, et al., 1974). Breccia pipes are collapse structures caused by dissolution of gypsum (calcium sulfate, $CaSO_4 \cdot H_2O$) and anhydrite (anhydrous calcium sulfate, $CaSO_4$) within the Minnelusa Formation in the Black Hills area. As described in SEIS Section 3.4.1.2, the areal extent of dissolution is limited to within a few kilometers [miles] downgradient from the Minnelusa outcrop. The probable maximum downgradient limit of dissolution has been mapped by the USGS and is approximately 8 km [5 mi] northeast of the proposed project area (Braddock, 1963). The applicant conducted detailed geologic mapping throughout proposed operating areas at the proposed Dewey-Burdock site and found no indication for the presence of breccia pipes (Powertech, 2009c, 2011).

The Madison Formation, which ranges in thickness from 61 to 305 m [200 to 1,000 ft], is mainly a dolomite unit characterized by extensive secondary porosity resulting from fractures and karst (caves and sinkholes) features. The effective porosity of the Madison aquifer is 0.05 (Rahn, 1985). It is the source of municipal water for numerous communities, including Rapid City and Edgemont. It is a highly heterogeneous aquifer with transmissivity in the range of 121 to 5,203 m^2/day [1,300 to 56,000 ft^2/day]. Regionally, the Madison aquifer is separated from the underlying Deadwood aquifer by the low-permeability Whitewood and Winnipeg Formations (see Figure 3.5-5). The Englewood Formation also underlies the Madison Formation. Previous studies have included the Englewood Formation as part of the Madison aquifer (Strobel, et al., 1999; Driscoll, et al., 2002). The Madison and Minnelusa aquifers are sources of large artesian springs in the Black Hills area, and groundwater flowpaths and velocities in both aquifers are influenced by hydraulic properties caused by secondary porosity (Driscoll, et al., 2002).

Regionally, the Whitewood and Winnipeg Formations act as overlying semiconfining units to the Deadwood aquifer (Strobel, et al., 1999). However, the Whitewood and Winnipeg Formations as depicted in Figure 3.5-5 are not present in the southern Black Hills, where the proposed Dewey-Burdock ISR Project is located (Naus, et al., 2001). At the proposed project area, the Englewood Formation acts as the upper confining unit to the Deadwood aquifer.

The Deadwood aquifer is 0 to 152 m [0 to 500 ft] thick and consists of basal conglomerate, sandstone, limestone, and mudstone. It exhibits transmissivity in the range of 23 to 93 m^2/day [250 to 1,000 ft^2/day]. The Deadwood aquifer is used mainly by domestic and municipal users near its outcrop area. Regionally, Precambrian rocks underlying the Deadwood act as a lower confining unit.

Regionally, groundwater flows radially outward from the Black Hills toward the surrounding plains. Groundwater recharge paths for aquifers in the Black Hills include precipitation, streamflow losses, and water flow across aquifers where confining layers are absent or ineffective. Rainfall ranges from 30 to 71 cm/yr [12 to 28 in/yr] in the Black Hills.

Approximately 2 percent of precipitation recharges the aquifers of the southwestern Black Hills, and the rest is accounted for by evapotranspiration and surface runoff (Powertech, 2009a). In general, streamflow recharge to groundwater is limited to aquifer outcrops or relatively shallow aquifers beneath stream valleys. Regionally, water elevations increase with depth, which provides an upward hydraulic gradient for groundwater flow across the major aquifers and limits the potential for downward recharge.

3.5.3.2 Aquifer Systems in the Vicinity of the Proposed Dewey-Burdock Project

Alluvial aquifers (formed by unconsolidated or loosely consolidated sediments) with thicknesses of 0 to 15 m [0 to 50 ft] are observed in the vicinity of the proposed project area along Beaver Creek, Pass Creek, and the Cheyenne River (Powertech, 2009a, 2011). They are typically unconfined, but may be confined locally. Based on an alluvial drilling program completed in May 2011, the alluvium in the Pass Creek drainage is up to 15 m [50 ft] thick and the alluvium in the Beaver Creek drainage is up to 9 m [30 ft] thick (Powertech, 2011). Many of the borings drilled into the alluvium along Beaver Creek and Pass Creek in May 2011 were dry; however, the thickness of saturated alluvium in three borings completed as alluvial monitoring wells ranged from 3 to 4 m [10 to 12 ft] (Powertech, 2011). Alluvial aquifers are separated from the underlying Fall River Formation by the low permeability Graneros Group confining unit (see Figure 3.5-5). Results of the alluvial drilling program did not indicate any areas of discharge to the alluvium along Beaver Creek and Pass Creek from the underlying Fall River aquifer (Powertech, 2011). Within the proposed project area, the Skull Creek shale of the Graneros Group has an average thickness of 61 m [200 ft], except in parts of the Burdock area where it has eroded leaving the Fall River aquifer exposed at the surface. The Skull Creek Shale has low vertical hydraulic conductivities of approximately 10^{-9} cm/sec [10^{-11} ft/sec].

The Skull Creek Shale is underlain by the Fall River aquifer, which has an average thickness of 46 m [150 ft] within the project area. The Fall River Formation crops out in the eastern part of the project area (see Figure 3.4.3), where it is geologically unconfined and partially saturated (i.e., the water table is below the top of the formation). The transmissivity of the Fall River varies in the range of 5 to 24 m^2/day [54 to 255 ft^2/day] in the Dewey area, and its storativity is on the order of 10^{-5} cm/sec [10^{-7} ft/sec] (Powertech, 2009a).

The Fall River aquifer is separated from the underlying Chilson aquifer by the Fuson Shale, which varies from approximately 6 to 24 m [20 to 80 ft] in thickness across the project area (Powertech, 2010a, 2011). Exploratory drilling data and isopach contours of the Fuson Shale in the Burdock area identified an approximate 1.6 km [1.0 mi]-wide, northwest-trending channel within the basal Fall River aquifer that has scoured the underlying Fuson Shale (Figure 3.5-6) (Powertech, 2010a). The existing drilling data indicate the thinnest section of the Fuson Shale {i.e., less than 9 m [30 ft]} is approximately 305 m [1,000 ft] outside the northern boundary of the initial Burdock area wellfield (BWF-1) (Figure 3.5-6).

Based on pumping tests conducted in the Burdock area in 1979, the Fuson Shale has estimated vertical hydraulic conductivities of 1×10^{-7} to 4.6×10^{-8} cm/sec [3.3×10^{-9} to 1.5×10^{-9} ft/sec] (Boggs and Jenkins, 1980). Based on the 1979 aquifer tests, Boggs and Jenkins (1980) suggested there may be a direct connection between the Fall River and Chilson aquifers through the Fuson. Additional aquifer pumping tests conducted in the Burdock area in 2008 also demonstrated a hydraulic connection between the Fall River and Chilson aquifers through the intervening Fuson Shale (Powertech, 2010a). Interpretations of both the 1979 and 2008 pumping test results were found to be consistent with a leaky-confined aquifer model

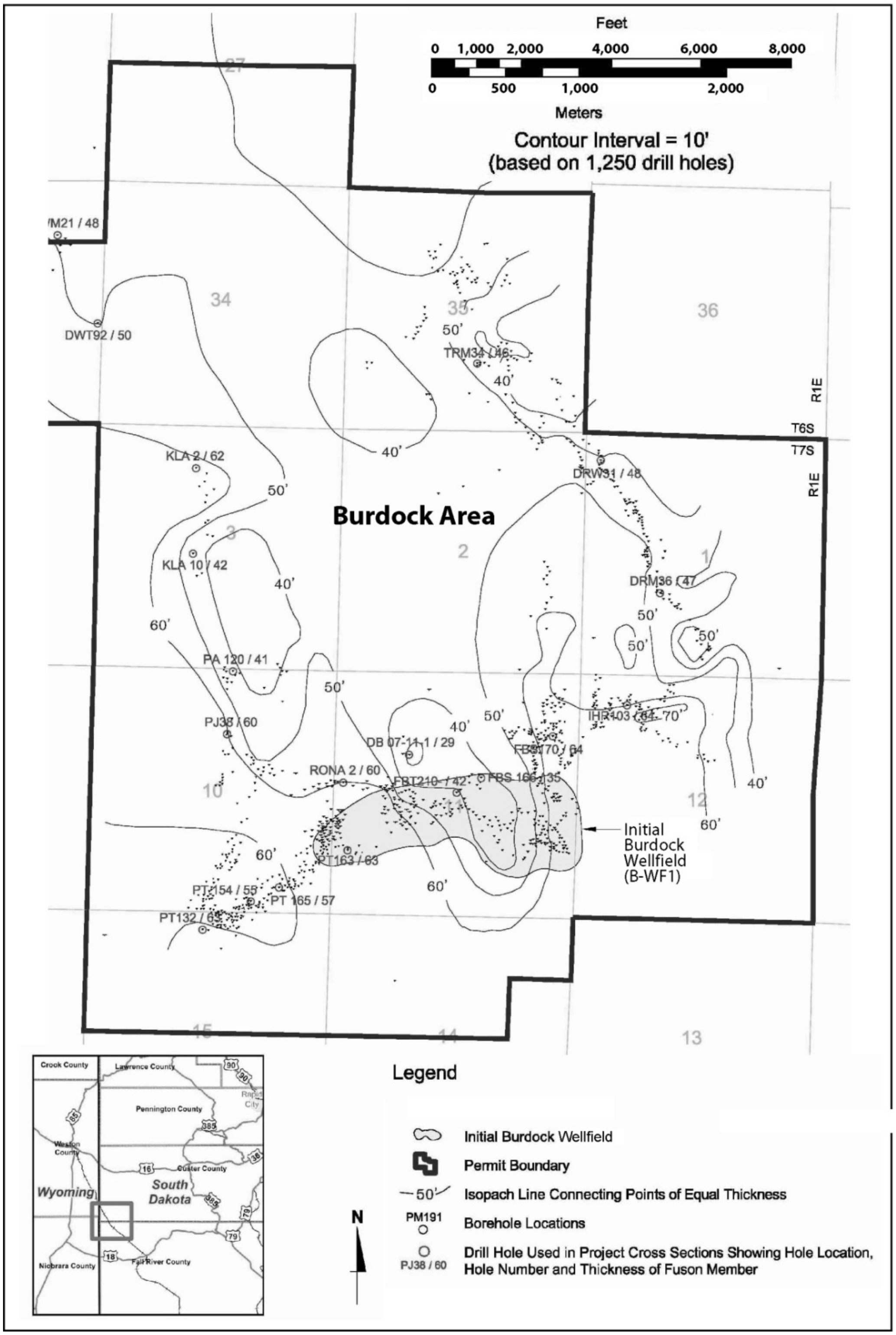

Figure 3.5-6. Isopach Map of the Fuson Shale at the Proposed Dewey-Burdock *In-Situ* Recovery Project
Source: Modified From Powertech (2010a)

(Powertech, 2010a). The applicant developed a numerical groundwater model using site-specific geologic and hydrologic information (Petrotek, 2012). Based on results of the numerical model, the applicant concluded that vertical leakage through the Fuson Shale is caused by improperly installed wells or improperly abandoned boreholes. The Fuson Shale is underlain by the Chilson aquifer, which varies in thickness from 37 to 61 m [120 to 200 ft]. Its transmissivity ranges from 18 to 55 m^2/day [190 to 590 ft^2/day] in the Burdock area, and its storativity is on the order of 10^{-4} cm/sec [10^{-6} ft/sec] (Powertech, 2009a).

Underlying the Chilson aquifer is the Morrison Formation with an average thickness of 18.3 to 42.7 m [60 to 140 ft] across the project area (Powertech, 2011). The Morrison Formation is the lower confining unit for the Inyan Kara Group aquifer system and has low vertical hydraulic conductivities of 10^{-9} cm/sec [10^{-11} ft/sec] (Powertech, 2009a).

The Morrison Formation is underlain by the Unkpapa then the Sundance aquifers. There is no intervening confining unit between the Unkpapa and Sundance aquifers (see Figure 3.5-5). They are considered to be minor aquifers and are a source of water within the proposed project area (Powertech, 2009a). These aquifers are separated from the underlying Minnekahta aquifer by the low permeability Spearfish Formation, which consists of shale and siltstone. The Spearfish Formation has an average thickness of 98 m [320 ft]. The applicant reported that the Minnekahta aquifer does not supply water for domestic, livestock, or agricultural uses in the proposed Dewey-Burdock ISR Project area (Powertech, 2010a).

Potentiometric surfaces for the Fall River and Chilson aquifers indicate groundwater flows from northeast to southwest (Powertech, 2009b). The directional groundwater flow at the proposed site is consistent with regional groundwater flow; regional flow moves outward radially from the Black Hills, which results in northeast-to-southwest regional flow in the general vicinity of the proposed project site. Potentiometric surfaces also indicate that the hydraulic gradient is upward from the Chilson aquifer to the Fall River aquifer in the Dewey area. At the Dewey pumping test area, the potentiometric surface difference between the Chilson and Fall River aquifers in the Dewey area is approximately 12 m [40 ft] (Powertech, 2010a). Potentiometric surfaces for the Fall River and Chilson aquifers, however, are nearly equal in the Burdock area, suggesting that these two aquifers could be hydraulically connected through the intervening Fuson shale (Powertech, 2009b). There is no evidence from exploratory drilling information (e.g., borehole and geophysical log) that supports the thickness of the Fuson shale as being less than 6 m [20 ft] in the Burdock area (Powertech, 2010a,b).

3.5.3.3 Uranium-Bearing Aquifers

The Chilson and Fall River aquifers, as part of the Inyan Kara Group aquifer, contain the uranium mineralization that the proposed project will extract (Powertech, 2009a). The initial wellfield in the Dewey area will be located in the mineralization zone of the Fall River Formation, and the initial wellfield in the Burdock area will be located in the mineralization zone of the Chilson member of the Lakota Formation (Powertech, 2009c). The Fall River Formation crops out in the eastern part of the project area, where it is geologically unconfined and partially saturated (i.e., the water table is below the top of the formation). The approximate boundary between fully saturated and partially saturated conditions in the Fall River is shown in Figure 3.5-7. The applicant has indicated that it has no plans at present to conduct ISR operations in Fall River orebodies in the eastern portion of the project area where the Fall River is geologically unconfined and partially saturated (Powertech, 2011). This will restrict the proposed ISR operations to confined portions of the underlying hydrogeologic system.

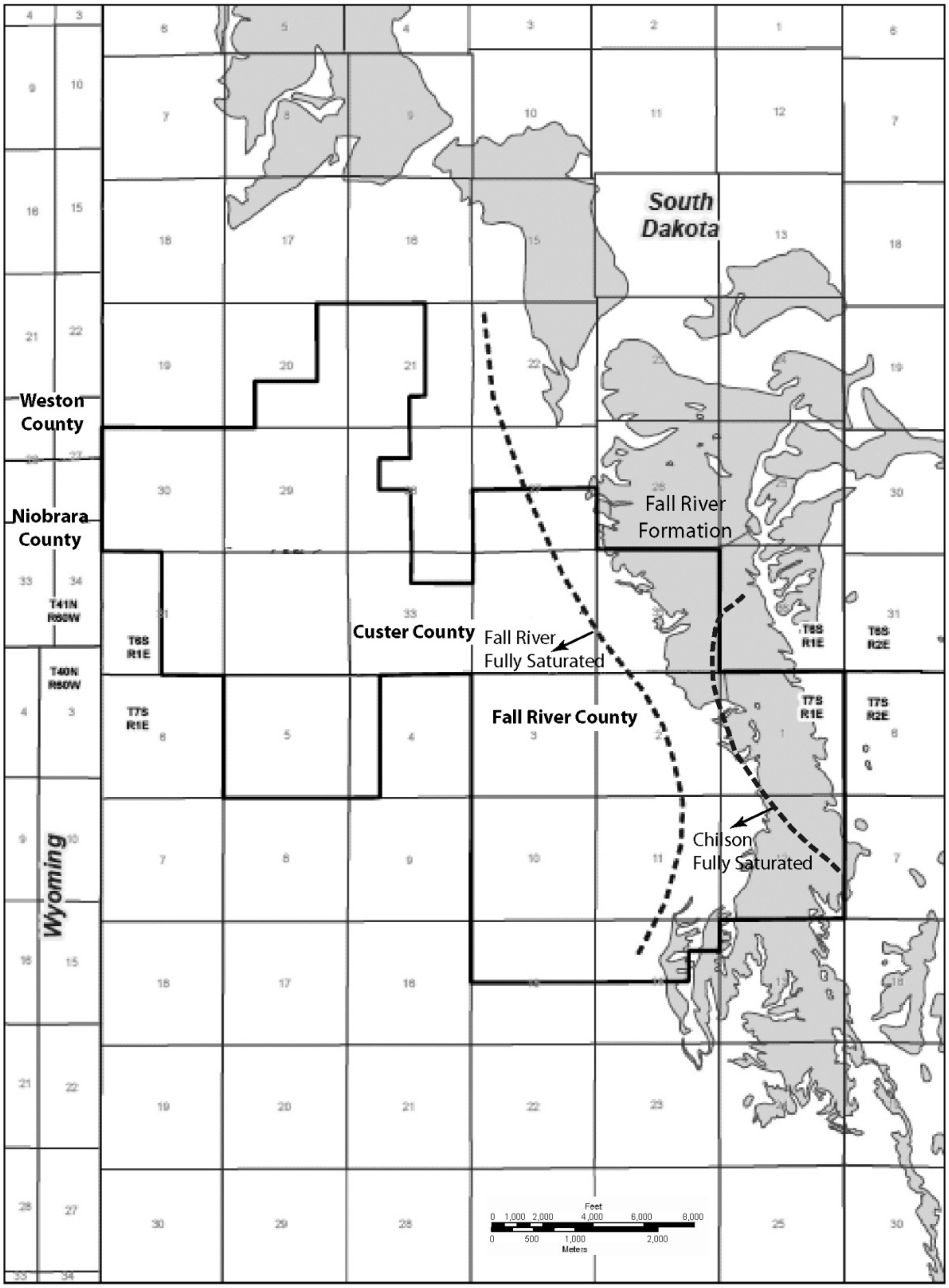

Figure 3.5-7. Map of the Proposed Dewey-Burdock *In-Situ* Recovery Project Area Showing the Approximate Locations of Fully Saturated Portions of the Fall River Formation and Chilson Member of the Lakota Formation. Shaded Areas Are Where Fall River Formation Is Exposed at the Ground Surface. Source: Modified From Powertech (2011)

The applicant is considering the possibility of conducting ISR operations in partially saturated portions of the underlying Chilson aquifer in the eastern part of the project area (Powertech, 2010a, 2011). The approximate boundary between fully saturated and partially saturated conditions in the Chilson is shown in Figure 3.5-7. Partially saturated portions of the Chilson along the eastern edge of the project area are not confined under pressure beneath the relatively impermeable Fuson Shale. Therefore, although the Chilson is geologically confined in this area, the partially saturated portions are considered hydrologically unconfined. The applicant has committed, as part of the license condition, to conduct additional hydrogeological investigations (e.g., delineation drilling and pump testing) prior to wellfield development to accurately measure and identify partially saturated portions of the Chilson aquifer to confirm sufficient potentiometric head {greater than 15.2 m [50 ft]} is available to perform normal ISR operations (Powertech, 2010a, 2011).

3.5.3.4 Other Surrounding Aquifers for Water Supply

The Madison aquifer is the most important aquifer in the region supplying municipal water for numerous communities, including Rapid City and Edgemont, South Dakota. Powertech reported that the Sundance and Unkpapa aquifers are minor aquifers, supplying local domestic and livestock water within the proposed project area (Powertech, 2009a, 2011).

3.5.3.5 Groundwater Quality

The applicant followed guidance in NUREG–1569 (NRC, 2003) and NRC Regulatory Guide 4.14 (NRC, 1980) to establish preoperational or baseline groundwater quality conditions at the proposed site (Powertech, 2009a, 2011). The applicant conducted initial baseline groundwater sampling of wells at the proposed Dewey-Burdock ISR Project from July 2007 through June 2008 (Powertech, 2009a). The baseline study sampled 19 groundwater wells quarterly: 14 were existing wells and 5 wells were newly drilled. Eight domestic wells and six stock watering wells were sampled, and three of these existing wells are located upgradient of the proposed uranium recovery areas. Groundwater sampling was undertaken in a number of aquifers: four wells in the Fall River Formation, seven wells in the Lakota Formation (Chilson Member), two wells in the Inyan Kara Group made up of the Fall River or Chilson, one well in the Sundance formation, and five wells in the alluvium were tested. The applicant conducted monthly sampling of an additional 12 wells from March 2008 to February 2009. Six of these wells were located in the Dewey area and six in the Burdock area. A set of Fall River and Chilson wells was sampled within areas upgradient and downgradient of proposed uranium recovery areas in both the Dewey and Burdock areas. The locations of all groundwater sampling sites are shown in Figure 3.5-2.

The initial baseline groundwater sampling results found that 28 out of 31 groundwater samples exceeded the MCLs for primary drinking water standards as provided by EPA regulations at 40 CFR Part 141. Wells with groundwater samples exceeding primary drinking water standards for arsenic (40 CFR Part 141, Subpart B), lead (40 CFR Part 141.86), uranium, Ra-226, and gross alpha (40 CFR Part 141.66) are shown in Table 3.5-4. This table provides data on constituent concentrations of inorganic chemicals, uranium, Ra-226, and gross alpha particle radioactivity and identifies the well and aquifer sampled. Of 25 groundwater samples collected from the proposed ore-bearing aquifer, 23 exceeded the MCLs for primary drinking water standards as provided by EPA regulations at 40 CFR Part 141; hence, groundwater from the proposed ore-bearing aquifer within the permit boundaries will not be used in public water systems and is unsuitable for private domestic use without treatment.

Table 3.5-4. Baseline Groundwater Samples With Values Exceeding the Maximum Contaminant Level for Arsenic (0.01 mg/L), Lead (0.015 mg/L), Uranium (Total, 0.03 mg/L), Ra-226 (Dissolved, 5 pCi/L), and Gross Alpha (Total, 15 pCi/L)

Well Identification	Aquifer	Arsenic (mg/L)	Lead (mg/L)	Uranium (mg/L)	Ra-226 (Dissolved) (pCi/L)	Gross Alpha (pCi/L)
2	Chilson					
7	Fall River					15.5
8	Fall River					
13	Chilson					19.5
16	Chilson				6.4–26.2	28.3–85.7
18	Fall River					15.7–31.7
42	Chilson				96.5–102	371–558
615	Chilson	0.021–0.024			7.2	15.1–38.3
619	Chilson				99.7–120	341–438
622	Fall River	0.027	0.023–0.03		7.9	15–1470
628	Inyan Kara				6.1–20.7	29.9–83.9
631	Fall River				9.5–22.1	46.5–162
635	Sundance					
650	Chilson		0.05			
675	Alluvial			0.0387–0.0502		18.3–55.2
676	Alluvial	0.021	0.06	0.0591–0.0687		31.9–95.5
677	Alluvial			0.0414–0.0471		38.7–129
678	Alluvial			0.0379–0.0387		18.9–54.7
679	Alluvial	0.011	0.015–0.022			18.4–22.4
680	Chilson			0.0541	1,110–1,440	4,090–6,730
681	Fall River				357–434	656–2220
688	Fall River	0.015			6.7	17.3–29.8
689	Chilson		0.017		5.4–7.9	23.9–64.3
694	Fall River					15.1–25.9
695	Fall River	0.016			5.2–10.4	18.7–44.0
696	Chilson					20.2–23.9
697	Chilson				5.6	18.2–21.7
698	Fall River			0.101–0.132	347–429	36.3–2110
3026	Chilson	0.022–0.044		0.0322	5.9–10.1	36.0–116
4002	Inyan Kara				52.3–63.6	120–314
7002	Chilson				8–8.8	29.5–91.4

Source: Powertech (2011)

Samples collected from wells 615 and 3026, which are within the Chilson aquifer, exceeded the MCL for arsenic {0.01 mg/L [0.01 ppm]}; wells 650 and 689, also within the Chilson aquifer, exceeded the MCL for lead {0.015 mg/L [0.015 ppm]}. Samples from well 622 in the Fall River aquifer and from wells 676 and 679 in alluvial aquifers along Pass Creek exceeded the MCL for both arsenic and lead. In addition, samples from wells 688 and 695 in the Fall River aquifer exceeded the MCL for arsenic. The MCL for uranium (0.03 mg/L) was exceeded in samples obtained from four of five wells in the alluvial aquifers. Samples from wells 680 and 3026 in the Chilson aquifer and well 698 in the Fall River aquifer also exceeded the MCL for uranium; these wells are within the Burdock area. The MCL for other metals, such as selenium {0.05 mg/L [0.05 ppm]}, was not exceeded in any of the groundwater samples.

More than 60 percent of the samples in the both Fall River and Chilson aquifers exceeded the MCL for dissolved Ra-226 [185 Bq/m_3 [5 pCi/L]}. Ra-226 levels exceeding the MCL ranged between 192 and 53,274 Bq/m^3 [5.2 and 1,440 pCi/L]. Approximately 75 percent of the wells sampled in the Fall River, Chilson, and alluvial aquifers produced samples that exceeded the MCL for gross alpha {555 Bq/m^3 [15 pCi/L]}. Gross alpha levels exceeding the MCLs in alluvial wells ranged between 677 and 4,772 Bq/m_3 [18.3 and 129 pCi/L]; however, gross alpha levels exceeding MCLs in the Fall River and Chilson aquifers were higher, ranging from 555 to 248,983 Bq/m^3 [15 to 6,730 pCi/L]. Wells 680 and 681 demonstrated Ra-226 levels exceeding 11,099 Bq/m^3 [300 pCi/L] and gross alpha concentrations exceeding 36,996 Bq/m^3 [1,000 pCi/L]; these wells are directly within mapped orebodies in the Chilson and Fall River aquifers. Another well (698) downgradient of abandoned open pit mines within the Fall River aquifer demonstrated uranium, Ra-226, and gross alpha levels in the range of 0.113 to 0.123 mg/L [0.113 to 0.123 ppm], 13,688 to 15,871 Bq/m^3 [370 to 429 pCi/L], and 44,765 to 78,061 Bq/m^3 [1,210 to 2,110 pCi/L], respectively, exceeding the corresponding MCLs.

Baseline groundwater samples also measured levels that exceeded the SMCLs for bulk water quality properties including pH, TDS, and other major constituents such as sodium and sulfate (Powertech, 2009a, 2011). Samples from six wells exceeded the SMCL for pH (6.5–8.5) with values ranging from 8.6 to 10.3. All the samples exceeded the SMCL for TDS {500 mg/L [500 ppm]} with values ranging from 670 to 9,700 mg/L [670 to 9,700 ppm]. The highest TDS values were obtained from alluvial aquifer samples. The SMCL for sodium {200 mg/L [200 ppm]} was exceeded in approximately half of the samples; measured values ranged from 201 to 2,140 mg/L [201 to 2,140 ppm]. Samples taken from alluvial aquifers produced the highest values for sodium. All samples taken from wells exceeded the SMCLs for sulfate {250 mg/L [250 ppm]}; wells in the alluvial aquifers measured the highest sulfate values {greater than 3,000 mg/L [3,000 ppm]}.

At the present time, a primary drinking water standard for Rn-222 has not been established; however, EPA has proposed a limit of 11,099 Bq/m^3 [300 pCi/L] (EPA, 2000). Only well 650, of all the wells tested during baseline groundwater sampling, produced samples that did not exceed the proposed EPA limit; well 650 in the Chilson aquifer lies upgradient of historic uranium mining activities (Powertech, 2009a, 2011). Well samples exceeding the EPA's proposed limit for Rn-222 produced values ranging from 11,247 to 17,092,120 Bq/m^3 [304 to 462,000 pCi/L]. Wells 680 and 42, located in the mapped orebodies in the Chilson aquifer, and well 681 in the Fall River aquifer have the highest concentrations of Rn-222. Well 42 provides water for domestic and stock uses.

Before ISR operations begin, the portion of the aquifer(s) designated for uranium recovery must be exempted from the underground source of drinking water (USDW) designation, in accordance with the Safe Drinking Water Act and pursuant to 40 CFR Part 146. A USDW is defined as an aquifer or its portion that supplies any public water system, or that contains a sufficient quantity of groundwater to supply a public water system and currently supplies drinking water for human consumption, or contains fewer than 10,000 mg/L [10,000 ppm] total dissolved solids, and which is not an exempted aquifer. An aquifer or aquifer portion that meets the criteria for a USDW may be determined to be an "exempted aquifer" if it does not currently serve as a source of drinking water and it cannot now and will not in the future serve as a source of drinking water because it is mineral, hydrocarbon, or geothermal energy producing, or can be demonstrated by a permit applicant as part of a permit application for a Class III operation to contain minerals that, considering their quantity and location, are expected to be commercially producible. The applicant, therefore, must obtain an aquifer exemption from EPA as a precondition to initiating ISR operations.

3.6 Ecology

The Nebraska-South Dakota-Wyoming Milling Region, as fully described in GEIS Section 3.4.5, encompasses the Middle Rockies, Northwestern Great Plains, Western High Plains, and the Nebraska Sand Hills ecoregions (NRC, 2009a). The proposed Dewey-Burdock ISR Project is located within the Black Hills Foothills and Sagebrush Steppe ecoregions (Figure 3.6-1). GEIS Section 3.4.5.1 provides the following description of these ecoregions:

- The Black Hills Foothills ecoregion is composed of the Hogback Ridge and the Red Valley. The Hogback Ridge forms a ring of foothills surrounding the Black Hills. The Red Valley encircles most of the Black Hills dome and acts as a buffer between the Hogback Ridge and the Black Hills. Natural vegetation within this region includes ponderosa pine (*Pinus ponderosa*), woodlands and open savannas with an understory of western wheat grass (*Elymus smithii)*, needle-and-thread grass (*Stipa comata*), little bluestem (*Schizachyrium scoparium*), blue grama (*Bouteloua gracilis)*, buffalo grass (*Hierochloe odorata*), and leadplant (*Amorpha canescens*). In addition, some burr oak (*Quercus macrocarpa*) is found in the north and Rocky Mountain juniper (*Juniperus scopulorum*) occurs in the south (Chapman, et al., 2004).

- The Sagebrush Steppe ecoregion is found in Montana and in the Dakotas with only a small area extending into Wyoming. Vegetation types in this region consist of big sagebrush, Nuttall saltbush (*Atriplex nuttallii*), and short grass prairie. The sparse sagebrush communities consist of dusky gray sagebrush (*Artemisia arbuscula* ssp. *Arbuscula)*, dwarf sage (*Artemisia columbiensis*), and big sagebrush (*Artemisia tridentata*). Prairie vegetation that can be found includes western wheatgrass, green needlegrass (*Nassella viridula*), blue grama, Sandberg bluegrass (*Poa secunda*), junegrass (*Koeleria macrantha*), rabbit brush (*Chrysothamnus*), fringed sage (*Artemisia frigid)*, and buffalo grass. The shrub vegetation of this ecoregion is transitional between the grasslands of the Montana Central Grassland and the woodland of the Pine Scoria Hills (Bryce, et al., 1996).

The applicant conducted ecological baseline studies from July 2007 through August 2008 at the proposed Dewey-Burdock site to fulfill the objectives specified in NUREG–1569 (NRC, 2003) and to meet SDDENR, SDGFP, and U.S. Fish and Wildlife Service (FWS) guidelines (Powertech, 2009a).

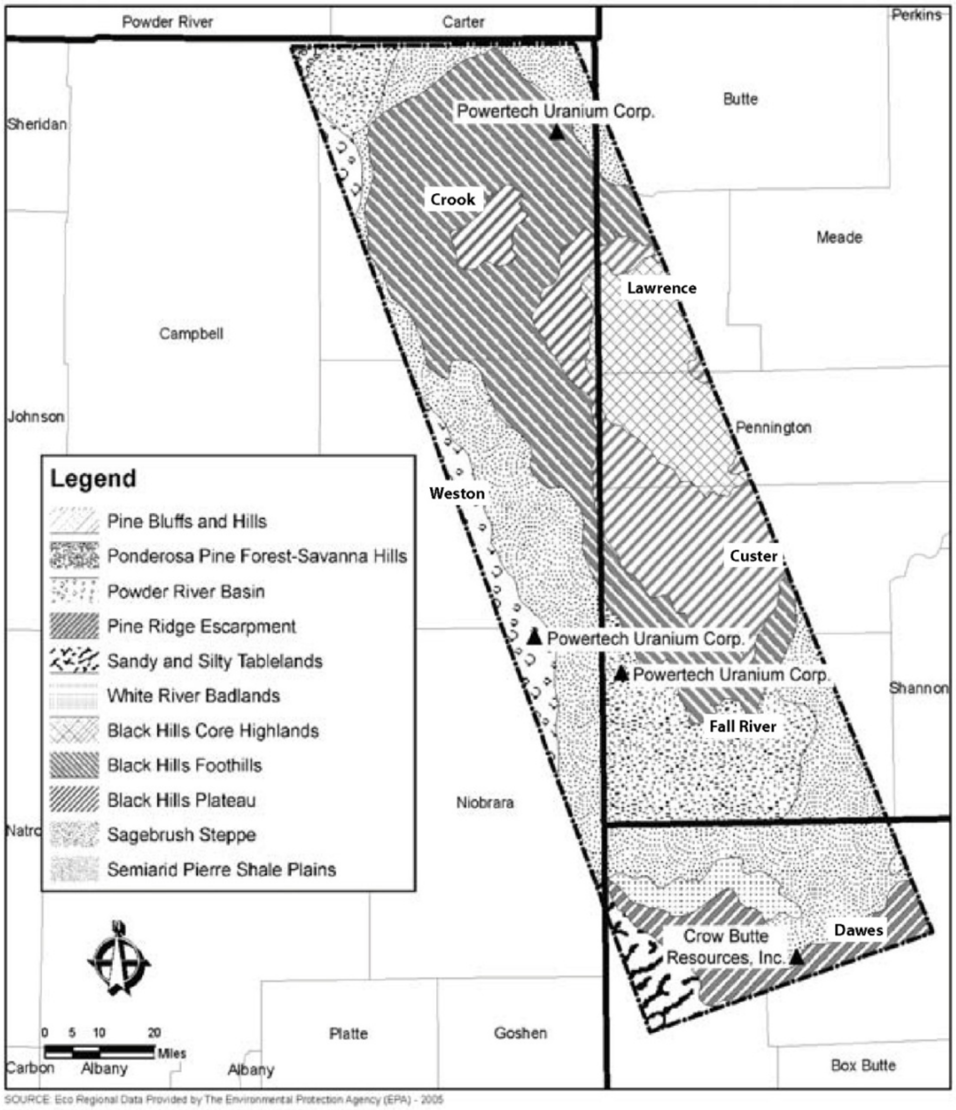

Figure 3.6-1. Ecoregions for the Nebraska-South Dakota-Wyoming Uranium Milling Region
Source: NRC (2009a)

These studies include vegetation and wildlife surveys, which are detailed in the following sections. As stated in SEIS Section 3.1, the information in this section forms the basis for assessing the potential ecological impacts (see Chapter 4) of the proposed action and each alternative (Chapter 2).

3.6.1 Terrestrial Ecology

The proposed project area is located within the geomorphologic Cheyenne River drainage basin and contains 4,282 ha [10,580 ac] of wildlife habitat, which supports medium- and small-sized mammals, as well as avian species within the Black Hills Foothills and Sagebrush Steppe ecoregions described previously. SEIS Figure 3.6-1 shows the ecoregions in the vicinity of the proposed project area. The area is characterized as semiarid continental to steppe environment, with a dry winter season with little precipitation (USGS, 1998). Two main drainages are within the proposed project area: Beaver Creek, a perennial stream, and Pass Creek, an ephemeral stream that supports some intermittent habitat, although dry stream channels and numerous ephemeral drainages are also present (see SEIS Section 3.5.1). Beaver Creek experiences low flow in most years resulting in a lack of deep-water habitat, which limits the number of water-dependent species found in the proposed project area. All natural drainages flow south and drain into the Cheyenne River, which is approximately 4 km [2.5 mi] south of the project area. The topography is primarily gently rolling in the western quadrant (more varied terrain with dry drainages and shrubland patches dissecting groups of pine tree in the central portion), and the highest elevation is in the eastern portion at the edge of the Black Hills (Powertech, 2009a).

3.6.1.1 Vegetation

Seven vegetation communities account for 96.7 percent of the 4,282-ha [10,580-ac] proposed project area (Powertech, 2009a). The remaining 3.3 percent of the project area is composed of disturbed areas, abandoned mine pits, shale outcrops, and open water. Table 3.6-1 summarizes the total area of each vegetation community. The survey, completed by the applicant, identified five native plant communities: big sagebrush shrubland, upland grassland, greasewood shrubland, ponderosa pine woodland, and cottonwood gallery (Powertech, 2009a). Agricultural land used for crop production is also present within the proposed project area.

The plains cottonwood (*Populus deltoides* ssp. *monilifera*) grows naturally along the riverbanks of Beaver and Pass Creeks and on the higher elevation hilltops within the proposed project area. Although not identified within the study area, American elm (*Ulmus americana*), green ash (*Fraxinus pennsylvanica*), willows, and bur oak are common in riparian corridors in western South Dakota (BLM, 1985). The plains cottonwood was the only tree species the applicant's vegetation surveys identified along watered drainages; it is most prevalent in the Pass Creek drainage. Rocky Mountain juniper is present as individual trees or in small stands in some of the dry drainages (Powertech, 2009a). Ponderosa pines (*Pinus ponderosa*) are dominant at higher elevations, on hilltops, and within gaps in vegetation in the central and eastern portions of the project area.

Table 3.6-1. Total Acreage of Vegetation Communities and Percentage of Permit Area

Vegetation Community/ Land Use	Permit Area (Hectares)	Permit Area (Acres)	Percent of Permit Area
Big Sagebrush Shrubland	1,012.34	2,501.56	23.70
Greasewood Shrubland	886.44	2,190.45	20.75
Upland Grassland	885.27	2,187.56	20.72
Ponderosa Pine Woodland	883.74	2,183.76	20.69
Agricultural Land	315.97	780.79	7.40
Cottonwood Gallery	97.37	240.60	2.28
Silver Sagebrush Shrubland	48.35	119.49	1.13
Disturbed	5.95	14.70	0.14
Existing Mine Pits	132.33	326.99	3.10
Shale Outcrop	0.89	2.19	0.02
Water	3.62	8.94	0.08
TOTAL	**4,272.27**	**10,577.03**	**100.00**
Source: Powertech (2009a).			

Threatened and endangered plant species were not encountered during the applicant's vegetation survey of the project area or within a 0.8-km [0.5-mi] perimeter around the area (Powertech, 2009a). The FWS South Dakota Field Office indicates threatened or endangered vegetative species have not been reported in Custer or Fall River Counties (FWS, 2010).

A noxious weed is any plant a federal, state, or county government designates as injurious to public health, agriculture, recreation, wildlife, or property (BLM, 2009b). Nonnative plant or invasive plants include not only noxious weeds, but also other plants not native to the United States. As a result, these plants have no natural enemies to limit reproduction and spread. Some invasive plants can produce significant changes to vegetation, composition, structure, or ecosystem function.

The South Dakota Department of Agriculture (SDDA) (2011) identifies six noxious weed state species that could be present in both Custer and Fall River Counties. The applicant's vegetation survey identified the presence of one of the six noxious weeds important on the state level, Canada thistle (*Cirsium arvense)*, within the Cottonwood Gallery vegetation community (Powertech, 2009a). Canada thistle invades open habitats, including prairies, savannas, fields, pastures, wet meadows, and open forests, forming dense stands, which shade out and displace native vegetation (Colorado State University, 2008). Once established it spreads rapidly and becomes difficult to eradicate.

In addition to state noxious weeds, SDDA identifies 15 noxious weeds locally important that could occur either in Custer or Fall River Counties. Two of the 15 local noxious weeds, field bindweed (*Convolvulus arvensis*) and houndstongue (*Cynoglossum officinale*), were documented during the vegetation surveys (Powertech, 2009a). Field bindweed was observed within the greasewood shrubland vegetative community, but its extent was not reported (Powertech, 2009a). Bindweed can quickly create a dense ground cover with intertwining stems and prevent other plants and crops from growing (Zollinger, 2000). Established bindweed is very persistent and difficult to control (Zollinger, 2000). Small or isolated bindweed plants can be controlled by tilling shortly after growth begins (Zollinger, 2000). Houndstongue was documented in the big sagebrush shrubland vegetative community near Beaver Creek (Powertech, 2009a). Houndstongue has a deep taproot, making it drought tolerant, and it is able to quickly establish in areas that have been previously disturbed (Zouhar, 2002). It is poisonous to horses and cattle (Zouhar, 2002). Preventing the dispersal of seeds is the best way to control the spread of houndstongue (Zouhar, 2002). The presence of other noxious weeds or invasive plants SDDA (2011) listed was not reported during the vegetation surveys conducted for the proposed project.

3.6.1.2 Wildlife

The applicant conducted wildlife surveys of terrestrial species for the proposed Dewey-Burdock ISR Project area (Powertech, 2009a). The applicant drew information from these surveys, as well as several additional reports and studies prepared by SDGFP, Wyoming Game and Fish Department (WGFD), BLM, FWS, and USFS and a draft environmental statement TVA prepared for the Edgemont uranium mine to prepare its application (Powertech, 2009a, Sections 3.5.5.3.1 and 9.3.5; TVA, 1979). Site-specific wildlife surveys targeted bald eagle winter roost sites, sage-grouse leks, nesting raptors (including eagles), big game, small mammal vertebrates (bats, mice, and rabbits), and other vertebrate species of concern.

3.6.1.2.1 Big Game

Pronghorn antelope (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), white-tailed deer (*O. virginianus*), and elk (*Cervus elaphus*) are the four big game species present in the proposed project area; pronghorn antelope is the most common species (Powertech, 2009a). GEIS Section 3.4.5.1 references a comprehensive listing of species in South Dakota compiled as part of the South Dakota GAP Analysis Project (South Dakota State University, 2012). NRC staff reviewed distribution maps provided as part of the South Dakota GAP Analysis Project that identify the presence of bighorn sheep (*Ovis canadensis*) and mountain lions (*Felis concolor)* predicted in the vicinity of the proposed project area. SDGFP reports no crucial big game habitats or migration corridors have been identified within a 1.6-km [1-mi] radius of the study area (Powertech, 2010a). Crucial areas are those that need to be protected or managed to maintain viable healthy populations of wildlife. GEIS Section 3.4.5.1 provides maps of areas that are important for winter survival, called wintering areas, for pronghorn antelope, mule deer, white-tailed deer, elk, and bighorn sheep, as well as for moose (*Alces alces)*; however, no wintering areas for big game are located in the vicinity of the proposed project area. NRC staff compiled the GEIS maps from information drawn from WGFD and SDGFP. In addition, BLM (BLM, 2011) reports there are no crucial birthing (parturition) or wintering habitats for pronghorn antelope, mule deer, white-tailed deer, elk, bighorn sheep, or moose west of the Dewey-Burdock site in Wyoming.

3.6.1.2.2 Avian Species

This section of the SEIS describes bird species identified at the proposed Dewey-Burdock ISR Project from surveys (Powertech, 2009a) and independent sources.

Upland Game Birds

The wild turkey (*Meleagris gallopavo*) and mourning dove (*Zenaida macroura*), both relatively common species, were the only upland game bird species regularly observed within the proposed project area during the applicant wildlife surveys. Three grouse species, including the Greater sage-grouse *(Centrocercus urophasianus)*, could potentially occur in the proposed project area. The Greater sage-grouse is a species of great concern in the arid west where sagebrush habitat occurs. The sage-grouse is listed as a federal candidate species (75 FR 13909), or a species that is being considered for listing as endangered or threatened, and it is discussed in more detail in SEIS Section 3.6.3. Sage-grouse were not observed during the applicant surveys (Powertech, 2009a). One sage-grouse lek, or breeding area, is located almost 8 km [5 mi] west of the site boundary in Wyoming (Hodorff, 2005; BLM, 2011; WGFD, 2011). Sharp-tailed grouse (*Tympanuchus phasianellus*) and ruffed grouse (*Bonasa umbellus*) are not known to breed in the project vicinity. Sharp-tailed grouse are more likely to potentially occur in the proposed project area than ruffed grouse because sharp-tailed grouse inhabit short grass prairies of western South Dakota, while ruffed grouse are found in limited numbers in the forests of the Black Hills (Peterson, 1995; SDGFP, 2012b; South Dakota State University, 2012).

Raptors

Suitable habitat for several raptor species occurs in the proposed project area and within a 1.6-km [1-mi] radius of the site. Raptor species observed during the applicant's wildlife surveys included the bald eagle (*Haliaeetus leucocephalus*), red-tailed hawk (*Buteo jamaicensis*), golden eagle (*Aquila chrysaetos*), ferruginous hawk (*Buteo regalis*), northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), turkey vulture (*Cathartes aura*), Cooper's hawk (*Accipiter cooperii*), rough-legged hawk (*Buteo lagopus*), merlin (*Falco columbarius*), great horned owl (*Bubo virginianus*), and long-eared owl (*Asio otus*) (Powertech, 2009a).

The bald eagle, red-tailed hawk, American kestrel, and northern harrier were the most commonly seen raptor species in the proposed project area (Powertech, 2009a). The red-tailed hawk is one of the most common hawks in North America that nests in trees in a variety of open and wooded habitats near ravines or open water. The red-tailed hawk is an opportunistic feeder and finds its prey, consisting mostly of rodents, from an elevated perch or while soaring (NPWRC, 2006a). The American kestrel is the smallest and most common falcon and nests in either natural or manmade crevices. The kestrel requires perches and open space for hunting small animals and insects (NPWRC, 2006b). The northern harrier prefers prairies and wetlands with plenty of room to glide across open country in search of small mammals, reptiles, frogs, insects, and birds. Northern harriers nest on the ground in marshes or areas with low vegetation (NPWRC, 2006c).

Although additional raptor species may be present in the survey area, particularly as seasonal migrants, no additional species were identified. The South Dakota Breeding Bird Atlas reports the burrowing owl (*Athene cunicularia*), northern saw-whet owl (*Aegolius acadicus*), and Sharp-shinned Hawk *(Accipiter striatus)* have been recorded in the vicinity of the proposed project area (Peterson, 1995). The SDGFP South Dakota Natural Heritage Program (SDNHP) collects information about these raptors (SDGFP, 2010). SDNHP inventories, protects, and manages state species that are rare, imperiled, candidate, threatened, or endangered. SDNHP classifies the burrowing owl, northern saw-whet owl, and sharp-shinned hawk as rare.

Five confirmed, intact raptor nests and one potential nest site were observed within the proposed project area, and the applicant identified two additional nests within a 1.6-km [1-mi] radius of the study area (Powertech, 2009a). The bald eagle, a state-listed threatened species, and the long-eared owl, a SDNHP rare species, successfully nested in the proposed project area. A merlin, another SDNHP rare species, was recorded at one of the potential nest sites within a 1.6-km [1-mi] radius of the proposed project area. SDNHP inventories, protects, and manages native plant and animal species and habitats as part of efforts to sustain the biological diversity of South Dakota. All eight nests are listed in Table 3.6-2; information on their locations, their status, and productivity at the time of the nest surveys in 2007 and 2008 is included. Occurrences of the bald eagle, golden eagle, ferruginous hawk, Cooper's hawk, long-eared owl, merlin, and other sensitive or protected species observed at the project site are detailed in Section 3.6.3.

SDGFP provided NRC with eagle surveys conducted on the proposed Dewey-Burdock project site from 2009 to 2011. SDGFP confirmed the bald eagle nest that Powertech reported as successful (produced fledgling) on the site during its 2009–2011 surveys was successful with one fledgling in 2009, but was not active (not occupied by a breeding pair) in 2010 and 2011. Approximately 1.2 km [0.75 mi] southeast of this nest along Beaver Creek, SDGFP observed an additional active nest with one successful fledgling in 2010. This nest remained active in 2011 but did not produce a fledgling (SDGFP, 2012c).

Table 3.6-2. Raptor Nest Locations and Activity Observed for the Proposed Dewey-Burdock Project (July 2007–August 2008)

Species	16-ha [40-ac] Block, and Section, Township, Range	Habitat	Status	Location (Area)
Long-Eared Owl	SESW 35, 6 South, 1 East	Ponderosa Pine	1 Owl Fledged	Permit Area (Burdock)
Red-Tailed Hawk (2 Nests)	SENE 29, 6 South, 1 East	Ponderosa Pine	1 Hawk Fledged	Permit Area (Dewey)
Red-Tailed Hawk	SESW 34, 6 South, 1 East	Cottonwood-riparian	2 Hawks Fledged	Permit Area (Burdock)
Bald Eagle	Mid-SW 30, 6 South, 1 East	Cottonwood-riparian	1 Eagle Fledged	Permit Area (Dewey)
Bald Eagle*	NENE 31, 6 South, 1 East	Cottonwood-riparian	1 eagle fledged (2010); active but no fledglings (2011)	Permit Area (Dewey)
Merlin	NWSW 36 6 South/1 East	Ponderosa Pine	Nest defense but no confirmed young	Within 1/2 mi of Perimeter (Burdock)
Great Horned Owl	SWNE 5 7 South/1 East	Lone, Live Cottonwood Tree	Status unknown†	Permit Area (Dewey)
Unidentified Hawk	NESW 28 41 North/60 West (Wyoming)	Lone, Dead Cottonwood Tree	Inactive	Within 1 mi of Perimeter (Dewey)

Source: Powertech, 2009a; SDGFP, 2010; SDGFP, 2012c
*Surveys conducted in 2010 and 2011 by South Dakota Game, Fish, and Parks
†One adult great horned howl was observed in the nest tree, but no chicks, feathers, droppings, or prey items were observed in or on the nest, or on the ground under the nest.

Waterfowl and Shorebirds

The proposed project area provides limited seasonal habitat for waterfowl and shorebirds, mainly along Beaver Creek and Pass Creek and the few scattered stocked reservoirs. Limited precipitation in the area results in little year-round nesting and brood-rearing habitat for these species. Therefore year-round residence is rare for species present during the spring migration period. Eight avian species associated specifically with water and/or wetlands were observed during the applicant baseline surveys: the American white pelican (*Pelecanus erythrorhynchos*), great blue heron (*Ardea herodias*), Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), American wigeon (*Anas americana*), killdeer (*Charadrius vociferus*), long-billed curlew (*Numenius americanus*), and upland sandpiper (*Bartramia longicauda*) (Powertech, 2009a). Based on the wetland survey results presented in SEIS Section 3.5.2, the proposed project may affect a total of 14.2 ha [35.1 ac] of wetland channels, isolated ponds, isolated depressions, and open water. The pelican, heron, and curlew are listed in the table in Section 3.6.3 (Protected Species) as BLM-sensitive species and in a table in Section 3.6.3 as rare species in South Dakota.

Nongame and Migratory Birds

Other avian species were observed flying over the proposed project area during wildlife surveys (Powertech, 2009a). The Clark's nutcracker (*Nucifraga columbiana*) was recorded flying over the proposed project area, but known nesting or other activities were not observed. A total of 36 avian species were observed during targeted breeding bird surveys within the proposed project area. The long-billed curlew was the only rare SDNHP species of the 36 observed during the breeding bird surveys, and it was suspected, although not observed, to have nested in the project area. The western meadowlark (*Sturnella neglecta*) was the most common species observed, followed by the mourning dove. Nest activity and locations of breeding birds observed during the applicant's wildlife surveys are summarized in Table 3.6-3.

The South Dakota Breeding Bird Atlas reports that the common poorwill (*Phalaenoptilus nuttallii*), Lewis' woodpecker (*Melanerpes lewis*), black-backed woodpecker (*Picoides arcticus*), pygmy nuthatch (*Sitta pygmaea*), sage thrasher (*Oreoscoptes montanus*), brewer's sparrow (*Spizella breweri*), and Cassin's finch (*Carpodacus cassinii*) have been recorded in the vicinity of the proposed project area (Peterson, 1995). SDNHP also designates these birds as rare (SDGFP, 2010).

3.6.1.2.3 Other Mammals, Reptiles, and Amphibians

Small- and medium-sized mammalian species surveyed in southwest South Dakota and that could occur in the vicinity of the proposed project area include coyote (*Canis latrans*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), bobcat (*Lynx rufus*), badger (*Taxidea taxus*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), skunk (*Mephitis mephitis)*, porcupine (*Erethizon dorsatum*), and weasel (*Mustela* spp.) (South Dakota State University, 2012). Smaller mammal species, including rodents (mice, rats, moles, voles, shrews, minks, gophers, squirrels, chipmunks, prairie dogs), jackrabbits (*Lepus* spp.), and cottontails (hares) (*Sylvilagus* spp.), inhabit the area and are often prey for larger mammals (South Dakota State University, 2012). During the wildlife surveys, small mammals were most frequently observed near Beaver Creek in the northwestern portion and Pass Creek in the central portion of the proposed project area (Powertech, 2009a). Results of mammal surveys and trapping events are presented in Table 3.6-4. Results of spotlight lagomorph (rabbits and hares) surveys are presented in Table 3.6-5.

One black-tailed prairie dog (*Cynomys ludovicianus*) colony was observed during wildlife surveys in the northwestern corner of the proposed project area (Section 31, T6S, R1E), and two others were observed within 1.6 km [1 mi] southwest of the project area (Powertech, 2009a). SDGFP mapped the prairie dog town within the project boundaries in 2008 and provided NRC with the results of its size and location. For landowner privacy purposes, a map of the prairie dog town is not presented in this report. The prairie dog town covers approximately 321 ha [794 ac] of land in the northwest portion of the project area. The presence of large, closely spaced prairie dog colonies {on the order of hundred hectares [several thousand acres]} could support and sustain a breeding population of black-footed ferrets (*Mustela nigripes*) (BLM, 2009a). According to SDGFP, private landowners and the public are allowed to shoot prairie dogs on private lands to manage the population in the prairie dog town (SDGFP, 2005b). It is reasonable to expect that local ranchers may poison and/or trap prairie dogs for population control. Black-footed ferrets (*Mustela nigripes*) dwell in prairie

Table 3.6-3. Breeding Bird Species Observed Within the Proposed Dewey-Burdock Project Area in June 2008

	Average Number of Birds Per Habitat Type						
Species*	**BB**	**COT GAL**	**G**	**GW**	**P-SB Edge**	**PP**	**AVG #/PLOT**
Western Meadowlark (*Sturnella Neglecta*)	3.0	1.7	2.9	7.0	2.0	—	2.8
Mourning Dove (*Zenaida Macroura*)	5.0	1.7	1.9	0.7	0.3	2.0	1.9
Long-Billed Curlew (*Numenius Americanus*)	**—**	**—**	**1.9**	**—**	**—**	**—**	**0.9**
Chipping Sparrow (*Spizella Passerina*)	—	—	—	0.3	4.0	1.6	0.6
Lark Sparrow (*Chondestes Grammacus*)	3.7	—	—	—	1.7	—	0.6
Grasshopper Sparrow (*Ammodramus Savannarum*)	—	—	0.1	4.3	—	—	0.5
Northern Flicker (*Colaptes Auratus*)	—	4.3	—	0.3	—	—	0.5
Mountain Bluebird (*Sialia Currucoides*)	—	—	—	—	2.3	2.0	0.5
Brewer's Blackbird (*Euphagus Cyanocephalus*)	—	3.7	—	—	—	—	0.4
Spotted Towhee (*Pipilo Maculatus*)	—	1.3	—	0.3	0.7	1.0	0.4
American Kestrel (*Falco Sparverius*)	0.3	2.3	0.2	—	—	—	0.4
Brown-Headed Cowbird (*Molothrus Ater*)	—	0.3	—	—	2.0	1.0	0.4
House Wren (*Troglodytes Aedon*)	—	2.7	—	—	—	—	0.3
Yellow Warbler (*Dendroica Petechia*)	—	2.0	—	—	—	—	0.2
Say's Phoebe (*Sayornis Saya*)	—	0.3	—	—	1.3	—	0.2
Bullock's Oriole (*Icterus Bullockii*)	—	1.7	—	—	—	—	0.2
Unknown Flycatcher	—	—	—	—	—	1.7	0.2
Eastern Kingbird (*Tyrannus Tyrannus*)	—	1.3	—	—	—	—	0.1
Red-Tailed Hawk (*Buteo Jamaicensis*)	—	0.3	0.1	0.3	—	—	0.1
Black-Capped Chickadee (*Poecile Atricapillus*)	—	0.3	—	—	—	0.7	0.1

Table 3.6-3. Breeding Bird Species Observed Within the Proposed Dewey-Burdock Project Area in June 2008 (Cont'd)

	Average Number of Birds Per Habitat Type						
Species*	**BB**	**COT GAL**	**G**	**GW**	**P-SB Edge**	**PP**	**AVG #/PLOT**
Yellow-Rumped Warbler (*Dendroica Coronata*)	—	0.3	—	—	—	0.7	0.1
European Starling (*Sturnus Vulgaris*)	—	1.0	—	—	—	—	0.1
Great Horned Owl (*Bubo Virginianus*)	—	1.0	—	—	—	—	0.1
Vesper Sparrow (*Pooecetes Gramineus*)	—	—	0.3	—	—	—	0.1
American Crow (*Corvus Brachyrhynchos*)	—	—	0.1	—	—	0.3	0.1
Red-Headed Woodpecker (*Melanerpes Erythrocephalus*)	—	0.7	—	—	—	—	0.1
Rock Wren (*Salpinctes Obsoletus*)	0.7	—	—	—	—	—	0.1
Western Kingbird (*Tyrannus Verticalis*)	I	0.7	—	—	—	—	0.1
American Robin (*Turdus Migratorius*)	—	0.3	—	—	—	—	<0.1
Common Nighthawk (*Chordeiles Minor*)	—	I	—	—	—	0.3	<0.1
Indigo Bunting (*Passerina Cyanea*)	—	0.3	—	—	—	—	<0.1
Killdeer (*Charadrius Vociferous*)	—	—	0.1	—	—	—	<0.1
Lazuli Bunting (*Passerina Amoena*)	—	0.3	—	—	—	—	<0.1
Western Wood Pewee (*Contopus Sordidulus*)	—	—	—	—	0.3	—	<0.1
Yellow-Breasted Chat (*Icteria Virens*)	—	0.3	—	—	—	—	<0.1
Red-Winged Blackbird (*Agelaius Phoeniceus*)	—	—	I	—	—	—	I
Turkey Vulture (*Carthartes Aura*)	I	I	—	—	—	—	I
Average # Birds/Transect	12.3	29.0	7.7	13.3	15.3	10.7	12.4
TOTAL SPECIES	5	23	10	7	10	10	36

Source: Powertech (2009a)
AVG = average; BB = Bentonite Breaks; COT GAL = Cottonwood Gallery; G = Grassland; GW = Greasewood; P-SB = Pine-Sagebrush; PP = Ponderosa Pine; I = Incidental flyover during breeding bird survey (not counted in totals).
***Bold** Long-billed curlew is tracked by the South Dakota Natural Heritage Program—South Dakota Department of Game, Fish, and Parks (SDGFP, 2010) and was suspected, although not observed, to nest within the proposed project area.

Table 3.6-4. Small Mammal Abundance Based on Trappings During Baseline Studies Conducted for the Proposed Dewey-Burdock Project in September 2007

	Captures Per 100 Trap-Nights*						
Species	**UG**	**PP**	**GW**	**CG**	**CB**	**P/S**	**Total**
Deer Mouse (*Peromyscus Maniculatus*)	6.67	22.86	5.71	16.19	17.14	15.24	11.53
Olive-Backed Pocket Mouse (*Perognathus Fasciatus*)	0.71	—	—	—	—	—	0.32
Northern Grasshopper Mouse (*Onychomys Leucogaster*)	0.24	—	—	—	—	—	0.11
Western Harvest Mouse (*Reithrodontomys Megalotis*)	0.24	—	0.95	—	—	—	0.21
Total Abundance	7.86	22.86	6.67	16.19	17.14	15.24	12.17
Total No. of Species	4	1	2	1	1	1	4

Source: Powertech (2009a)
*Excludes recaptures.
CB = Clay Breaks; CG = Cottonwood Gallery; GW = Greasewood; PP = Ponderosa; P/S = Pine/Sage Edge; UG = Upland Grassland

Table 3.6-5. Total Lagomorphs Observed During Spotlight Surveys and Abundance Indices Within the Proposed Dewey-Burdock Project in September 2007

	Species		
	White-Tailed Jackrabbit	**Cottontail**	**Totals**
Total Count*	12	28	40
Lagomorphs/Survey Mile†	1.5	3.4	4.9

Source: Powertech (2009a)
*Number given is highest count per species from two survey nights.
†Survey route totaled 13.1 km [8.2 mi].

dog towns and prey almost exclusively on prairie dogs (USGS, 2006b). The black-footed ferret is further discussed in Section 3.6.3.

The boreal chorus frog (*Pseudacris triseriata*), Woodhouse's toad (*Bufo woodhousei*), great plains toad (*B. cognatus*), and western painted turtle (*Chrysemys picta*) were heard and/or seen in Beaver Creek near stock reservoirs in the western portion of the proposed project area during the applicant's biological surveys. The western spiny softshell (*Trionyx spiniferus*) was also recorded in Beaver Creek during fisheries surveys, but not within the proposed project area. The genus *Trionyx* was used prior to the accepted *Apalone* (Somma, 2011). Spiny softshell turtle (*Apalone spinifera*) is a BLM sensitive species listed in Table 3.6-6. It is likely that the observed softshell was a spiny softshell turtle subspecies, the western spiny softshell (*Apalone spinifera hartwegi*). Lizards were often observed sunning themselves on rocks and sandy soil during the summer months. One snake skin, reportedly that of a bullsnake (*Pituophis melanoleucas sayi*), was also observed in the north central portion of the buffer area surveyed outside of the proposed project area (Powertech, 2009a).

The mountain goat (*Oreamnos americanus*) inhabits the Black Hills and prefers steep, rocky terrain (BLM, 2009a). The mountain goat was not observed on the proposed project site, but

Table 3.6-6. U.S. Bureau of Land Management Special Status Species That May Occur Within the Project Area

Common Name	Scientific Name	Federal Status	State Status*	General Habitat
Mammals				
Black-Tailed Prairie Dog	*Cynomys ludovicianus*	BLM Sensitive	SE	Grassland
Swift Fox	*Vulpes velox*	BLM Sensitive	ST	Grassland
Birds				
Bald Eagle	*Haliaeetus leucocephalus*	BLM Sensitive	ST	Forest/prairie
Black-Backed Woodpecker	*Picoides arcticus*	BLM Sensitive		Forest
Blue-Gray Gnatcatcher	*Polioptila caerulea*	BLM Sensitive		Shrubland
Burrowing Owl	*Athene cunicularia*	BLM Sensitive		Grassland
Chestnut-Collared Longspur	*Calcarius ornatus*	BLM Sensitive		Grassland
Dickcissel	*Spiza Americana*	BLM Sensitive		Grassland
Veery	*Catharus fuscescens*	BLM Sensitive		Forest
Ferruginous Hawk	*Buteo regalis*	BLM Sensitive		Grassland
Golden Eagle	*Aquila chrysaetos*	BLM Sensitive		Shrubland/grassland
Greater Sage-Grouse	*Centrocercus urophasianus*	BLM Sensitive and Candidate		Shrubland
Loggerhead Shrike	*Lanius ludovicianus*	BLM Sensitive		Shrubland
Long-Billed Curlew	*Numenius americanus*	BLM Sensitive		Grassland
Marbled Godwit	*Limosa fedoa*	BLM Sensitive		Grassland/wetland
Peregrine Falcon	*Falco peregrinus*	BLM Sensitive	SE	Forest
Red-Headed Woodpecker	*Melanerpes erythrocephalus*	BLM Sensitive		Forest
Swainson's Hawk	*Buteo swainsoni*	BLM Sensitive		Grassland
Three-Toed Woodpecker	*Picoides tridactylus*	BLM Sensitive		Forest
Trumpeter Swan	*Plegadis chihi*	BLM Sensitive		Wetland
Willet	*Cataptrophorus semipalmatus*	BLM Sensitive		Grassland/wetland
Wilson's Phalarope	*Phalaropus tricolor*	BLM Sensitive		Grassland/wetland

Table 3.6-6. U.S. Bureau of Land Management Special Status Species That May Occur Within the Project Area (Cont'd)

Common Name	Scientific Name	Federal Status	State Status*	General Habitat
Fish				
Banded killifish	*Fundulus diaphanus*		SE	River/stream
Northern Redbelly Dace	*Phoxinus eos*	BLM Sensitive	ST	River/stream
Amphibians				
Plains Spadefoot	*Spea bombifrons*	BLM Sensitive		Grassland/wetland
Northern Leopard Frog	*Rana pipiens*	BLM Sensitive		Wetland
Reptiles				
Snapping Turtle	*Cheldy serpentine*	BLM Sensitive		Wetland
Spiny Softshell Turtle	*Apalone spinifera*	BLM Sensitive		River/stream
Greater Short-horned Lizard	*Phrynosoma hernandesi*	BLM Sensitive		Grassland
Prairie Hognose Snake	*Heterodon nasicus*	BLM Sensitive		Grassland
Sources: SDGFP, 2010; BLM, 2009c; BLM, 2012b *SE = state endangered species; ST = state threatened species				

could inhabit the area east of the site according to South Dakota Gap Analysis Project information (South Dakota State University, 2012).

3.6.2 Aquatic

As discussed earlier in this section, Beaver and Pass Creeks form the two main drainage basins located within the proposed project area. Smaller drainages and depressions holding water adjacent to main drainage corridors provide potential aquatic habitat. The majority of the surface water features within the project area accumulate only as a result of snowmelt or major storm events. Old mine pits throughout the proposed project area are also locations where water accumulates, creating habitat.

The lack of permanent aquatic resources within the proposed project area is a factor limiting the presence of aquatic species. GEIS Section 3.4.5.2 describes the Cheyenne River as one of the major watersheds in South Dakota. The Cheyenne River originates in eastern Wyoming and flows along the southern edge of the Black Hills Uplift. The GEIS indicates approximately 45 fish species are found in the Cheyenne River watershed, including species of bass, catfish, carp, chub, trout, shiner, sunfish, and minnow. GEIS Table 3.4-4 lists the state-designated uses of the Cheyenne River and Beaver Creek as fisheries, fish and wildlife propagation, recreation, agriculture, and aesthetics, indicating that the water is acceptable for fishing, boating, swimming, agricultural irrigation, and growth of aquatic life.

The applicant conducted extensive fishery and habitat surveys that provide baseline information on stream flow and other habitat characteristics, including channel dimensions and features such as pool, riffle, glide, and run habitat types, sediment composition, water clarity, and specific conductivity, as well as aquatic benthic macro-invertebrate community composition, and the variety, condition, and relative abundance of fish species (Powertech, 2009a, Section 3.5.5.5). Radiological monitoring of riverine species was also conducted to establish baseline concentrations of select radionuclides in fish populations. The sampling locations for these studies were primarily in Beaver Creek, although additional sampling was conducted in the Cheyenne River downstream of the proposed project. Pass Creek does not maintain sufficient water to support aquatic life.

Waters classified as impaired are too polluted or otherwise too degraded to meet established water quality standards and fully support state-designated uses. Beaver Creek is identified as an impaired water under the criteria in Section 303(d) of the federal Clean Water Act (33 U.S.C. § 1251 et seq. 1972). The impairments indicate that Beaver Creek may not provide adequate habitat to provide growth of aquatic life. For the 2012 reporting cycle, the two areas of impairment for Beaver Creek are pH and fecal coliform (EPA, 2012a). An SDDENR-prepared water quality data report points to livestock as the source of fecal coliform (SDDENR, 2008). Pass Creek is not listed on the 303(d) list as an impaired water body (EPA, 2012a). Cattle grazing is the primary land use at and in the vicinity of the project area. Grazing activities contribute water pollutants, such as fecal coliform, and result in increased turbidity. Fecal coliform alters the pH levels and conductivity of water (EPA, 2006a).

Aquatic benthic macroinvertebrate communities, primarily insects, crustaceans, and mollusks, were sampled as part of habitat surveys in Beaver Creek. The results of these surveys indicate degraded water habitat conditions, which supports the EPA impaired classification (Powertech, 2009a). The small number and limited range of macroinvertebrate species collected also points to impaired water conditions. Aquatic insects are food sources for riparian predators, such as spiders, birds, bats, reptiles, and amphibians, and play an important role in the transfer of energy and materials from freshwater to terrestrial food webs. In addition, only a few sensitive species or species unable to tolerate degraded habitat were collected.

Twelve fish species were collected from two collection points in Beaver Creek: BVC04, located upstream of the project area, and BVC01, located downstream of the project area (see Figure 3.5-2). One collection point, CHR05, is located in Cheyenne River downstream of the proposed project area past the confluence of Beaver Creek and Cheyenne River (see Figure 3.5-2). Channel catfish (*Ictalurus punctatus)* is the most abundant fish species in Beaver Creek and the most likely to be caught and eaten by anglers. The 11 other species collected were the sand shiner (*Notropis stramineus)*, creek chub (*Semotilus atromaculatus)*, plains minnow (*Hybognathus placitusa)*, common carp (*Cyprinus carpioa)*, longnosed dace (*Rhynichthys cataractae)*, fathead minnow (*Pimephales promelas)*, river carpsucker (*Carpoides carpio)*, shorthead redhorse sucker (*Moxostoma macrolepidotuma)*, plains topminnow (*Fundulus sciadicus)*, plains killfish (*Fundulus zebrinus)*, and green sunfish (*Lepomis cyanellus)* (Powertech, 2009a). Fish were sampled and tested to identify baseline levels of select radionuclides in fish. The only South Dakota rare fish species collected was the plains topminnow (SDGFP, 2010), encountered in Beaver Creek downstream of the proposed project area. Although fish surveys were not conducted within the project area, NRC staff expect similar fish species encountered upstream and downstream of the site could occur within the project area.

Survey results demonstrated the presence of total uranium in fish species in 2008. The channel catfish was the only fish species with detectable total uranium levels during the first sampling event in April 2008; however, total uranium was detected in all fish samples from the second sampling event conducted in July 2008. Note the laboratory detection limit was lowered for the

July 2008 sample. All total uranium concentrations were detected at or below 0.5 mg/kg [0.5 ppm]. Radioactivity from Po-210, Th-230, and Ra-226 was detected in many fish, but at low concentrations. Pb-210 was only detected in one specimen where matrix interference was reported (Powertech, 2009a).

South Dakota issues fish consumption advisories for waterbodies with elevated contaminants that may be harmful to humans. Sampling activities have occurred in Fall River County at Angostura Reservoir and portions of the Cheyenne, and in Custer County at Stockdale Lake from 1994 to 2009. No waterbodies in Custer and Fall River Counties were sampled in 2011. No fish consumption advisories have been issued as a result of fish collection and sampling activities in Custer and Fall River Counties (SDDENR, 2011b).

3.6.3 Protected Species

Table 3.6-7 identifies species present in Custer and Fall River Counties that are listed as federally threatened or endangered (FWS, 2010; Powertech, 2009a). The results of wildlife surveys (Powertech, 2009a) and FWS correspondence (FWS, 2010, 2012b) have not identified federally listed threatened or endangered species on or within a 1.6-km [1-mi] radius of the proposed Dewey-Burdock ISR Project site. NRC staff initially requested information for federally listed species on March 15, 2010 (NRC, 2010c); a response was provided on March 29, 2010 (FWS, 2010). NRC staff requested updated information from FWS via e-mail on August 27, 2012; a response was provided the same day (FWS, 2012b). The bald eagle, which is no longer listed federally as threatened or endangered although it is listed as threatened by South Dakota, is known to be present at the site and was observed during the wildlife surveys (Powertech, 2009a). Endangered and threatened species and designated habitats that may be present in the project area are discussed more fully next. The BLM Montana/Dakotas State Director designates sensitive species within the BLM Montana State Office jurisdiction as those “requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA [Endangered Species Act]” (BLM, 2008). BLM special status species, collectively, are (i) BLM-designated sensitive species and (ii) federally proposed, candidate, and delisted species within 5 years of delisting (BLM, 2008). Because approximately 97.1 ha [240 ac] of the proposed project are

Table 3.6-7. Threatened or Endangered Animals That Occur in Custer and Fall River Counties or Were Observed in the Proposed Dewey-Burdock *In-Situ* Recovery Project Area*

Scientific Name	Common Name	Federal Status	State Status	Observed Onsite
Birds				
Centrocerus Urophasianus	Greater Sage-Grouse	Candidate	Not listed	No
Anthus spragueii	Sprague’s Pipit	Candidate	Not listed	No
Grus Americana	Whooping Crane	Endangered	Endangered	No
Haliaeetus Leucocephalus	Bald Eagle	Delisted	Threatened	Yes
Mammals				
Mustela Nigripes	Black-Footed Ferret	Endangered	Endangered	No
*Sources: FWS, 2010, 2012b; Powertech, 2009a; SDGFP, 2010				

under the control of BLM, NRC considered the BLM special status species that may occur in the project area in Table 3.6-6.

The SDGFP list of rare animals includes those that could become candidates for listing, as well as, locally rare species (SDGFP, 2010). Table 3.6-8 lists 10 species, all birds, observed at the proposed project area during the applicant-conducted baseline studies, along with their primary nesting habitats and historical occurrence in the general area. SDGFP takes conservation measures to sustain all native plants and animals and associated habitats. By taking a proactive approach to sustaining native species, listing of species as threatened or endangered can often be prevented.

Greater Sage-Grouse

Greater sage-grouse (*Centrocerus Urophasianus)* is a federal candidate species for threatened or endangered status resident in sagebrush shrubland habitats; sagebrush is essential in every phase of the life cycle of this species. Breeding habitat, referred to as leks, and stands of sagebrush surrounding leks are used in early spring; they are particularly important habitat because nesting birds often return to the same leks and nesting areas each year. Leks are common in more sparsely vegetated areas, such as ridgelines and disturbed areas adjacent to stands of sagebrush. Threats to the survival of this species include loss of habitat, agricultural practices, livestock grazing, hunting, and land disturbances related to energy/mineral development and the oil and gas industry

Table 3.6-8. Species Tracked by the South Dakota National Heritage Program Observed in the Proposed Dewey-Burdock Project Area

Species	Primary Habitat(s)	State Rank During Breeding Season	State Rank During Nonbreeding Season	Occurrence Within Proposed License Area (PLA) or 1.6-km [1-mile] Perimeter
Clark's Nutcracker (*Nucifraga Columbiana*)	Pines, Cliffs, and Canyons	S2	S2	Observed Flying Over PLA
Merlin (*Falco Columbarius*)	White Spruce, Pines, and Shrublands	S3	S3	Observed East of PLA Within 1 Mile, Presumed Breeder
Long-Eared Owl (*Asio Otus*)	White Spruce, Pines, and Shrublands	S3	S3	Observed Within PLA, Breeder
Bald Eagle (*Haliaeetus leucocephalus)*	Forests and Cliffs Near Open Water	S1	S2	Observed Within PLA, Breeder

Table 3.6-8. Species Tracked by the South Dakota National Heritage Program Observed in the Proposed Dewey-Burdock Project Area (Cont'd)

Species	Primary Habitat(s)	State Rank During Breeding Season	State Rank During Nonbreeding Season	Occurrence Within Proposed License Area (PLA) or 1.6-km [1-mile] Perimeter
Golden Eagle (*Aquila Chrysaetos*)	Cliffs, Canyons, and Grassland	S3, S4	S3	Observed Flying Over PLA Once
American White Pelican (*Pelecanus Erythrorhynchos*)	Islands or Sandbars of Large Wetlands	S3	SZ	Observed Flying Over PLA Once
Cooper's Hawk (*Accipiter Cooperii*)	Conifer or Deciduous Woodland	S3	SZ	Observed Flying Over PLA Once
Long-Billed Curlew (*Numenius Americanus*)	Prairie Grassland	S3	SZ	Observed Within PLA, Likely Breeder
Great Blue Heron (*Ardea Herodias*)	Riparian and Wetland	S4	SZ	Observed Flying Over PLA Once
Ferruginous Hawk (*Buteo Regalis*)	Prairie Grassland	S4	SZ	Observed

Sources: SDGFP (2010a); Powertech (2009a); SDGFP (2005a).
S1 = Critically imperiled because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.
S2 = Imperiled because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.
S3 = Either very rare and local throughout its range, or found locally (even abundantly at some of its locations) in a restricted range or vulnerable to extinction throughout its range because of other factors; in the range of 21 to 100 occurrences.
S4 = Apparently secure, though it may be quite rare in parts of its range, especially at the periphery. Cause for long-term concern.
SZ = No definable occurrences for conservation purposes, usually assigned to migrants.

(Sage-Grouse Working Group, 2006). This species was not identified during the applicant wildlife inventories, and few have ever been documented on or in the vicinity of the proposed site because of the limited habitat.

On March 5, 2010, FWS published a finding in the *Federal Register* that listing of the greater sage-grouse as a threatened or endangered species was warranted but precluded by higher priority listing actions (75 FR 13909). In effect, the species has been put on the federal list of candidate species, which contains plants and animals that are proposed for listing under the Endangered Species Act (ESA) Section 4 (75 FR 13909). FWS generally reevaluates the potential listing of candidate species every 12 months to determine whether the species' status should change to threatened or endangered at that time. However, due to a litigation settlement, a final determination whether the species should be proposed for listing under the ESA in the region is expected by the end of September 2015 (FWS, 2012a).

Although the total area of big sagebrush shrubland within the project area is about 1,012 ha [2,500 ac] (Table 3.6-1), large expanses of contiguous sagebrush that provide optimum coverage for breeding and wintering are not likely to occur within the project area based on USFS-conducted studies (Hodorff, 2005). The USFS studies were conducted for a section of the Buffalo Gap National Grassland that begins about 7.2 km [4.5 mi] south of the proposed project and extends south to the Black Hills Army Depot (Hodorff, 2005). FWS and SDGFP currently monitor only one lek in Fall River County that is located more than 13 km [8 mi] south of the site (SDGFP, 2009; Hodorff, 2005). This lek was last reported as active with five males observed in 2006 (SDGFP, 2012b). Figure 3.6-2 shows the sage-grouse nesting areas in the vicinity of the proposed project. Figure 3.6-3 presents a detailed view of occupied sage-grouse leks within 8 km [5 mi] of the site (WGFD, 2011; Hodorff, 2005).

Sprague's Pipit

The Sprague's pipit (*Anthus spragueii)* is a small bird and a federal candidate species that nests, breeds, and spends the winter in open grasslands of the United States (FWS, 2011b). The birds breed in northern states and Canada, and spend the winter in the southern states and Mexico (FWS, 2011a). Sprague's pipit primarily eats insects, spiders, and some seeds (FWS, 2011b). Because of its preference to breed in continuous, open grassland about 29 ha [71.6 ac] or more in size that has not been disturbed, habitat loss, conversion, and fragmentation threaten the continued existence of this species (76 FR 66370; FWS, 2011b).

Sprague's pipits were not observed during applicant-conducted surveys (Powertech, 2009a) and have not been reported to occur, but are believed to occur, in Custer and Fall River Counties (USGS, 2006c; FWS, 2012c). Based on results of breeding bird surveys conducted from 1994 to 2003, potential breeding distribution of the species extends north and northeast of the Black Hills (FWS, 2012b).

Whooping Crane

The whooping crane (*Grus Americana*), listed as a state and federal endangered species, feeds and roosts in wetlands and riverine habitats and upland grain fields, and uses central South Dakota for migration and staging areas (FWS, 2009). The current nesting range of the self-sustaining natural wild population is restricted to Wood Buffalo National Park in Saskatchewan, Canada, and the current wintering grounds of this population are restricted to the Texas Gulf Coast at Aransas National Wildlife Refuge and vicinity (NRC, 2009a). FWS correspondence indicates that the agency does not have information to confirm that whooping cranes are present within the proposed project boundaries, but the potential exists for whooping crane disturbances from proposed mining activities during spring and fall migrations (FWS, 2010). Migration periods occur from late September through October, and between the end of March and mid-May. Whooping cranes were not observed during applicant-conducted surveys (Powertech, 2009a); however, FWS recommends vigilant monitoring during proposed mining activities conducted during spring and fall, and immediate FWS notification if a whooping crane is observed (FWS, 2010). FWS recommends ceasing mining activities temporarily if a crane is observed until the bird leaves the area (FWS, 2010).

Bald Eagle

The bald eagle was delisted from the Federal List of Endangered and Threatened Wildlife in July 2007 (72 FR 37346), but continues to be protected under the Bald and Golden Eagle

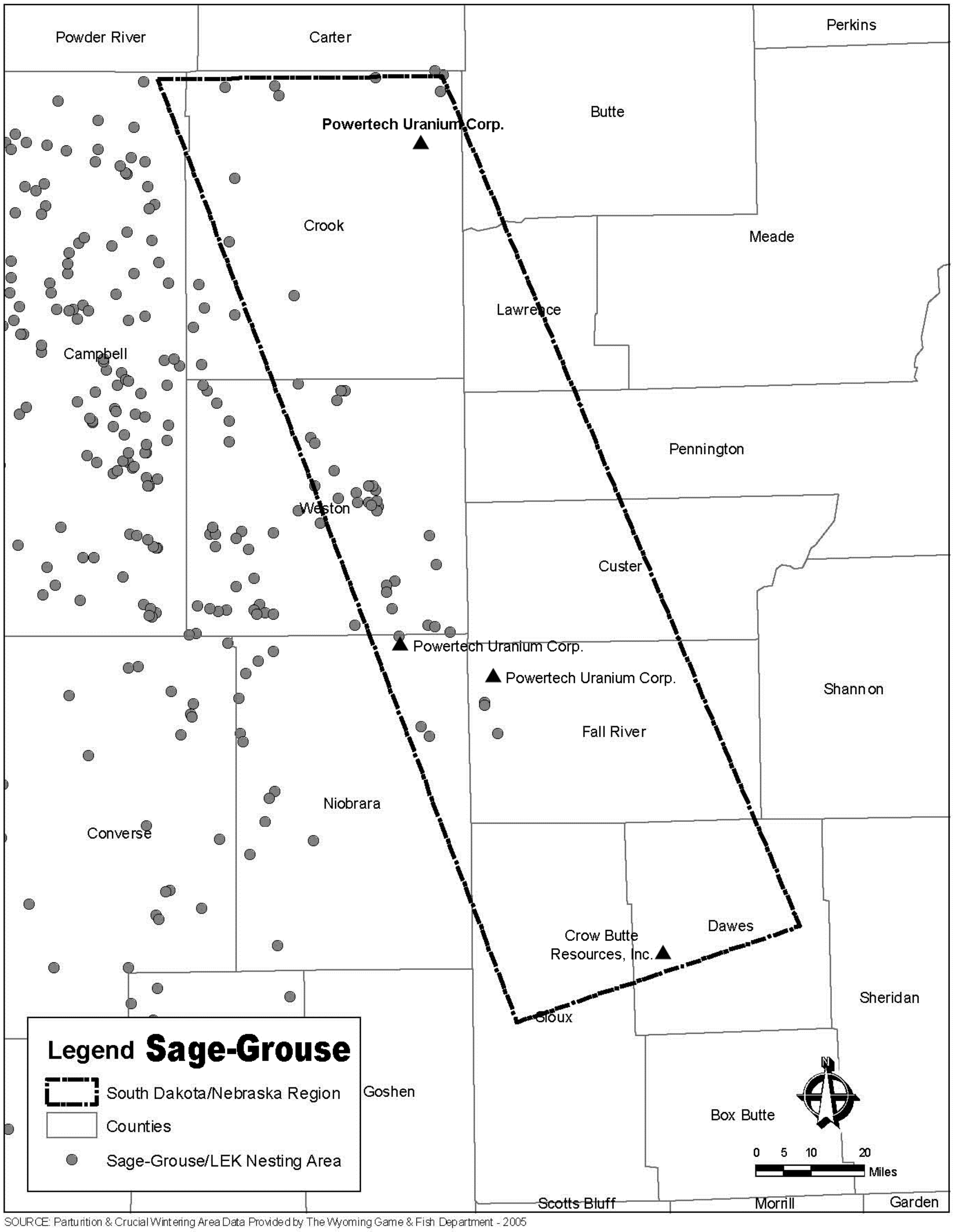

Figure 3.6-2. Sage-Grouse Lek Areas for the Nebraska-South Dakota-Wyoming Uranium Milling Region
Source: NRC (2009a)

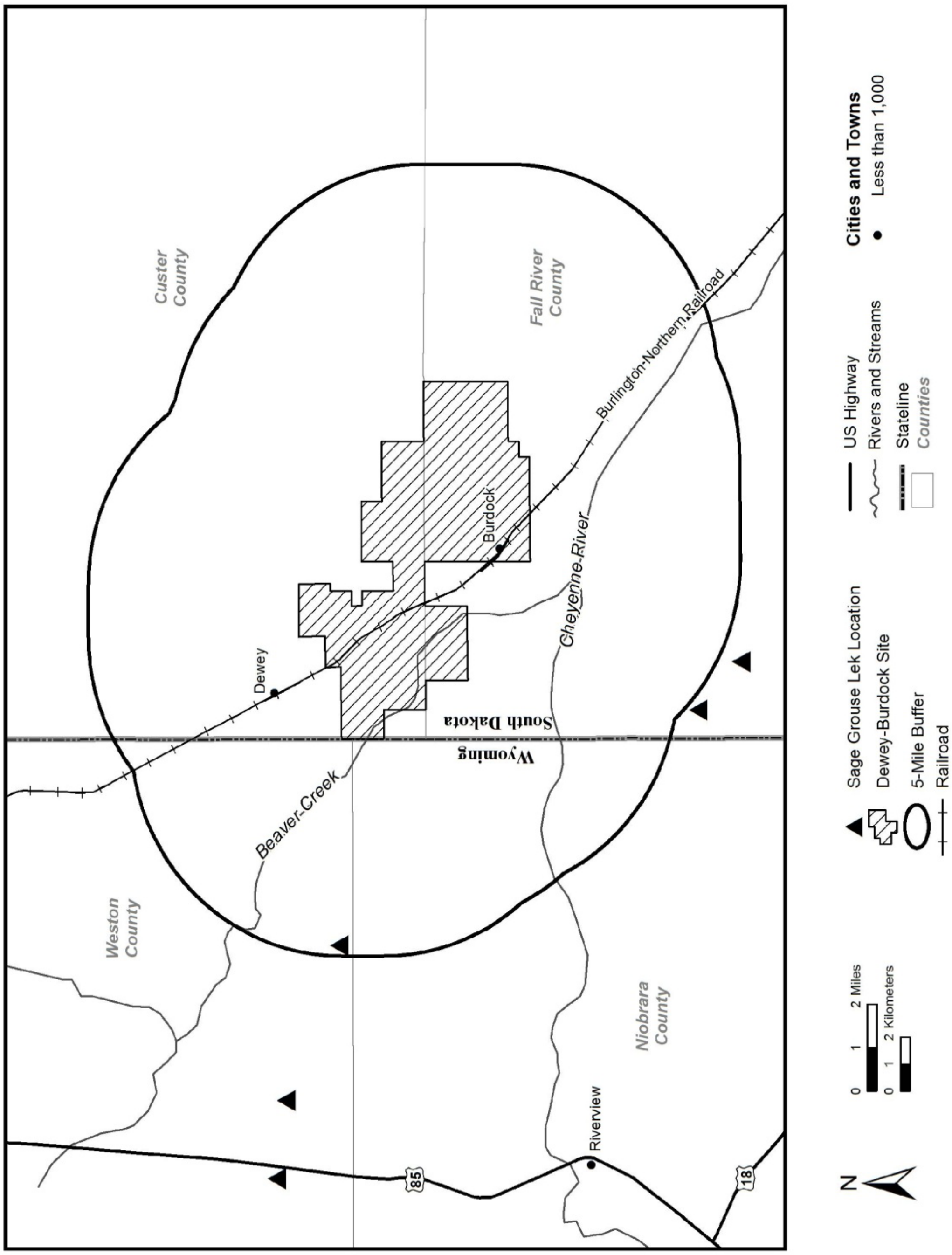

Figure 3.6-3. Occupied Sage-Grouse Leks Near the Proposed Dewey-Burdock Project
Source: NRC (WGFD, 2011; Hodorff, 2005; BLM, 2011)

Protection Act, under the Migratory Bird Treaty Act, and at the state level as a threatened species. FWS published its National Bald Eagle Management Guidelines in May 2007 (FWS, 2007) to ensure the continued protection of the species. The bald eagle is a large raptor species with a white head and tail and brown body feathers and is generally associated with lakes and other large, open bodies of water. Bald eagles prey on fish, small mammals, birds, and occasionally carrion. Migrating and wintering eagles congregate near open water areas where concentrations of prey are available, such as carcasses of game animals, and spawning areas for fish (NRC, 2009a). Two bald eagle nests were observed within the proposed project area along Beaver Creek during winter roost surveys conducted from 2007 to 2011 (Powertech, 2009a; SDGFP, 2012c) and produced one fledgling each year in 2008, 2009, and 2010. The first bald eagle nest was observed in 2008 and 2009 approximately 1.6 km [1 mi] west of the proposed Dewey satellite processing plant in a cottonwood tree along Beaver Creek. The second bald eagle nest was observed approximately 1.2 km [0.75 mi] southeast of the first nest along Beaver Creek. Bald eagles spend winter in the Black Hills (SDGFP, 2012a). Project construction will not directly impact any of these nests or roosts. Individual eagles nesting and foraging nearby may experience indirect disturbances from the proposed project, described further in SEIS Section 4.6.

Black-Footed Ferret

The black-footed ferret (*Mustela nigripes*) is federally listed as endangered. The species is native to North America and primarily inhabits the Great Plains region. The black-tailed prairie dog and the black-footed ferret can use the same habitat. The black-footed ferret is found almost exclusively in prairie dog colonies in basin-prairie shrublands, sagebrush-grasslands, and grasslands. The black-footed ferret is a small mammal in the weasel family with a natural to buff-colored body and black face, feet, and tail. It is dependent on prairie dogs for food and all essential aspects of its habitat, especially prairie dog burrows where it spends most of its life underground (USGS, 2006b). Potential suitable habitat for the black-footed ferret is present within the proposed Dewey-Burdock Project area (BLM, 2009a). One black-tailed prairie dog (*Cynomys ludovicianus*) colony is located in the northwestern corner of the proposed site, and two additional colonies are present within 1.6 km [1 mi] southwest of the proposed site boundary (Powertech, 2009a). SDGFP provided NRC staff with a 2008 survey of the prairie dog colony at the site for review; however, the map is not provided in this report to protect landowner privacy. The colony is approximately 321 ha [794 ac] and is within a greasewood shrubland vegetation community where wellfields D-WF3 and D-WF4 and irrigation areas are planned in the Dewey area. The presence of large, closely spaced prairie dog colonies {on the order of several hundred hectares [several thousand acres]} could support and sustain a breeding population of black-footed ferrets (BLM, 2009a). Because the colony is approximately 322 ha [795 ac] in size, it is unlikely the colony is large enough to support a breeding population of black-footed ferrets. However, FWS has reintroduced black-footed ferrets in the Cheyenne River and Conata Basin, South Dakota, located east of the Black Hills (FWS, 2000). Wind Cave National Park, South Dakota, is the closest known population to the proposed Dewey-Burdock Project area (South Dakota State University, 2012). Potential future ferret management decisions in Wind Cave National Park, South Dakota, and the Thunder Basin National Grassland, Wyoming, could expand populations into the project area (BLM, 2009a).

In 2003, FWS eliminated the requirement to conduct black-footed ferret surveys in the state of South Dakota in order to identify unknown ferret populations in black-tailed prairie dog habitat (FWS, 2003a,b). This requirement lift is referred to as an area being “block cleared.” FWS considers incidental takes of individual ferrets in black-tailed prairie dog habitat that is block cleared are not an issue and would not affect any wild population. However, permitted block clearance (no required survey) does not relieve federal agencies of the need to assess a proposed action's effect on the species' survival and recovery. In addition, FWS directs federal agencies to assess whether a proposed action could adversely affect the value of prairie dog habitat as a future reintroduction site for the black-footed ferret (FWS, 2003a,b). No black-footed ferrets have been identified on the proposed Dewey-Burdock ISR Project site, nor are they known to occur within the proposed Dewey-Burdock ISR Project area (Powertech, 2009a; FWS, 2000; USGS, 2006b).

3.7 Meteorology, Climatology, and Air Quality

3.7.1 Meteorology and Climatology

The proposed project area is located in southwestern South Dakota adjacent to the southwestern extension of the Black Hills; elevations in the area range between 1,097 and 1,189 m [3,600 and 3,900 ft] (Powertech, 2009a). The area is considered semiarid and experiences abundant sunshine, low relative humidity, and sustained winds.

Diurnal and seasonal temperatures vary greatly, and precipitation is generally light. Storm systems originating in the Pacific lose much of their moisture over the Cascade and Rocky Mountains before reaching the area.

The applicant established a weather station near the center of the proposed project area in July 2007 (Powertech, 2009a). Information collected at this onsite station includes temperature, wind speed/direction, and precipitation. The onsite data were collected over a 1-year period. Onsite data were supplemented with data from a meteorological station in Newcastle, Wyoming, to provide a historical perspective. The Newcastle station, operated by IML Air Science and located approximately 48.3 km [30 mi] north-northwest of the proposed Dewey-Burdock site, has collected hourly meteorological data since 2002. Although not a National Weather Service meteorological station, Newcastle meets the EPA requirements for ambient monitoring guidelines for the Prevention of Significant Deterioration (Powertech, 2011).

Newcastle provides a better comparison to the proposed project area in terms of elevation, surrounding topography, and proximity to the southwestern flank of the Black Hills than the Chadron National Weather Service station located about 105 km [65 mi] south-southeast of the proposed project area (Powertech, 2009a, 2011). Chadron is the closest National Weather Service station to the proposed Dewey-Burdock site that collects hourly wind data. Comparison of wind patterns supports the usage of the Newcastle information because the Dewey-Burdock and Newcastle data are similar and quite different from the Chadron site data (Powertech, 2011).

3.7.1.1 Temperature

As discussed in GEIS Section 3.4.6.1, temperatures fluctuate greatly throughout the year in the southwestern corner of South Dakota (NRC, 2009a). Summers can be quite warm, while winters are typically quite cold. The annual mean temperature from the data collected at the onsite station is 7.50 °C [45.5 °F. July recorded the highest average mean daily temperature at 24.9 °C [76.8 °F]. January recorded the lowest average mean daily temperature at −9.56 °C [14.8 °F] (Powertech, 2011). The proposed Dewey-Burdock site experiences greater mean temperature extremes during the hottest part of the summer and the coldest part of the winter relative to the Newcastle site. Even so, the onsite data compare favorably and fall within the range of the Newcastle historical data. Table 3.7-1 contains both the onsite data and the Newcastle station data. The region's low relative humidity contributes to the large diurnal temperature variations, which range between about −9.4 and −4.4 °C [15 and 24 °F] (Powertech, 2009a). The largest diurnal variation typically occurs in the summer.

3.7.1.2 Wind

As discussed in GEIS Section 3.4.6.1, windy conditions are common within the proposed project area in South Dakota. The average annual wind speed from the data collected from July 2007 to July 2008 at the onsite station was 3.89 m/s [8.7 mph]. The average annual wind speed at the Newcastle station over that same year was 3.13 m/s [7 mph] and over the 9-year period from 2002 to 2010 was 3.04 m/s [6.8 mph] (Powertech, 2011). Onsite wind speed averages were slightly higher than the values at Newcastle.

Figure 3.7-1 displays the annual wind rose generated from onsite data. Although the predominant wind direction is from the northwest, east-southeast winds are also common (Powertech, 2009a).

3.7.1.3 Precipitation

As discussed in GEIS Section 3.4.6.1, the proposed project area is located within a semiarid region that can be quite dry at times (NRC, 2009a). The average annual precipitation from the data collected at the onsite station is 31.54 cm [12.42 in] (Powertech, 2009a). Monthly totals ranged from 0.25 to 9.6 cm [0.10 to 3.8 in]. Historical data from the Newcastle station demonstrated an average annual precipitation of 38.4 cm [15.1 in], which is higher than the onsite value. Onsite data indicated that the wettest month was May, while the driest month was November. About 60 percent of the precipitation accumulates over the 3-month period from May to July. Thunderstorms occur frequently during this period and are responsible for much

Table 3.7-1. Site and Regional Monthly Temperature Information in °C*

Month	Mean Daily Temperature		Mean Daily Minimum Temperature	Mean Daily Maximum Temperature
	Site	Newcastle	Newcastle	Newcastle
January	−9.56	−5.11	−11.4	1.22
February	−4.71	−2.94	−9.44	3.55
March	1.42	1.67	−5.44	7.79
April	6.15	7.17	0.111	14.2
May	11.2	12.9	5.78	20.0
June	17.4	18.3	10.8	25.7
July	24.9	22.9	15.0	30.9
August	24.0	21.8	13.9	29.8
September	17.6	15.8	8.11	23.5
October	9.56	9.00	1.83	16.2
November	1.14	1.05	−5.11	7.22
December	−9.41	−3.67	−9.72	2.39
Annual	7.50	8.22	1.22	15.2

Source: Modified from Powertech (2009c).
*To convert Celsius (˚C) to Fahrenheit (˚F), multiply by 1.8 and add 32.

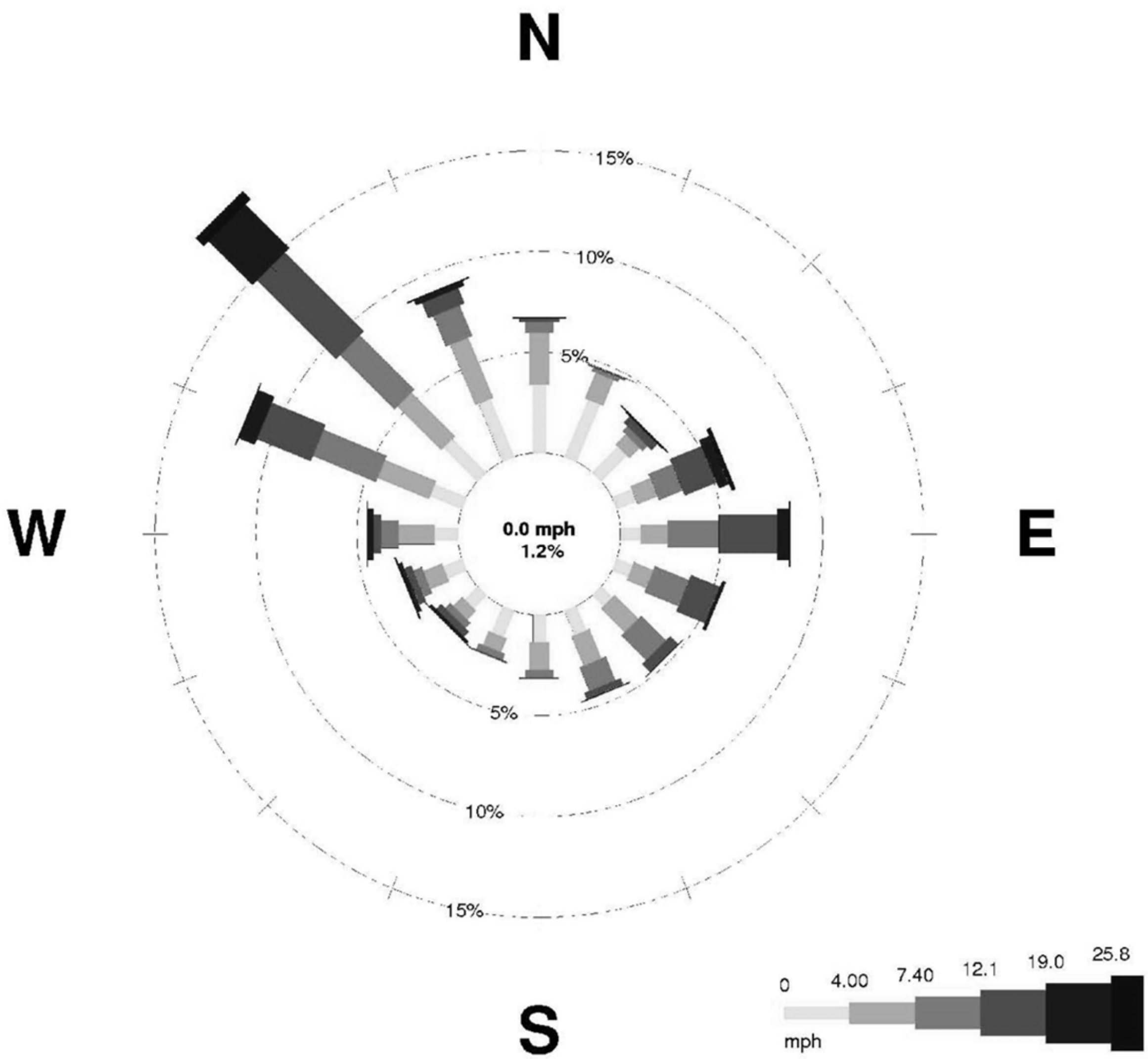

Figure 3.7-1. Annual Wind Rose Generated From Onsite Data
Source: Modified From Powertech (2011)

of the annual rainfall. The greatest daily onsite precipitation total was 3.28 cm [1.29 in], which occurred on May 23, 2008. On this date, the proposed project area received 1.8 cm [0.71 in] of precipitation between the hours of 8 p.m. and 9 p.m., which was the most rainfall within a 1-hour period over the sampled year. The area receives an annual average snowfall of 97 cm [38 in]. Snowfall can be expected from September through June. March averages 22 cm [8.5 in] of snowfall and has the highest average monthly snowfall (Powertech, 2009a).

3.7.1.4 Evaporation

As discussed in GEIS Section 3.4.6.1, the semiarid nature of the proposed project area produces conditions where evaporation rates exceed precipitation (NRC, 2009a). Applicant-conducted literature research determined a mean annual lake evaporation rate of 112 cm [44 in] for the proposed project area (Powertech, 2009c). GEIS Section 3.4.6.1 states the Nebraska-South Dakota-Wyoming Uranium Milling Region annual pan evaporation rate ranges from about 102 to 127 cm [40 to 50 in] (NRC, 2009a). Pan evaporation is a technique used to estimate the evaporation rate of other bodies of water such as lakes or ponds and is applicable to the various settling, outlet, and surge ponds the applicant proposes.

3.7.2 Air Quality

In 40 CFR Part 50, *National Primary and Secondary Ambient Air Quality Standards*, EPA established the National Ambient Air Quality Standards (NAAQS) to promote and sustain healthy living conditions (see GEIS Section 3.4.6.2). Primary NAAQS standards are established to protect public health, while secondary NAAQS standards are established to protect public welfare by safeguarding against environmental and property damage. These standards define acceptable ambient air concentrations for six common air pollutants: nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), carbon monoxide (CO), lead (Pb), and particulates (PM_{10} and $PM_{2.5}$). EPA requires states to monitor ambient air quality and evaluate compliance with the NAAQS.

Based on the results of these evaluations, EPA designates areas into various NAAQS compliance classifications (e.g., attainment or nonattainment) for each of the six criteria air pollutants. These classifications characterize the air quality within a defined area. These defined areas range in size from portions of cities to large Air Quality Control Regions composed of many counties. An Air Quality Control Region is a federally designated area for air quality management purposes. The proposed project area is located in the Black Hills-Rapid City Intrastate Air Quality Control Region, which is made up of Butte, Custer, Fall River, Lawrence, Meade, and Pennington Counties, South Dakota. The Black Hills-Rapid City Intrastate Air Quality Control Region meets all of the NAAQS regulations and, therefore, is classified as an attainment area for each criteria pollutant. Based on this attainment classification, the air quality in and around the proposed site can be considered good. Table 3.7-2 contains air pollutant emissions from EPA's National Emission Inventory for the counties within this Air Quality Control Region. The emissions in Table 3.7-2 include both stationary and mobile sources. Table 3.7-3 contains pollutant concentrations that reflect the existing ambient air conditions.

Table 3.7-2. Annual Air Pollutant Emissions in Metric Tons* From the U.S. Environmental Protection Agency's National Emission Inventory for Counties in the Black Hills-Rapid City Intrastate Air Quality Control Region

Area	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Butte County	2,426	395	1,745	304	61	379
Custer County	3,543	1,076	2,013	352	75	570
Fall River County	1,761	1,050	1,435	268	82	317
Lawrence County	8,750	1,088	3,338	582	163	1,241
Meade County	11,264	1,474	6,209	1,347	200	1,512
Pennington County	36,680	8,672	7,628	1,635	2,484	5,261
All Six Counties†	64,424	13,755	22,368	4,488	3,065	9,280
Custer and Fall River Counties‡	5,304	2,126	3,448	620	157	887

Source: Modified from EPA (2008) accessed on 28 Dec 2009.
*To convert metric tons to short tons, multiply by 1.10231.
†The Black Hills-Rapid City Intrastate Air Quality Control Region consists of these six counties.
‡The proposed site located in these two counties.

Table 3.7-3. Existing Conditions—Ambient Air Quality Monitoring Data

Pollutant*	Averaging Period	Form	2010 Value†*	Percent NAAQS‖	Location
Carbon monoxide	1 hour	Not to be exceeded more than once per year	0.960 ppm	3	UC #1 site in Union County‡
	8 hour	Not to be exceeded more than once per year	0.276 ppm	3	UC #1 site in Union County
Nitrogen Dioxide	1 hour	98th percentile, averaged over 3 years	3 ppb	3	Wind Cave
	Annual	Annual mean	0.2 ppb	0.4	Wind Cave
Ozone	8 hour	Annual fourth highest daily maximum averaged over 3 years	0.060 ppm	80	Wind Cave
$PM_{2.5}$	24 hour	98th percentile, averaged over 3 years	10.9 μg/m^3§	31	Wind cave
	Annual	Annual mean, averaged over 3 years	4.8 μg/m^3	32	Wind Cave
PM_{10}	24 hour	Not to be exceeded more than once per year on average over 3 years	41 μg/m^3	57	Wind Cave
Sulfur dioxide	3 hour	Not to be exceeded more than once per year	0.008 ppm	2	Wind Cave
	1 hour	99th percentile of 1 hour daily max averaged over 3 years	6 ppb	8	Wind Cave

Source: Modified from IML (2013) for the PM_{10} baseline value and SDDENR (2011a) for the other values.
*Lead is currently not monitored for because of historically low levels in the state. The proposed Dewey-Burdock project is not considered to be a source for airborne lead.
†2010 values represent the appropriate value for NAAQS compliance as described in the "form" column, which in some cases is an average over a 3-year period of measured values. The 3 years of measurement data are not presented here, but are provided in the source document.
‡Wind Cave in Custer County, located 46.7 km [29 mi] from the proposed project area, does not collect carbon monoxide data. The UC#1 site, located in Union County in the southeastern portion of the state, is the only South Dakota station reporting carbon monoxide values in the South Dakota Ambient Air Monitoring Annual Network Plan 2011.
§To convert μg/m^3 to oz/yd^3, multiply by 2.7×10^{-8}.
‖NAAQS = National Ambient Air Quality Standards.

EPA has revised the NAAQS since the publication of the GEIS. The following information updates the NAAQS as documented in GEIS Table 3.2.8. The ozone 1-hour and sulfur dioxide annual standards are no longer applicable. Additionally, new or revised standards, not identified in GEIS Table 3.2.8, include a nitrogen dioxide 1-hour 100 ppb standard, an ozone 8-hour 0.075 ppm standard, a 2.5 μm particulate matter annual 12 μg/m^3 standard, and a sulfur dioxide 1-hour 75 ppb standard. EPA has considered lowering the ozone standard from 0.075 ppm to 0.070 ppm (EPA, 2011). Table 3.7-4 contains the updated NAAQS. States may develop standards that are stricter or supplement the NAAQS. As described in ARSD 74:36:02:02, *Ambient Air Quality Standards*, South Dakota has not adopted stricter or supplemental standards.

As discussed in GEIS Section 3.4.6.2, EPA also established Prevention of Significant Deterioration (PSD) standards that set maximum allowable concentration increases for particulate matter, sulfur dioxide, and nitrogen dioxide pollutants above baseline conditions in attainment areas (NRC, 2009a). In part, the purpose of this requirement is to ensure that air

Table 3.7-4. National Ambient Air Quality Standards

Pollutant	Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide	Primary	8 hours	9 ppm	Not to be exceeded more than once per year
	Primary	1 hour	35 ppm	Not to be exceeded more than once per year
Lead	Primary and Secondary	Rolling 3-month average	0.15 μg/m^{3}*	Not to be exceeded
Nitrogen Dioxide	Primary	1 hour	100 ppb	98th percentile, averaged over 3 years
	Primary and Secondary	Annual	53 ppb	Annual mean
Ozone	Primary and Secondary	8 hours	0.075 ppm	Annual fourth highest daily maximum 8-hour concentration, averaged over 3 years
Particulate Matter 2.5 μm	Primary and Secondary	24 hours	35 μg/m^{3}	98th percentile, averaged over 3 years
	Primary	Annual	12 μg/m^{3}	Annual mean, averaged over 3 years
	Secondary	Annual	15 μg/m^{3}	Annual mean, averaged over 3 years
Particulate Matter10 μm	Primary and Secondary	24 hours	150 μg/m^{3}	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide	Primary	1 hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

Source: Modified from EPA (2012b).
*To convert μg/m^{3} to oz/yd^{3}, multiply by 2.7×10^{-8}.

quality in attainment areas remains good. There are several different classes of PSD areas. Different standards were developed for these different classifications, with Class I areas having the most stringent requirements. The proposed site is located in a Class II area. The closest Class I area near the proposed project is the Wind Cave National Park located in Custer County about 46.7 km [29.0 mi] away. Figure 3.2-2 contains a map displaying the locations of the proposed project, the Wind Cave National Park, and the other Class I area in South Dakota: Badlands National Park.

Protection of Class I air quality also includes consideration of visibility and atmospheric deposition. Air pollutants can reduce visibility and therefore negatively impact air quality in Class I areas. Visibility can be expressed by deciviews. A one-deciview change is defined as a change in visibility that is just perceptible to an average person.

Atmospheric deposition, also called acid depostion, refers to processes in which some air pollutants that contain nitrogen (e.g., nitrate, ammonium, and nitric acid) or sulfur (e.g., sulfate or sulfur dioxide) are deposited into terrestrial or aquatic ecosystems. Examples include (i) wet deposition, where precipitation removes pollutants from the air, and (ii) dry deposition where gravity causes the particulates to settle out of the air. Atmospheric deposition is expressed as the annual mass of material deposited over an area. Total deposition accounts for all of the wet and dry processes. Total deposition is often classified into two categories: total nitrogen deposition (i.e., the deposition from the various nitrogen-containing pollutants) and total sulfur deposition (i.e., the deposition from the various sulfur-containing pollutants). Wind Cave National Park serves as one of the Clean Air Status and Trends Network monitoring stations, which in part collects data on air deposition. The average annual total nitrogen deposition ranged from 2.72 to 3.56 kg/ha [2.45 to 3.20 lb/ac] over the 3-year period from 2009 to 2011, and the total annual sulfur deposition ranged from 0.90 to 1.16 kg/ha [0.81 to 1.04 lb/ac] over that same time period (IML, 2013).

EPA has revised the PSD standards since publication of the GEIS (documented in GEIS Table 3.2-9) as follows. New $PM_{2.5}$ standards have been added for two different time frames: annual and 24 hours. Table 3.7-5 contains the updated PSD standards.

Temperature and precipitation are two parameters that can be used to characterize climate change. Average U.S. temperatures have increased more than 1.1 °C [2 °F] over the past 50 years and are projected to rise more in the future (GCRP, 2009). From 1993 to 2008, the average temperature in the Great Plains increased by approximately 0.83 °C [1.5 °F] when compared to the 1961 to 1979 baseline (GCRP, 2009). From 2010 to 2029, the average temperature in the Great Plains is projected to increase approximately 1.7 °C [3 °F] relative to the 1961 to 1979 baseline (GCRP, 2009). The proposed Dewey-Burdock site is considered part of the Great Plains in this study. Although the U.S. Global Change Research Program (GCRP) did not incrementally forecast a change in precipitation by decade, it did project a change in spring precipitation from the baseline period (1961 to 1979) to the next century (2080 to 2099). For the region of South Dakota where the proposed Dewey-Burdock ISR Project is located, GCRP forecasts a 10 to 15 percent increase in spring precipitation (GCRP, 2009).

Table 3.7-5. Prevention of Significant Deterioration Class I and Class II Standards

Pollutant	Averaging Time	Class I Level (μg/m³)*	Class II Level (μg/m³)	Form
Particulate Matter 2.5 μm	Annual	1	4	Annual mean
	24 hours	2	9	Not to be exceeded more than once per year
Particulate Matter 10 μm	Annual	4	17	Annual mean
	24 hours	8	30	Not to be exceeded more than once per year
Sulfur Dioxide	Annual	2	20	Annual mean
	24 hours	5	91	Not to be exceeded more than once per year
	3 hours	25	512	Not to be exceeded more than once per year
Nitrogen Dioxide	Annual	2.5	25	Annual mean

Source: Modified from 40 CFR 52.21.
*To convert μg/m³ to oz/yd³, multiply by 2.7×10^{-8}.

The EPA administrator determined that greenhouse gas (GHG) in the atmosphere may reasonably be anticipated to endanger public health and welfare (74 FR 66496, 2009). As described in the *Federal Register* notice, the primary scientific basis supporting the administrator's endangerment finding were the major assessments by the U.S. Global Climate Research Program, the Intergovernmental Panel on Climate Change, and the National Research Council. The *Federal Register* notice also states that these assessments indicate that ambient concentrations of GHG emissions do not cause direct adverse health effects (e.g., respiratory or toxic effects), but rather cause indirect effects from the associated changes in climate. Based on EPA's determination, NRC recognizes that GHGs may contribute to climate change and that climate change may have an effect on health and the environment.

GHGs, which can trap heat in the atmosphere, are produced by numerous activities, including the burning of fossil fuels and agricultural and industrial processes. GHGs include carbon dioxide, methane, nitrous oxide, and certain fluorinated gases. These gases vary in their ability to trap heat and in their atmospheric longevity. GHG emission levels are expressed as CO_2 equivalents (CO_2e), which is an aggregate measure of total GHG global warming potential described in terms of CO_2 and accounts for the heat-trapping capacity of different gases. The Center for Climate Strategies estimated that GHG-producing activities in South Dakota accounted for approximately 36.5 million metric tons [40.2 short tons] of gross CO_2e emissions in 2005; levels of 39.1 and 46.6 million metric tons [43.1 and 51.4 short tons] are forecasted for years 2010 and 2020, respectively (Center for Climate Strategies, 2007).

EPA is promulgating new rules to address GHG emissions under the Clean Air Act permitting programs (EPA, 2010). Current requirements are focused on the nation's largest stationary source GHG emitters. New sources as well as existing sources with the potential to emit 90,718 metric tons [100,000 short tons] per year of CO_2e, will become subject to EPA PSD and Title V requirements. Modifications at existing facilities that increase GHG emissions by at least 68,039 metric tons [75,000 short tons] per year of CO_2e will also become subject to Title V requirements.

3.8 Noise

The proposed Dewey-Burdock ISR Project is located in an undeveloped remote location in open rangeland and pastureland. Cattle grazing and wildlife habitat are the primary land uses. GEIS Section 3.2.7 estimated that ambient noise levels in this undeveloped, arid, rural area, which is typical of the Nebraska-South Dakota-Wyoming Uranium Milling Region, will range from 22 to 38 decibels (dBA) (NRC, 2009a). Traffic along Dewey Road leading to the site is expected to generate noise; however, almost all of the land adjacent to Dewey Road within and in the vicinity of the proposed project is privately held with limited access (see SEIS Section 3.2 and Figure 3.2-1).

Ambient noise measurements were not part of the applicant's preapplication studies. The applicant reports the majority of existing ambient noise (i.e., background noise) in the vicinity of the proposed Dewey-Burdock ISR Project is generated by light automobile and truck traffic traveling on U.S. Highway 18 and State Highway 89 and freight/coal train operations on the BNSF railroad, which runs northwest to southeast through the project area (see Figure 3.2-1) (Powertech, 2009a, 2010a). The BNSF railroad transports coal from mining operations in the Powder River Basin of Wyoming as well as agricultural, consumer, and industrial products. The Edgemont, South Dakota, train master reports 50 freight trains pass through the project area daily (Powertech, 2010a). Noise levels ranging from 75 to 85 dBA are typical for a train traveling at approximately 80 kph [50 mph] on grade at a distance of 30 m [100 ft] (FRA, 2010). SEIS Section 2.1.1.1.7 described the applicant's plan to transport equipment, materials, supplies, yellowcake product, and waste materials by trucks during the lifecycle of the proposed project. As noted in SEIS Section 3.3, the applicant does not anticipate using the BNSF railroad as a transportation option for proposed project activities. Therefore, train traffic and associated noise are not expected to increase due to construction or operational activities at the proposed site.

Noise associated with the proposed project activities is considered because it may interfere with persons residing in and engaging in recreational activities in the surrounding area. Two permanent onsite residences, the Putnam dwelling and Beaver Creek Ranch headquarters, are located approximately 1.3 km [0.8 mi] south and 0.8 km [0.5 mi] west of proposed wellfields in the Dewey area, respectively (see Figure 3.2-1). The closest offsite residences, the Peterson and Kennobie dwellings, are located approximately 1.3 km [0.8 mi] southwest and 1.3 km [0.8mi] south, respectively, of proposed wellfields in the Burdock area (see Figure 3.2-1). Small communities within 48 km [30 mi] of the proposed Dewey-Burdock ISR Project site include Edgemont and Hot Springs in Fall River County, South Dakota; Custer in Custer County, South Dakota; and Newcastle in Weston County, Wyoming. These communities have populations ranging from 774 to 3,711 (see SEIS Section 3.11.1). Noise levels are expected to be slightly higher in these communities as a result of traffic and human activities. Rapid City in Pennington County, the nearest urban area, is approximately 161 km [100 mi] northeast of the project area. Urbanized communities, such as Rapid City, experience ambient noise levels from street noise, traffic, emergency vehicles, and construction. Noise levels in these types of urban areas range from 45 to about 78 dBA, with lower noise levels at night (WSDOT, 2012).

A number of recreational areas are present in Custer, Fall River, and Pennington Counties that could be sensitive to noise impacts. Major attractions include Mount Rushmore National Memorial, Jewel Cave National Monument, and Wind Cave National Park (see Figure 3.2-2). These attractions are located more than 32 km [20 mi] north and east of the proposed Dewey-Burdock ISR Project. Several USFS and state parks may be sensitive to noise impacts. Parcels of the BHNF border the proposed project area to the east and northeast, and the Buffalo Gap National Grassland is about 4.8 km [3 mi] south of the project boundary (see Figure 3.2-2). These lands are protected from extensive development, and the ambient noise levels will be expected to be similar to undeveloped rural areas (up to 38 dBA) (NRC, 2009a).

Noise associated with project activities can also displace wildlife and interfere with wildlife breeding habits. As described in SEIS Section 3.6.1, the proposed project area supports many medium to small mammals (e.g., coyote, red fox, raccoon, rodents, jackrabbits, and cottontails) and avian species (e.g., wild turkey and mourning dove). Big game species that occur in the proposed project area include pronghorn antelope, mule deer, white-tailed deer, and elk. However, there are no crucial big game habitats or migration corridors in the proposed project area or within 1.6 km [1 m] of the project boundary (Powertech, 2010a). Five confirmed, intact raptor nests and one potential nest site were observed within the proposed project area, and the applicant identified two additional nests within a 1.6-km [1-mi] radius of the study area (Powertech, 2009a). One black-tailed prairie dog colony was observed during wildlife surveys in the northwestern corner of the proposed project area, and two others were observed 1.6 km [1 mi] southwest of the proposed project area (Powertech, 2009a).

There are no federally listed threatened or endangered species within 1.6 km [1 mi] of the proposed Dewey-Burdock ISR Project site. The Greater sage-grouse and black-footed ferret could potentially occur in the area; however, no sage-grouse or black-footed ferret were observed during applicant wildlife surveys (Powertech, 2009a). Of state-listed species, the bald eagle is known to occur on and in the vicinity of the site and two bald eagle nests were observed during wildlife inventories conducted at the site (Powertech, 2009a; SDGFP, 2012c). As described in SEIS Section 3.6.3, the first bald eagle nest was observed in 2008 and 2009 approximately 1.6 km [1 mi] west of the proposed Dewey satellite processing plant in a cottonwood tree along Beaver Creek. A second bald eagle nest was observed approximately 1.2 km [0.75 mi] southeast of the first bald eagle nest along Beaver Creek.

The Federal Highway Administration (FHWA) has noise impact assessment procedures and criteria to help protect the public health and welfare from excessive vehicular traffic noise (FHWA, 2006). Recognizing that different areas are sensitive to noise in different ways, FHWA established noise abatement criteria (23 CFR Part 772) according to land use. These criteria are described in Table 3.8-1.

In situations where existing or expected future sound levels exceed FHWA-set noise abatement criteria, an individual is considered to be impacted by noise. Dewey Road crosses the southwestern portion of the Burdock area and the central portion of the Dewey area (Figure 3.2-1) and is expected to be a source of noise. Vehicular traffic noise levels are estimated to range from 54 to 62 dBA for passenger cars and 50 to 70 dBA for heavy trucks at a distance of 15 m [50 ft] from a receptor (NRC, 2009a). Noise from line sources, such as roads, is reduced by approximately 3 dBA per doubling of the distance from the source (NRC, 2009a).

The maximum sound level of heavy trucks is 70 dBA on roads within the proposed project area, such as Dewey Road; this is expected to be diminished to the level of a Category A Activity (57 dBA) at a distance of 480 m [1,575 ft] from the source. However, noise-dampening characteristics of topographic interference and vegetation are not part of these calculations (NRC, 2009a). At a distance greater than 480 m [1,575 ft] from Dewey Road, sound levels generated by heavy truck traffic are expected to be approximately 40 dBA. This calculation produces a conservative estimate of a baseline for ambient noise that is slightly higher than the GEIS statement that existing ambient noise levels in this region will be 22 to 38 dBA (NRC, 2009a). GEIS Figure 3.2-17 provides examples of sound levels for common activities (NRC, 2009a).

Table 3.8-1. Noise Abatement Criteria: 1-Hour, A-Weighted Sound Levels in Decibels (dBA)

Activity Category	Leq(h)*	Description of Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of these qualities is essential if the area is to continue to serve its intended purposes.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	—	Undeveloped lands.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Source: 23 CFR Part 772
*Leq(h) is an energy weighted, 1-hour, A-weighted sound level in decibels (dBA).

3.9 Historic and Cultural Resources

GEIS Section 3.4.8 provides a general overview of historic and cultural resources in southwestern South Dakota where the proposed Dewey-Burdock ISR Project is located (NRC, 2009a). The proposed project area is located within the prehistoric cultural subarea known as the Northwestern Plains. This region includes western Minnesota, North and South Dakota, Wyoming, and portions of eastern Idaho and southern Montana. Prehistoric inhabitants of the Northwestern Plains existed for 12,000 years as semi-nomadic hunters and gatherers. During the last 4,000 years, the archaeological record indicates Native Americans living on the Northwestern Plains primarily used bison for food, clothing, and shelter (Frison, 1991). During historic times, missionaries and traders were the first non-Indian people to arrive in the Black Hills followed by settlers, miners, and merchants traveling west to the Oregon Territory or the goldfields in California, Colorado, and Montana. In the late 1880s, the Black Hills were opened to homesteaders and an economy based on mining, logging, and ranching developed (Buechler, 1999).

The National Historic Preservation Act (NHPA) requires federal agencies to consider the effects of their undertakings on historic properties. Historic properties are defined as resources that are eligible for listing on the National Register of Historic Places (NRHP). The criteria for eligibility are listed in 36 CFR 60.4 and include (A) association with significant events in history; (B) association with the lives of persons significant in the past; (C) embodiment of distinctive characteristics of type, period, or construction; and (D) sites or places that have yielded or are likely to yield important information (ACHP, 2012). The historic preservation review process, NHPA Section 106, is outlined in regulations the Advisory Council on Historic Preservation (ACHP) issued in 36 CFR Part 800.

The issuance of a source material license is a federal action that may affect either known or undiscovered historic properties located on or near the Dewey-Burdock ISR Project. In accordance with the provisions of the NHPA, NRC is required to make a reasonable effort to identify historic properties in the area of potential effect (APE). The APE for this review is the area that may be directly or indirectly impacted by the construction, operation, aquifer restoration, and decommissioning of the proposed action. If no historic properties are present or affected, NRC is required to consult with the South Dakota State Historic Preservation Office (SD SHPO) before proceeding. If it is determined that historic properties are present, NRC is required to assess and resolve possible adverse effects of the undertaking.

The Archaeological Resources Protection Act of 1979, as amended [Public Law 96-95; 16 U.S.C. 470aa-mm], which regulates the permitting of archaeological investigations on public land, including those managed by BLM and South Dakota laws and regulations for the protection of archaeological resources were followed. Applicable laws and regulations are discussed more fully in GEIS Appendix B.

South Dakota Codified Law (SDCL) 34-27-6, Cemeteries and Burials, specifies the procedures for the treatment and handling of human remains if human remains are found during proposed project activities. The Native American Graves Protection and Repatriation Act of 1990 (NAGPRA), as amended [Public Law 101-601; 25 U.S.C. § 3001 et. Seq.], is applicable to burials found on BLM-managed lands. NAGPRA provides for the protection of Native American remains, funerary objects, sacred objects, or objects of cultural patrimony and their repatriation to affiliated tribes following a consultation process between tribes, museums, and/or land managing federal agencies.

The cultural resources investigations for the proposed Dewey-Burdock ISR Project included (i) a review of available archaeological, ethnographic and ethnological literature, (ii) a search and evaluation of archaeological records and collections maintained by the South Dakota Archaeological Research Center (ARC), (iii) archaeological field investigations including evaluative testing, (iv) a visual effects assessment, (v) preparation of an ethnohistoric background study, and (vi) tribal consultation, including a tribal survey, to assist in the identification of places of religious or cultural importance to Native American tribes. Historic and cultural resources are sites documenting past human activity containing artifacts, features, or architectural structures, and include sacred places important to Native American tribes. An overview of regional cultural history and archaeology and definition of the APE for the project area are presented in SEIS Sections 3.9.1 and 3.9.2. SEIS Section 3.9.3 describes the results of historic and cultural resource investigations. SEIS Section 3.9.4 summarizes NRC consultation efforts with Native American tribes.

3.9.1 Cultural History

The archaeological cultural sequence for the proposed project area is divided between the prehistoric periods (Paleoindian, Plains Archaic, Plains Woodland, and Late Prehistoric/Plains Village) and the more recent Protohistoric and Historic/Euroamerican cultural periods.
The prehistoric periods encompass about 11,000 years between 12,000 B.P. (before present; 10,000 B.C.) and 300 B.P. (about A.D. 1700). The Protohistoric and Historic/Euroamerican periods extend from about A.D. 1700 to A.D. 1959.

The proposed Dewey-Burdock ISR Project area is located on the southwestern edge of the Black Hills Uplift within the geographical area known as the Great Plains. The vegetation within and surrounding the project area is a mix of short grasses and shrubs typical of semiarid steppe land along with ponderosa pine forest toward the Black Hills (Powertech, 2009a). The elevation within the project area ranges from approximately 1,097 to 1,189 m [3,600 to 3,900 ft] above mean sea level, with the highest elevations along the pine breaks that overlap its eastern boundary. Topography in the western quarter of the project area consists of gently rolling terrain, while more varied terrain in the pine breaks and dissected hills comprise the rest of the project area. Two main streams pass through the project area: Beaver Creek (perennial) and Pass Creek (ephemeral) (see Figure 3.5-2). The primary land use within and in the vicinity of the project area is cattle grazing (Powertech, 2009a).

3.9.1.1 Prehistoric Periods

As mentioned previously, the prehistoric periods are divided into Paleoindian, Plains Archaic, Plains Woodland, and Late Prehistoric/Plains Village. Paleoindian (11,000 to 8,000 B.P.) sites in the region are typically identified by the presence of lanceolate points and date from the Late Glacial, Pre-Boreal, and Boreal climatic episodes. During these episodes, the climate underwent a warming trend and the grasslands and sagebrush steppe expanded at the expense of boreal forests and tundra (Noisat, 1996). Paleoindian groups were nomadic bands of hunters subsisting on big game animals such as mammoth, bison, and muskox. Paleoindian sites are found in diverse settings including protected mountains, foothill areas, and river valleys and in the interior of the Black Hills (BLM, 2009a; Tratebas, 1986). Sites are rarely found on upland prairie and grasslands typical of the Great Plains and Central Plains regions of South Dakota (Frison, 1991). By the end of the Paleoindian period larger game animals were replaced by modern antelope, bison, deer, and elk. These smaller grazers were better adapted to the changing environment that resulted from the onset of warmer and drier conditions in the Holocene era (Hester, 1960).

The Plains Archaic period (8,500 to 1,500 B.P.) in South Dakota is broken into three subperiods: Early, Middle, and Late. The Early Plains Archaic subperiod (8,500 to 5,000 B.P.) is marked by a shift to a warmer and dryer climate (BLM, 2009a). Sites from this period are characterized by semi-subterranean houses that are usually marked by the presence of one or more hearths, firepits, storage pits, and milling basins. These sites suggest that groups in the Early Plains Archaic subperiod participated in seasonal occupation and movement. The presence of various side- and corner-notched projectile points and side-notched knives also suggests a subsistence strategy that included hunting small- and medium-sized game, as well as, exploitation of floral species. Only a few Early Plains Archaic sites have been found in plains, foothill, and mountainous areas of the Black Hills (BLM, 2009a).

During the Middle Plains Archaic subperiod (5,000 to 3,000 B.P.) there was a return to moister, cooler conditions (BLM, 2009a). Middle Plains Archaic groups greatly utilized the Black Hills. Site assemblages reflect a relatively broad spectrum of hunting and gathering strategies, with an emphasis on bison hunting (BLM, 2009a). Site features include prepared pit houses, stone rings, and rock shelters.

The climate during the Late Plains Archaic subperiod (3,000 to 1,500 B.P.) gradually became wetter; grasslands expanded, increasing bison herds (BLM, 2009a). As a result, subsistence strategies shifted toward a more nomadic hunting economy. Recorded communal bison kill sites contain diagnostic Yonkee points (large corner-notched projectile points), which were the preferred method of felling the bison (Winham and Hannus, 1991).

The Woodland Period (2,500 to 1,000 B.P.) throughout the Great Plains is characterized by introduction of new technologies and social practices. In the Black Hills, the Late Archaic and Woodland periods overlapped and Woodland subsistence strategies are similar to those of the Late Plains Archaic period. Gradual changes from the Archaic to Woodland period include a greater reliance on horticulture, the introduction of ceramics, semipermanent dwellings, bow and arrow utilization, and burial mound construction (Grange, 1980; Hill and Kivett, 1940; Hoffman, 1968; Lueck and Winham, 2005). In the Black Hills region, Woodland cultural groups continued a hunting and gathering lifestyle of following bison herds. This nomadic subsistence strategy is evidenced by numerous sites with stone circles (teepee rings), as well as a lack of cultigens or semipermanent dwelling features identified in the archaeological record (Molyneaux, et al., 2000).

The Late Prehistoric/Plains Village period (1,500 to 300 B.P.) heralds the acceptance of new technologies, such as smaller projectile points adapted for use with arrows (Frison, 1991). Prior to the Late Prehistoric period, the points were hafted on spears. Also introduced at this time is earthenware technology, which improves food preparation techniques. Stewing, braising, and boiling were now possible, which significantly broadened the number of floral and faunal species that could be utilized. Peoples of the Late Prehistoric/Plains Village period in South Dakota are similar in many ways to earlier Plains Woodland cultural groups. Very few sites of the Late Prehistoric/Plains Village period have been documented within Custer and Fall River Counties (Buechler, 1999).

3.9.1.2 Protohistoric/Historic Era

The Protohistoric period (A.D. 1700–1840) is characterized by the beginnings of European interaction with the Plains tribal groups. European metal and decorative goods, firearms, and the domesticated horse were introduced into the region (Buechler, 1999; Frison, 1991; Molyneaux, et al., 2000). At the onset of the 18th century, tribes historically associated with the project area include the Crow, Plains Apache, Ponca, Comanche, Kiowa, and Kiowa-Apache (Buechler, 1999). By 230 B.P., groups of the Lakota Sioux, and to a lesser extent, Arapaho and Cheyenne, had forced these previous inhabitants out of the region to the south and west (Buechler, 1999). According to ethnographic accounts written by French Jesuits and fur trappers, from A.D. 1700 to 1800, the Lakota migrated westward from Minnesota, crossed the Missouri River, and transitioned from being hunter-gatherers and part-time farmers to nomadic hunters who primarily relied on bison for food, clothing, and shelter. With the acquisition of the horse, the Lakota became the dominant culture on the Northern Plains between the Missouri River and the Rocky Mountains (Robinson, 1904).

The Historic/Euroamerican period is subdivided into seven periods: Early Historic (A.D. 1801 to 1842), Preterritorial (A.D. 1843 to 1867), Territorial (A.D. 1868 to 1889), Expansion (A.D. 1890 to 1919), Depression (A.D. 1920 to 1939), World War II (A.D. 1940 to 1946), and Post-World War II (A.D. 1947 to 1959). The proposed Dewey-Burdock Project area has been historically used for cattle ranching, farming, and gold prospecting. The establishment of Custer County in 1877 was a direct result of Lieutenant George A. Custer's Black Hills Expedition of 1874, which confirmed the presence of gold within the area (Molyneaux, et al., 2000). The founding of Rapid City in 1876 created an eastern "gateway" into the heart of the Black Hills mining region as well as an important transportation hub. By the early 20th century, smaller communities had sprung up along the various railroad lines that facilitated the import and export of goods and services (Nielsen, 1996).

3.9.2 Area of Potential Effect

As described previously, the APE for the review of historic and cultural resources at the proposed Dewey-Burdock ISR Project is the area that may be directly or indirectly impacted by the construction, operation, aquifer restoration, and decommissioning of the proposed project. The APE for the proposed Dewey-Burdock ISR Project coincides with the extent of potential ground disturbance resulting from proposed facility construction and operational activities. The introduction of new visual, auditory, or other sensory elements also has the potential to diminish the integrity of historic properties in the project area.

The extent of the APE for facility construction and operations will depend on the disposal option used at the proposed project to dispose of liquid waste. As described in SEIS Section 2.1.1.1.2.4, the applicant plans to dispose of liquid wastes generated during uranium recovery operations through deep injection wells, land application, or a combination of both methods. The APE for facility construction and operations for all the liquid waste disposal options totals 1,067 ha [2,637 ac] (Figure 3.9-1). This area includes a 969-ha [2.394-ac] buffer zone surrounding 98.3-ha [243-ac] of projected areas for the plant facilities, wellfields, ponds, roads, and pipelines. If land application is used for liquid waste disposal, the APE for facility construction and operations will include an additional maximum area of approximately 506 ha [1,250 ac] surrounding proposed land application areas (Figure 3.9-1).

The introduction of new visual elements is expected to have the greatest potential to diminish the integrity of historic properties in the project area. The extent of the APE for visual impacts includes areas within a 4.8-km [3-mi] radius of the central processing plant in the Burdock area and the satellite processing facility in the Dewey area (see Figure 3.9-1). The central processing plant and satellite processing facility will be the tallest buildings constructed at the proposed Dewey-Burdock ISR Project site (Powertech, 2009a). Based on proposed locations of the central processing plant and the satellite processing facility, the APE for visual impacts will extend a maximum of 2.33 km [1.45 mi] from the eastern project boundary in the Burdock area and a maximum of 2.7 km [1.7 mi] from the western project boundary in the Dewey area (see SEIS Figure 3.9-1).

3.9.3 Historic and Cultural Resources Investigations

3.9.3.1 Level III Cultural Resource Investigations

NRC staff reviewed Level III cultural resource investigations and evaluative testing reports prepared by the Archaeology Laboratory Augustana College (ALAC) on behalf of the applicant for the proposed Dewey-Burdock ISR Project (Kruse, et al., 2008; Palmer and Kruse, 2008; Palmer 2008, 2009, 2012). The investigations included an archival and historic review of available sources, a search of ARC-maintained records and collections, and review of published field reports. A review of available data shows that six surveys have been conducted within the project boundary of the proposed Dewey-Burdock site (Kruse, et al., 2008). A total of 57 archaeological sites were previously recorded within the proposed project area (Kruse, et al., 2008).

Recent field investigations were conducted by pedestrian surveys of 4,173 ha [10,311 ac] between April and August 2007 and of an additional 526 ha [1,300 ac] between July and September 2008 of the proposed project area. The 2007 and 2008 field investigations included evaluative testing at 43 sites. In 2011, evaluative testing was conducted at 20 unevaluated sites located within the project boundary to provide data for recommendation on NRHP eligibility (Palmer and Kruse, 2012). The results of the evaluative testing determined that one site, 39FA1941, is recommended eligible for listing in the NRHP and 19 sites were recommended ineligible for listing in the NRHP (Palmer and Kruse, 2012). Results of the Level III cultural resource investigations are presented in the following sections.

3.9.3.1.1 Archaeological Sites

NRC reviewed site data on over 200 archaeological sites recorded within the proposed project area. During the field investigation, a number of small, individual sites were combined into larger, single sites. One-hundred and forty-nine (149) sites were determined ineligible for listing in the NRHP when measured against the evaluative criteria found in 36 CFR 60.4. Seventy-nine (79) of these sites are of isolated finds (single tool or few [n<10] items with no possibility of buried or other remains; can be aboriginal or historic; is not eligible by definition [SD ARC, 2006]); these sites lack physical integrity and context. Approximately 140 of these mostly prehistoric sites are located on highly disturbed and eroded landforms and have little potential to possess intact, significant buried cultural deposits.

Fifteen (15) archaeological sites, including two containing cairns and burials, have been recommended as eligible for listing in the NRHP (Table 3.9-1). SD SHPO has concurred with the sites recommended eligible to the NRHP under one or more criteria of eligibility in

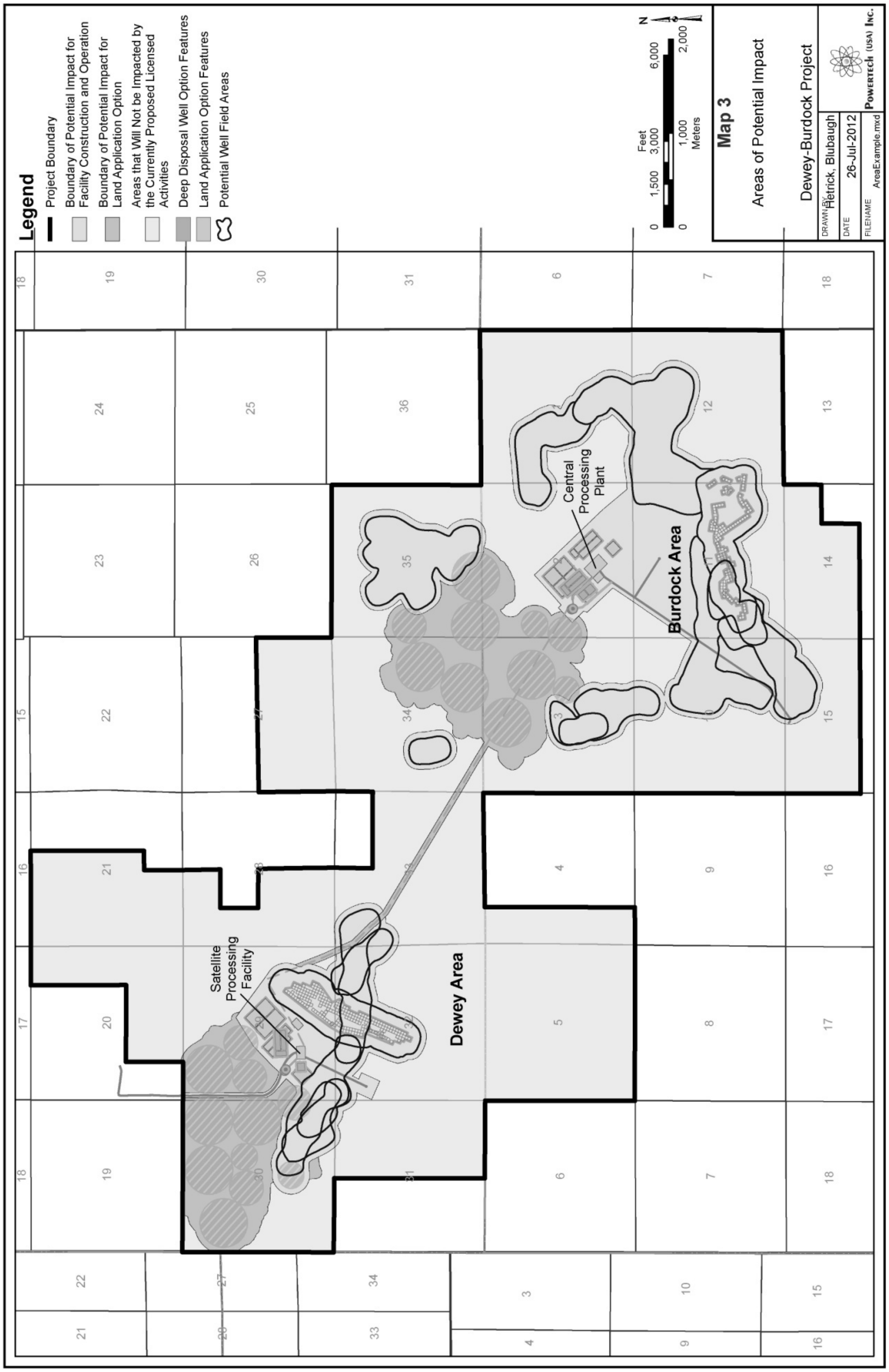

Figure 3.9-1. Map Showing Area of Potential Effect for Facility Construction and Operations for Review of Historic and Cultural Resources
Source: Modified from Powertech 2013

Table 3.9-1 (SD SHPO, 2012, 2014). The archaeological sites recommended for listing in NRHP are discussed next.

Site 39CU0271 was originally recorded in 1981, and was described as an extensive occupation site with at least 184 hearth features, ranging from severely eroded to completely intact (Chevance, 1978; Reher, 1981; Buechler, 1999). In 2007, ALAC relocated this site and expanded the boundaries to include 54 additional hearth features and a cairn feature. Artifacts recovered from the site consist of scrapers, bifaces, points, and other lithic tools. Charcoal samples were collected from seven hearths for radiocarbon dating. The radiocarbon test results revealed the hearths date from the Late Plains Archaic period to the Plains Woodland period. Following testing, Reher (1981) recommended avoidance of 38CU0271 and determined that the site is eligible for listing in the NRHP (Kruse, et al., 2008). In 2007, ALAC revisited the site and expanded the boundaries to include additional occupation areas, newly discovered hearths, and a cairn feature (Kruse, et al., 2008). While portions of the site have been subjected to wind and water erosion, other areas of the site retain intact soil deposits with the potential to contain intact cultural deposits (Kruse, et al., 2008). Site 39CU0271 was visited and recorded during tribal cultural surveys; however, the tribes offered no NRHP recommendations for this site (see SEIS Section 3.9.3.2.2).

Table 3.9-1. List of Archaeological Sites Within the Proposed Project Area Recommended Eligible for Listing in the National Register of Historic Places*

Historic Property (Site Number, Structure Identification, or Historic District)	Description	NRHP Determination†
39CU0271	Native American and Archaic artifact scatter and occupation site on a ridge slope with a cairn feature	Eligible, Criterion D
39CU0577	Native American/Euroamerican Occupation site; artifact scatter	Eligible, Criterion D
39CU0584	Native American occupation site and burial on a ridge slope	Eligible, Criterion D
39CU2735	Archaic- Prehistoric occupation site	Eligible, Criterion D
39CU0578	Native American/Euroamerican Dump and occupation site on a ridge slope	Eligible, Criterion D
39CU0586	Native American and Late Archaic occupation site on a ridge crest	Eligible, Criterion D
39CU0588	Native American occupation site on a ridge crest	Eligible, Criterion D
39CU2733	Native American hearth and artifact scatter on a ridge slope	Eligible, Criterion D
39CU2738	Native American occupation site on a ridge crest	Eligible, Criterion D
39CU0590	Native American artifact scatter on a ridge saddle	Eligible, Criterion D
39CU0593	Native American and Euroamerican occupation and artifact scatter on a hill slope	Eligible, Criterion D
39CU3592	Native American artifact scatter and hearth site	Eligible, Criterion D
39FA1941	Native American artifact scatter and hearth site	Eligible, Criterion D
39CU2000	Historic Railroad	Eligible, Critera A and C
39FA2000	Historic Railroad	Eligible, Criteria A and C

Sources: Kruse, et al. (2008); Palmer and Kruse (2008, 2012); Palmer (2009)
*Recommended eligible by Archaeology Laboratory Augustana College and the U.S. Nuclear Regulatory Commission. South Dakota State Historic Preservation Office (SD SHPO) has concurred with these recommendations (SD SHPO, 2012. 2014).
†The National Register for Historic Places criteria for eligibility are listed in Section 3.9 of this Supplemental Environmental Impact Statement.

Previously recorded sites 39CU0577, 39CU0578, 39CU0586, 39CU0588, 39CU2733, 39CU2738, and 39CU0590 are Native American occupation sites, and 39CU2735 is an Archaic site; all were determined eligible for listing in the NRHP under Criterion D (Kruse, et al., 2008). Site 39CU0593 is a Native American and Euroamerican occupation and artifact scatter located on a hill slope, determined eligible for listing in the NRHP under Criterion D (Kruse, et al., 2008). Site 39CU0584 is a Native American occupation site and contains a burial (affiliation unknown) located on a ridge slope, also recommended eligible for listing in the NRHP under Criterion D (Kruse,et al., 2008).

Sites 39CU2000 and 39FA2000 are historic railroad sites and are eligible for listing in the NRHP under Criteria A and C. Sites 39CU2000 and 39FA2000 are separate segments of the Burlington Northern Railroad and part of the original 1889 lines that linked the communities of Edgemont, South Dakota, and Newcastle, Wyoming, for the transportation of coal (Kruse, et al., 2008).

Site 39CU3592 is a sparse Native American artifact scatter with three hearths and a flint knapping activity area dating to the Archaic period. This site was recommended eligible for listing in the NRHP under Criterion D based on evaluative testing performed in 2008 (Palmer and Kruse, 2008).

Site 39FA1941 is a Native American artifact scatter and hearth site located on a ridge top toward the southeast quadrant of the proposed project area. In 2007, ALAC originally recorded the site (Kruse, et al., 2008), which underwent evaluative testing in 2011 (Palmer and Kruse, 2012). Twenty-six, mostly deflated hearth sites were recorded in the testing phase, and radiocarbon dating from one of the hearths indicates the site dates to the Late Archaic period. While the northern half of the site lacks integrity and has been destroyed by erosion, the southern half of the site at Area D possesses intact buried cultural deposits with intact features and associated activity areas. Site 39CU1941 is recommended eligible for listing under Criterion D (Palmer and Kruse, 2012). While numerous Archaic sites have been recorded in the region, very few possess an intact cultural zone with the potential to augment the archaeological record of the region (Palmer and Kruse 2012).

Archaeoloigcal field investigations documented 68 unevaluated archaeological sites within the proposed project area (Kruse, et al., 2008; Palmer and Kruse, 2008; Palmer 2008, 2009, 2012). Unevaluated sites are sites that have not been evaluated for NRHP eligibility. These sites will be subjected to archaeological testing and mitigation, if appropriate, prior to ground-disturbing activities.

Historic and ethnographic evidence indicates that sites with cairn features served as markers for trails, camps, burials, caches, and ceremonial centers (Kruse, et al., 2008). Unevaluated sites with burials or cairn features are listed in Table 3.9-2. This information on cairn features and burials was confirmed by tribes during consultation. With the exception of site 39CU3584, none of these sites are located within areas of proposed development (i.e., within the APE for facility construction and operations). During tribal cultural surveys of the Dewey-Burdock site, tribes visited, recorded, and recommended that five of the sites listed in Table 3.9-2 (39CU3620, 39FA1862, 39FA1881, 39FA1890, and 39FA1927 be listed in the NRHP under one or more of the eligibility criteria (see SEIS Section 3.9.3.2.2). Unevaluated archaeological sites with burial and cairn features are discussed below.

Table 3.9-2. Unevaluated Archaeological Sites With Burial or Cairn Features Within the Proposed Project Area

State Site Number	Description	National Register of Historic Places Determination
39CU0530	Cairn site	Unevaluated
39CU3564	Cairn site	Unevaluated
39CU3584	Cairn site	Unevaluated
39CU3587	Two historic Euroamerican burials	Unevaluated
39CU3620	Cairn site	Unevaluated
39FA1862	Cairn site with stone circles	Unevaluated
39FA1863	Cairn site with stone circles	Unevaluated
39FA1881	Cairn site	Unevaluated
39FA1890	Cairn site	Unevaluated
39FA1902	Historic site with historic burial and bridge structure	Unevaluated
39FA1927	Cairn site	Unevaluated
Sources: Kruse, et al. (2008); Palmer and Kruse (2008, 2012); Palmer (2009)		

Site 39FA1902 is an unevaluated site that consists of Native American and Euroamerican artifact scatters, a well/cistern, a historic bridge, and a possible historic grave located on scrubland and on a short grass pasture. A linear pile of limestone rocks located on the northeast edge of site 39FA1902 is purported to be a historic grave by a local informant. The remnant of a collapsed wooden fence near the rock pile suggests the possible grave was enclosed by a fence at some time in the past (Kruse, et al., 2008). The historic bridge structure is discussed in more detail in SEIS Section 3.9.3.1.2. During tribal cultural surveys, site 39FA1902 was specifically listed as being of no interest to the Northern Cheyenne and Northern Arapaho tribes (see SEIS Section 3.9.3.2.2). Representatives from both tribes examined the possible gravesite and determined that it was most likely not affiliated with tribes based on the presence of modern materials including pieces of broken concrete among the stones used to mark the location.

Site 39CU3584 consists of a Native American artifact scatter and two cairns located on a hill top. The artifact scatter dates to the Middle Archaic based on the discovery of one projectile point. This site lies within the proposed land application area at the Dewey site. The site underwent archaeological testing and was recommended ineligible for listing in the NRHP under criteria D, based on a lack of diagnostic artifacts and intact cultural deposits (Kruse, et al., 2008; Palmer and Kruse, 2012). SD SHPO recommended that site 39CU3584 be considered unevaluated for listing on the NRHP until all eligibility criteria have been applied (SD SHPO, 2012). Site 39CU3584 was visited and recorded during tribal cultural surveys; however, the tribes offered no NRHP recommendations for this site (see SEIS Section 3.9.3.2.2).

Site 39CU3587 is a prehistoric artifact scatter and two Euroamerican burials enclosed by posts from a collapsed fence located on a ridge top south of Beaver Creek. The burials were presumably enclosed by a fence, and only the posts remain. The site is unevaluated (Kruse, et al., 2008).

Site 39CU0530 is a Native American artifact scatter with one cairn and 29 hearths located on a forested ridge top and slopes. Areas of the site retain intact soil deposits with the potential to contain intact cultural deposits. The site is unevaluated (Kruse, et al., 2008).

Site 39CU3564 is a Native American lithic quarry site and one cairn located on an eroded hill top. The site is unevaluated (Kruse, et al., 2008).

Site 39CU3620 is sparse Native American lithic scatter, a cairn, and eight hearths located on a ridge slope. The site was designated unevaluated by archaeological survey teams (Kruse, et al., 2008). Site 39CU3620 was visited, recorded, and recommended eligible for listing on NRHP under Criteria A and C during tribal cultural surveys (see SEIS Section 3.9.3.2.2).

Site 39FA1862 is a prehistoric and Native American artifact scatter with three stone circles and four cairns on an eroded ridge top. The site was designated unevaluated by archaeological survey teams (Kruse, et al., 2008). Site 39FA1862 was visited, recorded, and recommended eligible for listing on NRHP under Criterion A during tribal cultural surveys (see SEIS Section 3.9.3.2.2).

Site 39FA1863 is a prehistoric and Native American artifact scatter with a stone circle, cairn, and stone alignment located on an eroded ridgetop. The site is unevaluated (Kruse, et al., 2008).

Site 39FA1881 is a sparse prehistoric, Native American artifact scatter with a cairn consisting of 10 to 12 large rocks. The site was designated unevaluated by archaeological survey teams (Kruse, et al., 2008). Site 39FA1881 was visited, recorded, and recommended eligible for listing on NRHP under Criteria A and D during tribal cultural surveys (see SEIS Section 3.9.3.2.2).

Site 39FA1890 is a prehistoric, Native American artifact scatter with a cairn consisting of five visible medium-sized cobbles. The site was designated unevaluated by archaeological survey teams (Kruse, et al., 2008). Site 39FA1890 was visited, recorded, and recommended eligible for listing on NRHP under Criterion A during tribal cultural surveys (see SEIS Section 3.9.3.2.2).

Site 39FA1927 is a Native American site consisting of an alignment of six cairns extending along a grassy ridge top. Ground surface visibility averaged 50 percent, and no artifacts were identified on the ground surface. The site was designated unevaluated by archaeological survey teams (Kruse, et al., 2008). Site 39FA1927 was visited, recorded, and recommended eligible for listing on NRHP under Criteria A and D during tribal cultural surveys (see SEIS Section 3.9.3.2.2).

Several other unevaluated archaeological sites are located within the APE for facility construction and operations and, therefore, could be potentially disturbed by ISR activities. These sites are listed in Table 3.9-3 and discussed next.

Site 39CU3584 was discussed previously and consists of a Native American artifact scatter and two cairns located on a hill top. This site lies within the proposed land application area at the Dewey site. As described previously, the site was recommended ineligible for listing in the NRHP under criteria D, based on a lack of diagnostic artifacts and intact cultural deposits (Kruse, et al., 2008; Palmer and Kruse, 2012). SD SHPO recommended that site 39CU3584 be considered unevaluated for listing on the NRHP until all eligibility criteria have been applied (SD SHPO, 2012). Site 39CU3584 was visited and recorded during tribal cultural surveys; however, the tribes offered no NRHP recommendations for this site (see SEIS Section 3.9.3.2.2)

Table 3.9-3. Unevaluated Archaeological Sites Within the Area of Potential Effect for Facility Construction and Operations

State Site Number	Description	National Register of Historic Places Determination
39CU0554	Artifact scatter	Unevaluated
39CU0558	Artifact scatter	Unevaluated
39CU0653	Artifact scatter	Unevaluated
39CU3584	Cairn site	Unevaluated
39CU3603	Artifact scatter, hearth	Unevaluated
39CU3615	Artifact scatter	Unevaluated
39CU3624	Artifact scatter	Unevaluated
39FA0096	Historic cabin	Unevaluated at Area 8 within historic cabin
39FA0274	Artifact scatter	Unevaluated
39FA0556	Artifact scatter	Unevaluated
39FA0740	Artifact scatter	Unevaluated
39FA0777	Artifact scatter	Unevaluated
39FA0778	Historic farmstead	Unevaluated
39FA1880	Artifact scatter	Unevaluated
39FA1920	Artifact scatter	Unevaluated
Sources: Kruse, et al. (2008); Palmer and Kruse (2008, 2012); Palmer (2009)		

Site 39FA0096, located at the south-central portion of the proposed project area, is a large occupation site with components that may date from the Paleolithic through the Historic period. Numerous hearths, artifact scatters, and historic ruins have been identified. Originally recorded as a homestead in 1970s, ALAC revisited the site in 2007 and the boundaries were subsequently expanded to include 16 new cultural locales (Kruse, et al., 2008). In 2011, the site underwent evaluative testing (Palmer and Kruse, 2012). The site is large and extends approximately 1,040 m [3,412 ft] north-south by 1,165 m [3,822 ft] east-west. During the 2011 evaluative testing, the site was divided into eight concentration areas (Area 1 to Area 8) and a total of 68 hearth features and artifact scatters were recorded across the site (Palmer and Kruse, 2012). Samples of charcoal from hearth features in Areas 4 and 6 underwent radiocarbon dating, and both date to the Late Archaic time period (Palmer and Kruse, 2012). Evaluative testing demonstrated that the prehistoric component site is a deflated surface scatter of artifacts and hearths (Palmer and Kruse, 2012). Based on the lack of cultural deposits between the hearth features, the site may represent a series of short-term occupations. The site probably was occupied briefly by mobile social and/or family units foraging in the surrounding area and using the site as temporary residence.

One previously documented possible historic burial was identified at Area 3, located at the center of site 39FA0096. During evaluative testing, shovel tests revealed a thin layer of silt followed by charcoal and chicken bones overlaying bedrock. The tests revealed very shallow soils which terminated when bedrock was hit at 15 cm [5.9 in] below surface. No evidence of human bones or remains was encountered. The feature was interpreted as the remains of a modern hunter’s campfire with charcoal and chicken bones and is decidedly not a burial (Palmer and Kruse, 2012).

Two log cabins, a cistern, a collapsed outbuilding, a remnant of a foundation, and piles of foundation rubble were also identified at the southeast corner of site 39FA0096 at Area 8. Shovel tests excavated around the historic cabin structures produced historic artifacts, but no additional features were identified (Palmer and Kruse, 2012). Additional shovel testing within the historic cabin structures is planned (Powertech, 2012a). A search on the General Land

Office Records on the BLM web site uncovered a 1915 land patent on 64.7 ha [160 ac] for Emaline Richardson (BLM, 2012a). A copy of the land patent is included in Appendix D.

A small portion of site 39FA0096 extends onto BLM surface lands. BLM reviewed ALAC's 2012 evaluative testing report (Palmer and Kruse, 2012) and concurred with findings that the site is heavily deflated and lacks integrity, having been destroyed by natural erosion. Moreover, the site does not display workmanship or feeling, and is not associated with an important event. BLM concurs that the portion of site 39FA0096 on BLM-administered lands is not eligible for listing on the NRHP under criteria D (BLM, 2012c). A copy of the BLM letter dated July 20, 2012, is included in Appendix D.

Preliminary information gathered through consultation with the tribes indicate site 39FA0096 has the potential to be of religious and cultural importance to the tribes based on the number of hearth features and extensive size of the site. Site 39FA0096 was visited, recorded, and recommended eligible for listing on NRHP under Criterion A during tribal cultural surveys (see SEIS Section 3.9.3.2.2).

Site 39FA0778 is a historic farmstead, originally recorded in 1983, and consists of corrals, root cellars, a well, and a house foundation. Historic artifacts consist of clear bottle glass and scatter of fired brick and milled lumber (Kruse, et al., 2008). SD SHPO requested that site 39FA0778 be designated as unevaluated because the site is located where the proposed Burdock central processing plant would be constructed (SD SHPO, 2012).

Sites 39CU0554, 39CU0558, 39CU3624, 39FA0274, 39FA0556, 39FA1880, and 39FA1920 are artifact scatters within or adjacent to proposed wellfield areas. These sites are unevaluated (Kruse, et al., 2008).

Site 39CU3603 is an artifact scatter and hearth site located within the right of way of a proposed pipeline connecting the Burdock central processing plant and the Dewey satellite facility. This site is unevaluated (Kruse, et al., 2008)

Sites 39CU0653, 39CU3615, 39FA0740, and 39FA0777 are artifact scatters within or adjacent to land applications areas. These sites are unevaluated (Kruse, et al., 2008).

3.9.3.1.2 Historic District, Historic Standing Structures, and Bridge Structure

Historic resources within the proposed project area currently listed or recommended eligible for listing on the NRHP are listed in Table 3.9-4.

The Edna and Ernest Young Ranch Historic District is located south of Beaver Creek in the northwest area of the APE. According to the SD SHPO Historic Sites Survey Form, the Edna and Ernest Young Ranch is a designated historic National Register District (90000949), added to the NRHP in 1990, under Criterion A, Exploration and Settlement. This ranch represents the development of "legal homestead ranching" in southwest Custer County, and the period of historical significance is from 1912 to 1940. The ranch is composed of 13 contributing buildings, 1 contributing structure, the Bakewell Ranch (CU00000050), and 1 non-contributing structure on a total of 52.6 ha [130 ac]. The main house of the Bakewell Ranch was constructed from

Table 3.9-4. List of Historic Structures Within the Proposed Project Area Currently Listed in the National Register of Historic Places (NRHP) or Structures Eligible for Listing in the NRHP

Historic Property (Structure Identification, or Historic District)	Description	Currently Listed on the NRHP or NRHP Determination*
Log Barn (Structure CU02500002)	Log barn located at site 39CU3619 was found eligible for listing on NRHP in April 2012 under Criterion A.	Eligible, Criterion A
Historic District 90000949- Edna and Ernest Young Ranch	This historic district covers 52.6 ha [130 ac] and is located approximately 4.8 km [3 mi] south of Dewey and south of Beaver Creek. The area of significance is exploration/settlement during the 1900–1924 and 1925–1949. There are 13 contributing buildings, 1 contributing structure and 1 non-contributing structure.	Listed in the NRHP in 1990 under Criterion A
Bakewell Ranch (Structure CU00000050)	The Bakewell Ranch is located within the Edna and Ernest Young Ranch National Register Historic District	Listed in the NRHP in 1990 under Criterion A
Sources: Kruse, et al. (2008); Palmer and Kruse (2008, 2012); Palmer (2009) *The NRHP criteria for eligibility are listed in Section 3.9 of this Supplemental Environmental Impact Statement.		

sandstone quarried locally. A copy of the SD SHPO Historic Sites Survey Form for the Edna and Ernest Young Ranch is included in Appendix D.

In 2011, an architectural historian evaluated a log barn structure (CU02500002) that is part of the Richardson Homestead (site 39CU3619) (Palmer and Kruse, 2012). The original Richardson Homestead is located south of Pass Creek and consists of nine buildings: a barn, chicken coop, granary, main house, root cellar, bunkhouse, pump house, and two garages/workshops. Other features that contributed to the setting and feel of the homestead were a cistern, rubble stone walkway, rock garden, garden plot, clothes line post, corral post and fence, and evidence of yard plantings (Palmer and Kruse, 2012). The main house was assessed, determined to lack structural integrity, and recommended as not eligible for listing in the NRHP. Without the inclusion of the main house, the Richardson Homestead did not qualify for listing as a historic district in the NRHP. The log barn structure possesses integrity given that log buildings in the Black Hills typically do not survive as they were not lived-in, permanent dwellings; they were typically abandoned, burned, or torn down. Thus, individually the log barn structure was determined eligible for listing on the NRHP under Criterion A (Palmer and Kruse, 2012).

Historic bridge structure (FA00000151) is located within archaeological site 39FA1902 discussed previously. Site 39FA1902 consists of prehistoric and historic artifact scatters, a well/cistern, a possible historic grave, and a historic wooden bridge that crosses an unnamed intermittent stream. The bridge is approximately 2.4 m [8.0 ft] long by 5.0 m [16.5 ft] wide, and the roadway associated with the bridge was not observed except for the approaches. The bridge appears to have been constructed from locally harvested pine timbers. The NRHP status of the historic bridge structure is currently unevaluated (Kruse, et al., 2008). As described previously, site 39FA1902 was specifically listed as being of no interest to the Northern Cheyenne and Northern Arapaho tribes (see SEIS Section 3.9.3.2.2). Representatives from both tribes examined the possible gravesite and determined that it was most likely not affiliated with tribes based on the presence of modern materials including pieces of broken concrete among the stones used to mark the location.

3.9.3.2 Places of Religious or Cultural Significance

Places of religious or cultural significance are resources associated with the cultural practices and beliefs of a living community that are rooted in history and remain important for a group to maintain its cultural heritage. These historic properties may not be represented in archaeological or historic contexts. On February 8, 2013, the NRC staff contacted 23 tribes interested in the Dewey-Burdock project and invited the 23 tribes to participate in a field survey of the project area for the purpose of identifying properties of religious and cultural significance to tribes (NRC, 2013). The NRC invited interested tribes to investigate any area within the 4,282 ha [10,580-ac] Dewey Burdock license area during the month of April 2013. A report summarizing the tribal cultural surveys completed at the proposed Dewey-Burdock project site is included as Appendix F of this SEIS. This report provides details on (i) survey participants, (ii) survey dates and methods, (iii) brief summary of tribal survey reports, findings, and recommendations, and (iv) NRC's determination of NRHP eligibility and effects. The following sections provide an overview of places of religious and cultural significance to tribes and the results of the tribal cultural survey completed at the Dewey-Burdock site.

3.9.3.2.1 Overview

Places of religious and cultural significance are often associated with Native American religious or cultural practices and include traditional gathering areas where particular plants or materials were harvested, a sacred mountain or landscape crucial to a tribe's identity, or burial locations that connect Native Americans with their ancestors. A place of religious or cultural significance to tribes demonstrates traditional cultural value if its significance to Native American beliefs, values, and customs "has been ethnohistorically documented and if the site can be clearly defined" (Parker and King, 1990).

Tribal groups and their descendants, including the historically documented Apache, Arapaho, Arikara, Assiniboine, Cheyenne, Crow, Hidatsa, Kiowa, Mandan, Pawnee, Ponca, Sioux, and Shoshone tribes, have made their homes in the Northern Plains for more than 12,000 years. The Black Hills is considered a place of paramount spiritual importance to tribal groups in the region (SRI, 2012).

A sense of connectedness and duality between the spiritual and earthly worlds in part illustrates the tribal worldview. What is important from a tribal perspective is the interconnectedness between the physical world and spiritual world. For example, in Lakota cosmology, there exists a spiritual realm and earthly realm and what happens in one realm is reflected in the other; the two worlds are interconnected and inform the other (SRI, 2012). Sundstrom (1996) writes that, "The activities and ceremonies conducted in the villages on earth were mirrored by the 'star villages'". Sometimes these realms converge, and the meeting point is reflected in the landscape. Some tribal members are able to interpret a "sacred" landscape or feature and recognize the same spiritual and physical features that made the place sacred to their ancestors. By extension, sacred places are considered sacred to tribal groups today visiting the sacred places and retelling of stories through oral tradition reinforces beliefs.

Past work on the Northern Plains has demonstrated that tribal groups might consider certain types of natural landforms and features culturally and spiritually significant. These landforms and features include mountain tops, cliffs, distinct topographic features, caves, rock shelters, springs and rivers, and especially the intersection between two features. For example, mountain tops may reflect increasing spirituality while cliffs and badlands are considered

"Deep Earth" (BLM, 2002)." Bear Butte and/or Bear Butte Lake, Devils Tower (Bear Lodge Peak), Inyan Kara and Harney Peak, and the Race Track are features of significance to one or more of the Northern Plains tribes (Sundstrom 1996). Liebmann (2002) explains that the Big Horn Medicine Wheel, "... is situated at a place in which ... two spiritual realms meet. ... the Big Horn Medicine Wheel lies at the juncture of two supernatural realms—the zenith and nadir; peak and underworld; the connection of spirit domains above and below." According to the BLM Casper Field Office (BLM, 2005), "The presence of flowing water or bodies of water and high isolated locations such as buttes in close proximity to one another were sometimes considered especially powerful or close to the spirits. These kinds of locations were commonly used for fasting or vision quests."

There are several man-made features that are commonly associated with culturally significant places. While a hilltop may be the physical setting for fasting, prayer, or a vision quest, man-made features associated with the sacred place may include vision quest structures, cairns, rock clusters, and stone alignments (SRI, 2012). Hand-laid stone alignments typically function as "directional markers/prayer lines associated with major ceremonial sites or drive lines to channel deer, antelope and bison." (BLM, 2002)

Sundstrom (2006), following Abbott, Ranney, and Whitten (1982), defines a cairn as "a pile of stones on the surface; this may have collapsed into a mosaic [an arrangement of stones in the form of a solid figure or pavement]." Cairns have been found in a variety of contexts, including markers for ceremonial sites, trail markers, memorials to notable events or people, medicine wheels, and to demarcate burials (e.g., Hall, 1985; Liebman, 2002; Sundstrom, 2006; USFS, 2004; BLM, 2002; Surface Transportation Board, 2010; SRI, 2012). Medicine wheels are rock alignments that have a cairn or stone circle at their centers from which stone alignments are laid out like spokes on a wheel (SRI, 2012).

Graves, burials, and cemeteries should be treated with respect and should not be disturbed. Tribal peoples continue to visit graves to pray and make offerings. There are several forms of burials including graves, cairns, and burial mounds. Burial mounds are found in eastern South Dakota and are not present within the APE (Winham and Hannus, 1990).

Physical landforms and landscape features within the APE that might possess cultural significance include (SRI, 2012):

- Bone beds
- Depressions
- Hills (conical shaped, "humped back," or odd shaped)
- Hilltops (ridge and flat top)
- Natural rock formations
- Quarries (fossil, mineral, and rock)
- Prominent knolls
- Promontories
- Rimrock

- Rockshelters
- Rugged, high altitude, isolated topographic features

Examples of man-made features and site types located within the APE that might be considered places of religious and cultural importance to the Northern Plains tribes (SRI, 2012):

- Archaeological sites
- Battle sites
- Burial mounds (not included in regions for Cameco/Powertech project areas)
- Burials
- Eagle catching sites/eagle trapping pits and lodges
- Fasting sites/structures
- Dance locations (e.g., Ghost Dance, Sun Dance)
- Medicine wheels
- Memorials
- Monuments
- Paint sources
- Pilgrimage/trail marker cairns
- Offerings and prayer sites (may include trees, springs, rock art, rivers)
- Rock art/petroglyphs
- Sacred sites (personal religious observations along the lines of the vision quest)
- Stone alignments
- Stone cairns
- Stone circles/rings (very large and very small)
- Sweat lodges
- Vision quest sites/structures

Through continued consultation with the tribes and an onsite field assessment, places that possess cultural and religious significance to the tribes may be identified. Section 3.9.3.2.2 discusses sites found during tribal cultural surveys within the license boundary.

3.9.3.2.2 Tribal Cultural Survey Results

As described previously, a report detailing the tribal cultural surveys completed at the proposed Dewey-Burdock ISR Project site is included as Appendix F of this SEIS. Seven tribes participated in the field survey at the proposed Dewey-Burdock site. These tribes included the Northern Arapaho Tribe, Northern Cheyenne Tribe, Turtle Mountain Band of Chippewa Indians, Crow Creek Sioux Tribe, Cheyenne and Arapaho Tribes of Oklahoma, Crow Nation, and Santee Sioux Tribe. The NRC staff received detailed written reports with NRHP eligibility recommendations from three of the seven tribes who participated in the tribal cultural survey (Northern Arapaho Tribe, Northern Cheyenne Tribe, Cheyenne and Arapaho Tribes of Oklahoma). The Crow Nation provided NRC staff with a copy of field notes identifying several sites of interest to that tribe. A summary of each tribe’s recommendations is provided in Appendix F. A detailed list of sites identified during the tribal cultural survey with management recommendations is included as Attachment 2 of Appendix F. The survey reports prepared by tribes along with maps recording the location of the discoveries identified during the tribal cultural survey are on file at NRC and at the tribal office of the tribe that prepared the report.

The tribal survey teams identified new artifact features or cultural features of interest to tribes at 24 known archaeological sites. In addition, 47 new artifact features and cultural features were identified. The locations of these represent 71 tribal sites. A number of the 47 new discoveries identified by tribes are situated near the boundaries of known archaeological sites and could reasonably be considered part of those sites if the current archaeological site boundaries were expanded to include them. Other new discoveries occur in close proximity to one another and may be culturally related.

Most of the new discoveries identified in the tribal cultural surveys are described in this report as individual tribal sites. When tribes indicated cultural relationships exist between new discovered features and known archaeological sites or between groups of individual tribal cultural features, this information is provided in the summary in Table F–2 and the list of tribal sites in Attachment 2 of Appendix F.

Tribal Review of Previously Reported Archaeological Sites

Tribal survey teams recorded 81 cultural features within the boundaries of 24 known archaeological sites. Some of the cultural features recorded by tribal survey teams correspond to features identified in the archaeological surveys; however, many represent new discoveries. Tribal survey teams provided specific recommendations for four (4) archaeological sites that were investigated without identifying new cultural features.

Tribal survey teams collectively recommended that 17 known archaeological sites be considered eligible for listing in the NRHP under one or more eligibility criteria. Tribal recommendations are summarized in Table 3.9-5. Sites 39FA0096, 39FA1890, 39FA1862 (outside APE), 39CU3607, 39CU3602, and 39FA1952 were recommended as NRHP-eligible under Criterion A. Sites 39CU0459, 39CU0584, 39CU3600, 39CU3604, 39CU3620, and 39FA1923 were recommended as NRHP-eligible under criteria A and C. Sites 39CU3567, 39FA1881, and 39FA1927 were recommended as NRHP-eligible under criteria A and D. Sites 39FA1922 and 39FA1926 were recommended as NRHP-eligible under criteria A, C, and D.

No sites were specifically classified as “not eligible,” although Site 39FA1902 was specifically identified as being of no interest to the Northern Cheyenne and Northern Arapaho tribes. Site 39FA1902 marks the location of a historic artifact scatter and a possible gravesite; it is likely an historic homestead. Northern Cheyenne and Northern Arapaho representatives examined the possible gravesite and because of the presence of broken concrete among the stones, they determined it was not likely of tribal origin. Survey teams recorded information about their visits to other previously recorded archaeological sites for consideration by the Tribal Historic Preservation Officers; however, no NRHP eligibility recommendations were offered by tribes for these sites. These sites included 39CU0251, 39CU0271, 39CU3572, 39CU3574, 39CU3576, 39CU3584, 39CU3593, 39CU3596, and 39FA1962.

Tribal Sites: New Discoveries

A total of 47 new discoveries were recorded as a result of the tribal cultural survey (Table 3.9-6). Forty-four (44) of the 47 new discoveries are individual tribal sites or cultural features and were assigned individual survey numbers. Three tribal sites represent multiple cultural features within a single site. For example, 11 GPS readings were taken to record the location of individual stones that make up a single stone feature (TS080-TS089 and TS098).

Table 3.9.5. Summary of Tribal Recommendations for Recorded Archaeological Sites*

State Site Number	Tribal Survey Number	Northern Cheyenne Tribe	Northern Arapaho Tribe	Cheyenne and Arapaho Tribes	Crow Nation
39CU0459	TS108-111	Eligible: A	Eligible: A, C		
39CU0584	TS043-046, TS053, TS132-140	Eligible: A	Eligible: A, C		
39CU3567	TS031-033, TS141	Eligible: A		Eligible: D	
39CU3600	TS114-115	Eligible: A	Eligible: A, C		
39CU3602	TS119	Eligible: A			
39CU3604	TS121-122	Eligible: A	Eligible: A, C		
39CU3607	TS116-117	Eligible: A			
39CU3620			Eligible: A, C		
39FA0096	TS001, TS004, TS013	Eligible: A			
39FA1862	TS112-113	Eligible: A			
39FA1881		Eligible: A, D			Place of Interest
39FA1890	TS012	Eligible: A			
39FA1902		No interest	No interest		
39FA1922†	TS014-017	Eligible: A, D	Eligible: A, C	Not eligible	Place of Interest
39FA1923†	TS018, TS142-143	Eligible: A	Eligible: A, C		Place of Interest
39FA1926	TS067-074, TS076-078	Eligible: A, D	Eligible: A, C		
39FA1927		Eligible: A	Not eligible	Eligible: D	Place of Interest
39FA1952	TS123-124	Eligible: A			

*See Appendix F, Attachment 2 of this Supplemental Environmental Impact Statement for further details concerning the listed sites.
†Sites 39FA1922 and 39FA1923 are located on U.S. Bureau of Land Management property. All others are on private land.

Table 3.9-6. Summary of Tribal Cultural Survey New Discoveries

Tribal Survey Number	Tribal Features	National Register of Historic Places Recommendation
TS002	Stone circle	Eligible Criterion A
TS003	Buffalo bones	No recommendation
TS005	Flake	No recommendation
TS006	Cairn	Eligible Criteria A, C, D
TS007-011	Stone circles (4), alignment	Eligible Criterion A, D
TS023	Burial	No recommendation
TS024	Stone circle	No recommendation
TS028	Stone circles (3); campsite; ceremonial site	No recommendation
TS030	Stone circle	No recommendation
TS036	Small cairn or marker	No recommendation
TS037	Small cairn	No recommendation
TS040	Ceremonial site	Eligible Criteria A, C
TS041-042	Ceremonial site	Eligible Criteria A, C
TS047	Ceremonial site	Eligible Criteria A, C
TS048	Burial	No recommendation
TS049	Burial	No recommendation
TS050	Burial	No recommendation
TS051	Fasting site	No recommendation
TS052	Stone circle	No recommendation
TS061	Stone circle	No recommendation
TS062	Effigy	No recommendation
TS063	No identification	No recommendation
TS064	Stone circle	No recommendation

Table 3.9-6. Summary of Tribal Cultural Survey New Discoveries (Cont'd)

Tribal Survey Number	Tribal Features	National Register of Historic Places Recommendation
TS065	Fasting site	No recommendation
TS066	Cairn	No recommendation
TS075	Cairn	No recommendation
TS079	Stone circle	No recommendation
TS080-089, TS098	Alignment and arc; ceremonial site; pipe ceremony location	Eligible Criteria A, C
TS090	Cairn	No recommendation
TS091	Ceremonial site	No recommendation
TS092	Cairn	No recommendation
TS093	Possible cairn	No recommendation
TS094	Cairn	No recommendation
TS095	Disturbed cairn (modern survey marker)	No recommendation
TS097	cairn	No recommendation
TS106	Fasting circle	Eligible Criteria A, C
TS107	Possible gravesite and fasting circle	Eligible Criteria A, C
TS118	Hearth	Eligible Criterion A
TS120	Hearth	Eligible Criterion A
TS125	Burial	No recommendation
TS126	Staff	No recommendation
TS127	Fasting site	No recommendation
TS128	Fasting site	No recommendation
TS129	Fasting site/ring	No recommendation
TS131	Possible grave	No recommendation
TS144	Cairn	No recommendation
TS145	Prayer/offering location	Eligible Criterion D

Five (5) associated tribal features (TS007-TS011) make up another tribal site. Another tribal cultural feature was assigned duplicate survey numbers (TS041 and TS042).

Twelve (12) of the 47 newly discovered cultural features were identified outside the license boundary. These features include five (5) discoveries on private land (TS024, TS061, TS062, TS075, TS079), five (5) discoveries on BLM property (TS125, TS126, TS127, TS128, TS129), and two (2) discoveries on U.S. Forest Service property (TS106, TS107). Sites TS107 and TS125 were identified as a possible gravesites. TS106 and TS107 were recommended as eligible for listing in the NRHP under criteria A and C. No eligibility recommendations were provided for the other 10 cultural features or sites.

Thirty-five (35) of the 47 new discoveries were identified within the project's license boundary. Ten (10) of these tribal sites were recommended as NRHP-eligible under one or more eligibility criteria. TS002, TS118, and TS120 were recommended as eligible under Criterion A. TS145 is recommended as eligible under Criterion D. TS007-011 is recommended as eligible under criteria A and D. TS040, TS041-TS042, TS047, and TS080-T089, TS098 are recommended as eligible under criteria A and C. TS006, a gravesite, is recommended as eligible under Criteria A, C, and D.

NRHP recommendations were not provided for 25 of the 35 new discoveries recorded within the project license boundary (TS003, TS005, TS023, TS028, TS030, TS036, TS037, TS048, TS049, TS050, TS051, TS052, TS063, TS064, TS065, TS066, TS090, TS091, TS092, TS093, TS094, TS095, TS097, TS131, and TS144). These features include isolated artifact finds, animal bone concentrations, stone circles, cairns, and possible fasting sites. TS023, TS048, TS049, TS050, and TS131 were identified during the field survey as possible gravesites.

3.9.3.3 Visual Impacts Assessment

In consultation with the SD SHPO and other consulting parties, NRC staff completed an assessment of potential visual impacts on historic properties (i.e., properties of any type listed in or considered eligible for listing in the NRHP). This assessment considered whether the construction of the central processing plant and satellite facility would create a visual effect on historic properties. The purpose of the study was to assess whether the introduction of new visual changes in the form of new processing facilities could have potential to diminish those aspects of integrity that qualify historic properties for inclusion in the NRHP. NRC's assessment considered potential visual effects on the integrity of each property's location, design, setting, materials, workmanship, feeling, or association in accordance with the Section 106 regulations at 36 CFR 800.5(a)(1). Setting, feeling, and association are generally those aspects of integrity considered most sensitive to visual intrusions and these aspects of integrity are most likely to contribute to the historic significance of historic properties considered eligible under Criteria A, B, or C. Integrity of setting is not often considered a contributing characteristic for properties considered eligible only on the basis of their historic information content (i.e., Criterion D).

As described in SEIS Section 3.9.2, NRC's assessment of visual effects included historic properties situated within a 4.8 km [3-mi] radius of the tallest or most prominent building within each processing facility. This assessment therefore includes recorded historic properties located within the license boundary as well as those near and outside the license boundary. The 4.8 km [3-mi] radius was selected based on (i) consultation with the SD SHPO, (ii) consultation with BLM, and (iii) a previous assessment done for the Dakota, Minnesota, and Eastern Railroad's (DM&E) Powder River Basin Expansion project (HDR Inc., 2009). The DM&E assessment considered visual intrusions associated with proposed railroad construction for all recorded historic properties within 4.8 km [3 mi] of the railroad project in South Dakota and Wyoming. Due to the proposed project's close proximity to the state of Wyoming, NRC staff also consulted with the Wyoming State Historic Preservation Office (WY SHPO) to determine whether reviewing properties located within a 4.8 km [3-mi] radius of the processing facilities would be acceptable for purposes of reviewing potential impacts to significant cultural and historical properties in this portion of the state of Wyoming. The WY SHPO staff agreed with NRC's proposed research approach (WY SHPO, 2013).

For the evaluation of potential visual effects to historic properties in South Dakota, NRC staff compiled a list of 31 historic properties that are either listed on the NRHP or considered eligible for listing on the NHRP under criteria A and/or C (Table 3.9-7). No historic properties within the project area appear to qualify as significant under Criterion B, and historic properties considered eligible for the NRHP solely under Criterion D were not evaluated for potential visual effects because aspects of integrity most likely to be affected by visual changes (i.e., setting, feeling, and association) are not necessary to convey the significance of those property types as sources of important historic information. This group of 31 historic properties includes one NRHP-listed historic district, the Edna and Ernest Young Ranch (90000949) also known as the Bakewell Ranch (CU00000050). The Young Ranch historic district includes several contributing ranch buildings including the principal residence. A nearby homestead district, known as the, Richardson Homestead (CU00000052) is considered not eligible but includes one individually eligible log barn (CU02500002). Other NRHP-eligible properties include one historic bridge

Table 3.9-7. List of Historic Properties Included in Visual Impacts Assessment

State Property Number	Tribal Survey Number(s)	National Register of Historic Places Determination
Bakewell Ranch (CU00000050) within the Edna and Ernest Young Ranch Historic District (90000949)		Eligible, Criteria A
Building 1 (CU02500002), Building 7 (CU02500003), Building 9 (CU02500004) at the Richardson Homestead (CU00000052)		Eligible, Criteria A
Beaver Creek Bridge (24020020)		Eligible Criterion C
39CU0459	TS108-111	Eligible, Criteria A, C
39CU0584	TS043-046, TS053, TS132-140	Eligible, Criteria A, C, D
39CU2000		Eligible, Criterion A, C
39CU3567	TS031-033, TS141	Eligible, Criteria A, D
39CU3600	TS114-115	Eligible, Criteria A, C
39CU3602	TS119	Eligible, Criterion A
39CU3604	TS121-122	Eligible, Criteria A, C
39CU3607	TS116-117	Eligible, Criterion A
39CU3620		Eligible, Criteria A, C
39FA0096	TS001, TS004, TS013	Eligible, Criterion A
39FA1862	TS112, TS113	Eligible, Criterion A
39FA1881		Eligible, Criteria A, D
39FA1890	TS012	Eligible, Criterion A
39FA1922	TS014-017	Eligible, Criteria A, C, D
39FA1923	TS018, TS142-143	Eligible, Criteria A, C
39FA1926	TS067-074, TS076-078	Eligible, Criteria A, C, D
39FA1927		Eligible, Criterion A
39FA1952	TS123-124	Eligible, Criterion A
39FA2000		Eligible, Criterion A, C
	TS002	Eligible, Criterion A
	TS006	Eligible, Criteria A, C, D
	TS007-TS011	Eligible, Criterion A

Table 3.9-7. List of Historic Properties Included in Visual Impacts Assessment (Cont'd)

State Property Number	Tribal Survey Number(s)	National Register of Historic Places Determination
	TS040	Eligible, Criteria A, C
	TS041-042	Eligible, Criteria A, C
	TS047	Eligible, Criteria A, C
	TS080-089, TS098	Eligible, Criteria A, C
	TS118	Eligible, Criterion A
	TS120	Eligible, Criterion A

(Beaver Creek Bridge, FA00000111), and 28 sites that make up 19 archaeological sites and 9 tribal sites.

Only one historic property located outside the license boundary was included in this review. The Beaver Creek Bridge (Structure FA00000111) is located southwest of the project boundary but falls within the 4.8-km [3-mi] radius from the central processing plant. Two rock art sites in Fall River County (39FA2530, 39FA2531) fell just outside the 4.8-km [3-mi] range for the central processing plant. No other NRHP-listed or eligible properties were identified outside the license boundary.

A review of NRHP listings for the State of Wyoming and state inventory records on file at the Wyoming Cultural Records Office at the University of Wyoming, Laramie, Wyoming, revealed that one NRHP-eligible property was located within a 4.8-km [3-mi] radius of the proposed satellite facility in Wyoming. However, because the environmental setting of this property is not considered to be among the characteristics that contribute to its cultural and historical significance, this property was not included in the line-of-site study and NRC has determined that no further consultation with the Wyoming SHPO is warranted for this project.

3.9.4 Tribal Consultation

The federal government and the State of South Dakota recognize the sovereignty of federally recognized Native American tribes. Pursuant to NHPA Section 106, federal agencies are required to undertake consultation and coordination with each tribal government that may have an interest in a proposed federal action. Consultation with the tribes that have heritage interest in the proposed Dewey-Burdock ISR Project is ongoing. Executive Order 13175 (November 2000), *"Consultation and Coordination with Indian Tribal Governments,"* excludes from the requirements of the order, "independent regulatory agencies, as defined in 44 U.S.C. §3502(5)." However, according to Section 8, "Independent regulatory agencies are encouraged to comply with the provisions of this order." Although the NRC is explicitly exempt from the Order, the Commission remains committed to its spirit. The agency has demonstrated a commitment to achieving the Order's objectives by implementing a case-by-case approach to interactions with Native American tribes. NRC's case-by-case approach allows both NRC and the tribes to initiate outreach and communication with one another.

As part of its obligations under Section 106 of the NHPA and the regulations at 36 CFR 800.2(c)(2)(B)(ii)(A), NRC must provide Indian tribes "a reasonable opportunity to identify its concerns about historic properties, advise on the identification and evaluation of historic properties and evaluation of historic properties, including those of religious and cultural importance, articulate its views on the undertaking's effects on such properties, and participate in the resolution of adverse effects." The NRC identified 23 Native American tribes that attach historical, cultural, and religious significance to sites within the Dewey-Burdock ISR Project area. The NRC continues consultation on historic properties with the following tribes:

- Cheyenne River Sioux Tribe
- Crow Creek Sioux Tribe
- Flandreau Santee Sioux Tribe
- Lower Brule Sioux Tribe
- Oglala Sioux Tribe
- Rosebud Sioux Tribe
- Sisseton-Wahpeton Sioux Tribe
- Standing Rock Sioux Tribe
- Yankton Sioux Tribe
- Three Affiliated Tribes (Mandan, Hidasta, and Arikara Nation)—North Dakota
- Turtle Mountain Band of Chippewa—North Dakota
- Spirit Lake Tribe—North Dakota
- Lower Sioux Indian Community—Minnesota
- Fort Peck Assiniboine and Sioux—Montana
- Northern Cheyenne Tribe—Montana
- Northern Arapaho Tribe—Wyoming
- Eastern Shoshone Tribe—Wyoming
- Ponca Tribe—Nebraska
- Crow Tribe—Montana
- Santee Sioux Tribe—Nebraska
- Omaha Tribe—Nebraska
- Cheyenne and Arapaho Tribes—Oklahoma
- Pawnee Tribe—Oklahoma

NRC staff formally initiated the Section 106 consultation process for the proposed Dewey-Burdock ISR Project by contacting 20 tribal governments by letters dated March 19, 2010 (SEIS Section 1.7.3.5, NRC 2010a). Additional invitations to consult with the NRC concerning the proposed project were sent to tribes on September 10, 2010 and March 4, 2011 (NRC 2010b; NRC 2011). NRC staff invited the tribes to participate as consulting parties in the NHPA Section 106 process and sought their assistance in identifying places of religious and cultural significance and any other cultural resources that may be affected by the proposed action. SEIS Section 1.7.3.5 describes consultation activities undertaken by NRC with tribal governments. Consultation correspondence associated with the Section 106 process is presented in Appendix A. At this time, consultation on the evaluation and effects determination of historic properties is ongoing with all consulting parties, including interested tribes. The outcome of this consultation effort will be included in the programmatic agreement.

3.10 Visual and Scenic Resources

As noted in GEIS Section 3.4.9, the Nebraska-South Dakota-Wyoming Uranium Milling Region is located within the Great Plains physiographic province adjacent to the southern end of the Black Hills. Vegetation within and in the vicinity of the proposed Dewey-Burdock ISR Project area is a mix of short grasses and shrubs typical of semiarid steppe land along with Ponderosa Pine forest toward the Black Hills (Powertech, 2009a). Springtime landscape color varies from light brown and green to dark green with wildflowers; dry winter season colors range from light brown to golden. The proposed project area is located in an undeveloped remote location with most of the land currently being used for grazing activities and associated facilities (e.g., fences, stock wells, and a few stock reservoirs). Infrastructure within the project area includes the BNSF Railroad (see Figure 3.2-1) that runs north through Edgemont toward Newcastle, Dewey Road that parallels the BNSF Railroad to the town of Dewey, overhead electricity lines, and several gravel and dirt access roads.

Elevation within the project area ranges from 1,097 to 1,189 m [3,600 to 3,900 ft] above mean sea level, with the highest elevations along pine breaks that overlap the eastern boundary of the project area (Powertech, 2009a). Topography within the project area and surrounding lands is gently rolling in the western quadrant, with more varied terrain in the pine breaks and dissected hills covering the rest of the project area. Two main streams pass through the proposed project area: Beaver Creek (a perennial stream) and Pass Creek (an ephemeral stream). Pass Creek joins Beaver Creek southwest of the proposed project area. Approximately 4 km [2.5 mi] south of the confluence of Beaver and Pass Creeks, Beaver Creek converges with the Cheyenne River.

Parcels of BHNF are located east and northeast of the proposed project boundary. The BHNF management plan and subsequent amendments have the objective of maintaining 85 percent of the region for low to moderate scenic integrity (USFS, 1997, 2001, 2005). USFS classifies areas that have not been subject to human-caused disturbances that detract from the character of the dominant landscape (e.g., the forested hillsides, towering rock formations, meadows, and tranquil streams that typify the Black Hills landscape) as having a high level of scenic integrity (USFS, 2005). Wind Cave National Park in South Dakota, which is approximately 47 km [29 mi] east of the proposed Dewey-Burdock ISR Project site, is designated a Prevention of Significant Deterioration Class I area. SEIS Section 3.7.2 states that Prevention of Significant Deterioration Class I areas must meet more stringent air quality standards because air quality may impact visual resources.

<u>Visual Resource Management Classes</u>

BLM evaluates the scenic or visual quality of the land it manages using the Visual Resource Inventory to assess the scenic value of a property and ensure that its value is preserved (BLM, 1986). In compiling the inventory, BLM completed a scenic quality evaluation, a sensitivity-level analysis, and a delineation of distance zones for properties; each property or area is assigned to one of four visual resource management (VRM) classes (BLM, 1984). Class I is most protective of visual and scenic resources, and Class IV is least restrictive.

As described in GEIS Section 3.4.9, BLM has assigned most areas in the Nebraska-South Dakota-Wyoming Uranium Milling Region as VRM Classes II through IV. Currently, BLM has not assigned a VRM classification to the region encompassing the proposed Dewey-Burdock ISR Project area. The South Dakota BLM field office resource management plan identifies the natural vegetation of the region as wheatgrass, grama grass, sagebrush, and pine savanna (BLM, 1985). Areas in Wyoming adjacent to the proposed site are identified as VRM Classes III and IV (BLM, 2000).

The applicant conducted a visual resource inventory to determine the scenic quality rating (SQR) of the proposed project area and surrounding 3.2-km [2-mi] area (Powertech, 2009a). The SQR is determined by rating key visual factors (e.g., landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications) according to form, line, color, texture, scale, and space on a comparative scale from zero to five (BLM, 1986). The visual resource inventory was conducted for two SQR units within the proposed project area that demonstrated similar physiographic characteristics. The total scores of the two SQR units were 11 and 13 (Powertech, 2009a). According to NUREG–1569, if the visual resource evaluation rating is 19 or less, no further evaluation or special management of scenic resources is required (NRC, 2003). Based on the scenic quality inventory and evaluation, the applicant classified the project area and the 3.2-km [2-mi] area surrounding the project area as VRM Class IV (Powertech, 2009a). The objective of this class is to manage activities that might require major modifications of the existing character of the landscape (BLM, 1986). The level of change permitted for this class is the least restrictive and can be high.

USFS has performed visual resource classification in the vicinity of the project area as part of its regional forest and grasslands management plans. USFS (2009) classified almost 95 percent of grasslands in Fall River County as having a low to moderate scenic integrity objective. A region with a low scenic integrity objective has a natural landscape that has been moderately altered (USFS, 1974, 1995). While visual changes that dominate the characteristic landscape are permitted, visual changes must be compatible with the forms, lines, colors, and textures of the existing natural surroundings. Landscapes classified as having a moderate scenic integrity objective have undergone only slight alterations; however, new forms, lines, colors, or textures may be introduced to the landscape only as long as changes are visually subordinate to the natural setting (USFS, 1995, 1974).

3.11 Socioeconomics

The proposed Dewey-Burdock ISR Project is located in the Nebraska-South Dakota-Wyoming Uranium Milling Region. General socioeconomic factors associated with this region are described in GEIS Section 3.4.10 (NRC, 2009a). Socioeconomic region of influence (ROI) is defined as the area where employees and their families will reside, spend their income, and use their benefits, thereby affecting the economic conditions in the region. This section describes current socioeconomic conditions and local community services within the ROI surrounding the proposed site that may be directly or indirectly affected by the proposed project. The proposed ISR facility and the local people and communities that will support it are expected to function (or form) as a dynamic socioeconomic system. Existing communities will provide the people, goods, and services required to construct and operate the facility. The construction and operation of the proposed facility is expected to create demand for employees, goods, and services. Personal income from wages and benefits will be spent on goods and services within other sectors of the communities and create additional opportunities for employment and income.

The proposed project is located in a rural portion of Fall River and Custer Counties, South Dakota. The existing communities that are expected to be part of an expanded socioeconomic system include (i) Edgemont (population 774) in Fall River County, located 21 km [13 mi] southeast of the site; (ii) the city of Hot Springs (population 3,711), located 64 km [40 mi] east in Fall River County; (iii) the city of Custer (population 2,067) in Custer County, located 80 km [50 mi] northeast of site; and (iv) Newcastle (population 3,532) in Weston, Wyoming, located 64 km [40 mi] north-northwest of the site (see Figure 1.1-1). Rapid City in Pennington County, South Dakota, located 100 km [62 mi] northeast of the site, is the closest urban area with a population of 67,956 (USCB, 2012).

Most construction and operations workers for the proposed Dewey-Burdock ISR Project will come from the surrounding communities of Edgemont, Hot Springs, and Custer in South Dakota. Additional workers are expected to come from Newcastle in Wyoming and other smaller communities within an 80-km [50-mi] radius of the proposed project site. An 80-km [50-mi] radius is likely the maximum commuting distance for employees (Powertech, 2009a). It is anticipated the majority of workers will reside near the proposed facility; therefore, Custer and Fall River Counties in South Dakota and Weston County in Wyoming are expected to experience the most significant socioeconomic changes. Rapid City in Pennington County, the largest city in the region, is expected to be an important source of equipment, supplies, services, and workers (Powertech, 2009a). Because Rapid City is 100 km [62 mi] from the project site, it is not expected to be directly within the Dewey-Burdock ROI.

The demographics of income, housing, employment structure, local finance, and education and public services in the ROI surrounding the proposed site are discussed next.

The demographic, income, housing, and other socioeconomic data reported in the GEIS were based on 2000 USCB data. The socioeconomic information in this SEIS incorporates 2000 and 2010 USCB (2012) data, as well as more recent reports; the USCB 2006–2010 American Survey 5-Year Estimates (USCB, 2012); and the USCB State and County QuickFacts (USCB, 2012).

3.11.1 Demographics

Population changes and projections for Custer and Fall River Counties in South Dakota and Weston County in Wyoming are shown in Table 3.11-1.

The population in Fall River County fell approximately 5 percent between 2000 and 2010, in comparison to approximately 9 and 13 percent gains in Weston and Custer Counties,

Table 3.11-1. Total Population and Percent Growth in Custer and Fall River Counties, South Dakota, and Weston County, Wyoming, 2000 to 2020

County/Town	Population			
	2000 Census	2010 Census	Percent Change	2020 Population Projections
Custer	7,275	8,216	+12.9	8,186
Custer City	1,860	2,067	+11.1	Not available
Fall River	7,453	7,094	-4.8	7,423
Edgemont	867	774	-10.7	Not available
Hot Springs	4,129	3,711	-10.1	Not available
Weston	6,644	7,208	+8.5	7,900
Newcastle	3,065	3,532	+15.2	3,871
Source: USCB, 2012; Brooks, 2008; WDAI, 2011				

respectively, over the same period. The Weston County population is expected to grow at a similar rate over the next decade (WDAI, 2011). Fall River and Custer Counties are expected to remain relatively stagnant through 2020 (Brooks, 2008). County population densities in 2010 ranged from 1.2 people per km² [3.0 people per mi²] in Weston County to 2.0 people per km² [5.3 people per mi²] in Custer County (Table 3.11-2).

The demographic profile for Custer and Fall River Counties in South Dakota and Weston County in Wyoming is presented in Table 3.11-2. All three counties have predominately white populations. American Indian/Alaskan Native and Hispanic/Latino (of any race) make up the main minority groups, although in small numbers. In 2010, minorities (race and ethnicity combined) comprised between 7 and 14 percent of the 3 counties that lie within the ROI.

3.11.2 Income

Income information for the ROI is presented in Table 3.11-3. According to USCB data, 2010 median household and per capita incomes were higher in Custer County, South Dakota, and Weston County, Wyoming, than in Fall River County, South Dakota (USCB, 2012). The average income levels in all three counties were lower than the statewide averages. Seventeen percent of the Fall River County population and 11 percent of Fall River County families live at or below the official poverty level (USCB, 2012). Approximately 8 percent of the population of Weston County and 10 percent of the population of Custer County live below the poverty level (USCB, 2012).

Table 3.11-2. Demographic Profile of the 2010 Population in Custer and Fall River Counties, South Dakota, and Weston County, Wyoming

Population Category	Custer County	Fall River County	South Dakota	Weston County	Wyoming
Race (percent of total population, not Hispanic or Latino)					
White	92.8	87.4	84.7	93.8	85.9
Black/African American	0.2	0.6	1.2	0.2	0.8
American Indian, Alaskan Native	2.8	6.7	8.5	1.2	2.1
Asian	0.3	0.4	0.9	0.3	0.8
Native Hawaiian, Pacific Islander	0.0	0.0	0.0	0.0	0.1
Some other race	0.0	0.0	0.1	0.0	0.1
Two or More Races	1.7	2.6	1.8	1.4	1.5
Ethnicity					
Hispanic or Latino (number of people)	182	159	22,119	216	50,231
Percent of total population	2.2	2.2	2.7	3.0	8.9
Minority Population (including Hispanic or Latino ethnicity)					
Total minority population	592	895	124,678	446	79,752
Percent minority	7.2	12.6	15.3	6.2	14.1
2010 Population Density (per Km²/Mi²)					
	2.0/5.3	1.6/4.1	4.1/10.7	1.2/3.0	2.2/5.8
Source: USCB, 2012					

Table 3.11-3. 2010 Income Information for Counties Within the Region of Influence

	Custer County	Fall River County	South Dakota	Weston County	Wyoming
Median Household Income (Annual Dollars)	46,743	35,833	46,369	53,853	53,802
Per Capita Income (Annual Dollars)	24,353	21.574	24,110	28,463	27,860
Families living below the poverty level (Percent)	4.3	11.4	8.7	5.8	6.2
Persons Below the Poverty Level (Percent)	9.7	17.4	13.7	7.9	9.8
Source: USCB, 2012.					

3.11.3 Housing

Housing data for the proposed Dewey-Burdock ISR Project ROI, including occupied and vacant units, vacancy rates, and median house values, are provided in Table 3.11-4. Of the more than 12,300 housing units in the ROI, which include single family homes, multifamily housing, mobile homes, and rental units, approximately 10,000 are occupied (USCB, 2012). Average annual vacancy rates in 2010 were approximately 21 percent in Custer and Fall River Counties, up from 18 percent in 2000. Vacancy rates decreased 23 percent in Weston County between 2000 and 2010. The median value of owner-occupied housing units is $160,700 in Custer County, $86,800 in Fall River County, and $115,200 in Weston County (USCB, 2012).

Based on the 2010 USCB housing information, Fall River County had an estimated 4,191 housing units, an increase of 10 percent over the 2000 data (USCB, 2012). In comparison, Custer County had an approximate 30 percent increase in total housing units since 2000, with a total of 4,628 units in 2010. The 2010 estimated data for Weston County indicated a slight increase in housing units since the 2000 census, with an increase of 9 percent (302 additional units).

3.11.4 Employment Structure

Based on information from the South Dakota Department of Labor (SDDOL), the total county labor force in April 2012 was estimated to be 4,390 for Custer County and 3,660 for Fall River County (SDDOL, 2012). Weston County had a smaller estimated labor force of 3,308 (Wyoming Department of Workforce Services, 2012). Unemployment rates for Custer and Fall River Counties were 5.0 and 4.7 percent, respectively, which slightly exceeded the statewide rate of 4.3 percent (SDDOL, 2012). The unemployment rate in Weston County was 5.1 percent, which approximately matched the statewide unemployment rate of 5.3 percent in Wyoming (Wyoming Department of Workforce Services, 2012).

The largest employment sector for both Custer and Fall River Counties in 2010 was government (local, state, or federal), which accounted for about 32 percent of the covered work force in South Dakota (SDDOL, 2012). Private sector employment involving 10 percent or more of the work force falls into three major categories: (i) leisure/hospitality, which includes the arts, entertainment, recreation, food service, and accommodations; (ii) trade/transportation/utilities, which includes retail, wholesale, transportation, warehousing, and utilities; and (iii) education and health services (SDDOL, 2012). The largest source of employment in Weston County in 2010 was agriculture, forestry, fishing and hunting, and mining, accounting for 24 percent of all

Table 3.11-4. Housing in Custer and Fall River Counties, South Dakota, and Weston County, Wyoming

Custer County			
	2000	**2010**	**Percent Change**
Total	3,624	4,628	+27.7
Occupied Housing Units	2,970	3,636	+22.4
Vacant Units	654	992	+51.7
Vacancy Rate (Percent)	18	21.4	+18.9
Median Value (Dollars)	89,100	160,700	+80.4
Fall River County			
	2000	**2010**	**Percent Change**
Total	3,812	4,191	+9.9
Occupied Housing Units	3,127	3,272	+4.6
Vacant Units	685	919	+34.2
Vacancy Rate (Percent)	18	21.9	+21.7
Median Value (Dollars)	54,300	86,800	+59.9
Weston County			
	2000	**2010**	**Percent Change**
Total	3,231	3,533	+9.3
Occupied Housing Units	2,624	3,021	+15.1
Vacant Units	607	512	-15.7
Vacancy Rate (Percent)	18.8	14.5	-22.9
Median Value (Dollars)	66,700	115,200	72.7
Source: USCB, 2012			

employment. Government-related jobs supported approximately 20 percent of the work force. Private sector retail trade accounted for 11 percent of the work force (USCB, 2012).

3.11.5 Local Finance

South Dakota does not impose a state income tax on its citizens or businesses. The majority of state revenue is generated from the 4 percent statewide sales and use taxes, and county and municipal sales and use taxes. The South Dakota Department of Revenue and Regulation (SDDRR) collects taxes at the state level, including (i) sales, use, and contractor's excise taxes; (ii) special taxes; (iii) motor vehicle fuel taxes; and (iv) motor vehicle fees and taxes (SDDRR, 2011). Towns with a municipal sales and use tax may also impose up to 1 percent gross receipts tax on various sales, including lodging, restaurant meals, alcoholic beverages, and admissions to places of amusement and cultural and sports events, and sales and use tax up to 2 percent which applies to all products and services that are subject to the state sales or use tax (SDDRR, 2011). Local governments are solely responsible for collection of property taxes, which are the primary source of funding for school systems and county, municipal, and other local government units. The 2011 taxable valuation of all property in Custer and Fall River Counties was $763 million and $416 million, respectively (SDDRR, 2012a). Gross sales totaled

$165 million for Custer County and $134 million for Fall River County (SDDRR, 2012b). Based on the 4 percent state sales and use tax, sales and tax revenues totaled $6.6 million for Custer County and $5.4 million for Fall River County.

Wyoming does not impose a corporate income or personal income tax. Wyoming has a 4 percent sales tax, and counties may tax lodging services up to 4 percent. Counties have the option of collecting an additional 1 percent sales tax for general purposes. Weston County has a 5 percent sales and use tax (4 percent state base tax and a 1 percent optional county tax) and a 4 percent lodging tax (Wyoming Department of Revenue, 2012). The approximate 2011 taxable valuation for all property in Weston County was $117 million (Weston County Assessor, 2012), and all sales and use tax revenues totaled $11.2 million (Wyoming Department of Revenue, 2012).

In addition to property taxes local governments collect, the states of Wyoming and South Dakota levy taxes on the value of the mineral production (a severance tax). Wyoming levies a uranium mining severance tax of 4 percent (Wyoming Statute, 2011). South Dakota levies an energy minerals severance tax on uranium of 4.5 percent (South Dakota Statute, 2012), as well as an additional conservation tax of 0.24 percent on the taxable value of any mineral produced from mineral extraction operations (South Dakota Statute, 2012).

3.11.6 Education

Five public school districts (kindergarten through 12th grade) are located in Custer and Fall River Counties: Custer School District, Elk Mountain School District, Hot Springs School District, Oelrichs School District, and Edgemont School District (SDDOE, 2010). There are approximately 2,024 students enrolled in Custer and Fall River County schools (kindergarten through 12th grade) (Table 3.11-5).

Public schools in Wyoming are generally organized at the county or subcounty level by school district. The school districts closest to the proposed project area are Weston County School District #1, with four kindergarten through 12th grade schools located in Newcastle, and Weston County School District #7, with three kindergarten through 12th grade schools located in Upton. There are approximately 1,043 students in county school districts in Weston County (Wyoming Department of Education, 2010).

The nearest postsecondary schools to the proposed project are located in Rapid City, 161 km [100 mi] to the northeast. Western Dakota Technical Institute (WDTI), South Dakota School of Mines and Technology (SDSMT), and the Rapid City Campus of the National American University (NAU) are located in Rapid City.

3.11.7 Health and Social Services

Medical facilities and health services in the ROI are listed in Table 3.11-6. Hospitals are located in Hot Springs, Custer City, and Newcastle. Fall River Hospital in Hot Springs is a 25-bed acute care facility providing emergency, laboratory, and surgical services. Custer Regional Hospital in Custer City is an 11-bed acute care facility that provides 24-hour emergency service, inpatient, and outpatient care. Weston County Health Services in Newcastle has a 21-bed hospital offering inpatient hospital service and acute care services including 24-hour emergency care and complete laboratory services.

Table 3.11-5. School Districts in Counties Located Within 80 km [50 mi] of the Proposed Dewey-Burdock ISR Project

School Districts in Custer and Fall River Counties, South Dakota	
Custer	
Number of students enrolled (K-12)	882
Number of schools	6
Student-teacher ratio	12
Elk Mountain	
Number of students enrolled (K-12)	26
Number of schools	1
Student-teacher ratio	10
Hot Springs	
Number of students enrolled (K-12)	840
Number of schools	3
Student-teacher ratio	14
Oelrichs	
Number of students enrolled (K-12)	126
Number of schools	3
Student-teacher ratio	7
Edgemont	
Number of Students enrolled (K-12)	150
Number of schools	2
Student-teacher ratio	10
School Districts in Weston County, Wyoming	
Weston County #1	
Number of students enrolled (K-12)	778
Number of schools	4
Student-teacher ratio	11
Weston County #7	
Number of students enrolled (K-12)	265
Number of schools	3
Student-teacher ratio	10
Sources: SDDOE, 2010; Wyoming Department of Education, 2010	

Primary and family medical care in the ROI is provided by the Fall River Health Clinic in Hot Springs, the Custer Regional Clinic in Custer City, the Edgemont Regional Clinic in Edgemont, and Weston County Health Services in Newcastle. The South Dakota Department of Health has Offices of Family and Community Health Services in Hot Springs and Custer City. These offices provide primary and preventative programs and services including immunizations, well child checkups and screenings, Supplemental Nutrition Program for Women, Infants, and Children (WIC), family planning and reproductive health, prenatal health, and health screenings

Table 3.11-6. Hospitals, Clinics, and Health Services in Hot Springs, Custer City, and Edgemont, South Dakota, and Newcastle, Wyoming

Hospitals	Location
Fall River Hospital	Hot Springs, South Dakota
Custer Regional Hospital	Custer City, South Dakota
Weston County Health Services	Newcastle, Wyoming
Clinics	**Location**
Fall River Health Clinic	Hot Springs, South Dakota
Custer Regional Clinic	Custer City, South Dakota
Edgemont Regional Clinic	Edgemont, South Dakota
Weston County Health Services	Newcastle
Health Services	**Location**
Office of Family and Community Health Services	Hot Springs, South Dakota; Custer City, South Dakota
Public Health Nursing	Newcastle, Wyoming
Behavioral Management Systems	Hot Springs, South Dakota

for adults. The Wyoming Department of Health has a Public Health Nursing Office in Newcastle. This office provides primary and preventative health services including family planning, immunizations, WIC, and maternal and family health. Behavioral Management Systems in Hot Springs provides a range of behavioral and mental health services and programs for area residents.

Police, fire department, and ambulance services in the ROI are listed in Table 3.11-7. Fall River, Custer, and Weston Counties have county sheriff's offices in Hot Springs, Custer City, and Newcastle, respectively. Hot Springs and Newcastle also have police departments.

Table 3.11-7. Police, Fire Department, and Ambulance Services in Hot Springs, Custer City, and Edgemont, South Dakota, and Newcastle, Wyoming

Police	Location
Fall River County Sheriff	Hot Springs, South Dakota
Hot Springs Police Department	Hot Springs, South Dakota
Custer County Sheriff	Custer City, South Dakota
Weston County Sheriff	Newcastle, Wyoming
Newcastle Police Department	Newcastle, Wyoming
Fire Departments	
Cascade Volunteer Fire Department	Hot Springs, South Dakota
Minnekahta Volunteer Fire Department	Hot Springs, South Dakota
Custer Volunteer Fire Department	Custer City, South Dakota
Edgemont Volunteer Fire Department	Edgemont, South Dakota
Newcastle Volunteer Fire Department	Newcastle, Wyoming
EMS/Ambulance	
Hot Springs Volunteer Ambulance Service	Hot Springs, South Dakota
Custer Ambulance Service	Custer City, South Dakota
Edgemont Ambulance Service	Edgemont, South Dakota
Newcastle Ambulance Service	Newcastle, Wyoming
Weston County Health Services	Newcastle, Wyoming

Volunteer fire departments and emergency medical services are located in Hot Springs, Custer City, Edgemont, and Newcastle. The South Dakota Department of Social Services has local offices in Hot Springs and Custer City. These offices provide assistance with applying for programs including Supplemental Nutrition Assistance Program (SNAP) and Temporary Assistance for Needy Families (TANF). These offices also provide assistance with medical eligibility resources for children and families, long-term care, and medical saving programs. The Wyoming Department of Family Services has a local office in Newcastle, which provides assistance for connecting with community resources, reporting child and adult abuse and neglect, and applying for programs including SNAP, TANF, and Medicaid.

3.12 Public and Occupational Health

Baseline radiation levels in and around the proposed Dewey-Burdock ISR Project area are summarized in this section. Descriptions of these levels are known as "preoperational" or "baseline" radiological conditions, and they would be used to evaluate potential radiological impacts associated with ISR operations. This section also describes applicable safety criteria and radiation dose limits established for public protection and occupational health and safety.

Radiation dose is a measure of the amount of ionizing energy that is deposited in the body. Ionizing radiation is a natural component of the environment and ecosystem, and members of the public are exposed continuously to natural radiation. Radiation doses to the general public result from radioactive materials in the Earth's soils, rocks, and minerals. Rn-222 is a radioactive gas found in most soils and rocks that escapes into ambient air as part of the natural decay of uranium and its progeny, Ra-226. Low levels of naturally occurring uranium and radium are present in drinking water and food products. Cosmic radiation from outer space is another natural source of radiation. In addition to natural sources of radiation, there are also artificial or human-made sources that contribute to the dose the general public receives. Medical diagnostic procedures using radioisotopes and x-rays are a primary human-made radiation source. The National Council for Radiation Protection (NCRP) estimates the average annual total effective dose equivalent from natural background radiation sources, including terrestrial and cosmic, is approximately 3.1 millisieverts (mSv) [310 millirem (mrem)] for U.S. residents, although the dose varies by location and elevation (NCRP, 2009). The average dose to the general public from background radiation sources in South Dakota is 6 mSv/yr [600 mrem/yr], due to higher elevation and higher than average concentrations of naturally occurring uranium in the soil in South Dakota (EPA, 2006b). The GEIS, however, reported that although background radiation levels in South Dakota are significantly higher than the national average, background radiation levels in western South Dakota are close to the national average because of lower-than-state-average radon gas levels (NRC, 2009a). The annual average dose to the public from all sources (natural and manmade) is 6.2 mSv [620 mrem] (NRCP, 2009).

3.12.1 Baseline Radiological Conditions

In accordance with NRC regulations at 10 CFR Part 40, Appendix A, Criteria 7 and 7A, the applicant developed and implemented a preoperational monitoring program to establish baseline radiological conditions at the proposed Dewey-Burdock ISR Project site (Powertech, 2009a). Results of the baseline radiological monitoring provide data on radiological conditions that will be used to evaluate future impacts of routine facility operations or accidental or unplanned releases, if a license is issued. The applicant followed guidance in NUREG–1569 (NRC, 2003) and NRC Regulatory Guide 4.14 (NRC, 1980) to establish preoperational radiological baseline conditions at the proposed site (Powertech, 2009a, 2011).

The applicant performed baseline radiological surveys and sampling at the site between August 2007 and July 2008 (Powertech, 2009a). The baseline radiological field investigations consisted of the following activities:

- Global positioning system (GPS)-based unshielded gamma-ray surveys at 100-m [328-ft] transect intervals in historical surface mine areas in the eastern portion of the proposed project area, 100-m [328-ft] transect intervals in proposed land application areas, and 500-m [1,640-ft] intervals in the remainder of the proposed project area (Figure 3.12-1). The purpose of the gamma-ray survey was to map ambient gamma radiation levels across the proposed site and identify areas for biased soil sampling.
- Surface soil 0–15 cm [0–6 in] sampling at 75 random and 5 biased locations spanning the proposed project area, and subsurface soil {15–30 cm [6–12 in] and 30–100 cm [12–39 in]} sampling at 9 random locations.
- Surface soil 0–15 cm [0–6 in] and subsurface soil {15–30 cm [6–12 in] and 30–100 cm [12–39 in]} sampling at 17 random locations in proposed land application areas.
- Sediment and surface water sampling from primary stream drainage areas and surface water impoundments.
- Shallow surface soil {0–5 cm [0–2 in]}, vegetation, and air particulate sampling at eight air monitoring stations {seven onsite stations and one located approximately 3 km [1.9 mi] west of the southwest corner of the proposed project area}.
- Radon monitoring in air at the eight air monitoring stations and eight additional locations within the proposed project area.
- Radon flux measurements at the nine random subsurface soils sampling locations (see second bullet).
- Ambient gamma and radon monitoring using thermoluminescent dosimeters (TLDs) for total ambient gamma and alpha track etch detectors for radon.
- Livestock sampling, consisting of samples from two locally grazing cows and one pig (Powertech, 2011).
- Fish sampling at two locations on Beaver Creek (one upstream and one downstream of the proposed project area) and one location on the Cheyenne River downstream of its confluence with Beaver Creek.
- Groundwater sampling at 31 wells within the proposed project area.

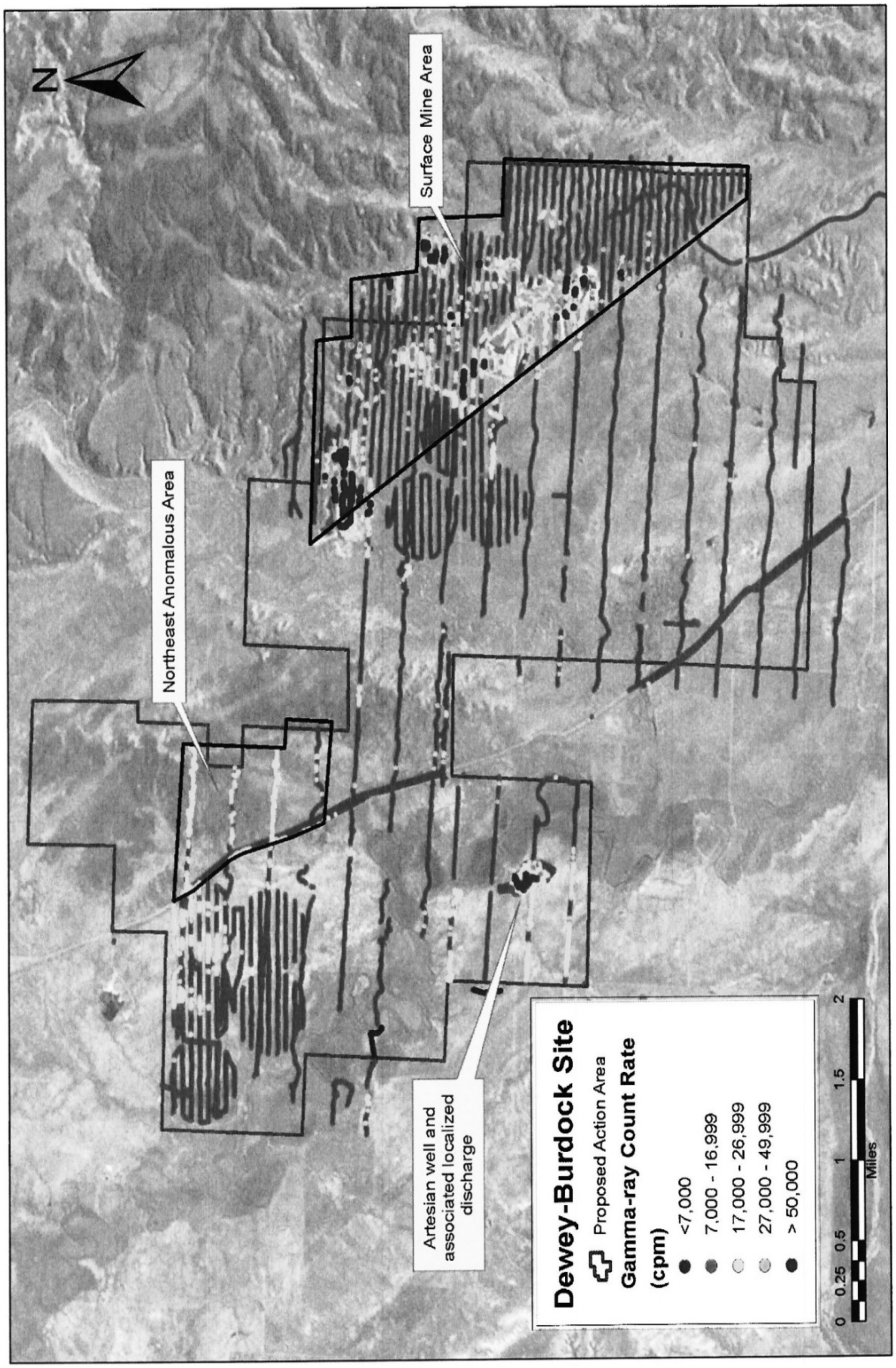

Figure 3.12-1. Map Showing Gamma-Ray Count Rates Obtained From Global Positioning Systyem-Based Gamma Survey at the Proposed Dewey-Burdock Project Site Source: Powertech (2009a)

3.12.1.1 Soils

The objective of the gamma-ray surveys is to characterize and quantify baseline or preoperational radiation levels and radionuclide concentrations in soils throughout the proposed project area. Results of the gamma-ray surveys are shown in Figure 3.12-1, and summary statistics for surface mine areas, proposed land application areas, and the remainder of the permit area are presented in Table 3.12-1. In the surface mine areas, gamma-ray count rates range from 5,550 to 460,485 counts per minute (cpm) [5.9 to 324 μrem/hr]. The mean count rate is 16,823 cpm [13.8 μrem/hr], and the median count rate is 12,717 cpm [10.9 μrem/hr]. Clusters of higher readings are associated with abandoned open pit uranium mines, waste rock, and drainages in the surface mine area (Powertech, 2009a). In areas where land application is proposed, gamma-ray readings range from 6,798 to 20,422 cpm [6.8 to 16.3 μrem/hr] with a median of 12,523 cpm [10.8 μrem/hr] in the Dewey area and from 8,498 to 24,248 cpm [8.0 to 19.0 μrem/hr] with a median of 12,232 cpm [10.6 μrem/hr] in the Burdock area. In the remainder of the proposed permit area, gamma-ray readings range from 5,883 to 171,243 cpm [6.1 to 121.9 μrem/hr] with a median similar to the proposed land application areas {12,664 cpm [10.9 μrem/hr]}. High count rates {i.e., count rates exceeding 17,000 cpm [13.9 μrem/hr]} are present in an 243-ha [600-ac] area located in the northern portion of the Dewey area and in the area of an artesian well and associated drainage in the southern part of the Dewey area (see Figure 3.12-1). The gamma-ray survey results presented in Figure 3.12-1 and Table 3.12-1 indicate the surface mine areas in the eastern and northeastern portions of the Burdock area have higher radiological measurements due to historic mining activities. Anomalous (i.e., high) gamma-ray readings identified in the southern part of the Dewey area in the area of an artesian well are likely due to discharging groundwater from the Inyan Kara aquifer. Anomalous gamma readings in the northern part of the Dewey area are likely caused by the deposition of windblown dust from surface mine areas to the southeast in the Burdock area.

All surface soil samples were analyzed for Ra-226, and selected samples focusing on roll-front areas and land application areas were analyzed for uranium, Th-230, and Pb-210 (Powertech, 2009a, Table 6.1-5). Over the entire permit area, the mean and median Ra-226 concentrations for surface soils samples are 0.107 and 0.048 Bq/g [2.9 and 1.3 pCi/g], respectively. The median Ra-226 concentration of 25 surface soil samples in surface mine areas was 0.052 Bq/g [1.4 pCi/g]. Five of the surface mine soil samples were biased samples used to determine the range of Ra-226 concentrations in soil; the concentrations in the biased samples exceeded 0.22 Bq/g [5.9 pCi/g] (Powertech, 2011). The median Ra-226 concentration of 55 surface soils samples in the remainder of the permitted area was 0.048 Bq/g [1.3 pCi/g]. Based on statistical

Table 3.12-1. Summary Statistics of Gamma-Ray Count Rates in Proposed Land Application Areas, Surface Mine Areas, and the Remainder of the Permit Area at the Proposed Dewey-Burdock Project

Parameter	Land Application Area		Surface Mine Area	Remainder of Permit Area
	Dewey	Burdock		
Mean	12,815	12,308	16,823	13,073
Standard Deviation	1,940	1,318	23,377	2,995
Median	12,523	12,232	12,717	12,664
Mode	11,778 (n=15)	12,266 (n=16)	12,138 (n=31)	12,585 (n=35)
Minimum	6,798	8,498	5,550	5,883
Maximum	20,422	24,248	460,485	171,243
No. of Counts	23,480	13,647	81,757	75,345
Source: Powertech (2009a)				

analysis using the interquartile range (IQR), three of these samples were identified as outliers exceeding a concentration of 0.096 Bq/g [2.6 pCi/g] (Powertech, 2011). The IQR is a measure of statistical dispersion and is equal to the difference between the third quartile (75th percentile) and the first quartile (25th percentile). With outliers removed, both the surface mine data and the wider permit area data sets fit a lognormal distribution. The geometric mean of both data sets is 0.048 Bq/g [1.3 pCi/g], and the data lie within a population range of 0.028 to 0.081 Bq/g [0.76 to 2.2 pCi/g]. For comparison, background Ra-226 levels in soil in the United States typically average 0.037 Bq/g [1.0 pCi/g] (NCRP, 2009). In areas where land application is proposed, Ra-226 concentrations range from 0.015 to 0.163 Bq/g [0.4 to 4.4 pCi/g] and average 0.048 and 0.030 Bq/g [1.3 and 0.8 pCi/g] in the Dewey and Burdock areas, respectively. Results for the other radionuclides indicate a positive relationship between the concentrations of Ra-226 and uranium, Th-230, and Pb-210. Uranium concentrations range from 0.014 to 2.48 Bq/g [0.37 to 67 pCi/g]. Th-230 concentrations range from 0.004 to 1.11 Bq/g [0.1 to 30 pCi/g]. Pb-210 concentrations range from 0.018 to 1.11 Bq/g [0.5 to 30 pCi/g] (Powertech, 2009a). Prior to operations, the applicant has committed to collect 15 additional surface soil samples {0–15 cm [0–6 in]} in the Dewey area to address differences in sample density between the Dewey and Burdock area (Powertech, 2011). The applicant will also collect surface soils samples at two air monitoring stations (AMS-08 and AMS-09 as depicted in Figure 7.2-1) prior to operations (Powertech, 2012b).

All subsurface soil samples were analyzed for Ra-226, uranium, Th-230, and Pb-210 (Powertech, 2009a, Table 6.1-5). In surface mine areas and within the broader permit area, subsurface Ra-226 concentrations range from 0.026 to 0.207 Bq/g [0.7 to 5.6 pCi/g] and are comparable to those observed in surface samples. In land application areas, Ra-226 concentrations in subsurface soils range from 0.015 to 0.152 Bq/g [0.4 to 4.1 pCi/g] and have a median of 0.037 Bq/g [1.0 pCi/g] in the Dewey area and a median of 0.030 Bq/g [0.8 pCi/g] in the Burdock area. Ra-226 concentrations in subsurface soils in the land application areas are comparable to surface soil samples, with no observed trends with depth (Powertech, 2009a).

3.12.1.2 Sediment and Surface Water

Sediment and surface water samples were collected from upstream and downstream sites on three primary streams (Beaver Creek, Pass Creek, and the Cheyenne River), sites on two ephemeral drainages, and impoundments (including stock ponds and open pit mines) within the proposed project area (Powertech, 2009a, Figure 6.1-12). Sediment samples were analyzed for Ra-226, uranium, Th-230, and Pb-210 (Powertech, 2009a, Table 6.1-8). Uranium concentrations in sediments range from 1.0 to 37 mg/kg [1.0 to 37 ppm] and average 5.5 mg/kg [5.5 ppm]. Ra-226 concentrations range from 0.015 to 0.32 Bq/g [0.4 to 8.6 pCi/g] and average 0.06 Bq/g [1.6 pCi/g]. Th-230 concentrations range from 0.015 to 0.29 Bq/g [0.4 to 7.8 pCi/g] and average 0.06 Bq/g [1.6 pCi/g]. Pb-210 concentrations range from 0.007 to 0.35 Bq/g [0.2 to 9.6 pCi/g] and average 0.08 Bq/g [2.2 pCi/g]. Sediment samples from the Darrow Mine Pit and Triangle Mine Pit (see SEIS Section 3.2.3 and Figure 3.2-3), which are historical open pit uranium mines, exhibit the highest radionuclide concentrations. Sediment samples from the Darrow Mine Pit and Triangle Mine Pit have average uranium concentrations of 34.5 and 18.5 mg/kg [34.5 and 18.5 ppm]; average Ra-226 concentrations of 0.25 and 0.10 Bq/g [6.9 and 2.6 pCi/g]; average Th-230 concentrations of 0.25 and 0.18 Bq/g [6.85 and 4.85 pCi/g]; and average Pb-210 concentrations of 0.25 and 0.11 Bq/g [6.8 and 2.95 pCi/g], respectively (Powertech, 2009a).

Radionuclides measured in surface water samples included gross alpha, Ra-226, uranium, and Pb-210. Summary statistics for these radionuclides at stream sampling locations are listed in Table 3.5-1. More than half of the stream samples from Beaver Creek and the Cheyenne River exceed the EPA-regulated MCL for gross alpha {555 Bq/m^3 [15 pCi/L]} in drinking water, as established in 40 CFR Part 141. Gross alpha concentrations range from 85 to 2,435 Bq/m^3 [2.3 to 65.8 pCi/L]. Total uranium concentrations range from 0.003 to 0.0378 mg/L [0.003 to 0.0378 ppm] with four of the samples from the Cheyenne River exceeding the EPA-regulated MCL for total uranium of 0.03 mg/L [0.03 ppm]. Total Ra-226 concentrations range from 0 to 189 Bq/m^3 [0 to 5.1 pCi/L] with one sample from Beaver Creek and one sample from the Cheyenne River exceeding the EPA-regulated MCL for total Ra-226 of 185 Bq/m^3 [5.0 pCi/L]. EPA's proposed MCL for Pb-210 of 37 Bq/m^3 [1.0 pCi/L] (EPA, 2000) was exceeded in 2 samples from Beaver Creek and 3 samples from the Cheyenne River. With the exception of gross alpha and uranium concentrations in the Darrow Mine Pit and the Triangle Mine Pit, water samples from impoundments at the proposed project demonstrate concentrations at or below EPA's proposed MCLs (Powertech, 2009a, Appendix 6.1–D). Uranium concentrations averaged 5.89 and 0.18 mg/L [5.89 and 0.18 ppm] at the Darrow Mine Pit and Triangle Mine Pit, respectively. Gross alpha concentrations averaged 205,091 and 5,513 Bq/m^3 [5,543 and 149 pCi/L] at the Darrow Pit Mine and the Triangle Mine Pit, respectively (Powertech, 2009a).

The applicant has committed to relocating upstream and downstream sediment and surface water sampling locations on Beaver Creek and Pass Creek closer to the proposed project boundary to better meet guidance in Regulatory Guide 4.14 (Powertech, 2011). Stream sampling sites BVC01, BVC04, PSC01, and PSC02 used for baseline monitoring (see Figure 3.5-2) will be replaced with sampling sites BVC11, BVC14, PSC11, and PSC12, which are located closer to the proposed project boundary (see Figure 7.2-2). Samples for each of these stream sampling sites will be collected monthly for 12 consecutive months prior to ISR operations (Powertech, 2011). The applicant's preoperational and operational surface water monitoring programs are discussed in SEIS Sections 7.2.4 and 7.3.3.

3.12.1.3 Air (Ambient Gamma, Radon, and Particulates)

TLDs were placed at each of the eight air monitoring stations established for the Dewey-Burdock ISR Project to measure ambient gamma dose rates. Based on the gamma dose rate monitoring results, projected exposure rates at the sample locations range from 0.91 to 1.23 mSv/yr [91 to 123 mrem/yr] with an average of 1.09 mSv/yr [109 mrem/yr] (Powertech, 2011, Table TR RAI 2.9-10). These values are within the range of reported background levels from natural radiation sources in the region and the United States, including cosmic radiation, external terrestrial radiation, and naturally occurring radon (NCRP, 2009).

Radtrack passive track etch detectors were placed at each of the eight air monitoring station locations and at eight additional locations to measure ambient Rn-222 concentrations in air. Rn-222 concentrations were measured quarterly over a 1-year period (Powertech, 2009a, Table 6.1-11). Period 1 (August 14 to September 27, 2007) ambient radon concentrations ranged from 37 to 363 Bq/m^3 [1.0 to 9.8 pCi/L] and averaged 89 Bq/m^3 [2.4 pCi/L]. Period 2 (September 27, 2007, to February 1–12, 2008) concentrations ranged from 15 to 67 Bq/m^3 [0.4 to 1.8 pCi/L] and averaged 44 Bq/m^3 [1.2 pCi/L]. Period 3 (February 1 through 12 to May 17, 2008) concentrations ranged from 15 to 122 Bq/m^3 [0.4 to 3.3 pCi/L] and averaged 67 Bq/m^3 [1.8 pCi/L]. Period 4 (May 17 to July 17, 2008) concentrations ranged from 18 to 38 Bq/m^3 [0.5 to 0.8 pCi/L] and averaged 18 Bq/m^3 [0.5 pCi/L]. The reported average ambient Rn-222 concentrations are within the range of background levels reported for the region (NCRP, 2009). Based on the gamma-ray survey results described in SEIS Section 3.12.1.1, radon concentrations adjacent to abandoned mine areas are expected to be higher than in other areas of the site. However, there was only one measurement {363 Bq/m^3 [9.8 pCi/L]} where this was the case, which resulted in the higher average radon concentration of 89 Bq/m^3 [2.4 pCi/L] during Period 1 (August 14 to September 27, 2007). To supplement background Rn-222 concentration data at the project site, the applicant will collect Rn-222 samples continuously for one year at three air monitoring stations (AMS-BKG, AMS-08, and AMS-09 as depicted in Figure 7.2-1) using passive track etch detectors (Powertech, 2012b). The detectors will be exchanged quarterly.

Radon flux rates were measured at nine locations on three occasions in mapped roll-front areas within the proposed project area. In fall (September) 2007, flux rates ranged from 0.025 to 0.065 Bq/m^2-s [0.68 to 1.77 pCi/m^2-s] and averaged 0.045 Bq/m^2-s [1.22 pCi/m^2-s] (Powertech, 2009a, Table 6.1-14). In spring (April) 2008, flux rates ranged from 0.010 to 0.049 Bq/m^2-s [0.28 to 1.33 pCi/m^2-s] and averaged 0.027 Bq/m^2-s [0.74 pCi/m^2-s]. In summer (July) 2008, flux rates ranged from 0.018 to 0.088 Bq/m^2-s [0.48 to 2.38 pCi/m^2-s] and averaged 0.055 Bq/m^2-s [1.5 pCi/m^2-s]. The flux rates measured at the proposed project site are well below the National Emissions Standards for Hazardous Air Pollutants (NESHAPS) requirements of 0.740 Bq/m^2-s [20 pCi/m^2-s] specified in 10 CFR Part 40, Appendix A, Criterion 6, which applies to uranium mill tailings. Although not applicable to the proposed action, the NESHAPS requirements are useful in demonstrating the relatively low magnitude of radon flux rates measured at the site.

Air particulate samples were collected bi-weekly over a 1-year period (August 2007 to August 2008) at each of the air monitoring station locations. Particulates were collected using high volume air samplers and analyzed for Ra-226, uranium, Th-230, and Pb-210 (Powertech, 2009a, Table 6.1-12). Results of the air particulate sampling are summarized as follows:

- Ra-226 concentrations ranged from below detection limits to a maximum of 1.7×10^{-12} Bq/cm^3 [4.7×10^{-17} uCi/mL]. The maximum concentration is less than 0.1 percent of the effluent release limit of 3.3×10^{-8} Bq/cm^3 [9.0×10^{-13} uCi/mL] specified in 10 CFR Part 20, Appendix B.

- Uranium concentrations ranged from below detection limits to a maximum of 3.4×10^{-10} Bq/cm^3 [9.1×10^{-15} uCi/mL]. The maximum concentration is less than 1 percent of the effluent release limit of 3.3×10^{-7} Bq/cm^3 [9.0×10^{-12} uCi/mL] specified in 10 CFRPart 20, Appendix B.

- Th-230 concentrations ranged from below detection limits to a maximum of 2.1×10^{-12} Bq/cm^3 [5.6×10^{-17} uCi/mL]. The maximum concentration is less than 0.01 percent of the effluent release limit of 1.1×10^{-7} Bq/cm^3 [3.0×10^{-12} uCi/mL] specified in 10 CFR Part 20, Appendix B.

- Pb-210 concentrations ranged from below detection limits to a maximum of 1.5×10^{-9} Bq/cm^3 [4.1×10^{-14} uCi/mL]. The maximum concentration was 6.78 percent of the effluent release limit of 2.2×10^{-8} Bq/cm^3 [6.0×10^{-13} uCi/mL] specified in 10 CFR Part 20, Appendix B.

3.12.1.4 Groundwater

As described in SEIS Section 3.5.3.5, the applicant conducted initial preoperational groundwater sampling of wells at the proposed Dewey-Burdock ISR Project from July 2007 through June 2008 (Powertech, 2009a). This baseline study consisted of 19 groundwater wells (14 existing and 5 newly drilled) sampled on a quarterly basis. An additional 12 wells were sampled on a monthly basis from March 2008 to February 2009. The wells were selected based on type of use, aquifer, and location in relation to orebodies (Powertech, 2009a). The locations of all groundwater sampling wells are shown in Figure 3.5-2, and the formation sampled in each well is listed in Table 3.5-3. Radiological constituents sampled in each well included gross alpha, Ra-226, uranium, and Rn-222 (Powertech, 2009a, Tables 6.1-18 and 6.1-19). Results of preoperational groundwater sampling are discussed in SEIS Section 3.5.3.5 and summarized as follows:

- The MCL for uranium {0.03 mg/L [0.03 ppm]} was exceeded in samples from all but one of the wells (679) in the alluvial aquifers. Within the Burdock area, samples from wells 680 and 3026 in the Chilson aquifer and well 698 in the Fall River aquifer also exceeded the MCL for uranium. The range of uranium exceeding the MCL was 0.0322 to 0.132 mg/L [0.0322 to 0.132 ppm].

- The MCL for dissolved Ra-226 {185 Bq/m^3 [5 pCi/L]} was exceeded in about 50 percent of the wells in the Fall River and Chilson aquifers. The range of Ra-226 exceeding the MCL was 185 to 52,910 Bq/m^3 [5 to 1,430 pCi/L].

- The MCL for gross alpha {555 Bq/m^3 [15 pCi/L]} was exceeded in about 75 percent of the wells. The range of gross alpha exceeding the MCLs in alluvial wells was 677 to 4,773 Bq/m^3 [18.3 to 129 pCi/L], while the range of gross alpha exceeding MCLs in the Fall River and Chilson aquifers was 555 to 240,500 Bq/m^3 [15 to 6,500 pCi/L].

- Two wells (680 and 681) with Ra-226 exceeding 11,100 Bq/m^3 [300 pCi/L] and gross alpha concentrations exceeding 37,000 Bq/m^3 [1,000 pCi/L] are directly within mapped orebodies in the Chilson and Fall River aquifers, whereas another (698) is downgradient of open pit mines within the Fall River aquifer.

- The only well not exceeding the proposed EPA limit for Rn-222 of 11,100 Bq/m^3 [300 pCi/L] (EPA, 2000) was well 650, a Chilson well upgradient of historic uranium mining activities. The Rn-222 values of samples exceeding the proposed limit ranged from 11,248 to 17.1×10^6 Bq/m^3 [304 to 462,000 pCi/L]. The wells with the highest concentration included wells 680 and 681, which are directly in mapped orebodies in the Chilson and Fall River aquifers, respectively, and well 42 in the Chilson aquifer used for domestic and stock water.

3.12.1.5 Vegetation, Livestock, and Fish

Vegetation samples (typically short grasses and clover plants) were collected in August 2007, April 2008, and July 2008 from representative grazing areas near each air monitoring station location. Composite samples of the vegetation were analyzed for Ra-226, uranium, Th-230, Pb-210, and Po-210 (Powertech, 2009a, Table 6.1-30). Results of the vegetation sampling are summarized as follows:

- Ra-226 concentrations ranged from 0.00074 to 0.00333 Bq/g [0.02 to 0.09 pCi/g] and averaged 0.00185 Bq/g [0.05 pCi/g].
- Uranium concentrations ranged from 0.00037 to .00148 Bq/g [0.01 to 0.04 pCi/g] and averaged 0.00074 Bq/g [0.02 pCi/g].
- Th-230 concentrations ranged from 0.00037 to 0.00111 Bq/g [0.01 to 0.03 pCi/g] and averaged 0.00074 Bq/g [0.02 pCi/g].
- Pb-210 concentrations ranged from 0.00222 to 0.0629 Bq/g [0.6 to 1.7 pCi/g] and averaged 0.0444 Bq/g [1.2 pCi/g].
- Po-210 concentrations ranged from 0.00296 to 0.00851 Bq/g [0.08 to 0.23 pCi/g] and averaged 0.00555 Bq/g [0.15 pCi/g].

In comparison to corresponding shallow {0–5 cm [0–2 in]} soil samples collected from air monitoring stations, radionuclide concentrations in the vegetation samples are one to two orders of magnitude lower (Powertech, 2009a). Pb-210 concentrations in the vegetation samples were significantly higher than the other radionuclides and are likely due to the higher relative abundance of Pb-210 in air particulates from radon decay products (Powertech, 2009a).

Three tissue samples, one liver and two meat samples, were collected from a locally grazing cow on June 25, 2008. These samples were analyzed for Ra-226, uranium, Th-230, Pb-210, and Po-210 (Powertech, 2009a, Table 6.1-31). Except for concentration of Po-210 in the liver tissue sample {0.74 Bq/kg [2.0×10^{-5} μCi/kg]}, radionuclide concentrations were at or below the lower limits of detection (see Powertech, 2009a, Table 6.1-31). To satisfy the food sampling requirements of Regulatory Guide 4.14 (NRC, 1980), the applicant collected tissue samples from another locally grazing cow and one free ranging, locally grazing pig in April 2011 (Powertech, 2011). These samples were analyzed for Ra-226, uranium, Th-230, and Pb-210 (Powertech, 2011, Table 2.9-19). The tissue sample from the locally grazing cow had measureable concentrations of uranium {0.085 Bq/kg [2.3×10^{-6} μCi/kg]}, Ra-226 {0.022 Bq/kg [6.0×10^{-7} μCi/kg]}, and Pb-210 {0.043 Bq/kg [1.16×10^{-6} μCi/kg]}, while the concentration of Th-230 was below the lower limit of detection. The tissue sample from the locally grazing pig had measureable concentrations of uranium {0.30 Bq/kg [8.1×10^{-6} μCi/kg]} and Ra-226 {0.029 Bq/kg [7.9×10^{-7} μCi/kg]}, while the concentrations of Th-230 and Pb-210 were below the lower limit of detection. In accordance with food sampling requirements in Regulatory Guide 1.14 (NRC, 1980), the applicant has committed to sampling one additional cow, bringing the total to three, and two additional pigs, bringing the total to three, prior to ISR operations at the Dewey-Burdock Project site (Powertech, 2011).

Twelve fish species (Powertech, 2009a, Table 3.5-27) were collected for radiological analyses in April 2008 and July 2008 from three sampling locations: (i) BVC04—Beaver Creek upstream of the proposed project area; (ii) BVC01—Beaver Creek downstream of the proposed project area; and (iii) CHR05—Cheyenne River downstream of its confluence with Beaver Creek (see Figure 3.5-2). Whole fish samples were analyzed for uranium, Po-210, Pb-210, Th-230, and Ra-226 (Powertech, 2009a, Table 3.5-30). In April 2008, the channel catfish (*Ictalurus punctatus*) was the only species collected that contained detectable uranium {0.05 mg/kg

[0.05 ppm] and 3.0×10^{-5} µCi/kg [1.11 Bq/kg]}. The channel catfish is the only species collected in the proposed project area that is typically caught for human consumption. In July 2008, uranium was detected in all the fish species collected due to increased sample sizes (see Powertech, 2009a, Table 3.5-30). Uranium concentrations ranged from 0.0066 to 0.04 mg/kg [0.0066 to 0.04 ppm], which is similar to the uranium concentration range of 0.003 to 0.0378 mg/L [0.003 to 0.0378 ppm] in stream samples (see SEIS Sections 3.12.1.2). Uranium radioactivity ranged from 2.7×10^{-5} to 4.4×10^{-6} µCi/kg [1.0 to 0.16 Bq/kg]. Radioactivity from Po-210, Th-230, and Ra-226 was undetectable or low in most of the fish samples collected in April and July 2008. Pb-210 was detected in only one fish specimen, the plains killifish (*Fundulus zebrinus*) collected in April 2008 at the downstream Beaver Creek location (BVC01). However, due to matrix interference, the precision of this measurement was equal to the detected concentration {0.02 µCi/kg ± 0.02 µCi/kg [740 Bq/kg ± 740 Bq/kg]}.

3.12.2 Public Health and Safety

NRC has the statutory responsibility, pursuant to the Atomic Energy Act of 1954, as amended by the Uranium Mill Tailings Radiation Control Act, to protect the public health and safety and the environment. NRC's regulations at 10 CFR Part 20 specify annual dose limits to members of the public of 1 mSv [100 mrem] total effective dose equivalent (TEDE) with no more than 0.02 mSv [2 mrem] in any 1-hour period from any external sources. This public dose limit from NRC-licensed activities is a fraction of the background radiation dose as discussed in Section 3.12.1.

Crow Butte is an operational ISR facility located approximately 105 km [65 mi] south-southeast of the Dewey-Burdock ISR Project in Dawes County, Nebraska. Because of its distance from the Dewey-Burdock site, the Crow Butte ISR facility is not considered to represent a source of radiation exposure in and around the proposed project area. Therefore, baseline radiological conditions represent the only radiation exposure to individuals in the area surrounding the proposed Dewey-Burdock ISR Project area.

As discussed in SEIS Section 3.12.1, elevated gamma-ray survey readings are associated with abandoned open pit uranium mines in the eastern and northeastern portion of the Burdock area (see Figure 3.12-1). Elevated gamma readings are also present in the northern part of the Dewey area and are likely due to the deposition of windblown dust from the abandoned surface mine areas to the southeast in the Burdock area. A final area of elevated gamma readings is present in the southern part of the Dewey area near an artesian well and is likely due to discharging groundwater from the Inyan Kara aquifer. Other than these areas of elevated radiological readings, the information provided for the proposed Dewey-Burdock ISR Project area does not contain any new or significant findings that are contrary or vary from the information and conclusion presented in the GEIS. The baseline radiological surveys presented in Powertech (2009a and 2011) provide adequate documentation of preoperational conditions for the proposed Dewey-Burdock ISR Project area and will be used as part of the overall baseline data package during operational and decommissioning activities.

The public health in a region is assessed by reviewing health studies conducted in the region over a period of time. In a review of the public health literature, specifically looking at radiological and chemical exposures, the applicant identified a South Dakota study with information specific to the proposed project area (Powertech, 2010a). The South Dakota Department of Health (SDDOH) conducted a study of cancer rates in nine South Dakota counties and reported that the presence of existing uranium mines was not associated with increased cancer death rates (SDDOH, 2006).

3.12.3 Occupational Health and Safety

Radiation Protection Standards at 10 CFR Part 20 are concerned with occupational health and safety risks to workers and provide limits on worker exposure to radiation. The regulations provide annual radiation dose limits for workers and incorporate the principal of maintaining doses “as low as is reasonably achievable” (ALARA) taking into consideration the purpose of the licensed activity and its benefits, technology for reducing doses, and the associated health and safety benefits. A maximum annual occupational dose is determined by the more limiting of two calculated dose equivalents: (i) 0.05 Sv [5 rem] total effective dose equivalent and (ii) the sum of the deep-dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye being equal to 0.5 Sv [50 rem]. The lower dose equivalent calculated is the maximum annual occupational dose. The lens of the eye is limited to a dose equivalent of 0.15 Sv [15 rem], and the skin (of the whole body or any extremity) is limited to a shallow dose equivalent of 0.5 Sv [50 rem]. Radiation safety measures that comply with these 10 CFR Part 20 standards must be implemented at ISR facilities to protect workers and to ensure radiation exposures and doses are below occupational limits as well as ALARA.

Also of concern, with respect to occupational health and safety, are industrial hazards and exposure to nonradioactive pollutants, which for an ISR operation can include normal industrial airborne pollutants associated with service equipment (e.g., vehicles), fugitive dust emissions from access roads and well field activities, and various chemicals used in the ISR process. Industrial safety aspects associated with the use of hazardous chemicals at the proposed Dewey-Burdock ISR Project will be regulated under the State of South Dakota regulations and the South Dakota Occupational Safety and Health Administration. The types of chemicals and impacts are discussed in SEIS Section 4.13.

The Occupational Safety and Health Administration (OSHA) does not compile data on workplace total recordable incident rates and lost-time incident rates specific to the ISR industry (Powertech, 2010a). Statistics for injuries and illnesses for the ISR industry are included in the category “Other Metal Ore Mining,” which includes both underground and surface (open pit) uranium mines (OSHA, 2010). Total recordable incidence rates and total lost-time incidents for the “Other Metal Ore Mining” category for years 2003 to 2008 are listed in Table 3.12-2. Total recordable incidents are work-related deaths, illnesses, or injuries resulting in loss of consciousness, restriction of work or motion, transfer to another job, or required medical treatment beyond first aid. A lost-time incident is a recordable incident that results in one or more days away from work, days of restricted work activity, or both, for affected employees. The incident rate is used for measuring and comparing work injuries, illnesses, and accidents within and between industries and can be an indicator of the impacts of operations on occupational health.

OSHA data for specific injury/illness and lost time in the ISR industry is not available, although the applicant provided operation-specific information from one licensed ISR facility in Texas (Powertech, 2010a). Over a 4-year period from 2006 through 2009, the Uranium Resources Inc. ISR facility in Lewisville, Texas, which employs about 100 people, reported 36 injuries or illnesses requiring medical attention, an average of 9 per year. Over the same period, the ISR facility reported four lost-time cases, an average of one per year, and one contractor fatality.

Table 3.12-2. Total Recordable Incidence Rates and Total Lost-Time Incidents for the Category "Other Metal Ore Mining"*

Year	Recordable Incidence Rate (Per 100 Employees)	Total Lost-Time Incidents (Per 100 Employees)
2008	3.6	2.2
2007	3.5	2.0
2006	3.8	2.6
2005	6.0	4.4
2004	<15 total cases	—
2003	<15 total cases	—

Source: OSHA (2010)
*Includes underground and surface uranium mining.

3.13 Waste Management

SEIS Section 2.1.1.1.6 describes the types and volumes of liquid and solid waste that could be generated by operation of the proposed Dewey-Burdock ISR Project. The applicant proposes the following disposal practices: (i) nonhazardous solid waste will be disposed in a sanitary landfill; (ii) solid byproduct material will be disposed at a licensed waste disposal site or a mill tailings facility licensed to receive byproduct material from outside sources; (iii) liquid byproduct material will be disposed using either (a) deep Class V disposal wells, (b) land application, or (c) a combination of deep Class V disposal wells and land application; and (iv) sanitary waste will be disposed in an onsite septic system. The applicant will not generate mixed waste from any of the proposed waste management options. Mixed waste consists of a mixture of hazardous waste (as defined by the Resource Conservation and Recovery Act) and radioactive waste (as defined by the Atomic Energy Act). The applicant expects the proposed Dewey-Burdock ISR Project to be classified as a Conditionally Exempt Small Quantity Generator of hazardous waste under the Resource Conservation and Recovery Act. SDDENR will determine whether that classification applies to the proposed facility (see Section 2.1.1.1.6.3). SEIS Section 2.1.1.1.6 describes the annual waste volumes that the proposed project is expected to generate. The present section describes the disposition of waste streams generated by the proposed project.

3.13.1 Liquid Waste Disposal

Liquid wastes generated from operation of the proposed Dewey-Burdock ISR Project will include well development and well test waters; stormwater; waste petroleum products and chemicals; sanitary wastewater; and liquid byproduct material including production bleed, process solutions, laboratory chemicals, plant washdown water, and restoration water. Process solutions include process bleed, elution and precipitation brines, and resin transfer wash. The applicant will collect stormwater and discharge to surface water in accordance with an SDDENR National Pollutant Discharge Elimination System permit. Waste petroleum products and chemicals meeting the definition of hazardous waste will be stored in small quantities until disposal in accordance with all applicable local, state, and federal regulatory requirements as described in SEIS Section 2.1.1.1.6.3. The applicant will dispose of sanitary wastewater from restrooms and lunchrooms in an SDDENR-permitted septic system. The applicant will dispose of liquid byproduct material, well development and well test waters via either (i) deep Class V well injection; (ii) land application; or (iii) a combination of deep Class V well injection and land application, as described under the proposed action in SEIS Section 2.1.1.1.6.2. Liquid byproduct material must be treated onsite using a combination of ion exchange, reverse osmosis, and radium settling depending on the disposal option selected as described in Section 2.1.1.1.6.2 (Powertech, 2009a–c). If the applicant uses the deep well disposal option, four to eight Class V wells will be installed, as described in SEIS Section 2.1.1.1.6.2. Figure 2.1-12 shows the proposed land application areas.

3.13.2 Solid Waste Disposal

Solid byproduct material (including radioactively contaminated soils or other media) that does not meet NRC unrestricted release criteria must be disposed of at a licensed facility, as required by 10 CFR Part 40, Appendix A, Criterion 2. As described in SEIS Section 2.1.1.1.6.3, the proposed action will generate solid byproduct material that does not meet NRC criteria for unrestricted release. In addition to the regulatory requirements, if an NRC license is granted, NRC staff will require, by license condition, an agreement to be in place before operations begin to ensure the availability of sufficient disposal capacity. The applicant has identified the White Mesa site as the disposal location for solid byproduct material, but a disposal agreement is not yet in place (Powertech, 2011). The White Mesa site, an operating conventional uranium mill in Blanding, Utah, is permitted to construct an additional 1,452,654 m^3 [1,900,000 yd^3] of tailings impoundment capacity (UDEQ, 2010a); however, in accordance with its license, it must obtain approval from Utah Department of Environmental Quality (UDEQ) to bury ISR waste. Furthermore, it may not receive more than 3,823 m^3 [5,000 yd^3] of ISR wastes from any single source (UDEQ, 2010b).

As discussed in SEIS Section 2.1.1.1.6.3, nonhazardous solid wastes are materials that are not hazardous waste and comply with NRC unrestricted release limits. All proposed phases of the Dewey-Burdock ISR Project will generate nonhazardous solid waste (Powertech, 2009a). The proposed project is expected to generate solid wastes that could include general facility trash, septic system solids, construction/demolition debris, and any solid byproduct material (such as piping, valves, instrumentation, or equipment) that has been decontaminated to meet NRC criteria for unrestricted release.

The applicant has proposed to dispose of nonhazardous solid waste at the Custer-Fall River Waste Management District landfill at Edgemont, South Dakota, approximately 24 km [15 mi] southeast of the proposed Dewey-Burdock site. The Custer-Fall River landfill received 9,964 short tons {approximately 19,060 m^3 [24,910 yd^3]} of solid waste in 2011 and has a remaining permitted solid waste capacity of 154,000 tons {approximately 294,567 m^3 [385,000 yd^3]} (Barker Concrete & Construction, Inc., 2012). The projected average annual rate of waste received at the landfill is 8,160 t/yr [9,000 T/yr] (SDDENR, 2010). The remaining capacity would allow operations of the landfill for an additional 17 years beyond mid-year 2012 (the time of the capacity estimate) if the annual receipt of waste continued at the projected annual average rate.

If additional disposal capacity is needed, the applicant has also proposed to dispose of nonhazardous solid waste at a landfill in Newcastle, Wyoming (Powertech, 2010a), approximately 64 km [40 miles] north of the proposed Dewey-Burdock ISR Project site. The most recent published documentation of landfill characteristics NRC staff identified is from American Engineering Testing, Inc. (AET, Inc.) (2011). The estimated volume of waste the Newcastle landfill receives annually is 12,118 m^3 [15,850 yd^3] (AET, Inc., 2011). The remaining permitted capacity of the Newcastle landfill was reported as 187,452 m^3 [245,000 yd^3] and estimated in 2011 to allow 12 additional years of operation (AET, Inc., 2011). These annual inputs to waste facilities are provided to show how the proposed action's generation rate compares with the regional generation from other sources.

Another more distant and higher capacity landfill serving Rapid City, South Dakota, is projected to be operational until 2050 (HDR Engineering Inc., 2010).

3.14 References

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4 ENVIRONMENTAL IMPACTS OF CONSTRUCTION, OPERATIONS, AQUIFER RESTORATION, AND DECOMMISSIONING ACTIVITIES AND MITIGATIVE ACTIONS

4.1 Introduction

The Generic Environmental Impact Statement (GEIS) for *In-Situ* Leach Uranium Milling Facilities (NRC, 2009a) evaluated the potential environmental impacts of implementing *in-situ* recovery (ISR) operations in four distinct geographic regions, including the Nebraska-South Dakota-Wyoming Uranium Milling Region where the proposed Dewey-Burdock ISR Project is located. This chapter evaluates the potential environmental impacts from Alternative 1 (implementing the proposed action, which includes options for liquid waste disposal) and Alternative 2 (the No-Action alternative). In addition, the U.S. Nuclear Regulatory Commission (NRC) staff considered other reasonable alternative actions at the proposed Dewey-Burdock ISR Project. These included alternative sites, alternative lixiviants, alternative well completion methods, conventional mining and milling, and conventional mining and heap leach processing. These alternatives were eliminated from detailed analysis for reasons described in Section 2.2 of the supplemental environmental impact statement (SEIS).

This chapter analyzes the four lifecycle phases of ISR uranium extraction (construction, operations, aquifer restoration, and decommissioning/reclamation) at the proposed site using the analytical approach described in the GEIS (NRC, 2009a). The results of the GEIS impact analyses for the Nebraska-South Dakota-Wyoming Uranium Milling Region, as summarized in Table 1.4-1, were used to focus the site-specific environmental review at the proposed Dewey-Burdock ISR Project. In situations where the GEIS concluded a wide range of impacts on a particular resource area could range from SMALL to LARGE, the NRC staff evaluated the resource area in greater detail for this site-specific SEIS. The site-specific analyses describe new information the NRC staff obtained during its independent site-specific review. The potential impacts of the new information were evaluated to determine whether they changed the expected impacts presented in the GEIS.

This chapter also analyzes the environmental impacts of liquid waste disposal options that the applicant may use at the proposed project site (see SEIS Section 2.1.1.1.2.4). These options include deep well disposal via Class V injection wells, disposal via land application, and disposal via a combination of Class V injection wells and land application. The applicant's use of deep well disposal is contingent on obtaining a permit for Class V injection wells from the U.S. Environmental Protection Agency (EPA). EPA is currently reviewing an application for a Class V injection well permit (see Table 1.6-1). The applicant's use of land application is contingent on obtaining an approved groundwater discharge plan (GDP) from the South Dakota Department of Environment and Natural Resources (SDDENR). SDDENR will permit land application only if the applicant demonstrates insufficient Class V disposal capacity (SDDENR, 2013a). SDDENR is currently reviewing a GDP application for land application (see Table 1.6-1).

SEIS Sections 4.2 through 4.14 evaluate potential impacts from both the proposed action (which includes construction, operations, aquifer restoration, and decommissioning/reclamation using Class V deep injection wells, land application, or a combination of both for management of process-related liquid waste streams) and the No-Action alternative (which means no ISR facility will be built and operated at the proposed Dewey-Burdock ISR Project). The No-Action alternative provides a baseline against which to compare the potential impacts from the proposed action.

NRC established a standard of significance for assessing environmental impacts in the conduct of environmental reviews based on the Council of Environmental Quality (CEQ) regulations, as described in the NRC guidance in NUREG–1748 (NRC, 2003a) and summarized as follows:

SMALL: The environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource considered.

MODERATE: The environmental effects are sufficient to alter noticeably, but not destabilize, important attributes of the resource considered.

LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource considered.

4.2 Land Use Impacts

As described in GEIS Section 4.4.1, potential environmental impacts to land use will occur during all phases of an ISR facility's lifecycle (NRC, 2009a). Impacts to land use will result from (i) land disturbances in conjunction with construction, operations, and decommissioning activities; (ii) access restrictions that will limit grazing and recreational activities; and (iii) competing access for mineral rights (e.g., leasing of land for both uranium and oil and gas exploration and development).

GEIS Construction Phase Summary

NRC staff concluded in the GEIS that land disturbances during the construction phase will be temporary and limited to small areas within permitted boundaries. After construction, disturbed areas around well sites, staging areas, and trenches will be immediately reseeded and restored. In GEIS Section 4.4.1.1, NRC staff also concluded that changes to land use due to grazing restrictions and limits on recreational activities are expected to be limited because restricted areas will be small, the restrictions will be temporary, and other land is available for these activities. Recognizing that the magnitude of land disturbances and access restrictions will vary significantly during construction, the NRC staff assessed the potential impacts on land use during construction in the Nebraska-South Dakota-Wyoming Milling Region as ranging from SMALL to LARGE. (NRC, 2009a)

GEIS Operations Phase Summary

Land use impacts from operational activities will be similar to impacts anticipated during the construction phase, because additional land disturbances and access restrictions are not expected while operational activities are ongoing. Because impacts from access restrictions and land disturbances will be similar to or less than construction impacts, NRC staff concluded in the GEIS that the overall potential impacts on land use from operational activities at an ISR facility will be SMALL. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

Because aquifer restoration will use the same infrastructure that is present during operation phases, land use impacts from aquifer restoration are expected to be similar to or less than operation impacts. As aquifer restoration proceeds and wellfields are closed, operational activities will diminish. Therefore, NRC staff concluded in the GEIS that aquifer restoration impacts to land use will be SMALL. (NRC, 2009a)

GEIS Decommissioning Phase Summary

NRC staff concluded in the GEIS that decommissioning an ISR facility will temporarily increase land-disturbing activities, such as, dismantling, removing, and disposing of materials equipment, and excavated contaminated soils. Access restrictions will remain in place until decommissioning and reclamation are complete, although a licensee may decommission and reclaim the site in stages. Reclamation of land to preexisting conditions and uses will help to mitigate potential long-term impacts. NRC staff concluded in the GEIS that impacts to land use during decommissioning may range from SMALL to MODERATE and will be SMALL after decommissioning and reclamation activities are complete. (NRC, 2009a)

The potential environmental impacts on land use from construction, operations, aquifer restoration, and decommissioning for the proposed Dewey-Burdock ISR Project are detailed in the following sections.

4.2.1 Proposed Action (Alternative 1)

As described in SEIS Section 3.2, the proposed Dewey-Burdock ISR Project site encompasses 4,282 ha [10,580 ac] (Powertech, 2009a). Approximately 97.5 percent of surface rights in the proposed project are held privately, and the U.S. Bureau of Land Management (BLM) holds the remaining 2.5 percent. Land will be converted temporarily from its primary use as rangeland to use as an ISR facility, with facilities constructed and wellfields brought into production over time. Subsurface mineral rights are divided among several private entities and BLM (Powertech, 2009b). The applicant leases both surface and subsurface mineral rights in portions of the proposed project area where it plans to extract uranium. The applicant controls the unpatented mineral claims associated with 1,708 ha [4,220 ac] of federal minerals the U.S. government reserved under the Stock-Raising Homestead Act. The applicant also maintains unpatented mining claims on the 97 ha [240 ac] of BLM-administered surface lands within the project area (see SEIS Section 3.2).

In the GEIS, NRC staff identified potential land use alterations to ecological, historical, and cultural resources that range from SMALL to LARGE. In this SEIS, NRC staff present potential ecological impacts from land use in SEIS Section 4.6 and potential historical and cultural impacts from land use in SEIS Section 4.9. Impacts to soils from surface disturbances are discussed in SEIS Section 4.4. NRC staff assessed potential impacts on mineral extraction, grazing, or recreational activities that may result from the land disturbances and associated access restrictions during the construction, operation, aquifer restoration, and decommissioning phases at the proposed facility.

The applicant described environmental impacts on land use for each of the liquid waste disposal options (which are discussed in following sections) include (i) disposal via Class V injection wells, (ii) disposal via land application, or (iii) combined disposal via Class V injection wells and land application.

4.2.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant's preferred option for disposal of liquid waste is deep well disposal via Class V injection wells. The section discusses potential environmental impacts on land use from construction, operations, aquifer restoration, and decommissioning associated with the Class V injection well disposal option at the proposed Dewey-Burdock ISR Project.

4.2.1.1.1 Construction Impacts

Construction phase activities, including drilling, trenching, excavating, grading, and surface facility construction, will have the largest direct land use impact at the proposed Dewey-Burdock site. As described in SEIS Section 2.1.1.1.2, initial construction of processing facilities, infrastructure (e.g., pipelines, access roads, power lines, and storage ponds), and wellfields is expected to be completed within 2 years (see Figure 2.1-1), followed by phased construction of additional wellfields during the operational phase.

A breakdown of estimated land disturbance for the facilities and infrastructure associated with the Class V injection well disposal option is provided in Table 4.2-1. For this disposal option, a total of 98.3 ha [243 ac] of land or 2.3 percent of the proposed permit area will be potentially disturbed by activities associated with construction of site buildings, pipelines, wellfields, ponds, and access roads (Powertech, 2010a). The total amount of BLM-managed land expected to be disturbed during construction activities is 4.7 ha [11.63 ac]. Land disturbance on BLM-managed land includes an access road, overhead power lines, wellfields, and underground pipelines. The total land area projected to be disturbed by construction activities for the Class V injection well

Table 4.2-1. Breakdown of Land Disturbance for the Class V Injection Well and Land Application Disposal Options at the Proposed Dewey-Burdock *In-Situ* Recovery Project

Facilities/Infrastructure	Surface Disturbance
Disposal Via Class V Injection Wells	
Site Buildings	9.7 ha [24 ac]
Trunkline Installation	10.1 ha [25 ac]
Access Roads	8.5 ha [21 ac]
Wellfields	56.7 ha [140 ac]
Impoundments (ponds)	13.4 ha [33 ac]
Total	98.3 ha [243 ac]
Disposal Via Land Application	
Site Buildings	9.7 ha [24 ac]
Trunkline Installation	10.1 ha [25 ac]
Access Roads	8.5 ha [21 ac]
Wellfields	56.7 ha [140 ac]
Impoundments (ponds)	55.0 ha [136 ac]
Irrigation Areas	425.7 ha [1,052 ac]
Total	565.7 ha [1,398 ac]
Source: Powertech (2010a)	

disposal option, 98.3 ha [243 ac], is relatively small compared to the 4,282-ha [10,580-ac] permitted area of the proposed project.

To mitigate impacts of surface disturbance during construction, the applicant proposes to reclaim the surface and reestablish vegetation in areas disturbed by drilling, pipeline installation, and facility construction as soon as construction activities are completed (Powertech, 2009a). In addition, the applicant proposes to minimize construction of new access and secondary roads by building only roads essential to operations. Vehicular traffic in the wellfields during construction will also be restricted to designated roads and kept to a minimum to reduce the area of surface disturbance (Powertech, 2009a).

The applicant will enclose the processing facilities, storage ponds, and wellfields to restrict and control access with fences (Powertech, 2009a). As discussed in SEIS Section 2.1.1.1.2.1, the Burdock central processing plant will be located on approximately 2.7 ha [6.7 ac] and surrounded by a controlled access area fence throughout the life of the project. The Dewey satellite facility will be located on 1.2 ha [2.9 ac] and will be surrounded by a controlled access area fence. Radium settling and storage ponds constructed for liquid waste management will be fenced throughout the life of the project to restrict access. As described in Section 2.1.1.1.2.4.1 of this SEIS, 2.7 ha [6.8 ac] of radium-settling and storage ponds in the Dewey area and 3.4 ha [8.3 ac] of radium-settling and storage ponds in the Burdock area will be fenced, if the Class V injection well disposal option is implemented. Fences surrounding the processing facilities and ponds will be inspected daily (Powertech, 2010a).

Fences restricting access to wellfields in the Dewey and Burdock areas will be temporary and will be removed after operations and reclamation of each wellfield are completed (Powertech, 2010a). To minimize the acreage fenced around the wellfields, fencing will enclose only the injection and production wells. Fencing will not surround the perimeter monitor wells (Powertech, 2010a). The applicant will cover each perimeter monitor well with a locking device to limit access. Header houses are to be secured within wellfield fencing (Powertech, 2010a). The applicant will use fencing techniques that preserve habitat and allow the movement of large game (Powertech, 2010a).

Fencing will not be built around the Class V injection wells to be used for deep well liquid waste disposal (Powertech, 2010a). Class V injection well heads and pumping equipment will be located inside locked buildings to restrict access (Powertech, 2010a).

Recreational activities, including hunting and off-road vehicle access, will be limited by fences and restrictions on access to roads and wellfields. As described in SEIS Section 3.2.2, hunting is currently open to the public on 3,521 ha [8,700 ac] within the project area. Hunting within the project area will remain open to the public during the construction phase (Powertech, 2011). Only a small part of the 4,282-ha [10,580-ac] of project area will be enclosed by fencing; 3.9 total ha [9.6 total ac] of processing facilities and 6.6 total ha [15.1 total ac] of radium-settling and storage ponds will be enclosed throughout the life of the project. Fencing around wellfields will be temporary. The public will have access to open, unfenced lands for recreational activities within and surrounding the proposed project area.

The exploration of mineral resources other than uranium (e.g., oil and natural gas) will be intermixed within the permit area or delayed until operations, decommissioning, and restoration activities end. Pending or potential oil and gas mineral leases are not present in the project area. Demand is low for oil and gas leases on available land near the Dewey-Burdock site (see

SEIS Section 3.2.3). In addition, no coal mines or coal bed methane production are located near the site.

Estimates of the amount of land disturbed by ISR facilities, presented in the GEIS, ranged from 49–753 ha [120–1,860 ac] (NRC, 2009a). The NRC staff concluded in the GEIS that the impact of disturbing this area will be SMALL. The land area projected to be disturbed by construction activities for the Class V injection well disposal option is 98.3 ha [243 ac] and is relatively small compared to the 4,282 ha [10,580 ac] of the proposed project area; this falls at the low end of land disturbance estimates in the GEIS. The applicant proposes to use the following concurrent mitigation measures to minimize the impacts of surface disturbance: reclaiming and re-vegetating disturbed areas, limiting construction of new access roads, and restricting vehicular traffic in wellfields.

Fenced areas around processing facilities and storage pond areas will be relatively small in comparison to the permitted area of the proposed project. Furthermore, fences around wellfields are temporary and will be removed after operational and reclamation phases are completed in the wellfields. Prohibiting grazing within fenced areas during construction will have only a SMALL impact on local livestock production. Because there will be abundant open land available around the proposed facilities and surrounding the proposed project area, impacts to recreational activities (primarily big game hunting) will be SMALL. Due to the low demand for oil and gas leasing and absence of coal bed methane production on land within and in the vicinity of the project area, the impact of competing access for mineral rights is expected to be SMALL. Therefore, the NRC staff conclude that overall land use impacts during the construction phase for the Class V injection well disposal option will be SMALL.

4.2.1.1.2 Operations Impacts

The primary changes to land use during the operations phase of the proposed Dewey-Burdock ISR Project will be land disturbance and access restrictions from the expansion of active wellfields and development of new wellfields. Land disturbance and access restrictions will result from drilling new wells and constructing additional header houses and pipelines.

Livestock grazing and recreational activities will be restricted from ISR surface facilities, surface impoundments, and wellfields during the operations phase. During the operational life of the project, fencing around wellfields will remove 56.7 ha [140 ac] of land from grazing and recreational uses (see Table 4.2-1). On BLM-managed land, fencing around wellfields B-WF1 through B-WF4 (see Figure 2.1.6) will remove 3.8 ha [9.4 ac] of land from grazing and recreational uses in the Burdock area over the operational life of the project. The applicant will restore and reclaim wellfields concurrently, as operations are completed and moved to the next wellfield (Powertech, 2009a). As uranium recovery activities cease at a wellfield, the area will be restored and reopened to grazing and recreational uses while a new wellfield is developed. The sequential movement of active operations from one wellfield to the next will minimize potential impacts on grazing and recreational uses throughout the operational life of the project.

If operations are licensed, the applicant has committed to working with BLM, South Dakota Game, Fish, and Parks (SDGFP) and private landowners to limit public access, primarily for hunting (Powertech, 2011). To limit hunting activities in areas of active ISR operations, temporary fencing, advisory signs, and gates will be installed near processing plants and wellfields. Hunting in areas of active ISR operations will also be limited by rules related to the SDGFP walk-in hunting program on private lands, which prohibit the discharge of a firearm within 98.4 m [300 ft] of a person or a structure (Powertech, 2011). Limits on hunting will continue over the operational life of the project.

In summary, impacts due to land disturbance during the operations phase of the proposed project will be limited to the wellfields and will be similar to impacts expected during the construction phase. Access restrictions during the operations phase will be similar to construction impacts. Processing facilities and storage ponds will remain fenced. The construction of temporary fencing around operational wellfields will restrict livestock grazing and hunting. Once operations are completed in a wellfield, the wellfield will be restored and reopened to grazing and recreational use. Substantial acreage within and surrounding the 4,282-ha [10,580-ac] project site will remain open to grazing and hunting. Therefore, NRC staff conclude that the overall impacts to land use from operations for the Class V injection well disposal option will be SMALL.

4.2.1.1.3 Aquifer Restoration Impacts

The aquifer restoration phase will use the same operational infrastructure and require the same level of infrastructure maintenance as the operations phase. Land use impacts from aquifer restoration will decrease as fewer wells and header houses are used. Additionally, equipment traffic and related impacts will diminish. NRC staff conclude that the potential impacts to land use during the aquifer restoration phase for the Class V injection well disposal option will be comparable to those of the operations phase and will be SMALL.

4.2.1.1.4 Decommissioning Impacts

As described in SEIS Section 2.1.1.1.5, decommissioning of the proposed Dewey-Burdock ISR Project will be based on an NRC-approved decommissioning plan, and all decommissioning activities will be carried out in accordance with 10 CFR Part 40 and other applicable federal and state regulatory requirements. The applicant will submit a decommissioning plan for NRC review and approval at least 12 months before the planned commencement of final decommissioning (Powertech, 2009b). At the proposed Dewey-Burdock site, the impact from dismantling and decontaminating the central plant, satellite facility, roads, and support facilities will be consistent with NRC staff conclusions reached in the GEIS. The land potentially disturbed as part of the proposed action will be returned to its preoperational condition and will be available for its preoperational use for livestock grazing and wildlife habitat (Powertech, 2009a).

After surface operations are complete and wellfields are restored, the applicant will proceed with the final steps of decommissioning and surface reclamation, and it will return the land to its preoperational conditions (Powertech, 2009b). The areas directly impacted by decommissioning include the central processing plant, satellite facility, wellfields and their infrastructure (i.e., pipelines and header houses), Class V injection wells, ponds, and access roads. SEIS Section 2.1.1.1.5 describes the decommissioning activities that are necessary to return the site to its previous land use. These activities include conducting radiological surveys, removing contaminated equipment and materials, cleaning up areas, plugging and abandoning wells, decontaminating and removing buildings and other onsite structures, and restoring disturbed areas (Powertech, 2009b). As disturbed areas are restored, they will be backfilled, contoured, and smoothed to blend with the natural terrain in accordance with the NRC-approved decommissioning plan. All wells are to be sealed and capped, and wellfield pipelines removed. After well plugging and abandonment and wellfield decommissioning are complete, seeded soil will be returned to the areas from which it was removed and contoured to blend with the natural terrain. As decommissioning and reclamation proceed, the amount of disturbed and fenced land will decrease and the structures that could alter the setting of the project area will be removed. The dismantling of the proposed project facilities, infrastructure, and roads, together with the reseeding and placement of soil will have impacts similar in scale to the construction phase.

At the end of decommissioning, all lands will be returned to their preoperational land use of livestock grazing and wildlife habitat, unless the state and the landowner justify or approve an alternative use (e.g., landowners will be given the option to retain roads or buildings constructed for the ISR project for private use) (Powertech, 2009a). Reclaimed lands will be released for other uses. Livestock grazing and recreational activities will no longer be restricted. The land use impacts for disturbed areas will be MODERATE until vegetation is reestablished in seeded areas. Once vegetation is reestablished in reclaimed areas, the NRC staff conclude the land use impacts for the Class V injection well disposal option will be SMALL.

4.2.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not obtained from EPA, the applicant will dispose of liquid waste generated by land application (see SEIS Section 2.1.1.1.2.4.2). The locations of land application areas for this disposal option are shown in Figure 2.1-12. The potential environmental impacts on land use from construction, operations, aquifer restoration, and decommissioning associated with the land application disposal option are discussed in the following sections.

4.2.1.2.1 Construction Impacts

A breakdown of estimated land disturbance for the facilities and infrastructure associated with the land application option is provided in Table 4.2-1. A total of 565.7 ha [1,398 ac] of land, or 13.2 percent of the proposed permit area, will be disturbed by activities associated with construction of facilities, pipelines, wellfields, storage ponds, irrigation areas, and access roads (Powertech, 2010a). This area of land disturbance is larger than anticipated for the Class V injection well disposal option {approximately 98 ha [243 ac]} due to the addition of land irrigation areas {426 ha [1,052 ac]} and the need for increased pond capacity for storage during nonirrigation periods {35 ha [136 ac]} (see Table 4.2-1). The land application option will not impact the total amount of BLM-managed land expected to be disturbed during construction activities at the proposed project site {4.7 ha [11.63 ac]}. As described in SEIS Section 4.2.1.1.1, land disturbance on BLM-managed land includes an access road, overhead power lines, wellfields, and underground pipelines (see SEIS Section 4.2.1.1.1). The total land area projected to be disturbed by construction activities for the land application option {i.e., 565.7 ha [1,398 ac]} is relatively small in comparison to the 4,282-ha [10,580-ac] permitted area of the proposed project.

Mitigation measures, such as performing concurrent reclamation and revegetation of disturbed surface areas, limiting construction of new access and secondary roads, and restricting vehicular traffic in wellfields and land application areas, will reduce the impacts of surface disturbance associated with construction activities for the land application disposal option (Powertech, 2009a).

With the exception of radium settling and storage pond areas, fencing restrictions and their impacts on land use during the construction phase for the land application option will be similar to those of the Class V injection well disposal option. Fenced areas around radium settling and storage ponds to restrict access will increase to approximately 12.5 ha [30.8 ac] in the Dewey area and approximately 13.6 ha [33.5 ac] in the Burdock area (see SEIS Section 2.1.1.1.2.4.2). The increase in fenced areas around ponds for the land application disposal option will remain small in comparison to the 4,282-ha [10,580-ac] permitted area for the proposed project. The applicant does not plan to construct fencing around potential land irrigation areas during the construction phase of the project, and these areas will remain open to hunting (Powertech, 2010a).

As noted in SEIS Section 4.2.1.1.1, the degree of land disturbance at ISR facilities analyzed in the GEIS ranged from 49–753 ha [120–1,860 ac], and NRC staff concluded in the GEIS that impacts from this range of disturbed land area will be SMALL (NRC, 2009a). The land area to be disturbed by construction activities for the land application option {i.e., 565.7 ha [1,398 ac]} is relatively small when compared to the 4,282-ha [10,580-ac] permitted area of the proposed project. The amount of disturbance falls within the estimates evaluated in the GEIS. Impacts of surface land disturbance will be minimized by mitigation measures, including concurrently reclaiming and revegetating surface disturbed areas, limiting construction of new access roads, and restricting vehicular traffic in wellfields and land application areas. Processing facilities, pond areas, and wellfields will be fenced; however, only relatively small areas will be restricted, and fencing around wellfields will be temporary. Therefore, the restriction of livestock grazing within areas fenced off during construction will have a SMALL impact on local livestock production. Land irrigation areas will not be fenced during the construction phase of the project. In addition, open land will be available around the proposed facilities and within the proposed project area. Because of these factors, impacts to recreational activities (primarily big game hunting) will be SMALL. Therefore, the NRC staff conclude that overall land use impacts during the construction phase for the land application disposal option will be SMALL.

4.2.1.2.2 Operations Impacts

The primary change expected to affect land use during the operations phase of the proposed facility is the expansion of active wellfields and development of new wellfields, and the impact will be similar to that of the construction phase. Grazing and recreational activities will be restricted from processing facilities, storage ponds, and wellfields during the operations phase. The need for fencing around wellfields will remove approximately 56.7 ha [140 ac] of land from grazing and recreation activities over the operational life of the project; this is the same acreage as the Class V injection well disposal option requires (see Table 4.2-1). On BLM-managed land, fencing around wellfields B-WF1 through B-WF4 will remove 3.8 ha [9.4 ac] of land from grazing and recreational activities in the Burdock area over the operational life of the project. The applicant will restore and reclaim wellfields concurrently, as operations are completed and moved to the next wellfield (Powertech, 2009a). Therefore, a wellfield where uranium recovery activities have ceased will be restored and reopened for grazing at the same time a new wellfield is being developed. The sequential movement of active operations from one wellfield to the next shifts and minimizes potential impacts to livestock grazing and recreational land over the operational life of the project.

In addition to fencing processing facilities, ponds, and wellfields, the applicant may fence land application areas to control livestock access to these areas (Powertech, 2010a). As described in SEIS Section 2.1.1.1.2.4.2, the maximum estimated area for land application is 426 ha

[1,052 ac], and this acreage includes operating irrigation pivots, standby irrigation pivots, and surface stormwater runoff catchment areas. The land application area is relatively small when compared to the 4,282-ha [10,580-ac] permitted area. Moreover, substantial open land within and surrounding the project site will be available for livestock grazing.

The applicant has committed to work with BLM, SDGFP, and private landowners to limit recreational activities (primarily hunting) within the project area to the extent practicable before operations begin (Powertech, 2011). Temporary fencing, signage, gates, and other means of restricting public access will be used in active ISR areas, such as wellfields and processing plants, and may be used in land application areas. The SDGFP walk-in hunting program on private lands, which prohibits the discharge of a firearm within 98.4 m [300 ft] of a person or a structure, will limit hunting where active ISR operations are ongoing (Powertech, 2011). Limits on hunting will be in effect over the operational life of the project.

Impacts due to land disturbance during the operations phase will be restricted to the wellfields and are expected to be similar to impacts from construction. Access restrictions during the operations phase will be similar to those of the construction phase, except for land irrigation areas. Processing facilities and storage ponds will remain fenced to restrict and control human and wildlife access. Temporary fencing will be constructed around operational wellfields to restrict grazing and hunting. A maximum of 426 ha [1,052 ac] of land irrigation area may be fenced to control livestock grazing and limit access by hunters. The acreage of land application area is relatively small in comparison to the permitted area. In addition, substantial open area within and surrounding the 4,282-ha [10,580-ac] project site will remain open to grazing and hunting. Therefore, NRC staff conclude that the overall impacts to land use from operations for the land application disposal option will be SMALL.

4.2.1.2.3 Aquifer Restoration Impacts

The surface disturbance and access restrictions anticipated in the construction and operational phases will continue during aquifer restoration if the land application disposal option is implemented. Land use impacts from aquifer restoration will decrease over time, as fewer wells and pump houses are used and overall equipment traffic diminishes. Thus, NRC staff conclude that the overall potential impacts to land use during the aquifer restoration phase for the land application disposal option will be comparable to those of the operations phase and will be SMALL.

4.2.1.2.4 Decommissioning Impacts

Decommissioning areas after the land application disposal option will bring about environmental impacts similar to those described in SEIS Section 4.2.1.1.4 for the Class V injection well disposal option. Decommissioning the proposed facility will require an NRC-approved decommissioning plan. All decommissioning activities will be carried out in accordance with 10 CFR Part 40 and other applicable federal and state regulatory requirements.

After surface operations are complete and wellfields are restored at the proposed facility, the applicant will proceed with the final steps of decommissioning and surface reclamation to return the land to its preoperational conditions (Powertech, 2009b). The areas directly affected by decommissioning will include the central processing plant, satellite facility, wellfields and related pipelines and header houses, irrigation areas, ponds, and access roads. SEIS Section 2.1.1.1.5 describes the decommissioning activities required to return the site to its previous land use.

These activities are summarized in SEIS Section 4.2.1.1.4 and include conducting radiological surveys, removing contaminated equipment and materials, cleaning up areas, plugging and abandoning wells, decontaminating and removing buildings and other onsite structures, and restoring disturbed areas (Powertech, 2009b). Land application areas will be included in decommissioning surveys to ensure soil concentration limits are not exceeded. As decommissioning and reclamation proceed, the amount of disturbed and fenced land will decrease and structures that affect the setting of the project area will be removed. The dismantling of the proposed project facilities, infrastructure, and roads and reseeding and placement of soil will have impacts similar in scale to the construction phase.

At the end of decommissioning, all lands will be returned to their preoperational uses of livestock grazing and wildlife habitat, unless the state and the landowner justify or approve an alternative use. For example, landowners will be given the option to retain roads or buildings constructed for the ISR project for private use (Powertech, 2009a). The reclaimed land will be released for other uses. Restrictions on livestock grazing and recreational activities will be terminated. The land use impacts for disturbed areas will be MODERATE until vegetation is reestablished in seeded areas. Once vegetation is reestablished in reclaimed areas, the NRC staff conclude the land use impacts for the land application disposal option will be SMALL.

4.2.1.3 Disposal Via Combination of Class V Injection and Land Application

If a permit for Class V injection wells is obtained from EPA but the capacity of the wells is insufficient to dispose of all liquid wastes generated at the facility, the applicant will dispose of liquid waste by a combination of Class V injection wells and land application (see SEIS Section 2.1.1.1.2.4.3). For the combined option, land application facilities and infrastructure will be constructed, operated, restored, and decommissioned on an as-needed basis, depending on Class V injection well disposal capacity (Powertech, 2011). The land application option requires the construction and operation of irrigation areas and increased pond capacity for storage of liquid wastes during nonirrigation periods (see SEIS Section 2.1.1.1.2.4.2), whereas the Class V injection well disposal option requires the construction and operation of four to eight Class V injection wells (see SEIS Section 2.1.1.1.2.4.1). Therefore, the environmental impacts of land disturbance and access restrictions associated with the land application option are greater than those for the Class V injection waste disposal option than for all phases of the ISR process. Furthermore, only a portion of land application facilities and infrastructure (e.g., irrigation areas and storage ponds) will be constructed, operated, and decommissioned for the combination disposal option. Thus, the environmental impacts on land uses for the combined disposal option will be less than for the land application option alone and greater than for the Class V injection well disposal option alone. Therefore, NRC staff conclude that the environmental land use impacts of the combined Class V injection well and land application option for each phase of the proposed project will be bounded by the significance of environmental land use impacts of the Class V injection well disposal option and the land application disposal option as summarized in Table 4.2-2.

4.2.2 No-Action (Alternative 2)

Under the No-Action alternative, NRC will not license the proposed Dewey-Burdock ISR Project and BLM will not approve the applicant’s modified Plan of Operations. Therefore, impacts, such as soil disturbances and access restrictions to current land uses from the proposed action, will not occur. Construction impacts will be avoided because wells will not be drilled and pipelines will not be laid. Operational impacts will also be avoided because no subsurface injection of

Table 4.2-2. Significance of Environmental Land Use Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

	Class V Injection Wells	Land Application	Combined Class V Injection Wells and Land Application*
Construction	SMALL	SMALL	SMALL
Operations	SMALL	SMALL	SMALL
Aquifer Restoration	SMALL	SMALL	SMALL
Decommissioning	MODERATE before vegetation reestablished and then SMALL after vegetation is established	MODERATE before vegetation reestablished and then SMALL after vegetation is established	MODERATE before vegetation reestablished and then SMALL after vegetation is established

*Significance of environmental impact for the combined disposal option is bounded by the significance of environmental impacts for the Class V injection well and land application disposal options.

lixiviant will occur. Without well drilling or the development of wellfields taking place, there will be no impacts from aquifer restoration activities. Impacts to land use from decommissioning activities will not occur, because unbuilt buildings require no decontamination, topsoil will not need reclaiming, and unstripped land surfaces need no revegetation. The current land uses on and near the project area, including grazing lands, natural resource extraction, and recreational activities, remain essentially unchanged under the No-Action alternative.

4.3 Transportation Impacts

As described in GEIS Section 4.4.3, potential environmental impacts from transportation to and from an ISR facility may occur during all phases of the facility lifecycle. Impacts will result from workers commuting to and from the site and from the shipment of construction equipment and materials, operational processing supplies, ion-exchange resins, yellowcake product, and waste materials. Impacts may also occur from fugitive dust emissions, noise, incidental wildlife or livestock kills, increased traffic on local roads, and from accidents. (NRC, 2009a)

<u>GEIS Construction Phase Summary</u>

NRC staff concluded in GEIS Section 4.4.2.1 that ISR construction activities will generate low levels of additional traffic (relative to local traffic counts) and will not significantly increase traffic or accidents on many of the roads in the region. Roads that have low traffic counts could be moderately impacted by the additional workers commuting during periods of peak employment. Additionally, NRC staff in the GEIS concluded that, depending on site-specific conditions, there could be a moderate impact from fugitive dust, noise, and incidental wildlife or livestock kills on, or near, site access roads. For these reasons, NRC staff concluded in the GEIS that the construction phase of ISR projects may result in transportation impacts that ranged from SMALL to MODERATE. (NRC, 2009a)

GEIS Operations Phase Summary

As described in GEIS Section 4.4.2.2, the low level of facility-related traffic during operations activities will not noticeably increase traffic or the occurrence of accidents on most roads, although local, less traveled roads could be moderately impacted during periods of peak employment. During the construction phase of ISR facilities there could be impacts from fugitive dust emissions, noise, and possible incidental wildlife or livestock kills either on or near site access roads as described in GEIS Section 4.4.1.1. (NRC, 2009a)

GEIS Section 4.4.2.2 also assessed the potential for and consequence from accidents involving the transportation of hazardous chemicals and radioactive materials. NRC staff in the GEIS recognized the potential for high consequences from a severe accident involving transportation of hazardous chemicals in a populated area. The probability of such accidents occurring was determined to be low because of the small number of shipments, comprehensive regulatory controls, and the applicant's use of best management practices (BMP). For radioactive material shipments [yellowcake product, ion-exchange resins, byproduct material], compliance with transportation regulations was expected to limit radiological risk for normal operations. The NRC staff concluded in GEIS Section 4.4.2.2 there will be a low radiological risk from transportation accidents. The use of emergency response protocols will help to mitigate the consequences of severe accidents that involved the release of uranium. NRC staff concluded in the GEIS that the potential environmental impact from transportation during operations may range from SMALL to MODERATE. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

NRC staff concluded in GEIS Section 4.4.2.3 that the magnitude of transportation activities during aquifer restoration will be lower than for the construction and operations phases. Aquifer-restoration-related transportation activities will be primarily limited to supply shipments, waste shipments, onsite transportation, and employee commuting. NRC staff concluded in the GEIS that transportation impacts from aquifer restoration will range from SMALL to MODERATE for the same reasons discussed previously for the operations phase. (NRC, 2009a)

GEIS Decommissioning Phase Summary

NRC staff concluded in GEIS Section 4.4.2.4 that transportation activities during decommissioning at ISR facilities and the potential impacts will be similar to the construction and operation phases, except the magnitude of transportation activities (e.g., number and types of waste and supply shipments, no yellowcake shipments) from decommissioning will be lower than for the operations phase. NRC staff concluded in the GEIS that the potential accident radiological risks from transportation during decommissioning will be bounded by the estimates of yellowcake transportation risk during operations based on the concentrated nature of the shipped yellowcake, the greater distance yellowcake is shipped compared to the byproduct material destined for a licensed disposal facility, and the number of shipments of yellowcake relative to byproduct material. NRC staff concluded in the GEIS the potential transportation impacts during decommissioning will be SMALL because of the reduced transportation activities. (NRC, 2009a)

Estimated transportation environmental impacts during the construction, operations, aquifer restoration, and decommissioning phases of the proposed ISR project are discussed next. Fugitive dust impacts are evaluated as air quality impacts in SEIS Section 4.7, noise impacts are described in SEIS Section 4.8, visual impacts are provided in SEIS Section 4.10, and potential impacts to livestock and wildlife are discussed in SEIS Section 4.6.1.1.2.

4.3.1 Proposed Action (Alternative 1)

The transportation activities for the proposed Dewey-Burdock ISR facility are described in SEIS Section 2.1.1.1.7. Under the proposed action, these activities include workers commuting to and from the site, and road transportation of construction equipment and materials, operational processing supplies, ion-exchange resins, yellowcake product, and waste materials. The applicant's preferred method for disposal of liquid byproduct material is by Class V injection well. If a permit is not obtained for Class V injection, the applicant will pursue land application of treated liquid effluent. If the capacity of either method is limited, the applicant will pursue a combination of both Class V injection and land application. The transportation impacts from the Class V injection well option are described in Section 4.3.1.1. The transportation impacts from the land application option and combined Class V injection and land application are described in Sections 4.3.1.2 and 4.3.1.3.

4.3.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant's preferred option for disposal of liquid byproduct material is deep well disposal via Class V injection wells. The potential transportation environmental impacts from construction, operations, aquifer restoration, and decommissioning associated with the Class V injection well disposal option at the proposed Dewey-Burdock ISR Project are discussed in the following sections.

4.3.1.1.1 Construction Impacts

As described in SEIS Section 3.3, the site is accessed by Dewey Road (also known as Fall River County Road 6463 and Custer County Road 769) and State Highways 18, 79, and 89. The applicant estimated traffic generated by proposed construction activities, including transportation of equipment, supplies, and workers (Powertech, 2009a, 2010a), and its analysis is described in SEIS Section 2.1.1.1.7. The NRC staff's impact analysis first compared the proposed traffic estimates and data with the information evaluated in GEIS Section 2.8 and then evaluated the estimated percentage increase in existing traffic that could result from the proposed Dewey-Burdock ISR Project.

The NRC impact analysis found the overall magnitude of the proposed daily construction traffic is less than the construction traffic evaluated in GEIS Section 2.8. Commuting workers constitute the majority of road traffic the applicant described for the construction phase. The applicant estimated 38 worker trips to the site daily for the proposed project, which is well below the upper range of 200 commuting worker trips to a site considered in the GEIS. The applicant has estimated the initial facility construction requiring these workers will take approximately 1 year (Powertech, 2010a). The applicant's proposed equipment and supply shipments, however, were higher than those assumed in GEIS Section 2.8 (9 one-way trips per day for the proposed project compared to 0.24 one-way trips per day considered in GEIS Section 2.8).

Table 4.3-1 compares the magnitude of the NRC staff's estimated local traffic counts from proposed construction activities with existing traffic counts on regional/local roads. Considering Table 4.3-1, the proposed traffic, if allocated completely to the individual road segments, will noticeably increase the existing traffic on low-traffic roads, such as unpaved Dewey Road

Table 4.3-1. Estimated Daily Traffic on Regional Roads for the Construction Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

Road Segment	Traffic Count*			Projected Traffic†		Percent Increase‡	
	All Vehicles	Auto	Truck	Auto	Truck	Auto	Truck
Dewey Road	225	225	—	301	18	34	—
U.S. Highway 18 (Edgemont to State Highway 89)	1,782	1,361	421	1,437	439	6	4
U.S. Highway 18 (Hot Springs to State Highway 79)	5,075	4,725	350	4,801	368	2	5
State Highway 89 (U.S. Highway 385 to U.S. Highway 18)	659	604	55	680	73	12	33
State Highway 79 (at U.S. Highway 18)	3,172	2,569	603	2,645	621	3	3

Sources: Powertech (2013a,b); SDDOT (2011)
*Traffic counts are annual average daily traffic for both directions of travel (Supplemental Environmental Impact Statement Section 3.3). The U.S. Nuclear Regulatory Commission calculated the auto traffic count as the difference between the all vehicle count and reported truck count; for Dewey road, the auto count was assumed equal to the all vehicle count. Data for all roads are for year 2011 and are from SDDOT (2011), except the Dewey count is from 2012 (Powertech 2013a).
†Projected traffic is the sum of the proposed action daily two-way traffic and the applicable traffic count. Proposed construction phase two-way traffic is double the round-trips reported in Table 2.1-7.
‡This analysis assumes all projected traffic will travel on each road. If proposed action traffic used multiple routes then this analysis overestimates impacts to each road segment.

(Fall River County Road 6463 and Custer County Road 769) and State Highway 89 but will not substantially increase traffic on more heavily traveled road segments, such as U.S. Highway 18 traveling from Edgemont or near Hot Springs or State Highway 79 at the junction with U.S. Highway 18. The projected daily traffic on Dewey Road, the road nearest the proposed site, represents a 42 percent increase over existing traffic considering both autos and trucks. State Highway 89 auto traffic was projected to increase by 13 percent if all workers commuted on that route and truck traffic was projected to increase 33 percent. Similarly, based on the traffic count information in Table 4.3-1, State Highway 89 is not a commonly used route for trucks; therefore, the projected increase in truck traffic from the proposed action is considered less likely to be concentrated there relative to other routes. While the projected increase in traffic on some road segments is a noticeable change in conditions, the NRC staff further evaluated the projected increases in traffic by considering the ability of the roads to accommodate the increased traffic. When the projected traffic for all the roads in the analysis is evaluated (ranging from 319 to 5,169 vehicles per day based on the sum of projected auto and truck traffic for each road), the magnitude of traffic is not expected to exceed the existing road capacity, and therefore the staff conclude the regional highways could accommodate the additional traffic from the proposed project.

The conclusion that existing road capacity will not be exceeded is based on the staff's consideration of other road capacity estimates in SEIS Section 3.3. Because the traffic projections in Table 4.3-1 are daily values for both directions of travel, the comparable one-way projected traffic is assumed to be half the tabulated values [e.g., 2,584 vehicles per day for the U.S. Highway 18 total of 5,169 (2,584 vehicles per day is well below the aforementioned range of capacities staff evaluated of 7,237 to 13,900 vehicles per day)]; therefore, the NRC staff conclude the highest projected traffic is below the estimated capacity.

Considering the magnitude of projected traffic from the proposed Dewey-Burdock ISR Project, the NRC staff conclude the increase in traffic volumes to the local and unpaved Dewey Road will result in SMALL impacts under the Class V injection well disposal option. This increase in traffic will incrementally accelerate degradation of the road surface, increase the generation of dust, and increase the potential for traffic accidents and wildlife or livestock kills. Based on the available capacity on the more distant regional roads, the staff conclude the potential traffic impacts to the remainder of regional roads under the Class V injection well disposal option will be SMALL.

The applicant intends to use existing roads on the site area to the degree possible; however, some new roads will be constructed to facilitate onsite transportation (SEIS Section 2.1.1.2.2). Impacts to land use related to the development of new access roads are addressed in SEIS Section 4.2.1.1. All roads constructed for the proposed action will be reclaimed except those landowners specify to remain for future use (Powertech, 2009a).

4.3.1.1.2 Operations Impacts

The proposed operational transportation activities for the Dewey-Burdock ISR Project are similar to those evaluated in GEIS Section 4.4.2.2 including employee commuting and truck shipments of yellowcake, ion-exchange resins, hazardous chemical supplies, and byproduct material. The types of impacts evaluated are also similar to those evaluated in the GEIS including impacts to traffic and potential hazards associated with shipment of yellowcake, ion-exchange resins, byproduct material, and hazardous materials.

Traffic generated by these proposed operations is described in SEIS Section 2.1.1.1.7. The overall magnitude of proposed operational transportation is less than the operational transportation evaluated in GEIS Section 4.4.2.2. Commuting workers constitute the majority of road traffic the applicant proposed for the operations phase. The applicant estimated a number of commuting workers trips to the site that was within the range considered in the GEIS (27 vehicle trips for the proposed project compared to 20 to 200 trips considered in the GEIS). For trucking activities, remote ion-exchange shipments were comparable to the GEIS Section 2.8 values and processing chemical shipments were less than GEIS values. The proposed operational byproduct shipments are less than the GEIS values, and proposed yellowcake shipments are at the low end of the range considered in the GEIS. (NRC, 2009a)

Table 4.3-2 compares the magnitude of the NRC staff's estimated increase in local traffic counts from proposed operations activities. The projected traffic for the operations phase for all road segments evaluated is lower than the projected traffic from the construction phase. Considering Table 4.3-2, the proposed traffic, if allocated completely to the individual road segments, will increase the existing traffic on unpaved Dewey Road (Fall River County Road 6463 and Custer County Road 769) but will not substantially increase traffic on more heavily traveled road segments, such as State Highway 89, U.S. Highway 18 (from Edgemont and near Hot Springs), or State Highway 79 at the junction with U.S. Highway 18. The projected daily traffic on Dewey Road, the road nearest the proposed site, represents a 24 percent increase over existing traffic. State Highway 89 traffic was projected to increase by nine percent if all workers commuted on

Table 4.3-2. Estimated Daily Traffic on Regional Roads for the Operations Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

Road Segment	Traffic Count*			Projected Traffic†		Percent Increase‡	
	All Vehicles	Auto	Truck	Auto	Truck	Auto	Truck
Dewey Road	225	225	—	279	4	24	—
U.S. Highway 18 (Edgemont to State Highway 89)	1,782	1,361	421	1,415	425	4	<1
U.S. Highway 18 (Hot Springs to State Highway 79)	5,075	4,725	350	4,779	354	1	1
State Highway 89 (U.S. Highway 385 to U.S. Highway 18)	659	604	55	658	59	9	7
State Highway 79 (at U.S. Highway18)	3,172	2,569	603	2,623	605	2	<1

Sources: Powertech (2013a,b); SDDOT (2011)
*Traffic counts are annual average daily traffic for both directions of travel (Supplemental Environmental Impact Statement Section 3.3). The U.S. Nuclear Regulatory Commission calculated the auto traffic count as the difference between the all vehicle count and reported truck count; for Dewey road, the auto count was assumed equal to the all vehicle count. Data for all roads are for year 2011 and are from SDDOT (2011) except the Dewey count is from 2012 (Powertech, 2013a).
†Projected traffic is the sum of the proposed action daily two-way traffic and the applicable traffic count. Proposed operations phase two-way traffic is double the round- trips reported in Table 2.1-7.
‡This analysis assumes all projected traffic will travel on each road. If proposed action traffic used multiple routes, then this analysis overestimates impacts to each road segment.

that route; however, because the road is more distant from the site, the NRC staff conclude it will be less likely to be used by all workforce commuters and therefore actual traffic impacts will be lower than projected. Based on the information in Table 4.3-2, the projected increases in truck traffic are low for all routes evaluated. Additionally, the magnitude of the projected operational traffic for all the roads evaluated (ranging from approximately 283 to 5,133 vehicles per day considering the sum of projected auto and truck traffic) will not exceed the existing road capacity (see additional discussion of capacity in SEIS Section 4.3.1.1), and the staff conclude the regional highways could accommodate the additional traffic from the proposed project.

Considering the magnitude of projected traffic from the proposed Dewey-Burdock ISR Project, the NRC staff conclude the increase in traffic volumes to the local and unpaved Dewey Road will result in SMALL impacts under the Class V injection well disposal option. This increase in traffic will incrementally accelerate degradation of the road surface, increase the generation of dust, and increase the potential for traffic accidents and wildlife or livestock kills. Based on the available capacity on the more distant regional roads, the staff conclude the potential traffic impacts to the remainder of regional roads will also be SMALL under the Class V injection well disposal option.

The potential radiological accident risk associated with yellowcake product shipments was evaluated in GEIS Section 4.4.2.2. The yellowcake transportation analysis assumed shipment volumes that ranged from 34 to 145 yellowcake shipments per year, which could result in a risk of 0.01 and 0.04 latent cancer fatalities, respectively, considering accident probabilities and consequences (NRC, 2009a). The proposed yellowcake transportation activities for the proposed Dewey-Burdock ISR Project are described in SEIS Section 2.1.1.1.7. These activities are similar in approach to the activities evaluated in the GEIS Section 4.2.2.2, and the quantities of material shipped, the number of shipments, and the shipment distances are within the magnitude of the yellowcake transportation activities evaluated in the GEIS. The applicant has estimated approximately 25 yellowcake shipments per year will be needed for the proposed action or an average of one shipment every 2 weeks. This estimate is based on the proposed 45,250 kg [1 million lb] annual yellowcake production rate and an assumed 18,100 kg [40,000 lb] capacity per yellowcake shipment (Powertech, 2009b). By comparison the GEIS does not differ significantly; it considers yellowcake shipped in drums that hold approximately 430 kg [950 lb] and shipments carrying 40 drums per load for a total shipment capacity of 17,200 kg [38,000 lb]. Therefore, the radiological accident risk associated with yellowcake shipment at the proposed Dewey-Burdock ISR Project will be bounded by the GEIS risk analysis. The shipment volume will not significantly affect the project-related traffic relative to the expected commuting workforce.

The GEIS Section 4.4.2.2 reported that previous accidents involving yellowcake releases result in up to 30 percent of shipment contents being released (NRC, 2009a). To limit the risk of an accident involving resin or yellowcake transport, the applicant has proposed that all such materials will be transported in accordance with U.S. Department of Transportation (USDOT) and NRC regulations, handled as low specific-activity materials, and shipped using exclusive-use-only vehicles (Powertech, 2009a). The NRC staff conclude the consequences of such accidents will also be limited because the applicant has proposed to develop emergency response procedures (Powertech, 2009a) for yellowcake and other transportation accidents that could occur during shipment to or from the proposed Dewey-Burdock ISR Project. The applicant also proposes to ensure its personnel and the carrier receive training on these emergency response procedures and that information about the procedures is provided to state and local agencies (Powertech, 2009a). Therefore, the NRC staff conclude the impact from a potential accident involving yellowcake transportation during the operations phase of the proposed project will be SMALL under the Class V injection well disposal option.

The potential impacts from ion-exchange shipments were evaluated in GEIS Section 4.2.2.2 as cited by GEIS Section 4.4.2.2. NRC staff concluded in the GEIS that the potential radiological impacts of these shipments will be bound by the risks from yellowcake shipments based on the less concentrated nature of the resins; the uranium being chemically bound to the resins, which will limit dispersion in the event of a spill; and the small shipment distance relative to yellowcake shipments (i.e., the likelihood of an accident increases with the distance traveled). The proposed ion-exchange transportation activities for the Dewey-Burdock ISR Project described in SEIS Section 2.1.1.1.7 are similar to the activities evaluated in the GEIS. The applicant plans to transport one loaded resin truck per day (Powertech, 2009a), which is consistent with the GEIS Section 2.8 assumption of one truck per day. Ion-exchange resin transported onsite between the Dewey site and the Burdock site central processing plant will traverse approximately 8 km [5.0 mi] of road (primarily on Dewey Road). Compliance with the applicable NRC and USDOT regulations for shipping ion-exchange resins, which are enforced by NRC onsite inspections, provides additional confidence that these materials can be safely shipped across the site area. Therefore, applying the GEIS impact analysis to the proposed activities, the NRC staff conclude the aforementioned SMALL potential radiological accident impacts from the proposed Dewey-Burdock facility yellowcake shipments bound the potential radiological accident impacts of the proposed ion-exchange resin shipments. The NRC staff conclude the resulting environmental impact from ion-exchange resin shipments will be SMALL; this is based on the fact that the risk of ion-exchange resin accidents is low, a resulting spill will be properly removed and disposed of, and the affected area will be reclaimed in accordance with applicable NRC and state regulations.

The potential impacts from operational byproduct material shipments were evaluated in GEIS Section 4.2.2.2 as cited by GEIS Section 4.4.2.2. NRC staff concluded in the GEIS the SMALL risks from transporting yellowcake during operations will bound the risks expected from byproduct material shipments, owing to the concentrated nature of shipped yellowcake, the longer distance yellowcake is shipped relative to byproduct material, and the relative number of shipments of each material. The proposed operational byproduct material transportation activities for the Dewey-Burdock ISR Project are described in SEIS Section 2.1.1.1.7. The applicant proposed to temporarily store operational byproduct material and then ship the material to an offsite disposal facility that is licensed to accept byproduct material. Byproduct material disposal facility options are described in SEIS Section 3.13.2. The applicant's estimated annual generation of 22 m^3 [29 yd^3] of byproduct material (including reverse osmosis reject solids, spent ion-exchange resins, and tank and pond sediments) will comprise approximately one shipment per year (SEIS Section 2.1.1.1.7). This magnitude of operational byproduct material shipping is lower than the range documented in the GEIS of 2.5 to 15 shipments per year (NRC, 2009a, Table 2.8-1). Transportation safety will be maintained by the applicant's proposed adherence to applicable NRC and USDOT transportation requirements, the applicant's proposed use of licensed third-party carriers, and the applicant's proposed emergency response measures (Powertech, 2009b). Based on the preceding analysis, the NRC staff conclude the applicant's proposed operational byproduct material shipment activities are consistent with the impact analysis in GEIS Section 4.4.2.2, and therefore environmental impacts of the proposed shipments under the Class V injection well disposal option will be bounded by impacts from the proposed yellowcake shipments (SMALL).

The potential impacts from transportation of process chemical supplies were also evaluated in GEIS Section 4.2.2.2 as cited by GEIS Section 4.4.2.2. The potential safety hazards associated with process chemicals the applicant intends to use for the proposed action (see SEIS Section 4.13.1.2.3) were also described and evaluated in GEIS Sections 2.11.2 and 4.2.11.2.4 (NRC, 2009a). The proposed operational hazardous chemical shipments for the Dewey-Burdock ISR Project are described in SEIS Section 2.1.1.1.7. The applicant proposes to store, use, and receive shipments of the following chemicals: sodium chloride (NaCl), sodium carbonate ($NaHCO_3$), sodium hydroxide (NaOH), hydrochloric acid (HCl), hydrogen peroxide (H_2O_2), carbon dioxide (CO_2), oxygen (O_2), anhydrous ammonia (NH_3), diesel fuel, gasoline, and bottled gases (Powertech, 2009b). The magnitude of operational chemical supply shipments is less than the value documented in the GEIS (NRC, 2009a, Table 2.8-1), and the types of chemicals shipped align with the materials evaluated in the GEIS (NRC, 2009a).

Transportation risks associated with incoming, onsite, and outgoing shipments involve potential in-transit accidents. The process chemicals described in the applicant's proposal are commonly used in industrial applications, and they will be transported following applicable USDOT hazardous materials shipping provisions. If an accident occurs, spill response will be handled via emergency response procedures, although a spill of nonradiological materials will be reportable to the appropriate state agency, EPA, and USDOT (NRC, 2009a). Spill material will be recovered or removed and the affected areas reclaimed. The release of anhydrous ammonia, a compound that the applicant may use in the precipitation circuit (Powertech, 2009b), could be hazardous to the public if released near a populated area. However, the proposed project is not situated in a populated area and the likelihood of such an accident occurring is small, calculated as 3.0×10^{-7} accidents per km [4.8×10^{-7} accidents per mi] based on NUREG–0706 accident data (NRC, 1980). The applicant proposes to maintain transportation safety by following applicable USDOT hazardous materials transportation requirements and the proposed use of licensed third-party carriers (Powertech, 2009a). Based on these considerations, the staff conclude the environmental impacts from operational hazardous chemical shipments under the Class V injection well disposal option will be SMALL.

NRC staff conclude the increase in traffic volumes will result in SMALL impacts to the local and unpaved Dewey Road and SMALL impacts to the remaining regional roads under the Class V injection well disposal option. Based on the low radiological risks from transportation accidents and the implementation of the applicant's additional safety practices as previously discussed, the overall impacts from the proposed transportation activities during the operations phase will be SMALL under the Class V injection well disposal option.

4.3.1.1.3 Aquifer Restoration Impacts

At the proposed Dewey-Burdock ISR Project, commuting workers constitute the majority of road traffic the applicant proposes for the aquifer restoration phase. The applicant estimated the number of worker trips per day to the site will be five (compared to 20 to 200 worker trips per day considered in GEIS Section 2.8). To evaluate the potential traffic impacts, the NRC staff assumed remote ion-exchange and processing chemical shipments will be similar to the operations phase and bounded by the GEIS values (NRC, 2009a).

Table 4.3-3 compares the magnitude of the NRC staff's estimated increase in local traffic counts from proposed aquifer restoration activities. The projected auto traffic for the aquifer restoration phase for all road segments evaluated is lower than the projected traffic from the construction and operation phases, and the projected truck traffic is similar to the operation phase. Considering Table 4.3-3, the proposed traffic, if allocated completely to the individual road segments, will increase the existing traffic on low-traffic roads, such as the unpaved Dewey Road (Fall River County Road 6463 and Custer County Road 769), but will not substantially increase traffic on the remaining road segments in the table. The projected daily traffic on Dewey Road, the road nearest the proposed site, is a 4 percent increase over existing traffic. Based on the low levels of projected traffic for all vehicle types and road segments, the NRC staff conclude the transportation impacts from the proposed aquifer restoration transportation activities will be SMALL under the Class V injection well disposal option.

4.3.1.1.4 Decommissioning Impacts

The proposed decommissioning traffic estimates for the Dewey-Burdock ISR Project are described in SEIS Section 2.1.1.1.7. NRC staff derived these estimates from applicant-provided information. The magnitude of estimated truck transportation for the proposed decommissioning phase is about two times greater than what is reported in the GEIS (NRC, 2009a, Table 2.8-1), due to the larger amount of estimated nonhazardous solid waste (e.g., facility demolition and equipment removal) from the proposed action that will need to be shipped offsite for disposal. Despite this increase, the overall level of transportation is still low at about one truck per day (two trips when both directions are included) based on the information in SEIS Section 2.1.1.1.7.

Table 4.3-4 compares the magnitude of the NRC staff's estimated increase in local traffic counts from proposed decommissioning activities. The projected traffic in Table 4.3-4 is based on the

Table 4.3-3. Estimated Daily Traffic on Regional Roads for the Aquifer Restoration Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

Road Segment	Traffic Count*			Projected Traffic†		Percent Increase‡	
	All Vehicles	Auto	Truck	Auto	Truck	Auto	Truck
Dewey Road	225	225	—	235	4	4	—
U.S. Highway 18 (Edgemont to State Highway 89)	1,782	1,361	421	1,371	425	<1	<1
U.S. Highway 18 (Hot Springs to State Highway 79)	5,075	4,725	350	4,735	354	<1	1
State Highway 89 (U.S. Highway 385 to U.S. Highway 18)	659	604	55	622	59	2	7
State Highway 79 (at U.S. Highway 18)	3,172	2,569	603	2,579	607	<1	<1

Sources: Powertech (2013a,b); SDDOT (2011)
*Traffic counts are annual average daily traffic for both directions of travel (Supplemental Environmental Impact Statement Section 3.3). The U.S. Nuclear Regulatory Commission calculated the auto traffic count as the difference between the all vehicle count and reported truck count for Dewey road, the auto count was assumed equal to the all vehicle count. Data for all roads are for year 2011 and are from SDDOT (2011), except the Dewey count is from 2012 (Powertech, 2013a).
†Projected traffic is the sum of the proposed action daily two-way traffic and the applicable traffic count. Proposed aquifer restoration phase two-way traffic is double the round-trips reported in Table 2.1-7.
‡This analysis assumes all projected traffic will travel on each road. If proposed action traffic used multiple routes, then this analysis overestimates impacts to each road segment.

applicant's proposed Class V injection well disposal option, which the applicant estimated will generate less decommissioning waste than the land application disposal option (and therefore will generate less truck traffic). The projected combined auto and truck traffic for the decommissioning phase for all road segments evaluated is lower than the projected traffic from the construction, operation, and aquifer restoration phases. Considering Table 4.3-4, the proposed traffic, if allocated completely to the individual road segments, will increase the existing traffic on low-traffic roads, such as the unpaved Dewey Road (Fall River County Road 6463 and Custer County Road 769), but will not substantially increase traffic on the remaining road segments in the table. The projected increase in daily traffic on Dewey Road, the road nearest the proposed site, is a six percent increase over existing traffic. Based on the low levels of projected traffic for all vehicle types and road segments, the NRC staff conclude the potential traffic-related impacts from the proposed decommissioning transportation activities will be SMALL under the Class V injection well disposal option.

Another potential transportation impact from proposed decommissioning activities is the radiological risk from the transportation of byproduct material for offsite disposal. The NRC staff consider the potential radiological accident risk associated with byproduct material shipments will be low based on the calculated risks from concentrated yellowcake product shipments discussed previously in SEIS Section 4.3.1.1.2 and in GEIS Section 4.2.2.2. The number of byproduct material shipments NRC staff estimated based on the applicant's proposal is low (Table 2.1-7) (approximately 31 annually for the Class V injection well option compared to

Table 4.3-4. Estimated Daily Traffic on Regional Roads for the Decommissioning Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

Road Segment	2011 Traffic Count*			Projected Traffic†		Percent Increase‡	
	All Vehicles	Auto	Truck	Auto	Truck	Auto	Truck
Dewey Road	225	225	—	239	2	6	—
U.S. Highway18 (Edgemont to State Highway 89)	1,782	1,361	421	1,375	423	1	<1
U.S. Highway 18 (Hot Springs to State Highway 79)	5,075	4,725	350	4,739	352	<1	1
State Highway 89 (U.S. Highway 385 to U.S. Highway 18)	659	604	55	618	57	2	4
State Highway 79 (at U.S. Highway18)	3,172	2,569	603	2,583	605	<1	<1

Sources: Powertech (2013a,b); SDDOT (2011)
*Traffic counts are annual average daily traffic for both directions of travel (Supplemental Environmental Impact Statement Section 3.3). The U.S. Nuclear Regulatory Commission calculated the auto traffic count as the difference between the all vehicle count and reported truck count; for Dewey road, the auto count was assumed equal to the all vehicle count. Data for all roads are for year 2011 and are from SDDOT (2011), except the Dewey count is from 2012 (Powertech, 2013a).
†Projected traffic is the sum of the proposed action daily two-way traffic and the applicable traffic count. Proposed decommissioning phase two-way traffic is double the round-trips reported in Table 2.1-7.
‡This analysis assumes all projected traffic will travel on each road. If proposed action traffic used multiple routes, then this analysis overestimates impacts to each road segment.

145 yellowcake shipments evaluated in the GEIS; annual values for the proposed action are the product of the reported daily values in Table 2.1-7 and 260 days/year shipping frequency). The applicant's annual byproduct material volume estimate in its surety (Powertech, 2009b) (see SEIS Section 2.1.1.6.3) indicates the material will consist primarily of pond leak detection equipment and liners. Relative to powdered yellowcake, this material is in a form that will be less dispersible (i.e., less likely to cause public exposure if released) and easier to clean up if an accident involving release occurred. The byproduct material will be transported and disposed of at a licensed facility. The applicant has proposed to pursue an agreement with the White Mesa site in Blanding, Utah, for disposal of solid byproduct material (SEIS Section 3.13.2). The trip distance to this facility from the proposed site of 1,210 km [752 mi] is less than the distance used in the risk analysis described in GEIS Section 4.2.2.2 for transporting yellowcake to the conversion facility in Metropolis, Illinois {approximately 2,414 km [1,500 mi]}. The applicant proposes to implement additional BMPs to reduce the risk of accidents including (i) enforcing safe driving and emergency response procedures and training for personnel and truck drivers, (ii) installing communication systems to connect trucks to shipper/receiver/emergency responders, (iii) and enforcing speed limits on the proposed project site to increase driver safety and to reduce conflicts with big game, livestock, and other vehicles (Powertech, 2009a).
All shipments will be required to comply with applicable USDOT regulations governing the transportation of radioactive material (including quantity limits, packaging requirements, and conveyance dose rate limits). Based on the preceding analysis, the NRC staff conclude the potential radiological risks from the proposed transportation of decommissioning byproduct material will be low and therefore the potential environmental impacts from the proposed

radioactive material transportation will be SMALL under the Class V injection well disposal option.

In conclusion, because of the low estimated traffic for the proposed Dewey-Burdock ISR Project relative to existing road traffic in the region surrounding the site, the NRC staff conclude the potential traffic-related transportation impacts during decommissioning will be SMALL under the Class V injection well disposal option. The low radiological risk from potential transportation accidents in comparison to the accident risks evaluated for the operation phase (i.e., no interstate transport of yellowcake product) supports the staff's conclusion that the radiological risks from transportation of decommissioning byproduct material for offsite disposal will also be SMALL. Therefore, the NRC staff conclude the overall transportation impacts related to the decommissioning phase will be SMALL under the Class V injection well disposal option.

4.3.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not obtained from EPA, the applicant proposes to dispose of liquid byproduct material generated at the proposed Dewey-Burdock ISR Project by land application (see SEIS Section 2.1.1.1.2.4.2). The potential transportation environmental impacts from construction, operations, aquifer restoration, and decommissioning associated with the land application liquid disposal option are discussed in the following sections.

4.3.1.2.1 Construction Impacts

The estimated daily traffic volume on regional roads for the construction phase for the land application option will be the same as that described in SEIS Section 4.3.1.1.1 and summarized in Table 4.3-1 for the Class V injection well disposal option. Commuting workers will constitute the majority of road traffic the applicant proposed for the construction phase. Considering Table 4.3-1, the proposed traffic will increase the existing traffic on low-traffic roads, such as Dewey Road, and State Highway 89 but will not substantially increase traffic on more heavily traveled road segments, such as U.S. Highway 18 traveling through Edgemont or near Hot Springs or State Highway 79 at the junction with U.S. Highway 18. As described in SEIS Section 4.3.1.1.1, when the projected traffic for all the roads in the analysis is evaluated (ranging from 319 to 5,169 vehicles per day based on the sum of projected auto and truck traffic for each road), the magnitude of traffic is not expected to exceed the existing road capacity. Therefore, NRC staff conclude the regional highways could accommodate the additional traffic from the proposed project.

Considering the magnitude of projected traffic from the proposed project, the NRC staff conclude the increase in traffic volumes to the local and unpaved Dewey Road will result in SMALL impacts under the land application disposal option. The projected daily traffic on Dewey Road represents a 42 percent increase over existing traffic considering both autos and trucks (see Table 4.3-1). This increase in traffic will incrementally accelerate degradation of the road surface, increase the generation of dust, and increase the potential for traffic accidents and wildlife or livestock kills. Based on the available capacity on the more distant regional roads, the NRC staff conclude the potential traffic impacts to the remainder of regional roads under the land application disposal option will also be SMALL.

The applicant intends to use existing roads on the site area to the degree possible; however, some new roads will be constructed to facilitate onsite transportation (SEIS Section 2.1.1.2.2). Impacts to land use related to the development of new access roads are addressed in SEIS

Section 4.2.1.1. All roads constructed for the proposed action will be reclaimed except those landowners specify to remain for future use (Powertech, 2009a).

4.3.1.2.2 Operations Impacts

The proposed operational transportation activities for the Dewey-Burdock ISR Project include employee commuting and truck shipments of yellowcake, ion-exchange resins, hazardous chemical supplies, and byproduct material. Traffic generated by these proposed activities for the land application option will be the same as that described in SEIS Section 4.3.1.1.2 and summarized in Table 4.3-2 for the Class V injection well disposal option.

Commuting workers will constitute the majority of road traffic the applicant proposed for the construction phase. Considering Table 4.3-2, the proposed traffic will increase the existing traffic on low-traffic roads, such as Dewey Roadand State Highway 89 but will not substantially increase traffic on more heavily traveled road segments, such as U.S. Highway 18 traveling through Edgemont or near Hot Springs or State Highway 79 at the junction with U.S. Highway 18. As described in SEIS Section 4.3.1.1.2, when the projected traffic for all the roads in the analysis is evaluated (ranging from approximately 283 to 5,133 vehicles per day based on the sum of projected auto and truck traffic for each road), the magnitude of traffic is not expected to exceed the existing road capacity. Therefore, NRC staff conclude the regional highways could accommodate the additional traffic from the proposed project.

Considering the magnitude of projected traffic from the proposed project, the NRC staff conclude the increase in traffic volumes to the local and unpaved Dewey Road will result in SMALL impacts under the land application disposal option. The projected daily traffic on Dewey Road represents an increase of 24 percent over the existing traffic level (see Table 4.3-2). This increase in traffic will incrementally accelerate degradation of the road surface, increase the generation of dust, and increase the potential for traffic accidents and wildlife or livestock kills. Based on the available capacity on the more distant regional roads, the staff conclude the potential traffic impacts to the remainder of regional roads will also be SMALL under the land application disposal option.

Proposed yellowcake transportation activities for the land application option will be same as those described in SEIS Section 4.3.1.1.2 for the Class V injection well disposal option. The applicant has estimated approximately 25 yellowcake shipments per year will be needed for the proposed action or an average of one shipment every 2 weeks. This estimate is based on the proposed 45,250 kg [1 million lb] annual yellowcake production rate and an assumed 18,100 kg [40,000 lb] capacity per yellowcake shipment (Powertech, 2009b). This shipment volume will not significantly affect the project-related traffic relative to the expected commuting workforce.

To limit the risk of an accident involving resin or yellowcake transport, the applicant has proposed that all such materials will be transported in accordance with USDOT and NRC regulations, handled as low specific-activity materials, and shipped using exclusive-use-only vehicles (Powertech, 2009a). The NRC staff conclude the consequences of such accidents will also be limited because the applicant has proposed to develop emergency response procedures (Powertech, 2009a) for yellowcake and other transportation accidents that could occur during shipment to or from the proposed Dewey-Burdock ISR Project. The applicant also proposes to ensure its personnel and the carrier receive training on these emergency response procedures and that information about the procedures is provided to state and local agencies (Powertech, 2009a). Therefore, the NRC staff concluded the impact from a potential accident involving yellowcake transportation during the operations phase of the proposed project will be SMALL under the land application disposal option.

Proposed ion-exchange transportation activities for the land application option will be the same as those described in SEIS Section 4.3.1.1.2 for the Class V injection well option. The applicant plans to transport one loaded resin truck per day (Powertech, 2009a). Ion-exchange resin transported onsite between the Dewey satellite facility and the Burdock central processing plant will traverse approximately 8 km [5.0 mi] of road (primarily Dewey Road). Compliance with the applicable NRC and USDOT regulations for shipping ion-exchange resins, which are enforced by NRC onsite inspections, provides confidence that these materials can be safely shipped across the site area. The NRC staff conclude the aforementioned SMALL potential radiological accident impacts from the proposed Dewey-Burdock facility yellowcake shipments bound the potential radiological accident impacts of the proposed ion-exchange resin shipments. The NRC staff conclude that the resulting environmental impact from ion-exchange resin shipments will be SMALL; this is based on the fact that the risk of ion-exchange resin accidents is low, a resulting spill will be properly removed and disposed of, and the affected area will be reclaimed in accordance with applicable NRC and state regulations.

Proposed operational byproduct material transportation activities for the land application option will be the same as those described in SEIS Section 4.3.1.1.2 for the Class V injection well disposal option. NRC staff concluded in the GEIS the small risks from transporting yellowcake during operations will bound the risks expected from byproduct material shipments, owing to the concentrated nature of shipped yellowcake, the longer distance yellowcake is shipped relative to byproduct material, and the relative number of shipments of each material. The applicant's estimated annual generation of 22 m^3 [29 yd^3] of byproduct material (including reverse osmosis reject solids, spent ion-exchange resins, and tank and pond sediments) will comprise approximately one shipment per year (SEIS Section 2.1.1.1.7). Transportation safety will be maintained by the applicant's proposed adherence to applicable NRC and USDOT transportation requirements, the applicant's proposed use of licensed third-party carriers, and the applicant's proposed emergency response measures (Powertech, 2009b). NRC staff conclude that the environmental impacts of the proposed byproduct material shipments under the land application disposal option will be bounded by impacts from the proposed yellowcake shipments (SMALL).

Proposed operational hazardous chemical shipments for the land application option will be the same as those described in SEIS Section 4.3.1.1.2 for the Class V injection well disposal option. Transportation risks associated with incoming, onsite, and outgoing hazardous chemical shipments involve potential in-transit accidents. The process chemicals described in the applicant's proposal are commonly used in industrial applications, and they will be transported following the applicable USDOT hazardous materials shipping provisions. If an accident occurred, spill response will be handled via emergency response procedures, although a spill of nonradiological materials will be reportable to the appropriate state agency, EPA, and USDOT (NRC, 2009a). Spill material will be recovered or removed and the affected areas reclaimed. The release of anhydrous ammonia, a compound that the applicant may use in the precipitation circuit (Powertech, 2009b), could be hazardous to the public if released near a populated area. However, the proposed Dewey-Burdock ISR Project is not situated in a populated area and the likelihood of such an accident occurring is SMALL, calculated as 3.0×10^{-7} accidents per km [4.8×10^{-7} accidents per mi] based on NUREG–0706 accident data (NRC, 1980). The applicant proposes to maintain transportation safety by adherence to applicable USDOT hazardous materials transportation requirements and the proposed use of licensed third-party carriers

(Powertech, 2009a). Based on these considerations, the staff conclude the environmental impacts from operational hazardous chemical shipments under the land application disposal option will be SMALL.

NRC staff conclude the increase in traffic volumes to the local and unpaved Dewey Road will result in SMALL impacts from travel on that road and SMALL impacts to the remaining regional roads under the land application disposal option. Based on the low radiological risks from transportation accidents and the implementation of the applicant's additional safety practices as previously discussed, the overall impacts from the proposed transportation activities during the operations phase will be SMALL under the land application disposal option.

4.3.1.2.3 Aquifer Restoration Impacts

The estimated daily traffic volume on regional roads during the aquifer restoration phase for the land application disposal option will be the same as that described in SEIS Section 4.3.1.1.3 and summarized in Table 4.3-3 for the Class V injection well disposal option. Commuting workers will constitute the majority of road traffic the applicant proposed for the aquifer restoration phase. The projected auto traffic for the aquifer restoration phase for all road segments evaluated is lower than the projected traffic from the construction and operation phases, and the projected truck traffic is similar to the operation phase. Considering Table 4.3-3, the proposed traffic, if allocated completely to the individual road segments, will increase the existing traffic on low-traffic roads, such as the unpaved Dewey Road (Fall River County Road 6463 and Custer County Road 769), but will not substantially increase traffic on the remaining road segments in the table. The projected daily traffic on Dewey Road, the road nearest the proposed site, is increased by four percent of the existing low level of traffic. Based on the low levels of projected traffic for all vehicle types and road segments, the NRC staff conclude the transportation impacts from the proposed aquifer restoration transportation activities will be SMALL under the land application disposal option.

4.3.1.2.4 Decommissioning Impacts

The proposed decommissioning transportation activities for the Dewey-Burdock ISR Project include employee commuting and truck shipments of nonhazardous solid waste (e.g., facility demolition and equipment removal) and byproduct material. Traffic generated by these proposed activities for the land application option will be the same as that described in SEIS Section 4.3.1.1.4 and summarized in Table 4.3-4 for the Class V injection well disposal option.

The applicant estimated that the proposed land application disposal option will generate more decommissioning waste than the Class V injection well disposal option (and therefore will generate more truck traffic). The projected combined auto and truck traffic for the decommissioning phase for all road segments evaluated is lower than the projected traffic from the construction, operation, and aquifer restoration phases. Considering Table 4.3-4, the proposed traffic, if allocated completely to the individual road segments, will increase the existing traffic on low-traffic roads, such as the unpaved Dewey Road (Fall River County Road 6463 and Custer County Road 769), but will not substantially increase traffic on the remaining road segments in the table. The projected daily traffic on Dewey Road, the road nearest the proposed site, is increased by six percent of the existing low level of traffic. Based on the low levels of projected traffic for all vehicle types and road segments, the NRC staff conclude the potential traffic-related impacts from the proposed decommissioning transportation activities will be SMALL under the land application disposal option.

Another potential transportation impact from proposed decommissioning activities is the radiological risk from the transportation of byproduct material for offsite disposal. The NRC staff consider the potential radiological accident risk associated with byproduct material shipments will be low based on the calculated risks from concentrated yellowcake product shipments discussed previously in SEIS Section 4.3.1.2.2. The number of byproduct material shipments NRC staff estimated based on the applicant's proposal is low (Table 2.1-7; approximately 34 annually for the land application option). The applicant's annual byproduct material volume estimate in its surety (Powertech, 2009b) (see SEIS Section 2.1.1.6.3) indicates the material will consist primarily of pond leak detection equipment and liners. Relative to powdered yellowcake, this material is in a form that will be less dispersible (i.e., less likely to cause public exposure if released) and easier to clean up if an accident involving release occurred. The byproduct material will be transported and disposed of at a licensed facility. The applicant has proposed to pursue an agreement with the White Mesa site in Blanding, Utah, for disposal of solid byproduct material (SEIS Section 3.13.2). The trip distance to this facility from the proposed site of 1,210 km [752 mi] is less than the distance used in the risk analysis described in GEIS Section 4.2.2.2 for transporting yellowcake to the conversion facility in Metropolis, Illinois {approximately 2,414 km [1,500 mi]}. The applicant proposes to implement additional BMPs to reduce the risk of accidents, including (i) enforcing safe driving and emergency response procedures and training for personnel and truck drivers; (ii) installing communication systems to connect trucks to shipper/receiver/emergency responders; and (iii) and enforcing speed limits on the proposed project site to increase driver safety and to reduce conflicts with big game, livestock, and other vehicles (Powertech, 2009a). All shipments will be required to comply with applicable USDOT regulations governing the transportation of radioactive material (including quantity limits, packaging requirements, and conveyance dose rate limits). Based on the preceding analysis, the NRC staff conclude the potential radiological risks from the proposed transportation of decommissioning byproduct material will be low, and therefore the potential environmental impacts from the proposed radioactive material transportation will be SMALL under the land application disposal option.

In conclusion, because of the low estimated traffic for the proposed project relative to existing road traffic in the region surrounding the site, the NRC staff conclude the potential traffic-related transportation impacts during decommissioning will be SMALL under the land application disposal option. The low radiological risk from potential transportation accidents in comparison to the accident risks evaluated for the operation phase (i.e., no interstate transport of yellowcake product) supports the staff's conclusion that the radiological risks from transportation of decommissioning byproduct material for offsite disposal will also be SMALL. Therefore, the NRC staff conclude the overall transportation impacts related to the decommissioning phase will be SMALL under the land application disposal option.

4.3.1.3 Disposal Via Combination of Class V Injection and Land Application

If a permit for Class V injection wells is obtained from EPA but the capacity of the wells is insufficient to dispose of all liquid byproduct material generated at the proposed Dewey-Burdock ISR Project, the applicant has proposed to dispose of liquid byproduct material by a combination of Class V injection wells and land application (see SEIS Section 2.1.1.1.2.4.3). For the combined option, land application facilities and infrastructure will be constructed, operated, restored, and decommissioned on an as-needed basis depending on the deep well disposal capacity (Powertech, 2011). The land application option will require the construction and operation of irrigation areas and increased pond capacity for storage of liquid byproduct material during nonirrigation periods (see SEIS Section 2.1.1.1.2.4.2), whereas the Class V injection well disposal option will require the construction and operation of four to eight deep disposal wells (see SEIS Section 2.1.1.1.2.4.1).

The relative volumes of byproduct material generated by the two disposal options differ during operations, aquifer restoration, and decommissioning phases with the land application option generating the larger amount of material for offsite disposal in each phase. The relative volumes of nonhazardous solid waste generated by the two disposal options differ during the decommissioning phase. The significance of these differences with regard to environmental impacts is low and does not change the impact conclusions for each disposal option. Therefore, the transportation environmental impacts associated with the land application option will be the same for the Class V injection well disposal option for all phases of the ISR process. Furthermore, only a portion of land application facilities and infrastructure (e.g., irrigation areas and storage ponds) will be constructed, operated, and decommissioned for the combined Class V injection well disposal and land application option. Therefore, the significance of environmental impacts on waste management resources for the combined disposal option will be less than for the land application option alone. Based on this reasoning, NRC staff conclude that the transportation environmental impacts of the combined Class V injection well disposal and land application option for each phase of the proposed Dewey-Burdock ISR Project will lie between or be bounded by the significance of environmental land use impacts of the Class V deep well injection option and the land application option as summarized in Table 4.3-5.

4.3.2 No Action (Alternative 2)

Under the No-Action alternative, traffic volumes and patterns will remain the same as described in SEIS Section 3.3. There will be no transportation of materials to and from the site to support licensed activities. There will be no transportation of either radionuclide or solid waste attributable to the proposed action because the facility will neither be licensed nor constructed and operated. Existing land use activities, predominantly livestock grazing, will persist.

4.4 Geology and Soils Impacts

Environmental impacts on geology and soils occur during all phases of an ISR facility lifecycle; however, the direct impacts on geology and soils will be concentrated during construction (NRC, 2009a).

Table 4.3-5. Significance of Transportation Environmental Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

	Class V Injection Wells	Land Application	Combined Class V Injection Wells and Land Application*
Construction	SMALL	SMALL	SMALL
Operations	SMALL	SMALL	SMALL
Aquifer Restoration	SMALL	SMALL	SMALL
Decommissioning	SMALL	SMALL	SMALL

*Significance of environmental impact for the combined disposal option is bounded by the significance of environmental impacts for the Class V injection well and land application disposal options.

<u>GEIS Construction Phase Summary</u>

As described in GEIS Section 4.4.3.1, the principal impacts on geology and soils are caused by earthmoving activities during construction of ISR surface facilities, access roads, wellfields, and pipelines. Earthmoving activities affecting soils include ground clearing, topsoil removal, and preparation of land surfaces before construction of facility structures. Such structures include the processing plant, satellite facilities, header houses, access roads, drilling sites, land application areas, and associated structures. Excavating and backfilling trenches for pipelines and cables will also impact soils. (NRC, 2009a)

NRC staff concluded in the GEIS that the impact on geology and soils from construction activities is dependent on local topography, surface and bedrock geology, and soil characteristics. Earthmoving activities are normally limited to a small portion of the project. Consequently, earthmoving activities will result in SMALL and temporary disturbance of soils, impacts that are commonly mitigated using accepted BMPs. Construction activities will increase the potential for wind and water erosion due to the removal of vegetation and the physical disturbance that will result from vehicle and heavy equipment traffic. These activities, however, will result in SMALL impacts if equipment operators adopt construction BMPs to either prevent or substantially reduce erosion. (NRC, 2009a)

<u>GEIS Operations Phase Summary</u>

As discussed in GEIS Section 4.4.3.2, during ISR operations, a non-uranium-bearing (barren) solution or lixiviant is injected through wells into the mineralized zone. The lixiviant moves through the host rock, dissolving uranium and other metals. Production wells withdraw the resulting “pregnant” lixiviant, which now contains uranium and other dissolved metals, and pump it to a processing facility for further uranium recovery and purification. During ISR operations the removal of uranium and other metals will permanently change the composition of uranium-bearing rock formations. However, the uranium mobilization and recovery process in the target sandstones does not result in the removal of rock matrix or structure, and therefore no significant matrix compression or ground subsidence is expected. Consequently, impacts on geology from ground subsidence at ISR projects will be SMALL. (NRC, 2009a)

In GEIS Section 4.4.3.2, NRC staff discussed the potential soil impacts from ISR operations resulting from the need to transfer barren and pregnant uranium-bearing lixiviant to and from the processing facility in aboveground and underground pipelines. If a pipe ruptures or fails, lixiviant could be released and (i) pond on the surface, (ii) runoff into surface water bodies, (iii) infiltrate and adsorb in overlying soil and rock, or (iv) infiltrate and percolate to groundwater. In the case of spills from pipeline leaks and ruptures, licensees are expected to initiate immediate spill responses using onsite standard operation procedures (e.g., NRC, 2003b, Section 5.7). As part of the monitoring requirements at ISR facilities, licensees must report certain spills to NRC within 24 hours. Regular inspection and monitoring also occurs to minimize the potential for spills and leaks through early detection. (NRC, 2009a)

Additionally, failure of settling and holding pond liners or embankment systems and buildup of certain constituents in land-applied water may negatively impact soils (NRC, 2009a). Licensees will be expected to construct and monitor settling and holding pond liners and embankments in accordance with NRC-approved plans, and licensees will be expected to obtain the appropriate permits from state regulatory agencies for land application and to conduct regular soil monitoring. Such actions will tend to mitigate impacts to soils from these waste disposal methods. Based on these considerations, NRC staff concluded in GEIS Section 4.4.3.2 that impacts to soils from spills during operations could range from SMALL to LARGE, depending on the volume of soil affected by the spill, but that the immediate response requirement to report spills at ISR facilities, the mandated spill recovery actions, and the required routine monitoring programs will reduce the potential impact from spills to SMALL. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

As described in GEIS Section 4.4.3.3, aquifer restoration programs typically use a combination of (i) groundwater transfer; (ii) groundwater sweep; (iii) reverse osmosis, permeate injection and recirculation; (iv) stabilization; and (v) water treatment and surface conveyance (NRC, 2009a). The groundwater sweep and recirculation process does not remove rock matrix or structure, nor will dewatering occur within the aquifer; therefore, no significant matrix compression or ground subsidence is expected. The water pressure in the aquifer decreases during restoration because a negative water balance must be maintained in the wellfield being restored to ensure water flows from the edges of the wellfield inward; this reduces the spread of contaminants outside of the wellfield. The influx of fluid will change the reservoir pressure but will not reactivate any local faults, because the change in reservoir pressure is limited by recirculation of treated groundwater. NRC staff concluded in the GEIS that ISR operations are unlikely to reactivate any local faults and are extremely unlikely to cause earthquakes. After analyzing these conditions the NRC staff concluded in the GEIS the environmental impact of aquifer restoration to the geology of the Nebraska-South Dakota-Wyoming Uranium Milling Region will be SMALL. (NRC, 2009a)

In GEIS Section 4.4.3.3, NRC staff also concluded impacts on soils from spills during aquifer restoration will range from SMALL to LARGE, depending on the volume of soil affected by the spill. Because of the requirements for immediate spill response at ISR facilities, for spill-recovery actions, and for routine monitoring programs, NRC staff concluded in the GEIS that impacts from spills will be temporary and the long-term impact on soils will be SMALL. (NRC, 2009a)

GEIS Decommissioning Phase Summary

As indicated in GEIS Section 4.4.3.4, the decommissioning of ISR facilities includes the following activities: (i) dismantling process facilities and associated structures; (ii) removing buried piping; and (iii) plugging and abandoning wells using accepted practices. The main impacts to the geology and soils at the project site during decommissioning will result from land reclamation activities and cleaning up contaminated soils. (NRC, 2009a)

The GEIS also states a licensee is required to submit a decommissioning plan to NRC for review and approval before decommissioning and reclamation activities may begin. NRC regulations require an applicant submit a final decommissioning plan to NRC for review and approval at least 12 months prior to the planned decommissioning of a wellfield or any portion of an ISR facility (NRC, 2003a). Any soils that have the potential to be contaminated will be surveyed to identify and clean up areas with elevated radionuclide concentrations, in accordance with NRC regulations at 10 CFR Part 40, Appendix A, Criterion 6 (6) (NRC, 2009a). The goal of reclamation is to return the site to preproduction conditions by replacing topsoil and reestablishing vegetation communities. (NRC, 2009a)

NRC staff concluded in the GEIS that the impacts on geology and soils from decommissioning will be detectable but SMALL. Disruption and/or displacement of existing soils will be temporary and relatively small in scale. Changes in the size and location of impervious surfaces will be measureable, but will involve only a few hectares [acres] of compacted soil beneath buildings and parking lots. These changes will not be on a large enough scale to alter existing natural conditions. (NRC, 2009a)

4.4.1 Proposed Action (Alternative 1)

As described in SEIS Section 3.2, the proposed Dewey-Burdock ISR Project site encompasses 4,282 ha [10,580 ac] (Powertech, 2009a). The topsoil in the areas of the Burdock central processing plant and the Dewey satellite facility and wellfield header houses will be removed before construction begins. The applicant has committed to removing topsoil to construct access roads and will adhere to road construction practices stipulated by landowners (Powertech, 2009a). Over the life of the project, the applicant estimates that the area of topsoil to be stripped and removed will be up to 98 ha [243 ac] for the Class V deep well injection option and up to 175 ha [433 ac] for the land application disposal option (Powertech, 2012d). The area of topsoil disturbance will be approximately the same as the total disturbance area in the Class V deep well injection option but smaller than the 566 ha [1,398 ac] of estimated disturbance in the land application option (see Table 2.4-1), since topsoil generally will not be stripped from center pivot irrigation areas.

The following sections discuss the environmental impacts on land use for each of the liquid waste disposal options proposed by the applicant: (i) disposal via Class V injection wells, (ii) disposal via land application, or (iii) combined disposal via Class V injection wells and land application.

4.4.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant’s preferred option for disposal of liquid waste is deep well disposal via Class V injection wells. The potential environmental impacts on geology and soils from construction, operations, aquifer restoration, and decommissioning associated with the Class V injection well disposal option at the proposed project are discussed next.

4.4.1.1.1 Construction Impacts

As described in SEIS Section 2.1.1.1.2, topsoil will be removed from building sites, storage areas, and access roads and stored in designated topsoil stockpiles, in accordance with SDDENR requirements (Powertech, 2009b). The applicant will mitigate soil losses due to stormwater runoff and wind erosion. Mitigation measures will include (i) locating topsoil stockpiles away from drainage channels or other locations that will lead to loss of material, (ii) constructing berms around the base of the stockpiles, and (iii) seeding the stockpiles with an approved seed mix to minimize sediment runoff and wind erosion (Powertech, 2009a).

The applicant will implement additional mitigation measures to limit potential soil erosion impacts during construction at the proposed Dewey-Burdock site (Powertech, 2009a). These measures include (i) reestablishing temporary and permanent native vegetation as soon as possible after disturbance; (ii) decreasing stormwater runoff from disturbed areas by using structures to temporarily divert and/or dissipate surface stormwater runoff; (iii) retaining sediment within disturbed areas by using silt fencing, retention ponds, and hay bales; (iv) implementing drainage designs to minimize potential erosion and/or providing riprap or other soil stabilization controls; and (v) constructing stream crossings at right angles with adequate embankment and culvert installations to minimize erosion. Construction activities at the proposed Dewey-Burdock site have the potential to compact soils. Compaction of soils could lead to decreased infiltration and increased stormwater runoff. To mitigate the effects of compaction at the proposed site, the applicant proposes to disc and reseed any compacted soils as soon as possible after construction activities are completed (Powertech, 2009a).

During wellfield construction at the proposed Dewey-Burdock site, well construction, exploration drilling, and delineation drilling will also impact soils. The applicant estimated that approximately 646 wells (including delineation, monitor, production, injection, and deep disposal wells) will be drilled in the development of the initial wellfields in the Burdock and Dewey areas (Powertech, 2010b). As discussed in SEIS Section 2.1.1.1.2.3.5, drilling activities include the construction of unlined mud pits. During excavation of mud pits, topsoil will be separated from the subsoil and placed at a separate location (Powertech, 2009a). The subsoil will then be removed and placed next to the mud pit. Once use of the mud pit is complete (usually within 30 days of initial excavation), the applicant will redeposit the subsoil in the mud pit followed by topsoil replacement (Powertech, 2009a). The applicant will follow a similar approach for pipeline ditch construction.

The NRC staff conclude the environmental impacts to geology and soils from construction activities for the Class V injection well option at the Dewey-Burdock site will be SMALL. This finding is based on NRC staff evaluation of the limited area to be disturbed by construction, the applicant commitment to proposed BMPs to limit soil erosion and compaction, the commitment to mitigative methods, the short duration of construction, and the procedures used to construct mud pits and pipeline ditches.

While the NRC staff concludes impacts to soils from construction will be SMALL, the staff recognizes that alternative methods to manage drilling fluids are available that the applicant could choose to implement to further limit the potential impacts from the use of mud pits during well drilling activities. Alternatives or mitigating measures to the use of mud pits during well drilling operations include, for example, lining the mud pits with an impermeable membrane, offsite disposal of potentially contaminated drilling mud and other fluids, and the use of portable tanks or tubs to contain drilling mud and other fluids.

4.4.1.1.2 Operations Impacts

As described in SEIS Section 2.1.1.1.3, the applicant's operational activities at the facility are consistent with the operations analyzed in the GEIS. Soil disturbance during the estimated 8-year operations phase of the proposed Dewey-Burdock ISR Project will be limited primarily to earthmoving activities associated with wellfield development (e.g., preparing and constructing drill sites and mud pits, expanding pipelines, and constructing wellfield access roads). Therefore, the amount of soil disturbance resulting from earthmoving activities during the operations phase of the proposed project will be less than that for the construction phase.

As described in SEIS Section 2.1.1.1.3, the applicant's operational activities at the facility are consistent with the operations analyzed in the GEIS. The removal of uranium from the target sandstones in the initial wellfields at the proposed project will occur at depths ranging from approximately 122 to 244 m [400 to 800 ft] below ground surface (bgs) in the Dewey area and approximately 61 to 122 m [200 to 400 ft] bgs in the Burdock area (Powertech, 2009c). The ISR process and lixiviant chemistry will not remove rock matrix material in the ore-bearing sandstones. Therefore, no significant matrix compression will result from the proposed uranium recovery operations. Dewatering of the source uranium formations (i.e., the Fall River Formation and Chilson member of the Lakota Formation) during ISR operations is not expected. Hydrogeologic characteristics of the uranium source formations (i.e., formation thicknesses and potentiometric surfaces, as described in SEIS Section 3.5.3.2) and results of aquifer pumping tests at estimated production flow rates (see SEIS Section 4.5.2.1.1.2.2) indicate that drawdown in nearby wells will be SMALL. Because rock matrix is not removed during the uranium mobilization and recovery process and dewatering of uranium source formations is not expected, no subsidence is expected from the collapse of overlying rock strata into the ore zone.

In accordance with 40 CFR 144.28(f)(6)(i), for Class III injection wells, the operator must not exceed an injection pressure at the wellhead which will be calculated as to assure that the pressure during injection does not initiate fractures in the injection or confining zone. To ensure that formation fracture pressures are not exceeded, the applicant will estimate maximum allowable wellhead pressures at the proposed project on a well-by-well basis as a function of depth, fracture gradient, and injected fluid pressure gradient (Powertech, 2012g). The applicant will implement operational controls to prevent exceedance of estimated pressures. Based on the depths of target mineralization zones {approximately 61 to 244 m [200 to 800 ft]}, an expected fracture gradient of 15.8 kPa/m [0.7 psi/ft], and an expected fluid pressure gradient of 9.8 kPa/m [0.433 psi/ft] for the injected fluid, the applicant estimates that maximum allowable wellhead pressures at the proposed project will range from approximately 365 to 1,475 kPa [53 to 214 psi] (Powertech, 2012g). The applicant will also specify the maximum injection pressure for each header house (Powertech, 2012g). Maximum estimated injection pressures will be calculated as the lowest value of the following: (i) the lowest value of maximum allowable wellhead pressure for all injection wells connected to the header house based on fracture pressure calculations; (ii) the manufacturer-specified maximum operating pressure for the well casing; or (iii) the manufacturer-specified operating pressure of the injection piping and fittings. The anticipated range of injection pressures at each header house is 239 to 1135 kPa [20 to 150 psig] (Powertech, 2012g). At each header house, the designated maximum injection pressure will be posted and monitored to ensure the formation fracture pressure is not exceeded.

The applicant will implement an NRC-required wellfield and pipeline flow and pressure monitoring program to detect unexpected losses of pressure due to equipment failure, a leak, or a problem with well integrity (Powertech, 2009a). This program, described in SEIS Section 7.3.2, ensures timely detection of any releases from leaks due to pipeline breaks or ruptures and minimizes the volume of such releases. The design of all radium settling and holding ponds at the Dewey-Burdock ISR Project includes a leak detection system (Powertech, 2009b). Detection of a pond leak will initiate measures to take the pond out of use, transfer its contents to another pond, investigate the cause, and repair the condition causing the leak. The applicant will also collect and monitor soils for yellowcake and ion-exchange resin contamination along transportation routes and in wellfield areas where spills and leaks are possible (Powertech, 2009a). If soil is contaminated by a pipeline spill, pond leak, or vehicle accident, the applicant will remove the contaminated soil and dispose of it at a licensed disposal facility to ensure all impacts are temporary (Powertech, 2009a). After decontamination is complete, the applicant is required by regulation to conduct radiation surveys to confirm that soils have been cleaned to the NRC standards for unrestricted use in 10 CFR Part 20 (Powertech, 2009a).

As described in SEIS Section 2.1.1.1.2.4, for the applicant to use deep well disposal, an EPA Class V underground injection control (UIC) permit is required. EPA evaluates the suitability of formations proposed for deep well injection and only allows Class V injection where an applicant demonstrates liquid waste can be safely isolated in a deep aquifer. EPA reviews the application to confirm the well is properly sited, such that confining zones and proper well construction minimize the potential for migration of fluids outside the injection zone.

The NRC will require liquid wastes injected into potential Class V injection wells at the proposed project to be treated to meet release standards at 10 CFR Part 20, Subparts D and K, as wells as Appendix B, Table 2, Column 2. Before injection of fluids into the Class V deep injection wells, the permittee must demonstrate (i) the injection zones are not underground sources of drinking water by providing analytical results for total dissolved solids above 10,000 mg/L [10,000 ppm] and (ii) there are adequate confining zones above and below the proposed injection zones. If the proposed injection zones are underground sources of drinking water (have total dissolved solids concentrations below 10,000 mg/L [10,000 ppm], the applicant will be required to obtain an aquifer exemption from EPA, or the EPA UIC permit will require liquid wastes to be treated to meet drinking water standards or contaminant-specific background concentrations for constituents regulated under the Safe Drinking Water Act (SDWA). The permit will also place an injection pressure limit prohibiting injection pressures at or above the injection zone formation fracture pressure. The applicant estimates that the average injection pressure during active operations will range from approximately 2,068 to 5,515 kPa [300 to 800 psi] (Powertech, 2011; Appendix 2.7–L).

In summary, based on analysis of the depth of the ore production zones and because the operations phase does not involve the removal of rock matrix, the staff find that the impacts to geology from subsidence at the proposed project will be SMALL. Systems and procedures will be in place to monitor and clean up soil contamination resulting from pipeline and wellfield spills, pond leaks, and vehicle accidents. NRC and the EPA Class V permit conditions will require liquid wastes to be treated prior to deep well injection to meet NRC release standards in 10 CFR Part 20, Subparts D and K, and Appendix B, Table 2, Column 2. Unless the applicant applies for and is granted an aquifer exemption, the EPA UIC permit will require liquid wastes to be treated to meet drinking water standards or contaminant-specific background concentrations for constituents regulated under the SDWA. Therefore, NRC staff conclude that site-specific impacts to geology and soils during the operational phase for the Class V injection well disposal option will be SMALL.

4.4.1.1.3 Aquifer Restoration Impacts

For the Class V injection well disposal option, the primary method of aquifer restoration will be reverse osmosis (RO) treatment with permeate injection (see SEIS Section 2.1.1.1.4.1.1). About 70 percent of the water withdrawn from the wellfields and passed through high pressure RO membranes will be recovered as permeates. Before reinjection into the wellfields, the permeate will be supplemented with makeup water from wells in the Madison Formation and injected into the wellfields at an amount slightly less than the amount withdrawn to maintain a slight restoration bleed. Although a 1 percent restoration bleed will typically be used to maintain hydraulic control of wellfields, higher bleed rates may be implemented to recover flare (i.e., outward spreading) of lixiviant from the wellfield pattern areas during aquifer restoration. If necessary, the applicant has proposed to increase the restoration bleed by withdrawing up to one pore volume of water through groundwater sweep over the course of aquifer restoration.

During the aquifer restoration phase, liquid wastes injected into the Class V deep injection wells will consist of bleed fluids from operating wellfields and the brine for the RO treatment system. The applicant estimates the maximum volume of liquid wastes injected into the Class V injection wells during aquifer restoration will be 567.75 Lpm [150 gpm] (see SEIS Section 2.1.1.1.4.1.1). The EPA UIC Class V permit will not place an upper limit on the injection rate; only the injection pressure will have an upper limit in the permit.

ISR activities during aquifer restoration at the proposed Dewey-Burdock facility will not remove rock matrix (NRC, 2009a). The source uranium formations lie 122 to 244 m [400 to 800 ft] bgs in the Dewey area and 61 to 122 m [200 to 400 ft] bgs in the Burdock area (Powertech, 2009a). Rock matrix is not removed by groundwater transfer and groundwater sweep during aquifer restoration. In addition, no significant matrix compression or ground subsidence is expected during aquifer restoration activities. For these reasons, the subsidence and collapse of overlying rock strata into the ore zone during the restoration phase is not expected. Therefore, the NRC staff conclude the environmental impact on geology during aquifer restoration will be SMALL.

The spill and leak detection program described for the operations phase in SEIS Section 4.4.1.1.2 will also be maintained during aquifer restoration because the plant and wellfield infrastructure will be used and monitored during aquifer restoration. The potential for spills and pipeline leaks to impact soils are SMALL and similar to impacts described for the operations phase. The NRC staff conclude that the potential for spills to impact the geology and soils is SMALL because of the regulatory requirements for immediate spill response, for implementing spill recovery actions, and for ongoing monitoring programs.

4.4.1.1.4 Decommissioning Impacts

The applicant will restore disturbed lands to their prior uses as livestock grassland and wildlife habitat (see SEIS Section 2.1.1.1.5). The Burdock central processing plant and Dewey satellite facilities will be decontaminated according to regulatory standards and the applicant's NRC-approved decommissioning plan (see SEIS Section 3.13.2). These structures will be demolished and trucked to a licensed disposal facility (see SEIS Section 2.1.1.1.5) or will be turned over to the landowner. Baseline readings of soils, vegetation, and radiological data will guide and provide a basis to evaluate final reclamation efforts. Any soils that have the potential to be contaminated will be surveyed to identify and clean up areas with elevated radionuclide concentrations, in accordance with NRC regulations at 10 CFR Part 40, Appendix A, Criterion 6 (6). Any contaminated soils will be disposed of in licensed disposal facilities. As discussed in SEIS Section 2.1.1.1.5.3, stockpiled topsoil will be redistributed over disturbed surfaces, which will be recontoured to match existing topography. Final revegetation will consist of seeding the area with a seed mixture approved by SDDENR, the local conservation district, BLM, and landowners (Powertech, 2009b).

Short-term impacts to geology and soils are expected as reclamation progresses; however, the result will be to return the land to uses that existed before proposed ISR activities began. The NRC staff conclude the environmental impacts of the decommissioning phase on geology and soils at the facility will be SMALL for several reasons. The temporary nature of the impacts on the land, the applicant's goal of decommissioning and reclaiming the site to preproduction conditions, and the fact that the magnitude of expected soil disturbance is within the range evaluated in the GEIS all support a finding of SMALL impacts.

4.4.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not obtained from EPA, the applicant will dispose of liquid waste generated at the proposed Dewey-Burdock ISR Project by land application (see SEIS Section 2.1.1.1.2.4.2). Environmental impacts on geology and soils from construction, operations, aquifer restoration, and decommissioning associated with the land application liquid waste disposal option are discussed in the following sections.

4.4.1.2.1 Construction Impacts

As described under SEIS Section 4.4.1.1.1, the applicant will implement mitigation measures to minimize soil losses from stormwater runoff and wind erosion of soil stockpiles. These measures include (i) locating topsoil stockpiles away from drainage channels or other locations that will lead to loss of material, (ii) constructing berms around the base of the stockpiles, and (iii) seeding the stockpiles with an approved seed mix to minimize sediment runoff and wind erosion. (Powertech, 2009a)

The mitigation measures to limit soil erosion impacts during construction of the land application disposal system will be the same as the Class V deep injection well disposal method described in SEIS Section 4.4.1.1.1 (Powertech, 2009a). These measures include (i) reestablishing temporary and permanent native vegetation as soon as possible after disturbance; (ii) decreasing stormwater runoff from disturbed areas by using structures to temporarily divert and/or dissipate surface runoff; (iii) retaining sediment within disturbed areas by using silt fencing, retention ponds, and hay bales; (iv) implementing drainage designs to minimize erosion and/or provide riprap or other soil stabilization controls; and (v) constructing stream crossings at right angles with adequate embankment and culvert installations to minimize erosion. Compaction of soils at the site could lead to decreased infiltration and increased stormwater runoff. The applicant plans to disc and reseed any compacted soils as soon as possible after construction activities are completed to mitigate compaction at the site (Powertech, 2009a).

Well construction, exploration drilling, and delineation drilling in the wellfield areas will also impact soils. The applicant estimates 642 delineation, monitor, production, injection, and deep disposal wells will be drilled as the initial wellfields in the Burdock and Dewey areas are developed (Powertech, 2010b). To prevent adverse impacts to groundwater quality, all production, injection, and monitoring wells, as well as all delineation drill holes, will be abandoned according to SDDENR regulations established in Administrative Rules of South Dakota (ARSD) 74:02:04:67 and 74:11:08 (Powertech, 2009a, 2012c). As discussed in SEIS Section 2.1.1.1.2.3.3, drilling activities will include the construction of unlined mud pits. Excavation of mud pits requires separating the topsoil from the subsoil and storing the topsoil at a separate location (Powertech, 2009a). The subsoil will be removed and placed next to the mud pit. Once use of the mud pit is complete (usually within 30 days of initial excavation), the applicant will redeposit the subsoil in the mud pit, followed by topsoil replacement (Powertech, 2009a). The applicant will follow a similar approach for pipeline trench construction.

The NRC staff evaluated the small area to be disturbed by construction, the applicant's plan to use BMPs to limit soil erosion and compaction, the short duration for construction, and use of mud pits and pipeline trenches and other construction methods that will limit environmental impacts. The NRC staff conclude that the environmental impacts to the geology and soils for the land application disposal option at the proposed project will be SMALL.

4.4.1.2.2 Operations Impacts

If land application is used to dispose of process-related liquid wastes, soils may be adversely impacted. The salinity of the treated wastewater could increase the salinity of soils (soil salinization) (NRC, 2009a), which will make the soil less permeable. In addition, land application of liquid wastes could cause radiological and/or other constituents (e.g., selenium and other metals) to accumulate in the soils and vegetation. Licensees of NRC-regulated ISR facilities are required to monitor and control irrigation areas (NRC, 2009a). The applicant proposes to collect and monitor soils and sediments for potential contamination in areas used for land irrigation (Powertech, 2009a). The applicant's land application monitoring program is described in SEIS Section 7.5. In addition, licensees must ensure that radioactive constituents in liquid effluents applied to land application areas are within allowable release limits (NRC, 2009a). NRC will require the applicant to treat liquid wastes applied to land application areas so they meet NRC release limit criteria for radionuclides, as referenced in 10 CFR Part 20, Appendix B. NRC will also require by license condition that the applicant conduct pre-operational and operational sampling of land application areas and the surrounding environment and report operational results to NRC semi-annually so NRC staff can evaluate existing conditions and trends. As stated in SEIS Section 2.1.1.1.6.2, land application will be carried out under a GDP approved by SDDENR (Powertech, 2012c). In accordance with permit program objectives, the applicant's proposed land application operations will have to meet applicable state standards for the protection of the environment including groundwater, soils, vegetation, biota, and wildlife. Both NRC and SDDENR have authority to request corrective actions or issue enforcement actions if standards or permit conditions are violated after operations begin. Because the monitoring and associated regulatory oversight by both NRC and SDDENR would be conducted for the duration of the proposed project, these activities would help to limit potential short-term and long-term impacts to soils. Finally, as described in SEIS Section 2.1.1.1.5, eventual decommissioning and reclamation activities after operations cease will further mitigate potential impacts to soils and restore vegetation prior to release of the site for other uses. Therefore, the NRC staff conclude that the environmental impacts to geology and soils while operating the land application disposal system for liquid wastes will be SMALL.

4.4.1.2.3 Aquifer Restoration Impacts

As described in SEIS Section 2.1.1.1.4.1.2, the primary method of aquifer restoration for the land application disposal option will be groundwater sweep with Madison Formation water injection (Powertech, 2011). The applicant estimates that typical liquid waste flow rates for the land application option during aquifer restoration will be approximately 1,892 Lpm [500 gpm]. None of the water recovered from the wellfields will be reinjected back into the wellfields. Makeup water for the Madison Formation will be injected into the wellfields at a flow rate sufficient to maintain the restoration bleed, which is typically 1 percent of the restoration flow rate (Powertech, 2011).

If land application is used to dispose of liquid wastes, soils at the proposed Dewey-Burdock Project will be impacted during aquifer restoration activities as the liquid evaporates. During aquifer restoration, the applicant continues routine soil monitoring for contamination of land application areas and must ensure that radionuclide contaminant levels do not exceed the release standards in 10 CFR Part 20, Appendix B and applicable state discharge requirements for land application of treated wastes. Routine monitoring and the inclusion of land application areas in decommissioning surveys provide environmental protections. Therefore, NRC staff conclude that impacts to soils from land application during aquifer restoration will be SMALL.

4.4.1.2.4 Decommissioning Impacts

If the land application disposal option is used, the environmental impacts of decommissioning the site will be similar to impacts described in SEIS Section 4.2.1.1.4 for the Class V injection well disposal option. Decommissioning of the site will follow an NRC-approved decommissioning plan, and all decommissioning activities must be carried out in accordance with 10 CFR Part 40 and other applicable federal regulatory requirements.

If the land application liquid waste disposal option is implemented at the Dewey-Burdock facility, the areas directly impacted by decommissioning will include the central processing plant, satellite facility, wellfields and their infrastructure (i.e., pipelines and header houses), irrigation areas, ponds, and access roads. SEIS Section 2.1.1.1.5 describes the decommissioning activities that will be undertaken to return the site to its previous land use. These include conducting radiological surveys; removing contaminated equipment and materials; cleaning up disturbed areas; plugging and abandoning wells; decontaminating, dismantling, and removing buildings and other onsite structures; and restoring disturbed areas (Powertech, 2009b). Land application areas will also be included in decommissioning surveys to ensure that soil concentration limits are not exceeded.

When decommissioning is complete, the land surfaces will be returned to their preextraction geologic condition. The NRC staff conclude the environmental impacts of the land application disposal option on the geology and soils for the land application option will be SMALL.

4.4.1.3 Disposal Via Combination of Class V Injection and Land Application

If a permit for Class V injection wells is obtained from EPA, but the capacity of the wells is insufficient to dispose of all liquid wastes generated at the ISR facility, the applicant will dispose of liquid waste by a combination of disposal using Class V injection wells and land application (see SEIS Section 2.1.1.1.2.4.3). Under the combined disposal option land application, facilities and infrastructure will be constructed, operated, restored, and decommissioned, as needed, depending on the Class V injection well disposal capacity (Powertech, 2011).

The potential environmental impacts of liquid waste disposal by land application for all phases of the ISR process will be greater than for liquid waste disposal by Class V well injection because of the increased land disturbance, thereby increasing potential for soil disturbance and soil erosion. However, implementing the combined disposal option will result in only a portion of land application facilities and infrastructure being constructed, operated, and decommissioned. Therefore, the environmental impacts of the combined disposal option will be less than for the land application option alone, but greater than the Class V injection well disposal option alone. NRC staff conclude that the environmental impacts of the combined Class V injection well and land application disposal option for each phase of the project will be bounded by the effects of the individual disposal methods and therefore will be SMALL as summarized in Table 4.4-1.

4.4.2 No-Action (Alternative 2)

Under the No-Action alternative, a license authorizing operation of an ISR facility will not be issued; therefore, construction and operation of the facility will not occur and aquifer restoration and decommissioning will not be needed. Buildings will not be constructed, wells will not be drilled, wellfields will not be developed, and pipelines connecting the wellfields to the central and satellite plants will not be constructed. The soils will not be disturbed, because earthmoving

Table 4.4-1. Significance of Geology and Soils Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

	Class V Injection Wells	Land Application	Combined Class V Injection Wells and Land Application*
Construction	SMALL	SMALL	SMALL
Operations	SMALL	SMALL	SMALL
Aquifer Restoration	SMALL	SMALL	SMALL
Decommissioning	SMALL	SMALL	SMALL

*Significance of environmental impact for the combined disposal option is bounded by the significance of environmental impacts for the Class V injection well and land application disposal options.

activities will not disturb or compact soils; therefore, existing topography will be unchanged. The geology of the area will be unaffected by the proposed action because no fluids will be injected into the subsurface through Class V injection well disposal or by the uranium extraction process.

The current land uses on and near the project area, which include grazing land for livestock, natural resource extraction, and recreational activities will continue, but there will be no impacts from the proposed action.

4.5 Water Resources Impacts

4.5.1 Surface Water and Wetlands Impacts

As discussed in GEIS Section 4.4.4.1, potential environmental impacts to surface waters and wetlands may occur during all phases of the ISR facility lifecycle (NRC, 2009a). Impacts to surface waters and wetlands may result from (i) road construction and crossings; (ii) erosion runoff; (iii) spills or leaks of fuels, lubricants, and process-related fluids; (iv) stormwater discharges; and (v) discharge of wellfield fluids as a result of pipeline or well head leaks. Potential impacts to surface waters and wetlands may be greater in areas containing jurisdictional waters and wetlands.

GEIS Construction Phase Summary

NRC staff noted in the GEIS that impacts to surface waters and wetlands during the construction phase of ISR facilities may result from construction of road crossings, filling channels, surface erosion, and surface water runoff. Temporary changes to spring and stream flows due to grading and changes in topography and natural drainage patterns are other potential impacts. U.S. Army Corps of Engineers (USACE) permits under Section 404 of the Clean Water Act are required for placing fill, excavating, or using earthmoving equipment to clear land in jurisdictional wetlands or waters of the United States (WUS). As a result of the USACE permitting process, impacts are expected to be mitigated through various mitigation options, such as banking and riparian/wetland enhancement. Potential impacts to surface waters and wetlands also include accidental spills or leaks of fuels and lubricants from construction equipment and stormwater runoff from limited impervious areas including buildings, roads, and parking areas that infiltrates and recharges shallow aquifers. NRC staff determined in the GEIS that these potential impacts will be temporary and mitigated through proper planning and design, the use of proper construction methods, and the implementation of BMPs, or restoration after the construction phase. Thus, NRC staff concluded in the GEIS that compliance with applicable federal and state regulations and permit conditions and the implementation of BMPs and other mitigation measures will result in potential impacts to surface water and wetlands during construction that will be SMALL. (NRC, 2009a)

GEIS Operations Phase Summary

The expansion of facilities or pipelines during the operations phase may result in impacts comparable to those described for the construction phase. The impacts to surface water and wetlands during operation activities may also involve accidental spills or leaks of process-related water and the discharge of stormwater runoff and process-related water. The impact from spills on surface waters and wetlands will be comparable to those described for the construction phase and will be dependent on the size of the spill, the success of remediation, the use of the surface water, proximity of the spill to surface water, and the volume of discharge to the surface waters. NRC staff noted in the GEIS that during operational activities, federal and state agencies regulate the discharge of stormwater runoff and process-related water through the permitting process, and hence, the impacts from permitted discharges will be mitigated through permit conditions. For these reasons, NRC staff concluded in the GEIS that impacts to surface waters and wetlands during operations will be SMALL to MODERATE. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

NRC staff noted in the GEIS impacts to surface waters and wetlands during the aquifer restoration phase may result from (i) produced water, (ii) stormwater runoff and accidental spills, and (iii) brine reject from the reverse osmosis system. NRC staff concluded in the GEIS the impacts from these activities will be similar to the impacts from operations, because the infrastructure will be in place and similar activities will be conducted (e.g., wellfield operation, transfer of fluids, water treatment, stormwater runoff). For these reasons, NRC staff concluded in the GEIS that aquifer restoration impacts on surface waters and wetlands will be SMALL. (NRC, 2009a)

GEIS Decommissioning Phase Summary

NRC staff concluded in the GEIS that surface water and wetland impacts from decommissioning will be similar to the impacts from construction. The activities to clean up, recontour, and reclaim disturbed lands during decommissioning will mitigate long-term impacts to surface waters and wetlands. NRC staff concluded in the GEIS that the potential impacts to surface waters and wetlands from decommissioning will be SMALL. (NRC, 2009a)

Potential environmental impacts to surface water and wetlands from construction, operations, aquifer restoration, and decommissioning for the proposed Dewey-Burdock ISR project are discussed in the following sections.

4.5.1.1 Proposed Action (Alternative 1)

As described in SEIS Section 3.5.1, the proposed Dewey-Burdock ISR Project lies within the Beaver Creek watershed, which includes Beaver Creek, Pass Creek, and their tributaries. Beaver Creek is a perennial stream, and its tributaries have ephemeral flow depending on the amount of precipitation. Pass Creek and its tributaries are dry for most of the year, except for short periods of high runoff following major storms (Powertech, 2009a). Beaver and Pass Creeks are not used for domestic water supply within the proposed project area, but water from Beaver Creek is used for local irrigation.

There are a number of abandoned open pit mines stretching from the eastern to the northern boundaries of the site in the Burdock area (see Figure 3.2-3). With the exception of Darrow Pit #2 and the Triangle Pit, the abandoned pits are usually dry. The Triangle Pit has permanent water storage at a depth greater than 30 m [100 ft]. The Triangle Pit is below the potentiometric surface of the Fall River Formation and is, therefore, hydraulically connected to the Fall River Formation. Water in the Triangle Pit has elevated dissolved uranium and gross alpha concentrations exceeding EPA-regulated maximum contaminant levels (MCLs) and is not used as a livestock or domestic water supply (see SEIS Section 3.12.1).

USACE identified 20 wetlands within the proposed project area (see SEIS Section 3.5.2), of which only 4 were considered jurisdictional: Beaver Creek, Pass Creek, and an ephemeral tributary to each. The jurisdictional ephemeral tributary to Beaver Creek has wetlands present near its confluence with Beaver Creek located in Section 32, Township 6 South, Range 1 East (Figure 4.5-1). The drainage area for this tributary includes surface facilities, infrastructure, and wellfields constructed in the Dewey area. The jurisdictional ephemeral tributary to Pass Creek has wetlands present near its confluence with Pass Creek located in Section 3, Township 7 South, Range 1 East (Figure 4.5-1). The drainage area for this tributary includes surface facilities, infrastructure, and proposed wellfields in the Burdock area.

The environmental impacts on surface waters and wetlands for each of the applicant-proposed liquid waste disposal options (i.e., disposal via Class V injection wells, disposal via land application, or disposal via combination of Class V injection wells and land application) are discussed in the following sections.

4.5.1.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant’s preferred option for disposal of liquid wastes is deep well disposal via Class V injection wells. The Class V injection wells, if permitted by EPA, will be near the satellite plant in the Dewey area and near the central processing plant in the Burdock area (see Figure 2.1-10). Potential environmental impacts to surface waters and wetlands from construction, operation, aquifer restoration, and decommissioning associated with the Class V injection well disposal option at the proposed project are discussed in the following sections.

4.5.1.1.1.1 Construction Impacts

The NRC staff evaluated the occurrence of surface water and wetlands and found it to be limited in area and quantity; Pass Creek and the tributaries to both Pass Creek and Beaver Creek are ephemeral and often dry. As described in SEIS Section 4.2.1.1, the deep well liquid waste disposal option is estimated to disturb 98.3 ha [243 ac] of land or 2.3 percent of the permit area (Powertech, 2010a). Land disturbance will result from construction of facilities, pipelines, initial wellfields, radium settling and holding ponds, Class V injection wells, and access roads (see Figure 4.2-1). The applicant is required to obtain construction and industrial stormwater National Pollutant Discharge Elimination System (NPDES) permits in accordance with SDDENR regulations in ARSD Chapter 74:52. The NPDES permit requirements for discharges to surface water, as established in ARSD 74:52, will control the amount of pollutants

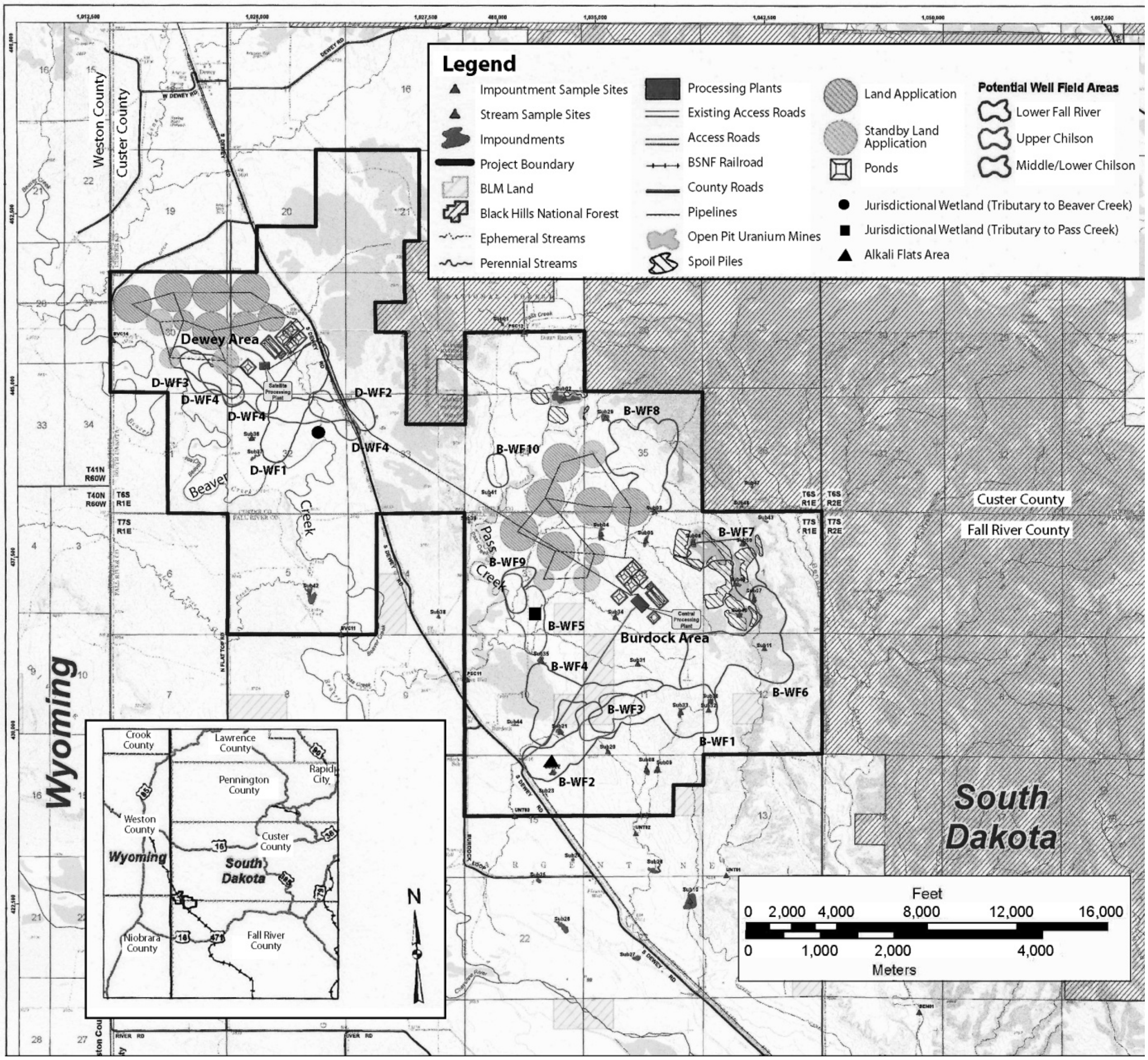

Figure 4.5-1. Map Showing Locations Identified as Jurisdictional Wetlands on Ephemeral Tributaries to Beaver Creek (Black Circle) and Pass Creek (Black Square) and Their Relation to Proposed Site Facilities in the Proposed Dewey-Burdock *In-Situ* Recovery Project Area
Source: Modified From Powertech (2011)

that can enter surface water bodies, such as streams, wetlands, and lakes. The applicant has not yet submitted an NPDES permit application (see Table 1.6-1).

The Burdock central plant and Dewey satellite facility and supporting buildings will be constructed outside the 100-year floodplain of Pass and Beaver Creeks and away from other small ephemeral drainages (see SEIS Section 3.5.1). These buildings will be located on relatively flat terrain, which will require minimum soil movement to create level pads for construction. Surface water runoff from precipitation (rain and snowmelt) will flow from the Burdock central plant area and the Dewey satellite facility area to natural drainages (Figure 4.5-1). Facility buildings will be located away from these intermittent drainage channels

and outside of floodplains so facilities will not flood. If an accidental spill occurs during the construction phase, the applicant will promptly mitigate it by following surface water monitoring and spill response procedures, which will be established as part of the NPDES permit (Powertech, 2009a).

Although facility buildings at the proposed project site will be outside the 100-year floodplain of Pass and Beaver Creeks and small ephemeral drainages, other facilities (e.g., storage ponds), infrastructure (e.g., access roads and the plant-to-plant pipeline), and wellfields will be within the 100-year floodplain of Pass and Beaver Creeks and small ephemeral drainages (see SEIS Section 3.5.1). To protect facilities and infrastructure from flood damage and avoid discharges from storage ponds that are located within the 100-year inundation boundary, the applicant proposes a system of structures, such as straw bales, collector ditches, and engineered diversion structures or berms (Powertech, 2011).

Applicant-proposed measures to protect against flooding in the wellfields include (i) locating above-grade wellfield infrastructure outside the 100-year flood inundation boundary, (ii) constructing diversion or erosion control structures to divert flow and protect any well heads placed within the 100-year inundation boundary, and (iii) sealing all well heads to withstand brief periods of submergence. All pipelines, including the proposed plant-to-plant pipeline, will be buried below the frost line and, therefore, will not be impacted by flooding (Powertech, 2011).

The applicant will use a phased approach to wellfield development. The Burdock B-WF1 wellfield and Dewey D-WF1 wellfield will be constructed during the initial construction phase of the project (Figure 4.5-1). Wellfield B-WF1 will be situated at least 1,006 m [3,300 ft] from Pass Creek and the ephemeral tributary to Pass Creek identified as a jurisdictional wetland. Wellfield D-WF1 is located at least 101 m [330 ft] north of Beaver Creek and 305 m [1,000 ft] northwest of the ephemeral tributary to Beaver Creek, which is a jurisdictional wetland (see Figure 4.5-1). However, wellfield D-WF1 crosses over ephemeral tributaries upstream of the tributary to Beaver Creek identified as a jurisdictional wetland.

Additional wellfields will be built and developed in phases as operations in preceding wellfields become uneconomical. Figure 4.5-1 shows that Dewey wellfield D-WF2 and a portion of Dewey wellfield D-WF4 are located 101 m [330 ft] north of the ephemeral tributary to Beaver Creek identified as a jurisdictional wetland. However, like wellfield D-WF1, wellfields D-WF2 and D-WF4 cross over ephemeral tributaries upstream of the tributary to Beaver Creek identified as a jurisdictional wetland. Figure 4.5-1 also shows that Burdock wellfields B-WF9 and B-WF10 cross nearby ephemeral tributaries upstream of Pass Creek. In addition, Figure 4.5-1 shows that the ephemeral tributary to Pass Creek identified as a jurisdictional wetland bisects wellfield B-WF5.

USACE permits under Section 404 of the Clean Water Act are required for placing fill material, excavating, or using earthmoving equipment to clear land in wetlands or WUS. The presence of wellfields within jurisdictional wetlands and crossing tributaries upstream of jurisdictional wetlands may require the applicant to obtain USACE permits before construction activities (e.g., drilling wells, laying pipeline, and constructing access roads). In addition, the applicant's plant-to-plant pipeline crosses Pass Creek between wellfields B-WF9 and B-WF10 in the Burdock area (see Figure 4.5-1) and may also require the applicant to obtain a USACE permit prior to construction. The USACE permitting process ensures that proper filling and dredging techniques are used and proper mitigation measures are defined and implemented to ensure protection of wetland habitat and water quality in affected jurisdictional wetlands. The applicant has committed to seek authorization from USACE and comply with Section 404 permitting requirements before conducting work in jurisdictional wetlands identified in the project area (Powertech, 2009a). At this time, the applicant has not applied for a Section 404 permit. Therefore, USACE has not conducted additional Section 404 permitting activities at the proposed project site, such as determining specific acreages of jurisdictional wetlands that could be impacted or identifying mitigation measures to be implemented to minimize wetland impacts.

Construction activities may generate a limited amount of surface water runoff. The applicant indicates surface waters will not be consumed and long-term discharge to surface waters will not occur during construction (Powertech, 2009a). The applicant will implement a stormwater pollution management plan (SWMP) to control stormwater runoff during construction and to ensure that surface water runoff from disturbed areas will not contaminate surface waters and wetlands (Powertech, 2009a). SWMP control measures will (i) minimize disturbance of surface areas, drainage channels, and vegetation; (ii) employ grading to direct stormwater runoff away from water bodies; (iii) use riprap at intersections to make bridges and culverts more effective; (iv) stabilize slopes; (v) avoid unnecessary off-road travel; (vi) provide rapid response cleanup procedures and training for potential spills; (vii) require storage of hazardous materials and chemicals in bermed or curbed areas; (viii) place surface piping outside identified 100-year floodplain levels; and (ix) build curbs around facilities and structures to control process fluid spills.

Proposed sites for radium settling and holding ponds for the deep well liquid waste disposal option are shown in Figure 2.1-10. As described in SEIS Section 2.1.1.1.2.4, radium settling and holding ponds will be constructed with linings that meet the requirements of NRC regulations in 10 CFR Part 40, Appendix A, Criterion 5 (NRC, 2003b, 2008). Approved construction uses liners, underdrains, and a leak detection system to identify and reduce the impact on the environment from any leaks.

Because the applicant has committed to (i) implementing mitigation measures to control erosion, stormwater runoff, and sedimentation; (ii) complying with USACE Section 404 permitting requirements for wetlands; (iii) complying with NPDES permit requirements for discharge to surface waters; and (iv) following NRC regulations concerning the construction of settling and holding ponds (e.g., use of liners, underdrains, and leak detection systems), NRC finds impacts to surface waters and wetlands during the construction phase to be SMALL.

4.5.1.1.1.2 Operations Impacts

The NRC staff has considered site-specific hydrological factors in assessing environmental impacts to surface water and wetlands during ISR operations in conjunction with the deep well disposal of liquid wastes option. The staff evaluated the occurrence of surface water and wetlands and found it to be limited in area and quantity. Beaver Creek is a perennial stream and does not bisect any wellfields in the Dewey area. Pass Creek and tributaries of Pass and Beaver Creeks have ephemeral surface water flows.

As described in SEIS Section 3.5.3.3, the Fall River and Chilson aquifers make up the Inyan Kara Group aquifer and contain the uranium mineralization that will be extracted at the proposed project (Powertech, 2009a). Beaver and Pass Creeks do not have a natural hydraulic connection with the underlying Fall River and Chilson aquifers across the Dewey-Burdock site. However, standing water in the Triangle Pit in the Burdock area is hydraulically connected to the Fall River Formation. In addition, pumping tests in the Burdock area indicated a certain degree of hydraulic communication between the Fall River aquifer and Chilson aquifer through the intervening Fuson Shale (see SEIS Section 3.5.3.2). Because the Triangle Pit is not a source of water for domestic use or livestock watering due to its poor water quality [specifically, elevated uranium and gross alpha concentrations exceeding EPA-regulated MCLs for drinking water (see SEIS Section 3.12.1)], the potential environmental impacts to the standing water at the abandoned Triangle Pit mine during ISR operations in conjunction with the Class V injection well disposal option will be SMALL.

As described in SEIS Section 3.5.1, groundwater from the Fall River and Chilson aquifers is discharging to the ground surface through improperly plugged exploratory boreholes at an area in the southwest corner of the Burdock area known as the “alkali flats” (Powertech, 2011). This area is within the proposed B-WF2 wellfield (see Figure 4.5-1). Although the alkali flats area is located outside the drainage areas of Beaver and Pass Creeks, it is near surface impoundments used for stock watering. As described in SEIS Sections 2.1.1.1.2.3.3 and 2.1.1.1.2.3.4, prior to wellfield development, the applicant proposes to identify and evaluate unplugged and improperly sealed boreholes using delineation drilling and wellfield pump testing. Based on the results of the delineation drilling and pump testing, the applicant will plug or otherwise mitigate the potential effects of any boreholes that will potentially affect surface waters and wetlands during ISR operations (Powertech, 2011).

The Class V injection well disposal option involves injecting process-related effluents into the Deadwood and Minnelusa Formations, which lie below the Morrison Formation (Powertech, 2011, Appendix 2.7L). The depth from the ground surface to the disposal horizon for the first 4 Class V injection wells ranges from 492 to 1,076 m [1,615 to 3,530 ft] (Powertech, 2011; Appendix 2.7L). As described in SEIS Section 2.1.1.1.2.4, an EPA Class V UIC permit is required for the applicant to use deep well disposal. EPA will evaluate the suitability of the formations proposed for Class V well injection. Class V injection disposal will be allowed only if the applicant demonstrates liquid waste can be isolated safely in a deep aquifer. In the Dewey-Burdock area, there is no evidence of any hydraulic connection between surface waters and proposed aquifers for the Class V injection well disposal option. Therefore, the potential environmental impacts to surface waters and wetlands from the Class V injection well disposal option during ISR operations will be SMALL.

In addition to site-specific hydrological information and a Class V deep well injection permit, the NRC staff have considered other permit requirements and mitigation measures to which the applicant has committed in assessing environmental impacts to surface water and wetlands during ISR operations in conjunction with the Class V injection well disposal option. The applicant will construct the central plant and satellite facility on concrete slabs surrounded by protective berms or curbs to contain and control accidental spills. Permitted discharge of processing effluents to surface waters will not be undertaken. Earthmoving activities sufficient to generate surface water runoff will not take place. The applicant will use its delineation drilling and pump testing program to identify and plug improperly sealed boreholes that may impact surface waters. The applicant will implement SWMP as part of the NPDES permit in accordance with SDDENR requirements to detain and treat stormwater runoff for these facilities and to ensure that runoff does not contaminate surface waters and wetlands (Powertech, 2009a). The SWMP will identify and evaluate routes by which spills could leave the facility and lay out BMPs as preventative measures to minimize stormwater contamination. Stormwater runoff will be diverted away from the facility and absorbed into soils. The applicant has committed to implement mitigation measures to control erosion and sedimentation, as part of the SWMP. The applicant will implement an emergency response plan to identify and clean up accidental spills and leaks (Powertech, 2009a). Pipelines will be buried to avoid freezing, and pipeline pressure will be monitored to detect leaks.

In conclusion, based on the aforementioned hydrological factors and the applicant's commitment to comply with permit requirements, the NRC staff conclude that environmental impacts to surface waters and wetlands from ISR operations in conjunction with the Class V injection well disposal option will be SMALL.

4.5.1.1.1.3 Aquifer Restoration Impacts

As described in SEIS Section 2.1.1.1.4.1.1, the primary method of aquifer restoration for the Class V deep injection well option is RO treatment with permeate injection. The RO reject, or brine, will undergo radium removal in the radium settling ponds and then will be disposed of in deep Class V injection wells. Under the EPA Class V UIC permit, deep well disposal of treated liquid wastes must not lead to concentration levels of hazardous constituents that cause adverse environmental impacts on surface waters and wetlands. For the Class V injection well disposal option, automated sensors will monitor the injection process to detect potential pipeline leaks or well ruptures that could result in a surface discharge. When monitoring detects potential problems, the applicant will take corrective actions, which include inspections for leaks and spills and rapid response cleanup and remediation to minimize impacts to soils and surface water (Powertech, 2009a). Liquid effluents will not be discharged to running or standing surface waters (Powertech, 2009a). The applicant's NPDES permit requirements for discharges to surface water and SWMP will be in place to ensure that stormwater runoff will not degrade surface water quality. The applicant's emergency response plan will be in place to address and clean up accidental spills and leaks (Powertech, 2009a). The applicant will follow NRC and state regulations concerning the construction of settling and holding ponds (e.g., use of liners, underdrains, and leak detection systems) used to treat and store restoration fluid prior to injection in the Class V well. The applicant is required to follow groundwater restoration activities in compliance with NRC's regulatory requirements (see SEIS Section 2.1.1.1.4). The goal of aquifer restoration is to return groundwater quality in the wellfields consistent with background water quality conditions or to standards consistent with NRC requirements at 10 CFR Part 40, Appendix A, Criterion 5B(5). Because the applicant commits to complying with permitting and regulatory requirements, NRC finds impacts to surface waters and wetlands during the aquifer restoration phase in conjunction with the Class V injection well disposal option at the proposed project site will be SMALL.

4.5.1.1.1.4 Decommissioning Impacts

The central plant, satellite facility, storage facilities, and pipelines of the facility will be removed during the decommissioning phase, in accordance with an NRC-approved decommissioning plan. The wells, including Class V injection wells, will need to be plugged and abandoned. The removal of buildings and infrastructure will have impacts similar to those for the construction phase as described in SEIS Section 4.5.1.1.1.1. The applicant will implement the mitigation measures described in SEIS Section 4.5.1.1.1.1 to control erosion, stormwater runoff, and sedimentation during decommissioning activities. The applicant's NPDES permit requirements will ensure that stormwater runoff will not contaminate surface water. The applicant is committed to implement an emergency response plan to address cleanup of accidental spills and leaks. After removal of surface structures, the applicant will replace topsoil in previously disturbed areas. The applicant will recontour the land surface to restore it to a surface configuration to blend with the natural terrain and will seed disturbed areas in wellfields in accordance with the NRC and SDDENR regulations (Powertech, 2009b). Access roads will be reclaimed and restored in a similar manner.

Well plugging and abandonment and pipeline removal requires temporary soil disturbance that may affect water quality of identified jurisdictional wetlands in the proposed project area. The applicant has committed to seek authorization from USACE and comply with Section 404 permitting requirements before conducting work in jurisdictional wetlands to ensure that wetland habitat and water quality is not impacted (Powertech, 2009a). Because the applicant commits to complying with permitting and regulatory requirements, NRC concludes that impacts to surface waters and wetlands during the decommissioning phase for the Class V injection well disposal option will be SMALL.

4.5.1.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not obtained from EPA, the applicant will dispose of liquid waste by land application (see SEIS Section 2.1.1.2.4.2). The environmental impacts to surface waters and wetlands from the construction, operation, aquifer restoration, and decommissioning associated with the land application liquid waste disposal are discussed in the following sections.

4.5.1.1.2.1 Construction Impacts

For the land application option, a total of 565.7 ha [1,398 ac] of land or 13.2 percent of the proposed permit area will be disturbed by activities associated with construction of facilities, pipelines, wellfields, storage ponds, irrigation areas, and access roads (Powertech, 2010a). This area of land disturbance is larger than for the Class V injection well disposal option {approximately 98 ha [243 ac]} due to the addition of land irrigation areas {426 ha [1,052 ac]} and the need for increased pond capacity for storage during nonirrigation periods {35 ha [136 ac]} (see Table 4.2-1).

All the surface disturbance and associated impacts to surface waters and wetlands discussed in SEIS Section 4.5.1.1.1.1, except for the ground surface disturbance and the impacts to surface waters and wetlands from construction of Class V deep injection wells, will be applicable during the construction phase for the land application disposal option.

Irrigation areas are situated on flat topography along Pass Creek and its tributaries in the Burdock area and along Beaver Creek and its tributaries in the northwest part of the Dewey area (see Figure 4.5-1). The applicant will apply treated liquid effluents to native vegetation or to existing soil after it has been prepared to grow crops such as alfalfa or salt-tolerant wheatgrass (Powertech, 2012c). Significant earthmoving activities will not be conducted to prepare irrigation areas. Runoff from precipitation events or snowmelt on land application areas will be conveyed to catchment areas downgradient of land application areas and allowed to evaporate or infiltrate (Powertech, 2012c). The soil horizon found throughout most of the project area is clayey (see SEIS Section 3.4.2), which will minimize infiltration and enhance evaporation.

Implementation of mitigation measures associated with the applicant's SWMP will control erosion, stormwater runoff, and sedimentation from disturbed areas, as part of the NPDES permit. The applicant's NPDES permit requirements for discharges to surface water will ensure that surface runoff, if any, will not contaminate surface water and wetlands. Additionally, the applicant will implement an emergency spill response plan to address cleanup of accidental spills and leaks. The applicant has committed to seek authorization from USACE and comply with Section 404 permitting requirements before conducting work in jurisdictional wetlands identified in the project area (Powertech, 2009a). The USACE permit ensures that proper filling and dredging techniques are used and proper mitigation measures are defined and implemented and to protect wetland habitat and water quality in affected jurisdictional wetlands.

Because minimal land disturbance will occur during preparation of irrigation fields, and the applicant has committed to implement mitigation measures discussed previously and to comply with permitting and regulatory requirements, the NRC staff conclude that impacts to surface waters and wetlands during the construction phase for the land application option will be SMALL.

4.5.1.1.2.2 Operational Impacts

Stormwater runoff from land irrigation areas and their potential discharge into surface waters will be the primary differences in surface water and wetlands impacts between the land application and Class V injection well disposal options. All hydrological factors (hydrological interactions between ore-bearing aquifers, creeks, and abandoned open pit mines) and the resultant assessment of SMALL impacts to surface waters and wetlands due to ISR operations in conjunction with the Class V injection well disposal option (see SEIS Section 4.5.1.1.1.2) also apply to ISR operations in conjunction with the land application option.

Because irrigation fields are located on flat topography (Figure 2.1-11), runoff of treated liquid wastes applied to land irrigation areas is not expected. Additionally, the SDDENR groundwater discharge plan will require land application activities to be conducted so that no ponding and no runoff of effluent (i.e., wastewater solutions) occur. As described in SEIS Section 3.5.1, proposed land application areas are located outside the applicant-modeled 100-year flood inundation boundaries of Beaver Creek and Pass Creek. Potential runoff produced by snowmelt or precipitation in land application areas will be diverted to adjacent catchment areas and allowed to evaporate or infiltrate (Powertech, 2012c). The applicant will grow crops on irrigation fields, which may require adjustments in water application rates to optimize both evaporation and crop production during the irrigation season (Powertech, 2009a, Section 4.5.2). However, the applicant's NPDES permit requirements will ensure that surface runoff at the ISR facilities and irrigation fields from rain events will not contaminate surface water bodies and wetlands. Implementation of mitigation measures will control erosion, runoff, and sedimentation over the land application areas. In addition, the applicant will implement an emergency spill response plan to address cleanup of accidental spills and leaks.

As described in SEIS Section 4.4.1.2.2, licensees must ensure that radioactive constituents in liquid effluents applied to land application areas are within allowable release limits (NRC, 2009a). The applicant proposes to treat liquid wastes applied to land application areas so they meet NRC release limit criteria for radiological contaminants, as referenced in 10 CFR Part 20, Appendix B, Table 2, Column 2 (see Table 7.5-3) (Powertech, 2011). SDDENR also regulates land application of treated wastewater, which requires the applicant to obtain an approved GDP and to comply with applicable state discharge requirements for land application of treated wastewater. Additionally, the GDP will require land application activities to be conducted so that no ponding and no runoff of effluent (i.e., wastewater solutions) occur. Therefore, the NRC staff conclude that treated liquid wastes applied to land application areas will contain contaminant levels below NRC and SDDENR requirements.

Based on the aforementioned hydrological factors and permit requirements, the NRC staff conclude that environmental impacts to surface waters and wetlands from ISR operations in conjunction with the land application option will be SMALL.

4.5.1.1.2.3 Aquifer Restoration Impacts

The aquifer restoration phase of the Dewey-Burdock ISR Project will generate liquid wastes that will be disposed of via land application. As described in the previous section, the applicant proposes to treat liquid wastes applied to land application areas so they meet NRC release limit criteria for radiological contaminants, as referenced in 10 CFR Part 20, Appendix B (Powertech, 2011). SDDENR also regulates land application of treated wastewater, which requires the applicant to obtain an approved GDP and to comply with applicable state discharge requirements for land application of treated wastewater. Liquid effluents will not be discharged into running or standing surface waters (Powertech, 2009a). The applicant's NPDES permit and SWMP will be in place to ensure that runoff from rain events will not contaminate surface waters and wetlands. The applicant's emergency response plan will be in place to address and clean up accidental spills and leaks (Powertech, 2009a). The applicant will follow NRC and state regulations concerning the construction of settling and holding ponds (e.g., use of liners, underdrains, and leak detection systems).

Because treated water applied onto irrigation fields will comply with NRC and state release limits for radioactive and hazardous constituents and because the applicant commits to complying with NPDES permitting and regulatory requirements, the NRC staff find impacts to surface waters and wetlands during the aquifer restoration phase in conjunction with the land application option to be SMALL.

4.5.1.1.2.4 Decommissioning Impacts

All the ground surface disturbance and the resultant impacts to surface waters discussed in SEIS Section 4.5.1.1.1.4 for the Class V injection well disposal option will be applicable for the land application option, except that the latter will not involve plugging and abandonment of Class V injection wells in the decommissioning phase. Under the land application option, production, injection, and monitoring wells will be plugged and abandoned, and the central plant, satellite facility, storage facilities, and associated pipelines will be removed in accordance with an NRC-approved decommissioning plan. The applicant has committed to seek authorization from USACE and comply with Section 404 permitting requirements before conducting work in jurisdictional wetlands to ensure that wetland habitat and water quality are not impacted (Powertech, 2009a). As part of the NPDES permit, the applicant will implement mitigation measures to control erosion, runoff from rain events, and sedimentation to ensure that surface water and wetlands are not contaminated. Additionally, the applicant is committed to implementing an emergency response plan to address cleanup of accidental spills and leaks.

After removal of surface structures, the applicant will replace topsoil in previously disturbed areas. Disturbed land surfaces, including irrigation fields used for land application of treated process fluid, will be recontoured to restore the surface configuration to blend with the natural terrain and seed disturbed areas in wellfields in accordance with the NRC and SDDENR regulations (Powertech, 2009b). Access roads will be reclaimed and restored in a similar manner. Because the applicant commits to complying with permitting and regulatory requirements, NRC concludes that impacts to surface waters and wetlands during the decommissioning phase for the land application disposal option will be SMALL.

4.5.1.1.3 Disposal Via Combination of Class V Injection and Land Application

If the applicant obtains the permit for Class V injection from EPA, but the capacity of the deep disposal wells is insufficient to dispose of all liquid effluents generated at the Dewey-Burdock ISR project, the applicant will dispose of liquid waste by a combination of Class V injection wells and land application (SEIS Section 2.1.1.1.2.4.3). In this case, land application facilities and infrastructures will be constructed, operated, and restored, and decommissioned as needed, based on the required capacity of Class V injection wells and produced volume of liquid effluents (Powertech, 2011).

If the capacity of Class V injection wells is sufficient to dispose of all liquid effluents, land application sites, facilities, and infrastructures for irrigation will be avoided. In this case, potential environmental impacts to surface waters and wetlands due to erosion and surface runoff of rainwater over land application sites will be eliminated. Therefore, the resultant environmental impacts to surface water and wetlands for the Class V injection well disposal option will be smaller than for the land application disposal option. Furthermore, only a portion of land application facilities and infrastructure (e.g., irrigation areas and storage ponds) will be constructed, operated, and decommissioned for the combined Class V injection well and land application option. Therefore, potential environmental impacts to surface waters and wetlands for the combined disposal option will be less than for the land application option alone.

Thus, NRC staff conclude that the environmental impacts of the combined Class V injection well and land application option for each phase of the proposed project will be bounded by the significance of environmental impacts of the Class V injection well option and the land application option as summarized in Table 4.5-1.

4.5.1.2 No-Action (Alternative 2)

Under the No-Action alternative, NRC will not license the Dewey-Burdock ISR Project and BLM will not approve the applicant's modified Plan of Operations. The central processing plant in the

Table 4.5-1. Significance of Environmental Surface Water and Wetland Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

	Class V Injection Wells	Land Application	Combined Class V Injection Wells and Land Application*
Construction	SMALL	SMALL	SMALL
Operations	SMALL	SMALL	SMALL
Aquifer Restoration	SMALL	SMALL	SMALL
Decommissioning	SMALL	SMALL	SMALL

*Significance of environmental impact for the combined disposal option is bounded by the significance of environmental impacts for the Class V injection well and land application disposal options.

Burdock area and the satellite facility in the Dewey area with their associated infrastructure (i.e., access roads and piping) will not be constructed. Furthermore, wellfields, surface impoundments, Class V injection wells, and land application sites will not be developed. The current land uses on and near the project area, including grazing lands and recreational activities, will continue. Therefore, there will not be any environmental impact to surface waters and wetlands from construction, operations, aquifer restoration, and decommissioning activities.

4.5.2 Groundwater Impacts

As discussed in GEIS Section 4.4.4.1, potential environmental impacts to groundwater could occur during all phases of an ISR facility's lifecycle, although impacts are more likely to occur during operations and aquifer restoration (NRC, 2009a). At ISR sites, ore-bearing aquifers are typically separated from adjacent aquifers at varying depths by confining layers, also known as aquitards. If the confining layers do not effectively isolate the ore-bearing aquifer from the hydrogeological system, the aquifers above and below the uranium-bearing aquifer can be adversely affected during ISR operations.

NRC staff reported in the GEIS that ISR facility impacts on groundwater resources can result from surface spills, leaks from buried piping, consumptive water use (i.e., water removed from available supplies without return to a water resource system), horizontal and vertical excursions of lixiviant from production aquifers, degradation of water quality from changes in production zone aquifer chemistry, and waste management practices involving land application and/or deep well injection. (NRC, 2009a)

GEIS Construction Phase Summary

NRC staff reported in the GEIS that potential impacts to groundwater during construction of an ISR facility are from the consumptive use of groundwater, injection of drilling fluids and mud during well drilling, and spills of fuels and lubricants from construction equipment. Surface activities that can introduce contaminants into soils are more likely to affect near-surface and shallow aquifers during construction. NRC staff concluded in the GEIS that during construction, groundwater use is limited and groundwater quality is protected by implementing BMPs, which include spill prevention and cleanup programs. In addition, the volume of drilling fluids and mud to be introduced into the environment during well installation is limited compared to the existing aquifer volume. Therefore, NRC staff concluded in the GEIS that construction impacts to groundwater resources are SMALL. (NRC, 2009a)

GEIS Operations Phase Summary

GEIS Section 4.4.4.2.2 discussed potential environmental impacts to shallow (near-surface) aquifers during ISR operations. During this phase, shallow aquifers could potentially be affected by lixiviant leaks from pipelines, wells, or header houses and from waste management practices such as the use of settling and holding ponds and disposal of treated wastewater by land application. Potential environmental impacts to groundwater resources in the production and surrounding aquifers also include consumptive water use and changes to water quality that could result from normal operations in the production aquifer and from possible horizontal and vertical lixiviant excursions beyond the production zone. Disposal of processing wastes by deep well injection during ISR operations could also impact groundwater in deep aquifers. (NRC, 2009a)

Shallow (Near-Surface) Aquifers

In the GEIS, NRC staff discussed the potential environmental impacts to shallow, near-surface aquifers during ISR operations. A network of buried pipelines transports lixiviant between the header house and the satellite or main processing facility. Piping connects injection and extraction wells to manifolds inside the header houses. Failure of pipeline fittings or valves, or failure of well mechanical integrity in shallow aquifers, could result in leaks and spills of pregnant and barren lixiviant, with adverse impacts on water quality in shallow aquifers. The potential environmental impacts of pipeline, valve, or well integrity failure depend on the depth to shallow groundwater; the current and anticipated future uses of shallow groundwater for domestic, agricultural, and livestock water demands; and the degree of hydraulic connection between shallow aquifers, production aquifers, and regionally important aquifers. Shallow aquifers may also be affected by disposal of treated process effluents by land application and hazardous wastewater leaks and spills from settling and holding ponds. NRC staff concluded in the GEIS that environmental impacts will range from MODERATE to LARGE if (i) groundwater in shallow aquifers is close to the ground surface, (ii) shallow aquifers are important sources for local domestic or agricultural water supplies, and (iii) shallow aquifers are hydraulically connected to other locally or regionally important aquifers. NRC staff concluded that environmental impacts will be SMALL if (i) shallow aquifers have poor water quality or noneconomic production yields and (ii) shallow aquifers are hydraulically separated from other locally and regionally important aquifers. Land application of treated process effluents during ISR operations is an accepted waste management practice at ISR facilities. Process-related effluents applied to land application areas undergo treatment to reduce radiological and hazardous constituents to levels that are protective of human health and the environment. Additionally, the GDP will require land application activities to be conducted so that no ponding and runoff of effluent (i.e., wastewater solutions) occurs during these activities. BMPs will also be in place to prevent surface runoff and erosion from rain events. Therefore, NRC staff concluded in the GEIS that the impacts of land disposal application of effluents on groundwater in shallow aquifers during ISR operations will be SMALL. (NRC, 2009a)

Production and Surrounding Aquifers

During ISR operations, potential environmental impacts to groundwater resources in the production and surrounding aquifers include consumptive water use. NRC staff reported in the GEIS that short term impacts of consumptive water use will be localized in the South Dakota region and will be SMALL to MODERATE, depending on aquifer characteristics. The localized effects are expected to be temporary because drawdown near wellfields will dissipate after pumping stops. After consideration of these factors, the NRC staff concluded long term impacts of consumptive water use will be SMALL in most cases. (NRC, 2009a)

NRC staff reported in the GEIS that degradation of groundwater quality in the production aquifer will occur during ISR operations. Groundwater quality in the overlying and underlying aquifers and adjacent aquifers could be degraded if horizontal or vertical lixiviant excursions occur beyond the production zone. The production portion of an ore-bearing aquifer will be exempted from being an underground source of drinking water (USDW) according to the criteria in 40 CFR 146.4 as long as (i) the production portion of the aquifer does not currently serve as a source of drinking water and, (ii) the permit applicant can demonstrate as part of a UIC permit application that the production portion contains minerals that, considering their quantity and location, are expected to be commercially producible. After uranium recovery is complete, the licensee must initiate aquifer restoration activities to restore the production zone to Commission-approved background water quality, if possible. If the water quality in the production aquifer cannot be restored to background conditions, NRC requires the production aquifer be restored to the MCLs provided in 10 CFR Part 40, Appendix A, Table 5C or to NRC-approved alternate concentrations limits (ACLs). Only after demonstrating that it cannot restore a particular hazardous constituent to the background concentration or MCL could a licensee request a license amendment from NRC for an ACL. To be approved, ACLs must demonstrate that the level will not pose a substantial present or potential hazard to human health or the environment as long as the ACLs are not exceeded (NRC, 2003b). After consideration of these factors, NRC staff concluded in the GEIS that potential impacts of ISR operations on water quality of a uranium-bearing production zone aquifer will be SMALL. (NRC, 2009a)

Deep Aquifers Below the Production Aquifers

In the GEIS, NRC staff found that disposal of processing effluents by deep well injection during ISR operations and restoration could impact groundwater quality in deep aquifers (NRC, 2009a). However, NRC staff concluded that impacts from deep disposal of process effluents in the Nebraska-South Dakota-Wyoming Uranium Milling Region are expected to be SMALL if (i) water production from deep aquifers is not economically feasible (e.g., low water yield); (ii) the groundwater quality in the deep aquifers is not suitable for domestic or agricultural uses; and (iii) the aquifers are confined above by sufficiently thick and continuous low permeability layers (NRC, 2009a).

<u>GEIS Aquifer Restoration Phase Summary</u>

NRC staff reported in the GEIS that the potential environmental impacts on groundwater resources during aquifer restoration are related to groundwater consumptive use and waste management practices, including discharge to waste storage ponds and potential deep disposal of brine resulting from reverse osmosis. In addition, aquifer restoration directly affects groundwater quality in the vicinity of the wellfield being restored. (NRC, 2009a)

The purpose of aquifer restoration is to return the groundwater quality in the production zone to groundwater protection standards in 10 CFR Part 40, Appendix A, Criterion 5B(5). These standards state that the concentration of a hazardous constituent must not exceed (i) the Commission-approved background concentration of that constituent in groundwater, (ii) the respective value in the table in paragraph 5C if the constituent is listed in the table and if the background level of the constituent is below the value listed, or (iii) an alternate concentration limit the Commission establishes. Potential environmental impacts are affected by the restoration techniques chosen, the severity and extent of the contamination, and the current and future use of the production and surrounding aquifers in the vicinity of an ISR facility. Consequently, NRC staff concluded in the GEIS that the potential environmental impacts of groundwater consumption during restoration could range from SMALL to MODERATE depending on site conditions. (NRC, 2009a)

<u>GEIS Decommissioning Phase Summary</u>

In the GEIS, NRC staff noted that environmental impacts to groundwater during dismantling and decommissioning of ISR facilities will result primarily from consumptive use of groundwater, potential spills of fuels and lubricants, and well abandonment. Consumptive groundwater use includes using water for dust suppression, revegetation of landscapes, and reclamation of disturbed areas. The environmental impacts expected during the decommissioning phase are the same impacts identified in the staff's analysis of the construction phase. In the GEIS, NRC staff concluded that consumptive use of groundwater during decommissioning will be less than during operations or aquifer restoration phases. Following BMPs as part of state-enforced NPDES permits and NRC-approved decommissioning plans will reduce the occurrence and effects of spills and facilitate cleanup (NRC, 2003a). Therefore, NRC staff concluded in the GEIS that the impact to groundwater resources in shallow aquifers from decommissioning will be SMALL (NRC, 2009a).

Discussion of the potential environmental impacts to groundwater from the construction, operations, aquifer restoration, and decommissioning of the proposed Dewey-Burdock ISR Project follows.

4.5.2.1 Proposed Action (Alternative 1)

As described in SEIS Section 3.5.3.3, ISR methods will be used to recover uranium from sandstone-hosted uranium orebodies in the Fall River and Chilson aquifers that make up the Inyan Kara Group aquifer. Orebodies in unconfined portions of the Fall River Formation in the Burdock area are not part of the recovery plan (Powertech, 2010a). However, the recovery plan does include partially saturated portions of the Chilson aquifer in the eastern portion of the Burdock area (see Figure 3.5-7). NRC staff determined that a license condition will be necessary for ISR operations in partially saturated portions of the Chilson aquifer, which will require the applicant to demonstrate the ability to detect and remediate excursions in partially saturated zones (NRC, 2013).

Potential impacts to groundwater at the proposed Dewey-Burdock ISR project may result from pumping water to meet required consumptive water demands and from potential water quality degradation. In the construction phase of the proposed project, groundwater in surficial (alluvium) and shallow aquifers could be impacted. In the operations and restoration phases of the proposed project, groundwater in the Fall River and Chilson aquifers could be impacted. If Class V injection well disposal of liquid wastes into the Deadwood and Minnelusa Formations that lie below the Morrison Formation is approved, groundwater in these aquifers could be impacted during the operations and restoration phases. If the land application liquid waste disposal option is used in the operations and restoration phases, the groundwater impacts will likely be localized and limited to near-surface aquifers. Near-surface aquifers include the Fall River aquifer in the northeastern part of the Burdock area.

In South Dakota, a water rights permit from SDDENR is required to withdraw water from an aquifer. The water rights permit ensures that unappropriated water is available in the aquifer for the use and withdrawal amount specified in the permit. In June 2012, the applicant submitted water appropriation permit applications to use Inyan Kara aquifer and Madison aquifer water at the proposed Dewey-Burdock ISR Project (see Table 1.6-1).

The water permit application for the Inyan Kara aquifer proposes to appropriate up to 33.8 ha-m [274.2 ac-ft] of water annually (Powertech, 2012h). This water is to be used primarily for the ISR process during the operations phase of the proposed project. The application proposes a gross withdrawal (pumping) rate of 32,172 Lpm [8,500 gpm] or an estimated annual withdrawal of approximately 1, 691 ha-m [13,710 ac-ft]. The consumptive use of water will be a small portion of the gross withdrawal rate. As described in the application, approximately 2 percent of the water {558 Lpm [170 gpm]} is production bleed, which will be disposed of as liquid waste (Powertech, 2012h). The remaining approximately 98 percent of the water is not lost, it is recirculated and reinjected back into the aquifer as part of the ISR process. Based on a review of the water permit application, which included an analysis of water availability and existing water rights, SDDENR concluded (i) approval of the application will not result in average annual withdrawals from the Inyan Kara aquifer that exceed the average annual recharge to the aquifer; (ii) there is reasonable probability that there is at least 33.8 ha-m/yr [274.2 ac-ft/yr] of unappropriated water available from the aquifer; (iii) SDDENR Water Rights Program observation well data indicate that unappropriated water is available from the Inyan Kara aquifer; and (iv) there is a reasonable probability that the withdrawals proposed in the application can be made without unlawful impairment of existing water rights or domestic wells (SDDENR, 2012a).

The water permit application for the Madison aquifer proposes to appropriate 109.6 ha-m [888.8 ac-ft] of water annually at a withdrawal rate of 2,085 Lpm [551 gpm] (Powertech, 2012i). This water would be used primarily during the aquifer restoration phase of the project. The amount of water that will be withdrawn from the Madison will depend on the liquid waste disposal method that will be used as part of the ISR process. The use of land application will require a diversion rate of 2,085 Lpm [551 gpm] and using deep Class V injection wells will require a withdrawal rate of 606 Lpm [160 gpm]. Based on a review of the application, which included an analysis of water availability and existing water rights, SDDENR concluded (i) there is reasonable probability that unappropriated water is available in the Madison aquifer to supply the proposed appropriation; (ii) approval of the application will not result in average annual withdrawals from the Madison aquifer that exceed the average annual recharge to the aquifer; and (iii) there is a reasonable probability that withdrawal proposed in the application can be made without impacting existing rights including domestic users (SDDENR, 2012b).

Environmental impacts to groundwater for each of the applicant-proposed liquid waste disposal options (i.e., disposal via Class V injection wells, disposal via land application, or disposal via combination of Class V injection wells and land application) are discussed in the following sections.

4.5.2.1.1 Disposal Via Class V Injection Wells

The applicant's preferred option for disposal of liquid wastes is deep well disposal via Class V injection wells (see SEIS Section 2.1.1.1.2.4). The applicant plans to inject process-related effluents into the Deadwood and Minnelusa Formations that lie below the Morrison Formation (Powertech, 2011, Appendix 2.7-L). Powertech estimates the injection zone depths for the Minnelusa Formation to be approximately 492 to 672 m [1,615 to 2,205 ft] below ground surface and for the Deadwood Formation to be approximately 943 to 974 m [3,095 to 3,195 ft] below ground surface in the Burdock area. In the Dewey area, the estimated Minnelusa Formation injection zone depth is approximately 594 to 774 m [1,950 to 2,540 ft] below ground surface and the estimated Deadwood Formation depth is approximately 1,045 to 1,076 m [3,430 to 3,530 ft] below ground surface. The use of deep well disposal requires an EPA Class V UIC permit (SEIS Section 2.1.1.1.6.2). EPA evaluates the suitability of formations for deep well injection and allows Class V injection only after an applicant demonstrates liquid waste can be isolated safely in a deep aquifer. NRC staff review of local and regional stratigraphies and local geologic cross sections shows no evidence of hydraulic connection between surface waters and aquifers targeted for deep well injection. In addition, NRC staff review of applicant calculations of the radius of fluid displacement resulting from Class V injection into the Minnelusa and Deadwood Formations indicates that the Dewey Fault will not act as a conduit for fluid to rise to a USDW via the faulted interface. Applicant calculations based on formation parameters derived from correlation of type logs and proposed injection rates show that the radius of fluid displacement around the deep injection wells will end more than 2,500 m [1.5 mi] from the Dewey Fault (Powertech, 2011, Appendix 2.7-L). The UIC permit will not allow injection into the Class V deep disposal wells unless the permittee demonstrates the wells are properly sited, such that confinement zones and proper well construction minimize the potential for migration of fluids outside of the approved injection zone.

Potential environmental impacts to groundwater from construction, operation, aquifer restoration, and decommissioning associated with the Class V injection well disposal option are discussed next.

4.5.2.1.1.1 Construction Impacts

The construction of facilities, pipelines, wellfields, deep disposal injection wells, holding ponds, and access roads in the construction phase for the onsite, deep well, liquid waste disposal option will disturb 98 ha [243 ac] of land (Powertech 2010a). The total land disturbance will be 2.3 percent of the permit area. The deep well disposal facilities, if approved, will be located near the satellite plant in the Dewey area and near the central processing plant in the Burdock area (see Figure 2.1-10).

Consumptive water use during construction will be limited to dust control, cement mixing, pump tests, delineation drilling, and well drilling and completion. The applicant estimates that groundwater consumption during construction at the Dewey and Burdock areas will be 8.25×10^7 L and 1.16×10^8 L [21.8×10^6 gal and 30.6×10^6 gal], respectively (Powertech, 2010a). Initially, water for construction activities will be withdrawn from existing wells in the Inyan Kara Group aquifers. The applicant plans to install wells in the deeper Madison aquifer early in the construction phase (Powertech, 2010a). As described previously, the applicant's water permit application for the Madison aquifer proposes to appropriate 109.6 ha-m [888.8 ac-ft] or 1.09×10^9 L [28.9×10^7 gal] of water annually to provide water for the proposed project (Powertech, 2012i). If permitted, the Madison aquifer will become the primary source of water for the project (Powertech, 2010a).

As described in SEIS Section 2.1.1.1.2.3.5, the applicant plans to use standard mud rotary drilling techniques to construct production, injection, and monitoring wells. Wells will be constructed using a small rotary drilling unit that uses bentonite or polymer drilling mud containing water that is pH-adjusted and mixed to control viscosity (Powertech, 2012g). The volume of drilling fluids and mud used during well installation will be limited. The introduction of drilling fluids to surficial (alluvial) aquifers at the proposed project might occur during well drilling, but the amount will be minor because drilling mud is designed to seal boreholes to set the casing. As part of the applicant's Class III UIC permit, all production, injection, and monitoring wells will be cased and cemented to prevent the migration of fluids into and between USDWs in accordance with EPA regulations in 40 CFR 146.32. In addition, the design and construction of Class V deep injection wells must meet EPA requirements. Prior to entering service, all wells will undergo mechanical integrity tests of the casing to ensure against well leakage.

During well installation, drilling fluids and mud will be stored in temporary mud pits to control the spread of fluids, protect the soil from contamination, and enhance evaporation. The applicant could choose alternative methods to manage drilling fluids to further limit the potential impacts from the use of mud pits during well drilling activities. These could include lining the mud pits with an impermeable membrane, offsite disposal of potentially contaminated drilling mud and other fluids, and the use of portable tanks or tubs to contain drilling mud and other fluids. The soil horizon found throughout most of the project area is clayey (see SEIS Section 3.4.2), which will minimize leakage from the mud pits and degradation of water quality of surficial and shallow aquifers.

The groundwater quality of near-surface aquifers can potentially be affected by stormwater runoff during construction, which in turn will be controlled by the applicant's SWMP that is part of the SDDENR-issued NPDES permit (see SEIS Section 4.5.1.1.1.1). The NPDES permit sets limits on the amount of pollutants entering ephemeral drainages that may be in hydraulic communication with alluvial aquifers at the site. The NPDES permit will also specify mitigation measures and BMPs to prevent and clean up spills. The applicant has not yet submitted an application for an NPDES permit to SDDENR.

Fuels and lubricants may enter surficial and shallow aquifers as spills during facility construction and drilling activities and during the installation of injection, production, and monitoring wells. Impacts to groundwater quality of near-surface aquifers will be minimized by UIC and NPDES permit requirements and implementation of BMPs during construction. The applicant commits to implement spill prevention and cleanup plans to minimize impacts to soils and groundwater, including rapid response cleanup and remediation (Powertech, 2009a). Additionally, only small volumes of fuel and lubricants will be stored at the site. Leaks or spills will be cleaned immediately to avert soil contamination and infiltration to surficial aquifers. Under the terms of the NPDES permit (or regulations), spills of petroleum product or hazardous chemicals that threaten groundwater and related habitats must be reported to SDDENR.

In summary, groundwater use during construction will be limited to routine activities, such as dust suppression, mixing cements, and drilling support. As noted previously, the applicant estimates that groundwater consumption during construction at the Dewey and Burdock areas will be 8.25×10^7 L and 1.16×10^8 L [21.8×10^6 gal and 30.6×10^6 gal], respectively (Powertech, 2010a). If the applicant is granted a water appropriation permit to use Madison aquifer water, NRC staff determine that the applicant will rely less on local water supplies in the permit area, and hence, environmental impacts on local aquifers (e.g., the Inyan Kara aquifer) and domestic and livestock wells from consumptive water use during construction will be SMALL. However, if the water appropriation permit is denied, water use from local shallow aquifers during construction could significantly impact domestic and livestock wells. For example, the applicant estimates consumptive groundwater use during construction to be the same as that currently being withdrawn for domestic and livestock use from the Inyan Kara aquifer within 2 km [1.2 mi] of the Dewey-Burdock site (see SEIS Section 4.5.2.1.1.2.2). However, the applicant has committed to removing all existing domestic wells within the project area from private use prior to ISR operations (Powertech, 2011). This process will begin during the construction phase and, therefore, the current usage rate from the Inyan Kara within the proposed project area will decline. In addition, results of numerical groundwater simulations indicate the Inyan Kara aquifer can sustain net extraction rates of up to 556 Lpm [147 gpm] over the 2 year construction phase (Petrotek, 2012). This equates to total groundwater consumption of 5.83×10^8 L [1.54×10^8] gal. Therefore, the NRC staff anticipates that the potential impact to shallow local aquifers and domestic and livestock wells from consumptive water use during the construction phase of the proposed project will be SMALL.

In addition to potential stress on local aquifers due to consumptive water use demands, groundwater quality in shallow aquifers (mostly alluvium and also the Inyan Kara aquifer at its outcrop areas in the eastern part of the Burdock area) could be threatened by stormwater runoff and spills of fuels and lubricants during construction activities. However, required NPDES permit compliance activities, such as monitoring and BMPs, will protect groundwater quality of shallow aquifers. Specifically, the NPDES permit requirements provide controls on the amount of pollutants entering ephemeral drainages during construction. The permit will also specify mitigation measures and BMPs to prevent and cleanup spills. The applicant has committed to implementation of BMPs, such as a spill prevention and cleanup plan to minimize soil contamination and infiltration (Powertech, 2009a). Therefore, the NRC staff conclude that the impacts to groundwater during the construction phase for the Class V injection well disposal option at the proposed project will be SMALL.

4.5.2.1.1.2 Operations Impacts

Groundwater in near-surface (alluvial) and shallow aquifers, production aquifers, aquifers overlying and underlying the production aquifers, and deep aquifers could be impacted during ISR operations if the deep disposal well option is used at the proposed Dewey-Burdock site. Potential impacts to these aquifers could result from pumping water to meet the required consumptive water demands and from potential water quality degradation during ISR operations. Such potential impacts are discussed in the following sections.

4.5.2.1.1.2.1 Shallow (Near-Surface) Aquifers

Alluvial aquifers with thicknesses up to 12 m [40 ft] are present along Beaver Creek, Pass Creek, and the Cheyenne River (see SEIS Section 3.5.3.2). The alluvial aquifers may be locally confined, and they are separated from the underlying Fall River aquifer by the low permeability Graneros Group, which consists of the combined Skull Creek Shale, Mowry, and Belle Fourche Shales. Within the project area, the Graneros Group ranges in thickness from 61 to 168 m [200 to 550 ft], except in the eastern part of the Burdock area, where it has eroded, leaving the Fall River Formation exposed at the surface (see SEIS Section 3.4.1.2 and Figure 3.4-3). An inventory of private wells within a 2-km [1.2-mi] radius of the site indicates that seven wells are completed in alluvial aquifers (Powertech, 2011). The alluvial wells are used solely for monitoring purposes and do not serve as water supply for domestic purposes or livestock watering (Powertech, 2011).

The Inyan Kara Group aquifer is the first near-surface aquifer encountered within the project area, and it is made up of two subaquifers: the Fall River and Chilson aquifers (see SEIS Section 3.5.3.1). The Fall River aquifer has an average thickness of 46 m [150 ft] within the project area and is exposed at the surface in the eastern part of the Burdock area, where the Graneros Group has been eroded (see Figure 3.4-3). The underlying Chilson aquifer varies in thickness from 37 to 61 m [120 to 200 ft] across the project area and is separated from the Fall River aquifer by the Fuson Shale, which has an average thickness of 15 m [50 ft] across the project area. The Chilson aquifer is underlain by a 30-m [100-ft]-thick section of the impermeable Morrison Formation, which hydrologically isolates the Chilson aquifer from deeper aquifers. Based on an inventory of private wells within a 2-km [1.2-mi] radius of the proposed project site, 33 wells obtain water from the Fall River aquifer, 41 wells obtain water from the Chilson aquifer, and 17 wells obtain water from an unknown component of the Inyan Kara aquifer (Powertech, 2011). These wells serve as water supplies for livestock, domestic purposes (e.g., drinking water), and monitoring.

Over the western and central parts of the proposed project area (i.e., the Dewey area and the western part of the Burdock area), the Fall River Formation is overlain by a 61-m to 168-m [200-ft to 550-ft] thick confining layer composed of the combined Skull Creek Shale, Mowry, and Belle Fourche Shales (Graneros Group). Where the Fall River aquifer is overlain by a thick confining layer, impacts to groundwater in this aquifer due to spills and leaks of pregnant or barren lixiviant on the ground surface resulting from pipeline, valve, and well integrity failure will be SMALL.

As described in SEIS Section 3.5.3.3, the Fall River Formation forms a shallow (near-surface) unconfined aquifer where it is exposed at the surface in the eastern part of the Burdock area. As a result, spills and leaks of pregnant or barren lixiviant on the ground surface resulting from pipeline, valve, and well integrity failure could impact water quality. Uranium orebodies are present in unconfined portions of the Fall River Formation in the eastern part of the Burdock area. However, the applicant stated that ISR operations will not be conducted in unconfined portions of the Fall River aquifer (Powertech, 2010a). The applicant stated that ISR operations in the Fall River Formation will be limited to uranium orebodies in confined aquifers in the Dewey portion of the project area, except for one proposed Burdock wellfield (B-WF10) (Powertech, 2010a; Petrotek, 2012). Wellfield B-WF10 is proposed in a confined and fully saturated portion of the Fall River Formation in the western part of the Burdock area (Petrotek, 2012).

The GEIS reported that NRC-required leak detection and cleanup programs greatly reduce the impact of radiological releases at or near the ground surface in shallow groundwater. The applicant is required to have leak detection, spill response, and cleanup programs as part of the NPDES permit (see SEIS Section 7.3.2). The applicant commits to implementing a spill prevention and cleanup plan that includes rapid response cleanup and remediation programs to minimize impacts on soils and groundwater (Powertech, 2009a). In addition, preventive measures, such as NRC-required mechanical integrity testing (see SEIS Section 2.1.1.1.2.3.5) and UIC permits obtained from EPA, will limit the likelihood of well integrity failure during operations, and hence, will minimize the risk of process fluid leaks from operational wells entering (or contaminating) shallow aquifers.

NRC staff determine that near-surface (alluvium) aquifers in the project area have limited occurrences near creeks and are not being used for domestic, agricultural, or livestock watering. Shallow aquifers occur in the eastern part of the Burdock area, where the Fall River aquifer crops out and/or is present in an unconfined condition. The applicant commits to refrain from extracting uranium in the shallow, unconfined Fall River aquifer in the Burdock area. Near-surface and shallow aquifers are hydrologically isolated from deep aquifers below the Chilson aquifer by the impermeable Morrison Formation. In addition, the NRC staff recognize that during ISR operations groundwater impacts will be mitigated and reduced by (i) implementation of leak detection and cleanup programs, (ii) mechanical integrity testing of wells, and (iii) adherence to UIC permit requirements. Therefore, NRC staff conclude that impacts to shallow (near-surface) groundwater during operations for the Class V injection well disposal option at the proposed project will be SMALL.

4.5.2.1.1.2.2 Operations Impacts to Production and Surrounding Aquifers

The potential environmental impact to groundwater in the production and other surrounding aquifers is related to consumptive water use and groundwater quality.

Water Consumptive Use

GEIS Section 4.4.4.2.2.2 included a discussion of the potential impacts of groundwater withdrawal and reinjection into the production zone during ISR operations (NRC, 2009a). Most of the water withdrawn from the aquifer is returned to the aquifer. The portion not returned to the aquifer is referred to as “consumptive use.” Consumptive use for ISR operations is primarily due to production bleed and other small losses. Production bleed is the net withdrawal maintained to ensure groundwater hydraulic gradients draw water in toward the production wells to minimize the potential movement of lixiviant and its associated contaminants out of the wellfield.

Consumptive water use during ISR operations could impact those who use local water from the production aquifer outside the exempted zone. This potential impact will lower water levels in nearby wells and reduce the yield of these wells. In addition, if the production zone is hydraulically connected to other aquifers above and/or below the production zone, consumptive use may impact the water levels in these overlying and underlying aquifers and reduce the yield in any nearby wells withdrawing water from these aquifers. (NRC, 2009a)

The applicant has committed to removing all existing domestic wells within the project area from private use prior to ISR operations (Powertech, 2011). The applicant will work with well owners to provide an alternative water source, such as a replacement well or alternative water supply for domestic use. Replacement wells will be located an appropriate distance from wellfields and target an aquifer outside the production zone that provides water in a quantity equal to that of the original well and of a quality suitable for the same uses as the original well (Powertech, 2011). In addition, the applicant will remove all stock wells within 0.4 km [0.25 mi] of any wellfield from private use prior to operation of the wellfield. Furthermore, the applicant will remove stock wells from private use that could be adversely impacted by or could adversely impact ISR operations. The applicant will also assume control of all wells used for monitoring within the project area boundary and secure the well heads to prevent unauthorized use. During operations, the applicant will monitor all domestic wells within 2 km [1.2 mi] of the wellfields and all stock wells within the project area (Powertech, 2011). In the event of significant drawdown or degradation of water quality in these wells, the applicant will provide alternative sources of water (e.g., a replacement well) to the well owner as described previously (Powertech, 2009a, 2011).

Based on historical records and field investigations of the proposed project area, 107 water wells were identified within 2 km [1.2 mi] of the proposed project site (Powertech, 2011). In addition, field investigations of 36 wells documented in historical records were conducted. Of the 36 wells, 8 were visually confirmed to be plugged and abandoned, while 28 wells were not identified at the surface during the field investigation (Powertech, 2011). The 107 identified water wells are screened in the following aquifers: Fall River (33 wells; 12 of these wells are flowing artesian wells), Chilson (41 wells; 14 of these wells are flowing artesian wells), unknown aquifer (17 wells), Inyan Kara (either the Fall River or Chilson or both; 3 wells), Unkpapa (5 wells), Sundance (1 well), and alluvial aquifers (7 wells) (Powertech, 2009a, 2011). The total estimated groundwater use from wells placed in the Fall River aquifer is 57 Lpm [15 gpm]. From wells placed in the Chilson aquifer, the total estimated groundwater use is 174 Lpm [46 gpm] (Powertech, 2009a). The total estimated flow from wells placed in the Inyan Kara Group aquifers (Fall River, Chilson, or both) is 265 Lpm [70 gpm].

Ore production zone pumping rates are estimated to be 9,084 Lpm [2,400 gpm] in the Burdock area and 6,056 Lpm [1,600 gpm] in the Dewey area during ISR operations (Powertech, 2011). These pump rates will draw down water levels in nearby wells in the production zones, potentially reducing the yield of these wells for livestock watering and domestic use. The applicant estimates that the maximum drawdown outside the project area resulting from projected ISR operations will be approximately 3.65 m [12 ft] in the Fall River aquifer and 3.05 m [10 ft] in the Chilson aquifer (Petrotek, 2012). The estimates are based on numerical modeling developed from site-specific parameters and calibrated to historical pumping test data (Petrotek, 2012). The numerical simulations were for net extraction rates resulting from a gross production pumping rate of 30,280 Lpm [8,000 gpm] (twice the applicant's estimated proposed pumping rate of 15,140 Lpm [4,000 gpm]), a 1 percent production bleed rate, and the use of groundwater sweep during aquifer restoration. As described previously, the applicant has committed to removing domestic wells within the proposed project area prior to operations. Therefore, the drawdown estimates represent the maximum anticipated drawdown amount for nearby domestic wells. The NRC staff analyzed the hydrogeologic characteristics of the Fall River and Chilson aquifers (i.e., formation thicknesses and potentiometric surfaces) and concluded that these estimated drawdowns will have a SMALL impact on nearby wells located in the Fall River and Chilson aquifers.

The NRC staff recognize that the Chilson aquifer is separated from the Sundance/Unkpapa Formation by a 30-m [100-ft] thick section of the impermeable Morrison Formation, which hydrologically isolates the Chilson aquifer from underlying aquifers (i.e., Sundance/Unkpapa). Therefore, the staff find that, for the Class V injection well disposal option, the impacts on water levels and water yields in wells located in the Sundance/Unkpapa Formation (Powertech identified six wells) due to pumping and drawdown in the Chilson aquifer during ISR production will be SMALL.

During ISR operations, the applicant plans to maintain a typical bleed rate of 0.875 percent of the production flow rate over the life of the proposed project (Powertech, 2011). However, instantaneous bleed rates may vary from 0.5 to 3 percent for short durations, ranging from days to months, to ensure a cone of depression is maintained and that no production fluids are released from the production zone (Powertech, 2009a). Because there is no evidence for fast flow paths, such as fractures, in the ore-bearing aquifers, NRC staff conclude that the cone of depression will be maintained during ISR operations. If the applicant uses a bleed rate of 3 percent during the operations phase, drawdowns in the nearest domestic wells in the Fall River and Chilson aquifers will be greater than those estimated in the previous paragraph for a 1 percent bleed rate. However, as noted previously, the maximum simulated drawdown was performed for a gross production pumping rate of twice that proposed by the applicant and for the optional groundwater sweep during aquifer restoration. Therefore, it represents a conservatively high estimate of the potential drawdown resulting from operation and restoration. In addition, drawdowns resulting from higher bleed rates (i.e., bleed rates greater than 1 percent) will be temporary (days to months). After production and restoration are complete and groundwater withdrawals are terminated at the proposed project, groundwater levels will tend to recover with time. Based on numerical modeling, the applicant estimates that water levels will recover to near pre-operational levels within 1 year after groundwater withdrawals cease (Petrotek, 2012).

Furthermore, the applicant will monitor private domestic, livestock, and agricultural wells as appropriate during operations and provide alternative sources of water to landowners in the event of significant drawdown to domestic and livestock wells within and adjacent to the proposed project area (Powertech, 2009a). Therefore, potential impacts to water yields and pumping costs in nearby wells due to drawdowns associated with higher bleed rates for the Class V injection well option will be short-term and SMALL.

As described in SEIS Section 4.5.2.1, the applicant's water permit application to SDDENR for groundwater use from the Madison aquifer proposes to appropriate 109.6 ha-m [888.8 ac-ft] or 1.09×10^9 L [28.9×10^7 gal] of water annually (Powertech, 2012i). If this permit is granted, the applicant will rely largely on Madison aquifer water during ISR operations. The Madison aquifer is approximately 844 m [2,765 ft] bgs in the Burdock area and approximately 945 m [3,100 ft] bgs in the Dewey area (Powertech, 2011, Appendix 2.7–L). Otherwise, the applicant will pump water from the Inyan Kara Group aquifers to meet operational needs at an estimated sustainable rate of 151 to 246 Lpm [40 to 65 gpm] (Powertech, 2009a, 2010a). Results of numerical groundwater simulations indicate the Inyan Kara aquifer can sustain net extraction rates of up to 363 Lpm [96 gpm] over the 8-year operations phase (Petrotek, 2012).

To mitigate impacts on the use of shallow groundwater, the applicant commits to (i) removing all existing domestic wells within the project area from private use prior to ISR operations, (ii) removing all stock wells within 0.4 km [0.25 mi] of any wellfield from private use prior to operation of the wellfield, (iii) removing stock wells that could be adversely impacted by or could adversely impact ISR operations from private use, (iv) controlling all monitor wells within the proposed project boundary, and (v) providing alternative sources of water to landowners in the event of significant drawdown or degradation of water quality to domestic wells within 2 km [1.2 mi] of the project boundary and stock wells within the proposed project area (Powertech, 2009a, 2011). After production and restoration are complete and groundwater withdrawals are terminated at the Dewey-Burdock Project, groundwater levels will tend to recover with time. Therefore, NRC staff conclude that the overall environmental impacts on local aquifers, production aquifers, and domestic and livestock wells from consumptive use during operations for the Class V injection well disposal option at the proposed project will be SMALL.

<u>Excursions and Groundwater Quality</u>

As described in the GEIS, groundwater quality in the production zone will be degraded during ISR operations (NRC, 2009a). The production portion of the aquifer will need to be exempted from being a USDW though an EPA-issued aquifer exemption in accordance with the criteria under 40 CFR 146.4. After production is completed, the licensee must initiate aquifer restoration activities to restore the production zone to Commission-approved background water quality, if possible. If the aquifer cannot be returned to background conditions, NRC requires that the production aquifer be returned to the MCLs provided in 10 CFR Part 40, Appendix A, Table 5C or to NRC-approved ACLs. Appendix B explains the process for granting an ACL. For proposed ACLs to be approved, they must be shown to protect human health at the site. For these reasons, NRC staff concluded in the GEIS that the potential impacts to the water quality of the uranium-bearing production zone aquifer as a result of ISR operations will be SMALL (NRC, 2009a).

To prevent horizontal excursions, inward hydraulic gradients need to be maintained in the production aquifer during ISR operations (NRC, 2009a). These inward hydraulic gradients are created by the net groundwater withdrawals (production bleeds) maintained through continued pumping during ISR operations. For the Dewey-Burdock ISR Project, the applicant plans to maintain a 0.5 to 3 percent production bleed rate (see SEIS Section 2.1.1.1.3.1.2). The inward hydraulic gradients will ensure that groundwater flow is toward the production zone and that horizontal excursions will not occur.

As required by NRC license condition, a licensee must take preventive measures to reduce the likelihood and consequences of potential excursions. An applicant must design and install a monitoring network capable of detecting both horizontal and vertical excursions from the production zone to demonstrate that restoration is feasible. A ring of monitoring wells within and encircling the production zone is required for early detection of horizontal excursions. The applicant's groundwater monitoring program is detailed in SEIS Sections 2.1.1.1.3.1.3 and 7.3.1.2. If excursions are detected in the monitoring well ring, corrective actions to either stop or reverse the fluid movement (i.e., excursions) are required. The applicant will need to modify wellfield operations, as necessary, to correct the excursion. As described in SEIS Section 2.1.1.1.3.1.3, corrective actions to monitor and stop or reverse an excursion may include increasing sampling frequency to weekly, increasing the pumping rates (and thus the net bleed) of production wells in the area of the excursion, and pumping individual wells to enhance recovery of extraction solutions. If these actions do not effectively retrieve the excursion within 60 days, the applicant is required by license condition to suspend injecting lixiviant into the production zone adjacent to the excursion until the excursion is retrieved and the upper control limit parameters are no longer exceeded.

Vertical excursions may also occur in aquifers overlying or underlying the production zone aquifer. An analysis presented in the GEIS indicated the potential for migration of production solutions into an overlying or underlying aquifer is minor if the aquitard (confining layer) separating the production zone from the overlying and underlying aquifer is sufficiently thick and the aquitard has low permeability (NRC, 2009a). The hydraulic gradient between the production zone and overlying or underlying aquifers is also used to determine the potential for vertical excursions. The upper confining layer (Skull Creek, Mowry, and Belle Fourche Shales, which are collectively referred to as the Graneros Group) at the Dewey-Burdock site has a thickness of approximately 61 to 168 m [200 to 550 ft] (see Figure 3.5-5). The applicant stated that it will not likely place any monitoring wells below the Lakota Formation due to the presence of a 30-m [100-ft]-thick underlying confining layer (Morrison Formation) and the upward vertical hydraulic gradient at the proposed Dewey-Burdock site (Powertech, 2009a). The thicknesses of the upper confining layer {approximately 61 to 168 m [200 to 550 ft]} and the lower confining layer {approximately 30 m [100 ft]} will minimize the potential impacts of vertical excursions. To ensure the detection of vertical excursions, NRC requires monitoring in the overlying and underlying aquifers. The applicant's groundwater monitoring program is detailed in SEIS Sections 2.1.1.1.3.1.3 and 7.3.1.2.

Vertical excursions can also occur due to improperly sealed boreholes, poorly completed wells, or loss of mechanical integrity of ISR injection and production wells. The applicant will use its delineation drilling and pump testing program to identify and plug improperly sealed boreholes that could result in vertical excursions (Powertech, 2011). The applicant will use its mechanical integrity testing program to mitigate the impacts of potential vertical excursions resulting from borehole failure of injection, production, and monitoring wells (see SEIS Section 2.1.1.1.2.3.5). The applicant must also conduct periodic mechanical integrity testing of each well to check for leaks or cracks in the casing, as required by 40 CFR 146.8. Because mechanical integrity testing reduces the likelihood of poor well integrity, the impacts from excursions involving failure or damage to a well casing will be SMALL.

In GEIS Section 2.11.4, NRC staff discussed excursions that occurred at operating ISR facilities (NRC, 2009a). Separately, NRC staff analyzed the environmental impacts from both horizontal and vertical excursions that occurred at three NRC-licensed ISR facilities (NRC, 2009b). In that analysis, which considered 60 events at 3 facilities, NRC staff found that, for most of the events, the licensees were able to control and reverse the excursions through pumping and extraction at nearby wells. Most excursions were short-lived, although a few continued for several years. In all cases, however, no impacts occurred to nonexempted portions of the aquifer (NRC, 2009b).

Many of the hydrogeologic conditions at the proposed Dewey-Burdock ISR Project are similar to those at other ISR facilities. Groundwater in the production zone aquifers displays sufficient hydraulic conductivity to minimize excursions during ISR activities. However, the Dewey-Burdock site has several distinctive man-made and hydrogeological features that could contribute to potential vertical or horizontal excursions.

First, Tennessee Valley Authority (TVA) drilled several thousand exploratory boreholes within the proposed Dewey-Burdock ISR Project area, which penetrate the Inyan Kara Group aquifers to the Morrison Formation (Powertech, 2010a). These boreholes may provide pathways to aquifers above and below production zone confining units, such as alluvial aquifers above the Graneros Group and deep aquifers below the Morrison Formation, although few explorations holes penetrated the entire thickness of the Morrison Formation (Powertech, 2011). Before developing wellfields, the applicant commits to properly plugging and abandoning or mitigating any historical wells and exploration holes that may potentially impact the control and containment of wellfield solutions within the proposed wellfield (Powertech, 2011). The applicant will use available information and best professional practices—including historical records, color infrared imagery, field investigations, and potentiometric surface evaluation—to locate or detect improperly plugged boreholes or wells in the vicinity of potential wellfield areas. In addition, the applicant will use pumping test results conducted as part of routine wellfield hydrogeologic package development to identify improperly plugged wells and exploration boreholes (Powertech, 2011).

Second, hydraulic communication (i.e., leakage) between the Fall River and Chilson aquifers through the intervening Fuson Shale (see Figure 3.5-5) in the Burdock area has been identified based on aquifer pumping tests [see safety evaluation report (SER) Section 2.4.3.4] and potentiometric surface differences (see SEIS Section 3.5.3.2). Leakage through the Fuson Shale has implications when evaluating the capability of reversing potential vertical excursions by drawing water back into producing wells. Using exploratory drilling data the applicant provided (Powertech, 2010b), NRC staff independently constructed isopach maps (i.e., maps showing the thickness of a bed or formation throughout a geographic area) for the Fuson Shale underlying the Burdock area using different statistical methods (e.g., kriging, inverse distance). The resultant isopach maps for the Fuson Shale were in good agreement with the isopach map for the Fuson Shale the applicant presented (see Figure 3.5-6). However, the thickness of the Fuson Shale at the proposed Dewey-Burdock site may be different from other areas, and the applicant has committed to collecting more detailed lithologic data in each wellfield prior to ISR operations to ensure hydraulic control of the production zone (Powertech, 2010a). The applicant also developed a numerical groundwater model using site-specific geologic and hydrologic information (Petrotek, 2012). Based on results of the numerical model, the applicant concluded that vertical leakage through the Fuson Shale is caused by improperly installed wells or improperly abandoned boreholes. NRC staff reviewed the applicant's numerical groundwater model and calibration, and it determined that the model was appropriately developed and sufficiently calibrated. As noted previously, the applicant has committed to locating unknown boreholes and wells, and committed to plugging and abandoning historical wells and exploration holes, holes drilled by the applicant, and any wells that fail mechanical integrity tests (Powertech, 2011).

Finally, the applicant plans to conduct ISR operations in partially saturated portions of the Chilson aquifer in the Burdock area (Powertech, 2011). ISR operations in partially saturated aquifers present special challenges with regard to controlling production fluids and detecting and remediating excursions. As described in SEIS Section 2.1.1.1.2.3, the applicant has committed to collect more detailed lithologic data through delineation drilling and conduct additional hydrogeologic investigations (including pump tests) in each proposed wellfield to ensure that hydraulic control of the production zone can be maintained (Powertech, 2010a, 2011). The applicant will be required to submit detailed operational plans, including monitoring well layouts, for NRC and EPA approval before conducting ISR operations in partially saturated aquifers at the proposed Dewey-Burdock site (Powertech, 2010a, 2011). NRC staff have also included a license condition for ISR operations in partially saturated portions of the Chilson aquifer. This license condition will require the applicant to demonstrate the ability to detect and remediate excursions in partially saturated zones (NRC, 2013).

In summary, NRC staff conclude that the impact from excursions at the proposed Dewey-Burdock ISR Project will be SMALL because (i) EPA will exempt uranium-bearing production aquifers from USDW classification according to the criteria under 40 CFR 146.4,(ii) the applicant will be required to submit wellfield operational plans for NRC and EPA approval, (iii) inward hydraulic gradients will be maintained to ensure groundwater flow is toward the production zone, and (iv) the applicant's NRC-mandated groundwater monitoring plan will ensure that excursions are detected and corrected. Impacts from vertical excursions will be SMALL because (i) uranium-bearing production zones in the Fall River and Chilson aquifers are hydrologically isolated from adjacent aquifers by thick, low permeability shale layers (i.e., the overlying Graneros Group and underlying Morrison Formation); (ii) a prevailing upward hydraulic gradient occurs across the major aquifers; (iii) the applicant's required mechanical integrity testing program will mitigate the impacts of potential vertical excursions resulting from borehole failure; and (iv) the applicant commits to properly plugging and abandoning or mitigating any previously drilled wells and exploration holes that may potentially impact the control and containment of wellfield solutions within the proposed project area. Moreover, because the applicant must initiate aquifer restoration in the production aquifers (i.e., Fall River and Chilson aquifers) to return groundwater to Commission-approved background levels or to NRC-approved alternative water quality levels at the end of ISR operations, NRC staff conclude that groundwater quality impacts to the production and surrounding aquifers as a result of ISR operations for the Class V injection well disposal option will be SMALL.

4.5.2.1.1.2.3 Operations Impacts to Deep Aquifers Below the Production Aquifers

Potential environmental impacts to confined, deep aquifers below the production aquifers could occur from deep well injection of process-related liquid effluents. Under the SDWA, EPA has statutory authority to permit and regulate injection well activities that may affect the environment. EPA Region 8 administers the deep well disposal UIC program in South Dakota and is responsible for issuing any permits for deep well disposal at the proposed Dewey-Burdock Project site.

At the proposed Dewey-Burdock ISR Project, the applicant plans to dispose of liquid waste using Class V (nonhazardous) deep injection wells, land application, or a combination of both deep well injection and land application (see SEIS Section 2.1.1.1.2.4). For the Class V injection well disposal option at the proposed project, the applicant will inject process-related liquid waste into the Deadwood and Minnelusa Formations, which both lie below the Morrison Formation (Powertech, 2011, Appendix 2.7-L). However, deep well injection into these formations depends on securing a Class V (nonhazardous) UIC permit through an EPA-permitting process. For disposal through a UIC Class V well, an EPA permit, if granted, will require that the waste stream to be injected will not be classified as hazardous under the Resource Conservation and Recovery Act (RCRA). EPA will also evaluate the suitability of the proposed deep injection wells. EPA will only allow deep well injection if the liquid wastes can be safely isolated in the deep aquifers. If a license is granted, NRC will also require the liquid wastes to be treated and monitored to verify they meet NRC release standards in 10 CFR Part 20, Subparts D and K and Appendix B, Table 2, Column 2. If the proposed injection zones are underground sources of drinking water {have a total dissolved solids concentration below 10,000 mg/l [10,000 ppm]}, the EPA UIC permit will require the injectate to be treated to meet drinking water standards or contaminant-specific background concentrations for constituents regulated under the SDWA, unless the applicant applies for and is granted an aquifer exemption. The applicant's Class V injection well monitoring program is detailed in SEIS Section 7.6.

At the Dewey-Burdock site, the Madison aquifer is an important aquifer in the region supplying municipal water for numerous communities, including Rapid City and Edgemont, South Dakota. As noted previously, the proposed injection zones for the deep disposal wells are the Minnelusa Formation and the Deadwood Formation, which respectively lie above and below the Madison Formation (Figure 3.5-5). There are confining layers at the base of the Minnelusa Formation, which separate the Madison Formation from the overlying Minnelusa Formation. Locally, these confining layers may be absent or provide ineffective confinement, which could enhance hydraulic connection between the Minnelusa aquifer and the underlying Madison aquifer (Naus, et al., 2001). However, based on water levels in Minnelusa and Madison observation wells in the area, SDDENR concluded that there is a significant difference in the potentiometric surfaces of the two aquifers suggesting that the aquifers are hydraulically separated in the vicinity of the site (SDDENR, 2012b). The Englewood Formation underlies the Madison Formation and should provide a confining layer between the Madison Formation and the underlying Deadwood Formation. As described in SEIS Section 3.5.3.1, the Whitewood and Winnipeg Formations (see Figure 3.5-5) are not expected to be present in the southern Black Hills (Naus, et al., 2001). As stated previously, the UIC permit will not allow injection into the Class V deep disposal wells unless the permittee demonstrates the wells are properly sited, such that confinement zones and proper well construction minimize the potential for migration of fluids outside of the approved injection zone. Based on the protective requirements of the EPA UIC Class V permit, NRC staff conclude that the impact of the deep Class V disposal wells on the deep aquifers will be SMALL.

4.5.2.1.1.3 Aquifer Restoration Impacts

Consistent with the GEIS, the primary goal of aquifer restoration at the proposed Dewey-Burdock ISR Project is to return groundwater quality within the production zone of a wellfield to Commission-approved background water quality conditions or to standards consistent with NRC requirements at 10 CFR Part 40, Appendix A, Criterion 5B(5) (Powertech, 2009b). These standards state the concentration of a hazardous constituent must not exceed

(i) the Commission-approved background concentration of that constituent in groundwater; (ii) the respective value in the table in paragraph 5C (in 10 CFR Part 40, Appendix A) if the constituent is listed in the table and if the background level of the constituent is below the value listed; or (iii) an ACL the Commission establishes. Appendix B explains the process for granting an ACL. For proposed ACLs to be approved, they must be shown to protect human health at the site.

In addition to NRC requirements at 10 CFR Part 40, Appendix A, Criterion 5B(B), groundwater in the production zone aquifer will have to be restored to State of South Dakota standards. In accordance with ARSD 74:54:01:04, groundwater in the production zones will be required to be restored to established ambient concentrations or South Dakota groundwater quality standards.

NRC staff examined available groundwater restoration data from three NRC-licensed ISR facilities (COGEMA's Irigary/Christensen Ranch facility, Power Resources Inc.'s Smith Ranch/Highland Uranium Project facility, and Crow Butte Resources Crow Butte facility) (NRC, 2009b). NRC staff has approved 11 wellfield restorations at the three sites. The restoration data show that pre-operational concentrations are attainable for many parameters (50 to 70 percent of the 35 parameters commonly monitored) but are not attainable for other constituents, in particular, the major and trace cations with solubilities most susceptible to the oxidation state of the aquifer water (i.e., iron, manganese, arsenic, selenium, uranium, vanadium, and radium-226). However, for the approved restorations, the impacts to groundwater in the exempted aquifer met all regulatory standards for the state or EPA UIC program, met the quality designated for its class of use prior to ISR operations, have been shown to decrease in the future due to natural attenuation processes, and have been shown to meet drinking water standards at the perimeter of the exempted aquifer. Therefore, the impacts to the exempted aquifer for each of the approved restorations do not pose a threat to human health and the environment.

Hydraulic control of the ore zone must be maintained during aquifer restoration. This is accomplished by maintaining an inward hydraulic gradient through a restoration bleed. During aquifer restoration at the proposed Dewey-Burdock site, the restoration bleed will typically be 1 percent of the restoration flow (Powertech, 2011). The applicant plans to begin restoration of the first wellfield in both the Burdock and Dewey areas immediately after production activities end in that wellfield (Powertech, 2009a). Subsequently, as additional wellfields are completed, the applicant plans to restore each wellfield as soon as reasonably achievable or practicable following production (Powertech, 2011).

As described in SEIS Section 2.1.1.1.4.1, the applicant's primary method of aquifer restoration for the Class V injection well disposal option is groundwater treatment with RO and permeate injection (Powertech, 2009b, 2011). This method uses a RO system consisting of pressurized, semipermeable membranes that will treat groundwater removed from the wellfields in the Dewey and Burdock areas. The RO system removes more than 90 percent of the total dissolved solids in groundwater being restored. The reverse RO reject, or brine, undergoes radium removal in the radium settling ponds and then disposal in one or more Class V injection wells. The total liquid waste flow rate will be approximately 746 Lpm [197 gpm] during concurrent uranium production and aquifer restoration and approximately 568 Lpm [150 gpm] during aquifer restoration alone (Powertech, 2011). These liquid waste flow rates are lower than the proposed disposal capacity of up to 1,135 Lpm [300 gpm] for the Class V injection well disposal option (see SEIS Section 2.1.1.1.2.4.1).

About 70 percent of the water withdrawn from the wellfields and passed through the RO membranes will be recovered as permeate. Before reinjection into the wellfields, the permeate will be supplemented with makeup water from wells in the Madison Formation and injected into the wellfields at an amount slightly less than the amount withdrawn to maintain a slight restoration bleed. As noted previously, the restoration bleed will maintain hydraulic control of the wellfields during aquifer restoration and will typically be 1 percent of the restoration flow unless groundwater sweep is used in conjunction with RO treatment with permeate injection, in which case the restoration bleed will average approximately 17 percent as described in SEIS Section 2.1.1.1..4.1.3.

As described in SEIS Section 4.5.2.1, the applicant submitted a water appropriation permit to SDDENR in June 2012 for groundwater use from the Madison aquifer. However, if the applicant cannot secure a water appropriation for use of Madison aquifer water, the applicant will have to either identify an alternative source of water to meet aquifer restoration water requirements or reduce pumping rates to meet the estimated sustainable net extraction rate from the Inyan Kara aquifer, which is estimated to be at least 556 Lpm [147 gpm] for 2 years and 363 Lpm [96 gpm] for 8 years (see SEIS Sections 4.5.2.1.1.1 and 4.5.2.1.1.2.2.). Reducing the pumping rate will extend the aquifer restoration phase (Powertech, 2010a). After production and restoration are complete and groundwater withdrawals are terminated, groundwater levels will tend to recover with time (NRC, 2009a). Based on numerical modeling, the applicant estimates that water levels will recover to near pre-operational levels within 1 year after groundwater withdrawals cease (Petrotek, 2012). Thus, the potential long-term environmental impact from consumptive use during the restoration phase at the proposed project for the Class V injection well disposal option will be SMALL.

Aquifer restoration will directly impact groundwater quality in the production zone. At the end of operations in wellfields, the applicant must initiate aquifer restoration to return groundwater to Commission-approved background conditions. If these aquifers cannot be returned to Commission-approved background conditions, NRC will require that the production aquifer be returned to the MCLs provided in 10 CFR 40, Appendix A, Table 5C, or to NRC-approved alternate concentration limits. Restoration to these standards will ensure that groundwater within the exemption boundary will not pose a threat to surrounding groundwater. For these reasons, potential impacts to the water quality of the Fall River and Chilson aquifers and surrounding aquifers as a result of aquifer restoration for the Class V injection well disposal option will be SMALL.

As described previously, leakage between the Fall River and Chilson aquifers through the intervening Fuson Shale in the Burdock area has been identified based on aquifer pumping tests (see SER Section 2.4.3.4) and potentiometric surface differences (see SEIS Section 3.5.3.2). Because leakage may occur through the Fuson Shale, a potential exists for drawdown-induced migration of radiological contaminants from abandoned open pit mines in the Burdock area (e.g., Triangle Pit mine) from the Fall River aquifer into the hydraulically connected Chilson aquifer.

To address uncertainties in the confining properties of the Fuson Shale in the Burdock area, the NRC staff will impose by license condition that the applicant design and implement a monitoring well network (NRC, 2013). Specifically, for wellfields in the Burdock area where the production zone is located in the Chilson aquifer, the NRC will require monitoring wells to be placed in the

Fall River aquifer to identify any lack of confinement. A proposal for the monitoring well network must be submitted to NRC staff for review and written verification at least 60 days prior to construction.

In addition, the applicant committed to conducting hydrogeological characterization and aquifer pumping tests in each wellfield, in order to examine the hydraulic integrity of the Fuson Shale and ensure drawdown-induced migration of potential contaminants will not impact aquifer restoration goals (Powertech, 2010a). By license condition, NRC will also require the applicant to provide the results of the hydrogeological characterization and aquifer pumping tests for review and written verification before any proposed wellfields are developed (NRC, 2013). Further, wellfields in the vicinity of the abandoned mine pits in the Burdock area, specifically wellfields B-WF6, B-WF7, and B-WF8 (see Figure 2.1-6), will be prohibited from operating until NRC staff have reviewed and approved the hydrogeologic data packages for those wellfields (NRC, 2013).

Based on NRC requirements and applicant commitments, the potential for contaminants from abandoned open pit mines in the Burdock area to be drawn through the Fuson Shale into production zones within the Chilson aquifer during aquifer restoration will be SMALL.

As with the operations phase, a network of buried pipelines is used during the restoration phase for transporting fluids between the pump house and the satellite facility, or central processing plant. These pipelines are also used to connect injection and extraction wells to manifolds inside the header houses. However, the fluids transported in these pipes during restoration are generally less concentrated than during production. The failure of pipeline fittings or valves, or failures of well mechanical integrity in shallow aquifers, could result in leaks and spills of these fluids that could impact water quality in shallow aquifers. As discussed in SEIS Section 4.5.2.1.1.2.1, the applicant committed to implementing a leak-detection and spill-cleanup program (Powertech, 2009a). The EPA-mandated UIC program will also require preventive measures, such as well mechanical integrity testing. Consequently, implementing these measures will result in potential SMALL impacts to alluvial or shallow (near-surface) aquifers during the aquifer restoration phase at the proposed project.

As previously discussed in SEIS Section 4.5.2.1.1.2.3, it is assumed that the potential environmental impact to deep aquifers below the production aquifers from deep well injection of treated liquid wastes will be SMALL. The applicant will need an EPA UIC Class V permit for deep disposal wells at the proposed project (Powertech, 2009c). EPA will evaluate the suitability of the proposed deep injection wells and will only allow deep well injection if the waste fluids can be suitably isolated in a deep aquifer. Consequently, NRC staff determine that the potential environmental impact from the Class V injection well disposal option on targeted deep aquifers located below the production zone aquifers will be SMALL.

As described in SEIS Section 2.1.1.1.4.2, the applicant will implement a restoration monitoring plan to detect and correct horizontal and vertical excursions during aquifer restoration. After aquifer restoration is complete, groundwater levels will tend to recover with time (NRC, 2009a), and therefore long-term impacts to consumptive water use will be SMALL. Continued implementation of a leak-detection and spill-cleanup program and preventative measures, such as well mechanical integrity testing, will result in SMALL impacts to alluvial or shallow (near-surface) aquifers. The applicant’s UIC Class V permits from EPA for deep well disposal will ensure that the impact to deep aquifers during aquifer restoration will be SMALL. Moreover, restoration to Commission-approved background conditions (or NRC-approved water quality standards) in accordance with NRC license conditions will ensure that groundwater within the exemption boundary will not threaten surrounding groundwater.

Before NRC terminates an ISR source material license, a licensee is required to demonstrate that there will be no long-term impacts to USDWs. NRC review and approval of the wellfield restoration will ensure that the restoration standards are met and that these standards are protective of public health and the environment. Therefore, NRC staff conclude that the impacts from aquifer restoration in the Burdock and Dewey areas for the Class V injection well disposal option will be SMALL.

4.5.2.1.1.4 Decommissioning Impacts

After completion of ISR operations at the Dewey-Burdock ISR Project site, improperly plugged and abandoned wells could potentially impact aquifers above the production zone by providing hydrologic connections between aquifers. As part of the restoration and reclamation activities, all monitor, injection, and recovery wells at the proposed Dewey-Burdock site will be plugged and abandoned in accordance with SDDENR and EPA UIC regulations (see SEIS Section 2.1.1.1.5.2). In addition, the applicant will submit decommissioning plans, including detailed plans for plugging and abandoning wells, to NRC for review and approval.

The applicant has committed to implementing an emergency response plan to address cleanup of accidental spills and leaks that may occur during decommissioning. The applicant will implement the mitigation measures to control erosion and stormwater runoff. The applicant's NPDES permit will ensure that stormwater runoff will not contaminate surface water or shallow groundwater. After removal of surface structures, the applicant will replace topsoil in previously disturbed areas, recontour the land surface to restore it to a surface configuration to blend with the natural terrain, and seed disturbed areas in wellfields in accordance with the NRC and SDDENR regulations (Powertech, 2009b). Access roads will be reclaimed and restored in a similar manner.

If this process is properly implemented following the NRC-approved decommissioning plan and the abandoned wells are properly isolated from the flow domain, the potential environmental impacts to groundwater from decommissioning for the Class V injection well disposal option will be SMALL.

4.5.2.1.2 Disposal Via Land Application

If the permit for Class V injection wells is not obtained from EPA, the applicant proposes to dispose of liquid waste generated at the proposed Dewey-Burdock ISR Project by land application (see SEIS Section 2.1.1.2.4.2). Potential environmental impacts to groundwater from construction, operation, aquifer restoration, and decommissioning for the land application disposal option are discussed in the following sections.

4.5.2.1.2.1 Construction Impacts

The construction of facilities, pipelines, wellfields, holding ponds, irrigation areas, and access roads in the construction phase of the land application disposal option will disturb 566 ha [1,398 ac] of land (Powertech 2010a). The total land disturbance will be 13.2 percent of the permit area. The locations of land application areas are shown in Figure 2.1-12. As described in SEIS Section 4.5.1.1.2.1, significant earthmoving activities will not be conducted to prepare land irrigation areas. All the ground surface disturbances and the resultant impacts to groundwater discussed in SEIS Section 4.5.2.1.1.1, except for those from construction of deep well disposal facilities, will be applicable during the construction phase of the proposed ISR project for the land application disposal option.

The applicant must obtain a Class III UIC permit, an NPDES permit, and a water appropriation permit before construction activities begin. Consumptive water use during construction will be limited to dust control, cement mixing, pump tests, delineation drilling, and well drilling and completion. The volume of drilling fluids and mud used during well installation will be limited. The introduction of drilling fluids to surficial (alluvial) aquifers at the proposed project might occur during well drilling, but the amount will be minor because drilling mud is designed to seal boreholes to set the casing. As part of the applicant's Class III UIC permit, all production, injection, and monitoring wells will be cased and cemented to prevent the migration of fluids into and between USDWs in accordance with EPA regulations in 40 CFR 146.32. All wells will undergo mechanical integrity tests of the casing to ensure against well leakage prior to entering service.

During well installation, drilling fluids and mud will be stored in temporary mud pits to control the spread of fluids, prevent soil contamination, and enhance evaporation. The applicant could choose alternative methods to manage drilling fluids that will further limit the potential impacts from the use of mud pits during well drilling activities (e.g., lining the mud pits with an impermeable membrane, offsite disposal of potentially contaminated drilling mud and other fluids, and the use of portable tanks or tubs to contain drilling mud and other fluids). The soil horizon found throughout most of the project area is clayey (see SEIS Section 3.4.2), which will minimize leakage from the mud pits and degradation of water quality of surficial and shallow aquifers.

Stormwater runoff during construction will be controlled by the applicant's SWMP, which is part of the SDDENR-issued NPDES permit (see SEIS Section 4.5.1.1.1.1). Runoff from precipitation events or snowmelt on land application areas will be conveyed to catchment areas downgradient of land application areas and allowed to evaporate or infiltrate (Powertech, 2012c). The NPDES permit sets limits on the amount of pollutants entering ephemeral drainages that may be in hydraulic communication with alluvial aquifers at the site. The NPDES permit will also specify mitigation measures and BMPs to prevent and clean up spills. The applicant has not yet submitted an application for an NPDES permit to SDDENR.

Potential environmental impacts to groundwater during construction will be localized and limited to groundwater in near-surface (alluvial) aquifers. As described in SEIS Section 4.5.1.1.2.1 for the Class V injection well disposal option, impacts on local aquifers and domestic and livestock wells from consumptive water use during the construction phase of the project will be SMALL. If the applicant is granted a water appropriation permit to use Madison aquifer water, environmental impacts on local aquifers (e.g., the Inyan Kara aquifer), and domestic and livestock wells from consumptive water use during construction will be minimal. In the event SDDENR denies the applicant's water appropriation permit, the applicant will rely solely on Inyan Kara aquifer water during the construction phase. Results of numerical groundwater simulations indicate the Inyan Kara aquifer can sustain net extraction rates of up to 556 Lpm [147 gpm] over the 2 year construction phase (Petrotek, 2012). This equates to total groundwater consumption of 5.83×10^8 L [1.54×10^8] gal, which exceeds the project-wide construction phase groundwater consumptive use estimate of 1.98×10^8 L [5.24×10^7 gal] (Powertech, 2010a). In addition, the applicant has committed to removing all domestic wells within the proposed project area from private use prior to operations (Powertech, 2011). Therefore, NRC staff conclude that the impacts to groundwater during construction for the land application option at the proposed project will be SMALL.

4.5.2.1.2.2 Operations Impacts

Groundwater in near-surface (alluvial) and shallow aquifers, production aquifers, aquifers overlying and underlying the production aquifers, and deep aquifers could be impacted during ISR operations for the land application disposal option at the proposed Dewey-Burdock project. Potential environmental impacts on groundwater could result from consumptive water uses from these aquifers and potential water quality degradations in these aquifers during ISR operations. Such potential impacts are discussed in the following sections.

4.5.2.1.2.2.1 Shallow (Near-Surface) Aquifers

All the ground surface disturbances and the potential resultant impacts to groundwater in shallow (near-surface) aquifers discussed in SEIS Section 4.5.2.1.1.2.1, except for those from construction of Class V injection well disposal facilities, will be applicable during the operations phase of the proposed ISR project for the land application disposal option. Briefly, NRC staff find that near-surface (alluvium) aquifers in the project area occur only near creeks and are not being used for domestic, agricultural, or livestock watering. Near-surface and shallow aquifers are not hydraulically connected to the deep aquifers the applicant proposed for the Class V injection well disposal option. Shallow aquifers occur in the eastern portion of the Burdock area, where the Fall River aquifer crops out and/or is present in an unconfined condition. The applicant commits to refrain from extracting uranium in the shallow unconfined Fall River aquifer in the Burdock area; however, there will be wellfields in this area for extracting uranium from the partially saturated Chilson sandstone. Moreover, the applicant is required to have leak detection, spill response, and cleanup programs as part of the NPDES permit. The applicant commits to implementing a spill prevention and cleanup plan that includes rapid response cleanup and remediation programs to minimize impacts on soils and groundwater. In addition, preventive measures, such as NRC-required mechanical integrity testing and UIC permits obtained from EPA, will limit the likelihood of well integrity failure during operations, and hence, will minimize the risk of process fluid leaks from operational wells into aquifers.

The applicant’s proposed land application areas in the Dewey area and in the Burdock area (see Figure 2.1-12) cover approximately 426 ha [1,052 ac] of the permitted land. These areas include all normally operating irrigation pivots, standby irrigation pivots, and areas constructed to contain surface stormwater runoff. In the Dewey area, the proposed land application sites are over confined portions of the Fall River and Chilson aquifers and away from their outcrop areas. In the Burdock area, the easternmost irrigation fields are located downdip of the outcrop area of the Fall River aquifer. The minimum estimated thickness of the Graneros Group in this area is 7.6 m [25 ft] (see Figures 2.1-12 and 3.5-7). Therefore, treated liquid waste applied to the easternmost land application areas is unlikely to recharge the Fall River aquifer due to the presence of the overlying Graneros Group shale. For the rest of the proposed land application sites, the impacts to groundwater will be localized and limited to near-surface (alluvial) aquifers, if they exist underneath the proposed irrigation fields, because alluvial aquifers are separated from the underlying Fall River aquifer by the low permeability, 61-m [200-ft]-thick Skull Creek shale. As discussed in SEIS Section 4.5.2.1.1.2.1, the applicant has proposed to remove all existing domestic wells within the project area from private use prior to ISR operations (Powertech, 2011).

As described in SEIS Section 4.4.1.2.2, licensees must ensure that radioactive constituents in liquid effluents applied to land application areas are within allowable release limits (NRC, 2009a). The applicant proposes to treat liquid wastes applied to land application areas so they meet NRC release limit criteria for radiological contaminants, as referenced in 10 CFR Part 20, Appendix B (Standards for Protection Against Radiation) (Powertech, 2011). SDDENR also regulates land application of treated wastewater, requiring the applicant to obtain an approved GDP and comply with applicable state discharge requirements for land application of treated wastewater. State regulations also prohibit surface runoff from permitted land application areas and the GDP will require land application activities to be conducted so that no ponding and runoff of effluent (i.e., wastewater solutions) occurs during these activities. Therefore, the NRC staff conclude that applied treated effluents on land application sites will not introduce additional contamination to the soil or surface runoff that is harmful to human health or the environment.

Due to existing hydrological conditions at the site, and the permitting and regulatory requirements the applicant must meet, NRC staff conclude that potential environmental impacts to groundwater in shallow aquifers from operations for the land application disposal option will be SMALL.

4.5.2.1.2.2.2 Operations Impacts to Production and Surrounding Aquifers

The potential environmental impact to groundwater in the production and other surrounding aquifers is related to consumptive water use and groundwater quality.

Water Consumptive Use

The potential impacts to groundwater in the production and surrounding aquifers due to consumptive water uses—impacts the staff discusses in SEIS Section 4.5.2.1.1.2.2—will also apply during ISR operations for the land application liquid waste disposal option. To summarize, in June 2012 the applicant submitted a water appropriation permit for use of the Madison aquifer. If SDDENR approves the permit application, the applicant will rely largely on Madison aquifer water during ISR operations. Otherwise, the applicant will pump water from the Inyan Kara aquifer to meet operational needs at an estimated sustainable rate of 151 to 246 Lpm [40 to 65 gpm] (Powertech, 2009a, 2010a). Results of numerical groundwater simulations indicate the Inyan Kara aquifer can sustain net extraction rates of up to 363 Lpm [96 gpm] over the 8 year operations phase (Petrotek, 2012). Therefore, NRC staff conclude that the impacts on local aquifers and domestic and livestock wells from consumptive water use during ISR operations will be SMALL. In addition, the applicant will monitor and provide alternative sources of water to landowners in the event of significant drawdown to domestic wells within and adjacent to the proposed project area. After production and restoration are complete and groundwater withdrawals are terminated at the Dewey-Burdock ISR Project, groundwater levels will tend to recover with time. Land application of treated liquid wastes will not require additional consumptive water demands. Therefore, NRC staff conclude that the overall environmental impacts on local aquifers, production aquifers, and domestic and livestock wells from consumptive use during operations for the land application option will be SMALL.

Excursions and Groundwater Quality

Potential impacts to groundwater quality from excursions in the production and surrounding aquifers during ISR operations (discussed in SEIS Section 4.5.2.1.1.2.2) will also be applicable during ISR operations for the land application liquid waste disposal option. Impacts from horizontal excursions will be SMALL because (i) uranium-bearing production aquifers will be exempted as USDWs through the EPA-issued aquifer exemption in accordance with the criteria under 40 CFR 146.4, (ii) the applicant will be required to submit wellfield operational plans for NRC and EPA approval, (iii) inward hydraulic gradients will be maintained to ensure groundwater flow is toward the production zone, and (iv) the applicant's NRC-mandated groundwater monitoring plan will ensure that excursions are detected and corrected. Impacts from vertical excursions will be SMALL because (i) uranium-bearing production zones in the Fall River and Chilson aquifers are hydrologically isolated from adjacent aquifers by thick, low permeability shale layers (i.e., the overlying Graneros Group and underlying Morrison Formation); (ii) a prevailing upward hydraulic gradient occurs across the major aquifers; (iii) the applicant's required mechanical integrity testing program will mitigate the impacts of potential vertical excursions resulting from borehole failure; and (iv) the applicant commits to properly plugging and abandoning or mitigating any previously drilled wells and exploration holes that may potentially impact the control and containment of wellfield solutions within the proposed project area. Moreover, at the end of ISR operations, the applicant must to initiate aquifer restoration in the production aquifers (i.e., Fall River and Chilson aquifers) to return groundwater to Commission-approved background levels or to NRC-approved alternative water quality levels. Therefore, NRC staff conclude the impact to groundwater quality from potential horizontal and vertical excursions will be SMALL.

The applicant proposes land irrigation areas in both the Dewey and Burdock areas of the project (Figure 2.1-12). NRC staff find that no additional contamination will be introduced into the production and surrounding aquifers due to land application of effluents, because (i) the applicant will treat process effluents to meet NRC release limit criteria for radiological contaminants as referenced in 10 CFR Part 20, Appendix B, Table 2, Column 2 and applicable SDDENR release limit requirements before applying them onto irrigation fields and (ii) the irrigation fields are underlain by low permeability shale layers (Graneros Group). Any recharge to the Fall River aquifer from land application of liquid wastes during proposed ISR operations will be remediated as part of restoration activities. As discussed in SEIS Section 4.5.2.1.1.2.1, the applicant has proposed to remove all existing domestic wells within the project area from private use prior to ISR operations (Powertech, 2011). Therefore, NRC staff conclude that the overall environmental impacts to production and surrounding aquifers from potential horizontal and vertical excursions during ISR operations for the land application option will be SMALL.

4.5.2.1.2.2.3 Operations Impacts to Deep Aquifers Below the Production Aquifers

Production zone aquifers at the Dewey-Burdock site are separated from deeper aquifers by a continuous and hydrologically impermeable 30-m [100-ft]-thick section of the Morrison Formation. In addition, there are no known unplugged or improperly abandoned wells or exploratory drills extending from ground surface to aquifers below the Morrison Formation within the project area. Therefore, the NRC staff conclude that, for the land application disposal option, environmental impacts to groundwater in the deep aquifers below the production aquifers from ISR operations will be SMALL.

4.5.2.1.2.3 Aquifer Restoration Impacts

As discussed in the GEIS, the impacts of consumptive groundwater use during aquifer restoration are generally greater than during ISR operations (NRC, 2009a). This is particularly true during the sweep phase, when a larger volume of groundwater is generally withdrawn from the production aquifer. During the sweep phase, groundwater is not reinjected into the production aquifer and all withdrawals should be considered consumptive. Larger withdrawals will produce larger drawdowns in the production aquifer, resulting in a greater impact on the yields of nearby wells.

As described in SEIS Section 2.1.1.1.4.1.2, the primary method of aquifer restoration for the land application disposal option will be groundwater sweep with Madison Formation water injection (Powertech, 2011). In this method, water from production zones will be pumped to the Burdock central processing plant or Dewey satellite facility for removal of uranium and other dissolved species in ion exchange columns. The partially treated water undergoes radium removal in the radium settling ponds and then disposal in land application areas. The typical liquid waste flow rates for the land application option will be approximately 2,070 Lpm [547 gpm] during concurrent uranium production and aquifer restoration and approximately 1,892 Lpm [500 gpm] during aquifer restoration alone. None of the water recovered from the wellfields will be reinjected back into the wellfields. Instead, makeup water from the Madison Formation will be injected into the wellfields at a flow rate sufficient to maintain the restoration bleed, which will typically be 1 percent of the restoration flow rate (Powertech, 2011).

As described in SEIS Section 4.5.2.1, the applicant submitted a water appropriation permit to SDDENR in June 2012 for groundwater use from the Madison aquifer. However, if the applicant cannot secure a water appropriation for use of Madison aquifer water, the applicant will have to either identify an alternative source of water to meet aquifer restoration water requirements or reduce pumping rates to meet the estimated sustainable net extraction rate from the Inyan Kara Group aquifers, which the applicant estimates is at least 363 to 556 Lpm [96 to 147 gpm] (see SEIS Sections 4.5.2.1.1.1 and 4.5.2.1.1.2.2.). Based on the typical liquid waste flow rates stated in the previous paragraph, reducing the pumping rate to 363 to 556 Lpm [96 to 147 gpm] will extend the aquifer restoration phase. After production and restoration are complete and groundwater withdrawals are terminated, groundwater levels will tend to recover with time. Based on numerical modeling, the applicant estimates that water levels will recover to near pre-operational levels within 1 year after groundwater withdrawals cease (Petrotek, 2012). Thus, the potential long-term environmental impact from consumptive use during the restoration phase for the land application disposal option will be SMALL.

The applicant will implement a restoration monitoring plan to detect and correct horizontal and vertical excursions during aquifer restoration (see SEIS Section 2.1.1.1.4.2). Continued implementation of a leak-detection and spill-cleanup program and preventive measures, such as well mechanical integrity testing, will result in SMALL impacts to alluvial or shallow (near-surface) aquifers. Moreover, restoration to Commission-approved background conditions (or NRC-approved water quality standards) in accordance with NRC license conditions will ensure that groundwater within the exemption boundary will not threaten surrounding groundwater.

Before NRC terminates an ISR source material license, the licensee must demonstrate that there will be no long-term impacts to USDWs. NRC review and approval of the wellfield restoration will ensure that the restoration standards are met and that they are protective of public health and the environment. Although consumptive water use will increase during aquifer restoration, groundwater levels will tend to recover with time after-aquifer restoration activities are complete. As described in SEIS Section 4.5.2.1.1.3, license conditions and applicant commitments will ensure that potential drawdown-induced migration of radiological and hazardous contaminants from abandoned open pit mines (e.g., Triangle pit mine) in the Burdock area through the Fuson Shale into production zones in the Chilson aquifer will not impact aquifer restoration goals. Therefore, NRC staff conclude that the impacts from aquifer restoration in the Burdock and Dewey areas for the land application disposal option will be SMALL.

4.5.2.1.2.4 Decommissioning Impacts

All impacts to groundwater discussed in SEIS Section 4.5.2.1.1.4 for the Class V injection well disposal option are applicable during the decommissioning phase for the land application liquid waste disposal option. The applicant is committed to implement an emergency response plan to address cleanup of accidental spills and leaks that may occur during decommissioning. The applicant will implement mitigation measures to control erosion and stormwater runoff. The NPDES permit will ensure that stormwater runoff will not contaminate groundwater. After removal of surface structures, the applicant will replace topsoil in previously disturbed areas, recontour the land surface to restore it to a surface configuration to blend with the natural terrain, and seed disturbed areas in wellfields in accordance with the NRC and SDDENR regulations (Powertech, 2009b). Access roads will be reclaimed and restored in a similar manner.

As part of the restoration and reclamation activities, all monitor, injection, and recovery wells at the proposed Dewey-Burdock site will be plugged and abandoned in accordance with SDDENR and EPA UIC regulations (see SEIS Section 2.1.1.1.5.2). The applicant will submit decommissioning plans, including detailed plans for plugging and abandoning wells, to NRC for review and approval. If this process is properly implemented and the abandoned wells are properly isolated from the flow domain, the potential environmental impacts to groundwater from decommissioning for the land application disposal option will be SMALL

4.5.2.1.3 Disposal Via Combination of Class V Injection and Land Application

If the applicant obtains the permit for Class V injection from EPA, but the capacity of the Class V injection wells is insufficient to dispose of all liquid effluents generated at the Dewey-Burdock ISR project, the applicant will dispose of liquid waste by a combination of Class V injection wells and land application (SEIS Section 2.1.1.1.2.4.3). In this case, land application facilities and infrastructures will be constructed, operated, restored, and decommissioned as needed, based on the produced volume of liquid effluents exceeding the disposal capacity of the Class V injection wells (Powertech, 2011).

If the capacity of Class V injection wells is sufficient to dispose of all liquid wastes, there will be no need for land application sites, facilities, and infrastructures for irrigation. In this case, environmental impacts will be avoided to shallow aquifers underneath the irrigation fields, if they exist, in the Burdock and Dewey areas and to the Fall River aquifer in the easternmost land application fields in the Burdock area near its outcrop. Therefore, the resultant environmental impacts to near-surface aquifers will be smaller than when partially or fully developed land application sites are needed for disposal of liquid wastes. Similarly, environmental impacts to shallow aquifers during ISR operations and aquifer restoration will be larger for fully developed irrigation sites than partially developed irrigation sites. However, because shallow aquifers are of limited extent and will be removed from domestic use prior to ISR operations, NRC staff determine that impacts to shallow aquifers as a result of ISR operations with the combined Class V injection well and land application option will be SMALL.

Impacts to the production aquifers and groundwater wells within the project area from ISR operations and aquifer restoration with the combined disposal option will be similar to those for the Class V injection well disposal option alone or for the land application option alone, because (i) the production aquifers are overlain and underlain by a thick, hydrologically impermeable shale layer over most of the project site, except for the eastern part of the Burdock area; (ii) the applicant is committed to restricting ISR operations to confined aquifers; and (iii) process effluents will be treated before they are applied on land application areas, and hence, will not introduce additional contamination to the Fall River aquifer at or near its outcrop areas.

Impacts to the deep aquifers from ISR operations and aquifer restoration with the combined Class V injection well and land application option will be similar to those for the Class V injection well disposal option alone, because aquifers proposed for deep well injection do not have hydrogeologic interaction with near-surface or production aquifers.

Therefore, NRC staff conclude that the environmental impacts of the combined Class V injection well and land application option for each phase of the proposed Dewey-Burdock ISR Project will be bounded by the significance of environmental impacts of the Class V injection well option and the land application option, as summarized in Table 4.5-2.

4.5.2.2 No-Action (Alternative 2)

Under the No-Action alternative, NRC will not license the Dewey-Burdock ISR Project and BLM will not approve the applicant's modified Plan and Operations. The Burdock central processing plant and the Dewey satellite facility with their associated infrastructure (i.e., access roads and piping) will not be constructed. Furthermore, wellfields, surface impoundments, Class V injection wells, and land application sites will not be developed or operated. Lixiviant will not be injected into the production aquifer. Consumptive use of groundwater will not occur. Liquid effluent waste will not be generated; therefore, there will be no threat to groundwater quality. Wells that have already been constructed will be plugged and abandoned to prevent potential degradation and contamination. The current land uses on and near the project area, including grazing lands and recreational activities, will continue. Consequently, the No-Action alternative will result in no impacts to groundwater.

4.6 Ecological Resources Impacts

As discussed in GEIS Section 4.4.5, potential environmental impacts to ecological resources, including both flora and fauna, could occur during all phases of the ISR facility lifecycle (NRC,

Table 4.5-2. Significance of Environmental Groundwater Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

	Class V Injection Wells	Land Application	Combined Class V Injection Wells and Land Application*
Construction	SMALL	SMALL	SMALL
Operations	SMALL	SMALL	SMALL
Aquifer Restoration	SMALL	SMALL	SMALL
Decommissioning	SMALL	SMALL	SMALL

*Significance of environmental impact for the combined disposal option is bounded by the significance of environmental impacts for the Class V injection well and land application disposal options.

2009a). Impacts could include removal of vegetation from the site (with the associated reduction in wildlife habitat and forage productivity and an increased risk of soil erosion and weed invasion); modification of existing vegetative communities as a result of site activities; loss of sensitive plants and habitats; and the potential spread of invasive species and noxious weed populations. Impacts to wildlife could include loss, alteration, and/or incremental fragmentation of habitat; displacement of and stresses on wildlife; and direct and/or indirect mortalities. Aquatic species could be affected by disturbance of stream channels, increases in suspended sediments, fuel spills, and habitat reduction.

GEIS Construction Phase Summary

As discussed in GEIS Section 4.4.5.1, during construction, terrestrial vegetation may be affected through (i) the removal of vegetation from the milling site (and associated reduction in wildlife habitat and forage productivity and an increased risk of soil erosion and weed invasion); (ii) the modification of existing vegetative communities; (iii) the loss of sensitive plants and habitats as a result of clearing and grading; and (iv) the potential spread of invasive species and noxious weed populations. (NRC, 2009a)

The percentage of vegetation removed and land disturbed by construction activities evaluated in the GEIS (from less than 1 percent up to 20 percent) will cause a SMALL impact compared to the total permit area and surrounding plant communities. The GEIS evaluated ISR facilities that ranged in facility size from 1,000 to 7,000 ha [2,471 to 17,297 ac] with disturbed area estimates of 49 to 753 ha [120 to 1,860 ac]. Additionally, NRC staff concluded in the GEIS that clearing of herbaceous vegetation in an open grassland or shrub steppe community was expected to have a short-term SMALL impact, given the rapid colonization of annual and perennial species in the disturbed areas. The clearing of wooded areas could have a long-term impact given the pace of natural succession, and such impacts could range from SMALL to MODERATE, depending on the amount of surrounding woody areas. Noxious weeds will be expected to be controlled with appropriate spraying techniques, and therefore impacts will be SMALL. (NRC, 2009a)

GEIS evaluation of impacts during construction included terrestrial wildlife that may be affected through (i) habitat loss or alteration and incremental habitat fragmentation, (ii) displacement of wildlife from project construction, and (iii) direct and/or indirect mortalities from project construction. NRC staff noted in the GEIS that construction impacts to wildlife habitat will be minimized with the timely reseeding of disturbed areas following construction. In general, wildlife species will be expected to disperse from the proposed license area as construction activities approached, although smaller, less mobile species could perish during clearing and grading. Habitat fragmentation, temporary displacement, and direct or indirect mortalities will be possible; thus, the potential impact on terrestrial wildlife from construction could range from SMALL to MODERATE. (NRC, 2009a)

GEIS Operations Phase Summary

As discussed in GEIS Section 4.4.5.2, wildlife habitats could be altered by operations (fencing, traffic, and noise), and limited wildlife mortalities could occur due to conflicts between species habitat and operations. Fencing could limit access to crucial wintering habitat and water. South Dakota does not specify fencing construction. However, SDGFP field and regional personnel evaluate fencing construction design on a case-by-case basis, which may minimize impediments to big game movement (SDGFP, 2008). NRC staff noted in the GEIS that potential impacts to vegetation may occur as a result of land application of wastewater, increasing vegetation growth and/or negatively affecting vegetation from the build-up of salts in the soils. Licensee requirements to monitor and control irrigated areas will limit impacts to ensure release limits are met (NRC, 2009a).

As further indicated in GEIS Section 4.4.5.2, temporary contamination or alteration of soils could occur from operational leaks and spills and possibly from transportation or land application of treated wastewater. However, detection and response to leaks and spills (e.g., soil cleanup) and eventual survey and decommissioning of all potentially impacted soil will limit the magnitude of impacts to terrestrial ecology. The implementation of spill detection and response plans will mitigate impacts to aquatic species from spills around well heads and from pipeline leaks. Mitigation measures, such as SDGFP-recommended fencing and netting for ponds (SEIS Section 1.7.3.7), leak detection and spill response plans, and periodic wildlife surveys, will also limit the potential impact, and the NRC staff concluded in the GEIS that the impact to wildlife and vegetation will be SMALL. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

GEIS Section 4.4.5.3 describes potential impacts to ecological resources during the aquifer restoration phase that are similar to operations. These impacts could include habitat disruption, spills and leaks, and animal mortalities. Because existing (in-place) infrastructure will be used during aquifer restoration, little additional ground disturbance will occur, and therefore potential impacts will be SMALL. (NRC, 2009a)

GEIS Decommissioning Phase Summary

NRC staff concluded in the GEIS that land use impacts from decommissioning an ISR facility will be comparable to, but overall less than, those described for construction and will further decrease as decommissioning and reclamation proceed. As described in GEIS Section 4.4.5.4, during decommissioning and reclamation, there will be temporary land disturbance from soil excavation, recovery and removal of buried piping, and demolition and removal of structures. Wildlife will be temporarily displaced, but will be expected to return after decommissioning and reclamation are complete and vegetation and habitat are reestablished. Wildlife could come in conflict with heavy equipment or vehicles. Decommissioning and reclamation activities could also result in temporary increases in sediment load in local streams, but aquatic species will recover quickly as sediment load decreases. However, revegetation and recontouring will restore habitat previously altered during construction and operations. Land that is used for irrigation will be included in decommissioning surveys to ensure potentially impacted (contaminated) areas will be appropriately characterized and remediated, as necessary, in accordance with NRC regulations. As a result, the potential impacts to ecological resources during decommissioning are expected to be SMALL. (NRC, 2009a)

Potential environmental impacts to ecological resources from construction, operations, aquifer restoration, and decommissioning for the proposed Dewey-Burdock ISR Project are provided in the following sections.

4.6.1 Proposed Action (Alternative 1)

The staff's ecological impact analysis for the proposed Dewey-Burdock ISR Project site involves evaluating interactions between the proposed project activities and the local animals and habitat that could be affected by the project. If an applicant or licensee adhered to recommended standard management practices from appropriate agencies, the potential ecological impacts could be mitigated as discussed in the following sections. NRC staff correspondence is ongoing throughout the SEIS process for the proposed project. BLM's 1986 Resource Management Plan (RMP) for South Dakota is currently being revised. The most recent, working BLM mitigation and reclamation guidelines (BLM, 2012a) were made available to NRC staff and are incorporated into this SEIS.

ISR facility lifecycle phases can have direct and indirect impacts on local habitat and wildlife populations. These impacts are both short-term (lasting until successful reclamation is achieved) and long-term (persisting beyond successful completion of reclamation). However, long-term impacts are not expected to be substantial due to the relatively limited habitat disturbance associated with the ISR extraction method. Because of increased traffic levels and physical disturbance during the construction phase, injury or mortality to wildlife will be more likely than during any of the other waste project phases. Plant and animal community alteration will be greatest under the land application option because of the large amount of land {about 308 ha [760 ac]} that will receive treated liquid waste annually from April through October.

4.6.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant's preferred option for disposal of liquid wastes is deep well disposal via Class V injection wells. Potential environmental impacts on ecology from construction, operations, aquifer restoration, and decommissioning associated with the deep Class V injection well disposal option at the proposed Dewey-Burdock ISR Project are discussed in the following sections.

4.6.1.1.1 Construction Impacts

The construction phase of the proposed Dewey-Burdock ISR Project could potentially impact ecological resources from clearing vegetation; constructing the central processing plant and the satellite facility; developing the holding ponds and wellfields, including drilling wells and laying pipeline; building header houses; and constructing access roads. Construction activities will also result in an increase in vehicular traffic and the potential for animal collisions with vehicles. There will also be a temporary increase in dust from construction, some of which will deposit on vegetation, both on- and offsite, affecting the ability for obligate species to forage. However, vegetation in this naturally dusty, arid region will likely have adapted to moderate, temporary increases of dust coverage. Potential impacts on wildlife from dust adjacent to access roads and disturbed land near the plant site will be limited by applicant dust control measures, such as water application (Powertech, 2009a). However, fugitive dust will still be generated from travel on unpaved roads and disturbed land (see fugitive dust analysis in SEIS Sections 4.7.1.1.1 and 4.7.1.2.1), and therefore localized areas will likely experience short-term and intermittent dust accumulation potentially affecting wildlife.

The applicant's implementation of the road and right-of-way, SDGFP-recommended fencing and netting for ponds (SEIS Section 1.7.3.7), post-construction restoration/reclamation measures, as well as those measures intended to reduce human disturbance and incidental wildlife mortalities, will minimize impacts on wildlife. The standard recommended construction mitigation measures including perimeter fencing, netting, leak detection and spill response plans, erosion controls, and other BMPs described elsewhere in the SEIS will also minimize overall ecological impacts. BLM (2012b–d) has determined wildlife timing stipulations for certain species to protect their populations and habitats (in the table in the Raptors section). The applicant plans to initiate construction activities outside the recommended time restriction periods (Powertech, 2009a); however, activities will continue year round within the area of approved disturbance (e.g., wellfield patterns, roads, plant areas). BLM South Dakota wildlife timing restrictions are included in the table in the Raptors section.

4.6.1.1.1.1 Construction Impacts on Terrestrial Ecology

The terrestrial ecology of the proposed Dewey-Burdock ISR Project is discussed in the following sections. Potential impacts to vegetation and wildlife from construction for the deep Class V injection well disposal option are described in Sections 4.6.1.1.1.1.1 and 4.6.1.1.1.1.2, respectively.

4.6.1.1.1.1.1 Construction Impacts on Vegetation

For the deep Class V injection well disposal option, the applicant estimates that the land disturbed will be approximately 42 ha [103 ac] excluding wellfields (Powertech, 2010a). Potential wellfields will disturb an additional 57 ha [140 ac]. The wellfields, Burdock central plant, Dewey satellite plant, and deep Class V injection wells at the proposed project will be located primarily within the upland grassland and greasewood shrubland vegetation communities, and smaller disturbed areas within the big sagebrush shrubland, silver sagebrush shrubland, and ponderosa pine woodland communities. Table 4.6-1 provides the land disturbance by vegetation type for the Class V injection well disposal option. Figure 4.6-1 depicts the planned activities in relation to the vegetation communities.

Direct impacts from construction activities at the proposed project for the deep Class V injection well disposal option will include vegetation disturbance (modification of structure, species composition, and areal extent of cover types) of about 98 ha [243 ac]. Indirect impacts will include the short-term and long-term increased potential for noxious species [e.g., Canada thistle (*Cirsium arvense),* houndstongue *(Cynoglossum officinale)*, and field bindweed

Table 4.6-1. Disturbed Land by Vegetation Type for Dewey-Burdock Deep Class V Injection Well Disposal Option

Activity	Vegetation Community (Hectares [acres])							Total Disturbed Area Hectares [acres]
	Big Sage-Brush Shrub-Land	Cotton-wood Gallery	Grease-wood Shrub-land	Mine Pit	Ponderosa Pine Wood-land	Silver Sage-Brush Shrub-land	Upland Grass-land	
Site Facilities	0.8 [2]	0	3.2 [8]	0	0.4 [1]	0	5.7 [14]	9.7 [24]
Trunklines	2.4 [6]	0	2.4 [6]	0	1.2 [3]	0.8 [2]	3.2 [8]	10.1 [25]
Access Roads	2.0 [5]	0	2.0 [5]	0.4 [1]	0.8 [2]	0.4 [1]	2.4 [6]	8.5 [21]
Well Fields	8.5 [21]	0	18.2 [45]	2.0 [5]	8.5 [21]	4.4 [11]	15.0 [37]	56.6 [140]
Impound-ments	0	0	4.1 [10]	0	0	0	9.3 [23]	13.3 [33]
Totals	13.8 [34]	0	29.9 [74]	2.0 [5]	10.9 [27]	5.7 [14]	36.0 [89]	98.3 [243]
Source: Powertech 2012a								

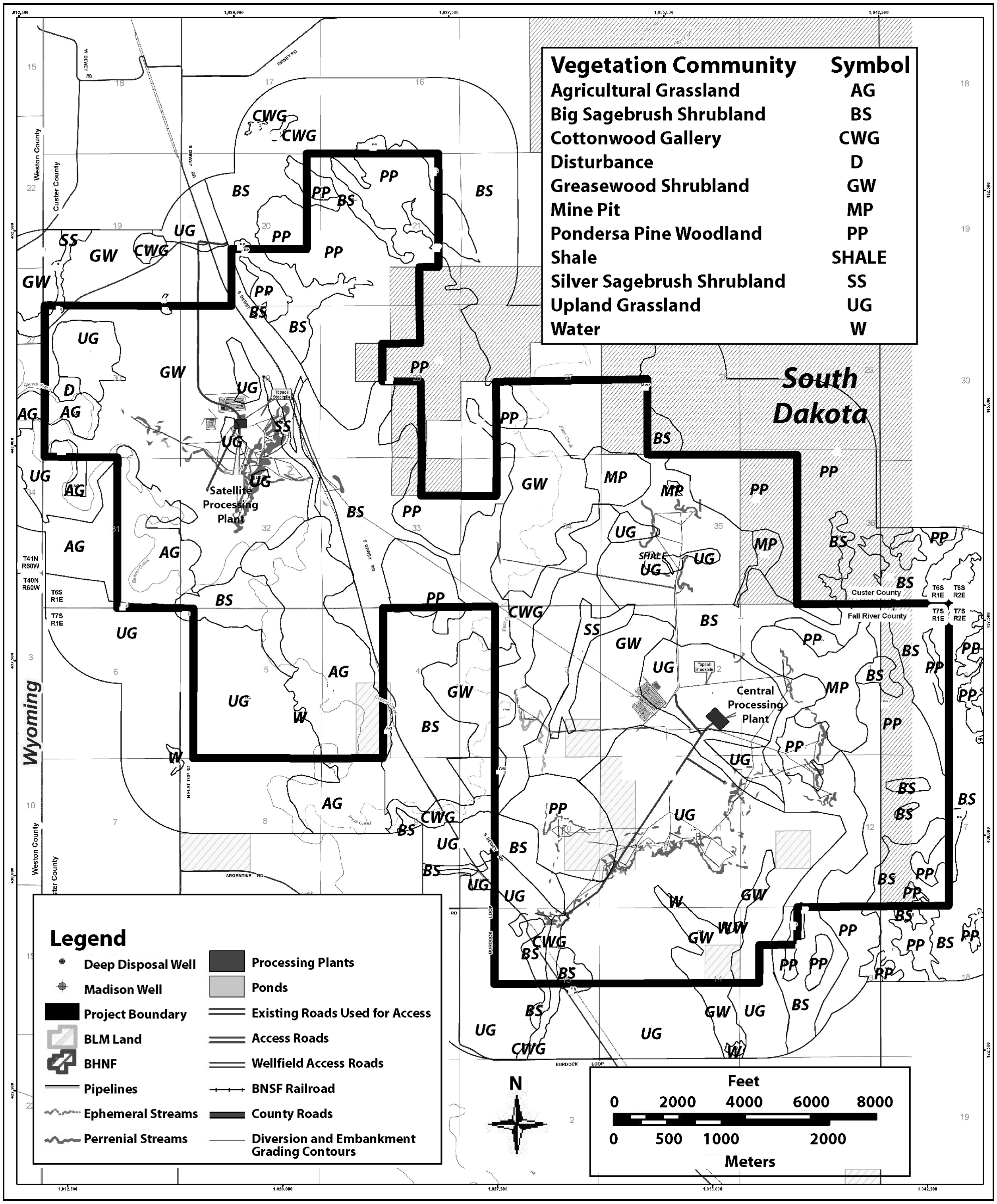

Figure 4.6-1. Map of Dewey-Burdock Planned Facilities and Vegetation Communities for the Deep Class V Injection Well Disposal Option (Source: Powertech, 2012a)

(*Convolvulus arvensis)*] invasion, establishment, and expansion; potential soil erosion; shifts in species composition or changes in vegetative density; reduction of wildlife habitat; reduction in livestock forage; and changes in visual aesthetics.

As previously stated, the construction activities, increased soil disturbance, and increased traffic during construction for the Class V injection well disposal option could stimulate the introduction and spread of undesirable, invasive, nonnative species within the proposed license area. One state- and two county-listed noxious weeds, Canada thistle and field bindweed, respectively, were observed in the proposed project area during the applicant-conducted baseline surveys. These species are perennial and may quickly invade large areas depending on the season of the year. The applicant has proposed mitigation measures, which include conducting weed control as needed to limit the spread of noxious, invasive, and nonnative species on disturbed areas (Powertech, 2009a). If the applicant uses herbicides as a weed control method, the applicant should take precautions to minimize potential impact to the environment. Herbicides can drift to unintended areas due to wind and soil erosion, eliminate desired species from an area, and leave soil susceptible to erosion if not used and managed properly. For example, herbicides formulated with surfactant are toxic to fish and aquatic life and should not be used in or near water (Zollinger, 2012). Plant and wildlife species could be unintentionally impacted during normal application from indirect contact of herbicide residue and consumption of prey affected during application. South Dakota State University published a 2013 weed control guide (Moechnig, et al., 2012) for pastures and range land with recommended techniques, herbicides, and precautions to control regional noxious, invasive, and nonnative vegetative species that the applicant could employ. Applicant use of weed control techniques that incorporate South Dakota State University weed control guidance (Moechnig, et al., 2012) and BLM mitigation and reclamation guidelines (BLM, 2012a) will reduce potential impacts to wildlife and desirable vegetation from use of herbicides.

In areas where vegetation was removed, the applicant has committed to reestablish vegetation concurrently with construction activities according to NRC licensee requirements to conduct reclamation under an approved site reclamation plan (Powertech, 2009a). For the proposed Dewey Conveyor project, BLM concluded that reestablished vegetation in this region often consists of annual forbs and native cool grasses with few shrubs for the first couple of years (BLM, 2009). Reestablishment of herbaceous plant cover can usually be completed within a few years, but reestablishment of shrubland communities may take much longer. SDDNER recommends that the large-scale mine permit include conditions requiring (i) concurrent and interim reclamation in all areas where mining or land disturbance is completed; (ii) that revegetation success be equivalent to vegetative cover in reference areas using SDDENR-approved statistical methods; and (iii) that a post closure bond be held for 30 years after the reclamation bond is released to help ensure revegetation success. However, final permit conditions may change based on the final determination by the hearing board.

If active revegetation measures are used with Natural Resource Conservation Service (NRCS)-, SDDENR-, and BLM-approved seed mixtures, rapid colonization by annual and perennial herbaceous species in the disturbed staging areas and rights-of-way will restore most vegetative cover within the first growing season (NRC, 2009a). On BLM land, BLM reclamation guidelines will be required to provide for stable soils and achieve vegetation cover; however, the exact species is not necessarily required, similar to the predisturbance cover (BLM, 2012a). BLM could require the applicant to reseed areas where initial seeding was not successful. Reclamation and reseeding, as soon as practicable following project completion, in accordance with a reclamation plan will ensure that vegetative communities are restored as quickly as possible. To stabilize soils and support the ecosystem, the applicant commits to reestablishing, as soon as conditions allow, vegetation in disturbed areas with the BLM-, NRCS-, and SDDENR-approved native seed mixture and rate provided in Table 4.6-2 (Powertech, 2009a, 2012b).

Construction of wellfields will be phased and some vegetation will be affected, but impacts will not generally affect a sizeable segment of any species' population. In general, vegetation development in the region is expected to be sparse due to the limited amount of annual precipitation. To mitigate the potential impact to vegetation, disturbed areas will be both temporarily and permanently revegetated and tilled where soil has been compacted to promote vegetation growth in accordance with SDDENR regulations and the mine permit (Powertech, 2009a). Some encroachment from native populations and/or establishment of early successional species bordering disturbed areas will also be expected, which will facilitate the revegetation process. Additionally, the applicant will take mitigative measures to minimize the spread of noxious weeds (Powertech, 2009a).

No federally listed threatened or endangered plant species are known to occur within the proposed project area (FWS, 2010). Therefore, the NRC staff conclude the impact on federally listed plant species during the construction phase will be SMALL, based on the foregoing analysis that about 98 ha [243 ac] of vegetation will be disturbed primarily in the upland grassland and greasewood shrubland vegetation communities. The applicant commits to mitigation measures that will reduce the overall impacts, but vegetation could still experience long-term impacts especially within the sagebrush shrubland communities. The NRC staff conclude construction impacts on vegetation for the deep Class V injection well disposal option will be SMALL.

4.6.1.1.1.1.2 Construction Impacts on Wildlife

As described in SEIS Section 1.2, the total amount of BLM-managed land expected to be disturbed by the applicant over the life of the proposed project is 4.7 ha [11.63 ac]. The majority of the disturbed BLM land consists of the upland grassland vegetation community southwest of the central processing plant in the Burdock area. A proposed access road will border BLM land in

Table 4.6-2. Reclamation Seed Mixture

Reclamation Seed Mixture Species*	Drill Seeding Rate {kg/ha [lb/ac]}	Broadcast Seeding Rate {kg/ha [lb/ac]}
Western Wheatgrass (*Elymus smithii)*	2.17 [1.94]	5.43 [4.85]
Sideoats Grama (*Bouteloua curtipendula*)	1.62 [1.45]	4.06 [3.62]
Green Needlegrass (*Nassella viridula*)	1.62 [1.45]	4.06 [3.62]
Slender Wheatgrass (*Elymus trachycaulus)*	1.58 [1.41]	3.94 [3.52]
Little Bluestem (*Schizachyrium scoparium*)	1.02 [0.91]	2.54 [2.27]
Totals	8.02 [7.16]	20.06 [17.90]
*Pure live seed Source: Powertech, 2012b		

the greasewood shrubland vegetation community. A proposed “restoration line” will traverse a corner of BLM land in the big sagebrush shrubland vegetation community outside of the ISR project boundary.

Planned land disturbance of about 98 ha [243 ac] during construction will be noncontiguous acres composed of the Burdock central plant, the Dewey satellite plant, and associated storage facilities; deep Class V disposal wells; wellfields and the associated infrastructure (e.g., pipelines and header houses); and new access roads. Most of the habitat disturbance will consist of scattered, confined drill sites for wells in the wellfields, which will not result in large expanses of habitat being dramatically transformed from their original character as in surface mining operations.

Indirect impacts could occur from displacement of wildlife from increased noise, traffic, or other disturbances associated with the development of the proposed project and from small reductions in existing or potential cover and forage due to habitat alteration, fragmentation, or loss. Indirect impacts typically persist longer than direct impacts. However, ISR uranium extraction does not generally involve large-scale habitat alteration.

Certain vegetative communities that exist in the proposed license area could be difficult to reestablish through artificial planting and natural seeding, and recovery could take many years. Consequently, wildlife species associated with specific habitats, such as blue grama (*Bouteloua gracilis)* grasslands and big sagebrush, could be reduced in number or replaced by generalist species with broader habitat requirements until natural reseeding of certain vegetation occurs or reclamation matures to its target mix. The proposed project area is dominated by big sagebrush shrubland followed by greasewood shrubland, ponderosa pine woodland, and upland grassland. The latter three vegetative communities are almost equal in area. The wildlife species using these habitat types are limited in their occurrence in the proposed license area (see SEIS Section 3.6.1.2), and because the actual surface disturbance will be small and noncontiguous, negative impacts to these wildlife species will be SMALL. In addition, the NRC staff conclude that construction impacts resulting from habitat loss or alteration, displacement of wildlife, and mortality due to encounters with vehicles or heavy equipment at the proposed project will be SMALL. The applicant commits to impose and enforce speed limits during all ISR phases to reduce impacts to wildlife throughout the year and particularly during the breeding season (Powertech, 2009a, Section 5.5). To mitigate habitat disturbance, the applicant will use existing roads when possible and limit construction of new primary and secondary roads to provide access to more than one drill site (Powertech, 2009a). In addition, the applicant will restore areas where topsoil has been replaced and construct brush piles and rock piles to enhance wildlife habitat (Powertech, 2009a).

<u>Big Game</u>

Pronghorn antelope (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), white-tailed deer (*O. virginianus*), and elk (*Cervus elaphus*) are the four most common big game species that occur within the proposed project area, and bighorn sheep (*Ovis canadensis*) and mountain lions (*Felis concolor)* are predicted to be in the vicinity of the site. As described in Section 3.6.1.2.1, no crucial big game habitat or migration corridors occur on or within at least 1.6 km [1 mi] of the proposed Dewey-Burdock ISR Project (SDGFP, 2010a; BLM, 2011).

Pronghorn antelope, mule deer, white-tailed deer, and elk in the project area could be directly affected by the disturbance of a portion of yearlong range, loss of forage, and vehicular collision accidents. For the deep Class V injection well disposal option, an estimated maximum of 98 ha [243 ac] will be incrementally disturbed during the life of the proposed project. Pronghorn antelope will be the most impacted big game species because they are the most common within the project area. Pronghorn antelope are sagebrush obligates occupying shrubland habitat year round and eating shrubs. Shrubland vegetation communities cover about 45 percent of the proposed project areas. Mule deer are also found in the project area all year and eat shrubs, but mule deer also enjoy grassland and riparian vegetation habitats and eating grasses and forbs. Elk compete seasonally with horses and cattle in the grassland vegetation community for their preferred food in spring and summer, and are found mostly in the ponderosa pine woodland habitat on the proposed site in fall and winter. Grassland and pine woodland habitats together comprise about 22 percent of the proposed project area. White-tailed deer, the least common big game species in the proposed project area, prefer the treed cottonwood gallery vegetation habitat, which comprises about 2 percent of the proposed project area. (Powertech, 2009a)

Because of these habitat disturbances, the yearlong range-carrying capacity for big game will be reduced over the life of the ISR facility. The SDDENR large scale mine permit will require that reclaimed rangeland is capable of withstanding proper (animal) stocking rates for two consecutive years after the life of the ISR facility prior to bond release. During the construction phase of the proposed project, the projected daily traffic on Dewey Road, the road nearest the proposed site, is estimated to increase by approximately 182 percent (see SEIS Sections 4.3.1.1). This increase in traffic will increase the potential for traffic collisions and wildlife or livestock kills. However, direct impacts to pronghorn antelope, mule deer, white-tailed deer, and elk will be SMALL because the continued existence of the species will not be threatened as a result of vehicle collisions.

Indirect impacts to pronghorn antelope, mule deer, white-tailed deer, and elk could include displacement into surrounding areas from increased human activity, noise, lighting, and the increased potential for poaching and/or harvest from improved access via new roads. Migration of these species toward the Black Hills may also increase predation from other animals. Mountain lions present in the Black Hills prey on white-tailed deer, mule deer, elk, bighorn sheep, and mountain goats (SDGFP, 2010b). The human presence during construction could affect big game use of adjacent areas. Some short-term disturbance (during the lifecycle of the ISR facility) of big game habitat could occur because of the proposed project construction. Adequate big game habitat exists in the surrounding area; these species could return to the areas affected by construction once these activities were completed. The proposed staged reclamation of disturbed areas will provide grass and forage within a few years of habitat disturbance. To the extent practicable, the applicant has proposed implementing speed limits within the proposed project area and fencing to permit big game passage as mitigative actions, and vegetative forage losses from construction will be mitigated by the applicant's plan for staged reclamation of disturbed areas to further reduce big game conflicts associated with the proposed construction activities (Powertech, 2009a). NRC staff conclude that because big game animals are highly mobile species and staff does not expect long-term effects on big game populations from the deep Class V injection well disposal option, the potential impacts to these species during the construction phase will be SMALL.

Upland Game Birds

The only upland game birds observed within the proposed Dewey-Burdock ISR Project area are the wild turkey (*Meleagris gallopavo*) and mourning dove (*Zenaida macroura*), which are common in the region. Mourning doves are the most abundant game bird in South Dakota and can be found across fields to woodlands and residential areas. Doves are opportunists and eat the seeds of grasses, forbs, and crops as they ripen, changing their feeding habits as different foods become available (SDGFP, 2009a). Essentially all of South Dakota and Wyoming provides habitat that support mourning doves, including the area that surrounds the proposed license area; therefore, the proposed project will not threaten the continued existence of mourning doves.

Within the proposed project area, wild turkeys will most likely use the cottonwood gallery and ponderosa pine vegetative communities, woody draws, and riparian areas along Beaver Creek for roosting, feeding, nesting, and brood rearing (SDGFP, 2009b). Hens will also select the upland grassland community for nesting if tall grasses were present (SDGFP, 2009b). While woody corridors are not abundant in the proposed project area, they also are not unique in the surrounding area. Black Hills National Forest (BHNF) borders the proposed project area to the east and provides ample habitat that could support displaced turkeys during construction activities. Because turkeys wander great distances and require large areas of suitable habitat, NRC staff do not expect the proposed project construction will impact the general population of wild turkeys.

SEIS Section 3.6.1.2.2 explains that sharp-tailed grouse (*Tympanuchus phasianellus*), ruffed grouse (*Bonasa umbellus*), and Greater sage-grouse *(Centrocercus urophasianus)* could potentially occur in the proposed project area. Greater sage-grouse is the most likely grouse species to potentially be impacted by construction of the proposed Dewey Burdock ISR project because of the regional decline and segmentation of sagebrush habitat. As discussed in SEIS Section 3.6.3, Greater sage-grouse are not reported to occur within 6.4 km [4 mi] of the proposed project boundary. Because NRC staff expect that similar habitat is present in the proposed project area that U.S. Fish and Wildlife Service (FWS) evaluated for the nearby Buffalo Gap National Grassland (described in SEIS Section 3.6.3; Hodorff, 2005), it is unlikely that optimum canopy coverage of sagebrush habitat is present to support breeding and wintering populations within the proposed project area.

In recent years, BLM and state agencies in the region have developed strategies and management measures to preserve, conserve, and restore the sagebrush habitat to prevent further population decline and prevent the listing of the sage-grouse as threatened or endangered species under the Endangered Species Act (ESA). BLM is in the process of revising RPMs and has initiated scoping to prepare an EIS; this will require detailed studies on proposed and alternative policies, and analysis of how implementation of the policies may affect the environment (BLM, 2012d). The BLM Rocky Mountain Region expects several final EISs to be published in 2014, which may identify new issues and best management strategies for sage-grouse that may also benefit other upland game birds. FWS is required to make a decision in 2015 on whether to propose protecting the species under the ESA (FWS, 2012a). In August 2012, FWS issued a draft report to help achieve sage-grouse conservation objectives before the 2015 decision. Recommendations from these studies could be implemented at the proposed Dewey-Burdock ISR Project when they are finalized and become available.

Portions of the proposed Dewey-Burdock ISR Project site will be disturbed during construction activities; therefore, some birds will be displaced and some temporary habitat loss will occur. The applicant commits to (i) minimize disturbance of surface areas and vegetation, where possible; (ii) minimize construction of new access and secondary roads so more than one drill site can be accessed; and (iii) construct new roads, power lines, and pipelines in the same corridors to the extent possible to reduce overall disturbance and minimize new surface disturbance (Powertech, 2009a). All lands disturbed by project activities will be concurrently revegetated following approved reclamation practices (Powertech, 2009a), which will restore the habitat loss experienced from proposed construction activities. In addition, the applicant has committed in its application to adhere to regulatory timing and spatial restrictions (noise, vehicular traffic, and human proximity) as a mitigative measure that will decrease impacts during breeding season (Powertech, 2009a). Because the site does not support populations of upland game birds that depend on the site for continued existence and because mitigation measures are expected to limit potential impacts to upland game bids, NRC staff conclude potential impacts to upland game birds during the construction phase for the deep Class V injection well disposal option will be SMALL.

Raptors

Twelve species of raptors were recorded within the proposed license area during Powertech's wildlife survey: bald eagle (*Haliaeetus leucocephalus*) (nested), red-tailed hawk (*Buteo jamaicensis*) (nested), golden eagle (*Aquila chrysaetos*), ferruginous hawk (*Buteo regalis*), northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), turkey vulture (*Cathartes aura*), Cooper's hawk (*Accipiter cooperii*), rough-legged hawk (*Buteo lagopus*), merlin (*Falco columbarius*) (nested), great horned owl (*Bubo virginianus*) (nested), and long-eared owl (*Asio otus*) (nested) (Powertech, 2009a). As explained in SEIS Section 3.6.1.2.3, the burrowing owl (*Athene cunicularia*), northern saw-whet owl (*Aegolius acadicus*), and sharp-shinned hawk *(Accipiter striatus)* could be present in the vicinity of the proposed project area (Peterson, 1995). Although some of these raptors (bald eagle, burrowing owl, ferruginous hawk, and golden eagle) are considered BLM sensitive species, the populations of these species are not imperiled with the exception of the bald eagle, which is a state-threatened species (SDGFP, 2012a). The bald eagle, red-tailed hawk, American kestrel, and northern harrier were the most commonly seen raptor species in the proposed project area and will be the primary raptor species impacted by project activities. Raptors are particularly sensitive to noise and the presence of human activity, which will be heightened during the ISR construction phase. Five raptor nests (four active and one unknown) were recorded within the proposed project area during surveys conducted in 2007 and 2008, as summarized by species in SEIS Table 3.6-2 (Powertech, 2009a). Two other nest sites, one inactive and one defended but not confirmed active, occurred within 1.6 km [1 mi] of the proposed license area. As described in SEIS Section 3.6.1.2.2, one active bald eagle nest was reported in 2011 within the proposed project area along Beaver Creek, about 1.6 km [1 mi] west of the proposed Dewey satellite processing plant.

Direct impacts to raptor species for the deep Class V injection well disposal option include displacement, loss of forage habitat, increased potential for collisions with structures and vehicles, increased potential for nest abandonment and reproductive failure due to increased human disturbances, and potential reduction in prey populations within the project site. Avian collision and electrocution with overhead power lines could occur year round. The potential for eagle collisions with electric transmission lines is considered to be low because their foraging behavior is relatively slow compared to falcons and other raptors. Indirect impacts to raptors could include nesting disruption and displacement of prey species, which may reduce food availability within the area. Nesting success by resident raptors could be reduced from disturbances caused by the proposed ISR construction and associated traffic. Birds may continue to use nest sites as they acclimate to the proposed ISR construction activities and could return to inactive nests in the area. The applicant has committed to adhering to timing and distance restrictions determined by appropriate regulatory agencies to protect raptor nests during breeding season (Powertech, 2009a). In addition, the applicant has committed to mitigation measures to limit noise and vehicular traffic (Powertech, 2009a) during the construction phase of the proposed project, which will reduce overall impacts to raptors. If a disturbance occurs (called a “take”) where birds protected under the conventions are pursued, hunted, shot, wounded, killed, trapped, captured or collected in violation of the Bald and Golden Eagle Protection Act (BGEPA) and/or Migratory Bird Treaty Act (MBTA), the applicant will be required to perform a consultation and mitigation of the take with FWS. The applicant has committed to follow an FWS-approved raptor monitoring and mitigation plan to minimize conflicts between active nest sites and project-related activities if direct impacts to raptors occur (Powertech, 2009a). However, NRC staff anticipate there will be fewer direct impacts to raptors compared to a higher potential for indirect impacts. Mitigation measures provided in SEIS Chapter 6 will support the continued nesting success of area raptors and minimize potential direct and indirect impacts.

The applicant could mitigate potential impacts to raptor species from power distribution lines by following the Avian Power Line Interaction Committee guidance to avoid activities near active nests, especially prior to the fledging of young (Avian Power Line Interaction Committee, 2006). In addition, the applicant could site all planned facilities outside of the BLM-recommended buffer zone for all raptor nests identified within the proposed project area and adhere to BLM-recommended timing restrictions presented in table located in Table 4.6-3. Figure 4.6-2 shows the 16-ha [40-ac] areas where raptor nests are located near the proposed project area. The potential wellfield areas in Figure 2.1-6 identify where potential drilling/disruptive activity could occur around each orebody, if a particular orebody were mined. Based on the applicant’s intent to follow a raptor mitigation plan and implementation of the mitigative measures previously described, the potential impact to raptor species during the construction phase of the proposed Dewey-Burdock ISR Project for the deep Class V injection well disposal option will be SMALL.

<u>Waterfowl and Shorebirds</u>

Eight avian species associated specifically with water and/or wetlands were observed during baseline surveys conducted at the proposed project site: the American white pelican (*Pelecanus erythrorhynchos*), great blue heron (*Ardea herodias*), Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), American wigeon (*Anas americana*), killdeer (*Charadrius vociferus*), long-billed curlew (*Numenius americanus*), and upland sandpiper (*Bartramia longicauda*) (Powertech, 2009a). In western South Dakota, long-billed curlew and

Table 4.6-3. BLM Recommended Seasonal Wildlife Stipulations

Affected Areas/Species	Activities and/or Timing Restriction	Restricted Area
Sharp-tailed grouse/greater prairie chicken	Surface use prohibited March 1–June 15 except for operations and maintenance	Within a 3.2-km [2-mi] radius of a lek in nesting/brood-rearing habitat*
	Prohibit surface disturbance/occupancy or human activity year round	Within a 0.4-km [0.25-mi] radius of an occupied lek*

Table 4.6-3. BLM Recommended Seasonal Wildlife Stipulations (Cont'd)

Affected Areas/Species	Activities and/or Timing Restriction	Restricted Area
	Siting structures that are more than 3 m [10 ft] tall or power lines	Within a 3.2-km [2-mi] radius of nesting areas
Peregrine falcon	Prohibit surface disturbance/occupancy or human activity year round	Within 1.6-km [1-mi] radius of a nest including nests recorded during the preceding 7 breeding seasons*
Bald eagle	Prohibit surface disturbance/occupancy or human activity year round	Within a 0.8-km [0.5-mi] radius of a nest including nests recorded during the preceding 5 breeding seasons*
Golden eagle, osprey, burrowing owl, ferruginous hawk, Swainson's hawk, prairie falcon, other raptors	Prohibit surface disturbance/occupancy or human activity year round	Within a 0.4-km [0.25-mi] radius of occupied nest*
Greater sage-grouse	December 1–March 31 March 1–July 1 Prohibit surface disturbance/occupancy or human activity year round	Within crucial winter range for greater sage-grouse. Routine maintenance, production, and emergency response activities are allowed.* Within a 3.2-km [2-mi] radius of a lek in general habitat areas. Routine maintenance, production, and emergency response activities are allowed.* Within a 0.4-km [0.25-mi] radius of an occupied lek*
Piping plover	Prohibit surface disturbance/occupancy or human activity year round	Within a 0.4-km [0.25-mi] radius of piping plover habitat*
Interior least tern	Prohibit surface disturbance/occupancy or human activity year round	Within a 0.4-km [0.25-mi] radius of wetlands identified as least tern habitat*
Big game winter ranges	December 1–March 31	Surface-disturbing and disruptive activities in winter ranges*

*The authorized officer may grant an exception, modification, or waiver to a stipulation based on certain criteria
Source: BLM, 2012b,c,d

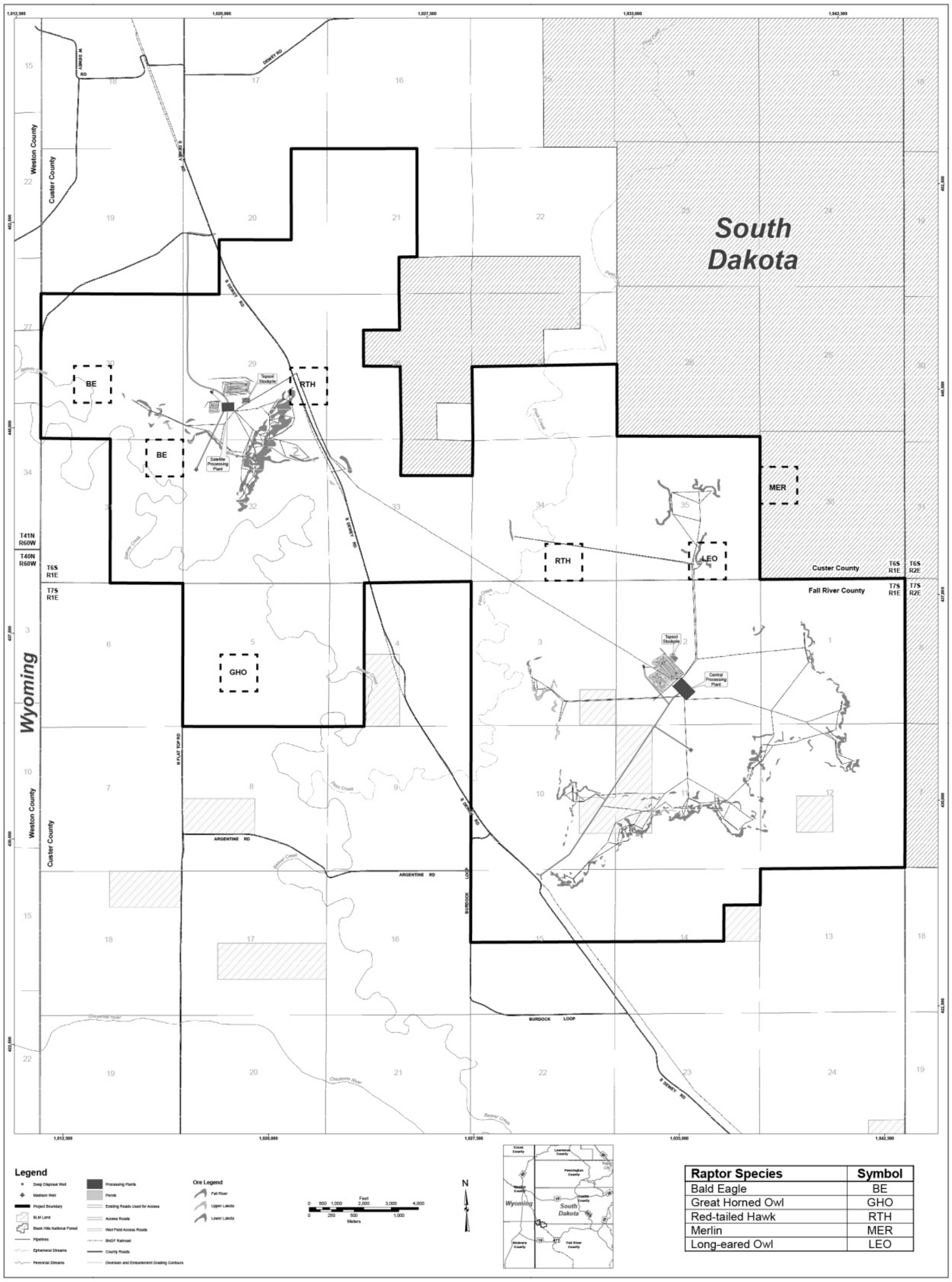

Figure 4.6-2. Map of Raptor Nest Locations in the Dewey-Burdock Project Area and Planned Facilities for the Deep Class V Injection Well Disposal Option Sources: BLM, 2012c; SDGFP, 2012c; Powertech, 2012a

upland sandpiper are often found in grasslands, but habitat requirements in this environment are not well known (SDGFP, 2005a). As described in SEIS Section 3.6.1.2.2, the long-billed curlew is a rare species in South Dakota. A large portion of the curlew breeding range occurs in South Dakota, but does not include winter habitat (Fellows, 2009). The continued existence of the species is most threatened by fragmentation, vegetation conversion, and loss of breeding habitat consisting of open, mixed-grass prairie and grazed cattle pastures across its current breeding range (Fellows, 2009). Areas about 0.8 km^2 [0.5 mi^2] or larger of the upland grassland vegetative community {total 885.27 ha [2,187.56 ac]} are found in the Burdock area east of Pass Creek, which is more than in the Dewey area. Construction impacts will affect nesting and breeding curlew the most from early March to mid-July.

At the proposed Dewey-Burdock site, relatively little habitat exists to support large groups or populations of either waterfowl or shorebirds and no breeding waterfowl or shorebirds were observed during wildlife surveys; therefore, NRC does not expect that proposed construction activities for the deep Class V injection well disposal option will destabilize waterfowl or shorebird populations. The applicant has committed to use existing roads when possible and obtain USACE permits when appropriate before construction activities (SEIS Section 4.5.1.1.1.1.). These actions, in addition to reseeding and other mitigation measures explained in SEIS Section 4.6.1.1.1.1, will limit potential long-term impacts to waterfowl and shorebird habitat. Therefore, the potential impact to waterfowl and shorebirds during the construction phase for the deep Class V injection well disposal option will be SMALL.

Construction impacts to nongame and migratory birds for the Class V injection well disposal option are expected to be similar to those discussed for other birds previously described in this section associated with forested, grassland, and shrubland vegetative communities. Some long-term habitat loss {up to about 98 ha [243 ac]} and potential reduction in the carrying capacity for nongame/migratory birds within the proposed project area will occur; however, there is habitat available regionally for displaced animals. Direct impacts will include habitat loss and fragmentation, alteration of plant and animal communities, overhead electric line collisions and electrocution, and increased human activity or noise that could cause collision mortality or the birds to avoid a specific area or reduce breeding efficiency.

Nongame and Migratory Birds

Direct loss of ground nests, eggs, and birds from construction activities could occur; however, these impacts will affect only a few birds and are not expected to have any long-term impacts on the general population of the individual species. NRC expects the proposed project will not influence migratory movement patterns, because most bird species are able to fly over the area without restrictions. Nongame and migratory birds will benefit from mitigation measures described in Chapter 6 because these will limit noise, vehicular traffic, and other human disturbances near these areas. Therefore, the potential impact to nongame and migratory birds during the construction phase will be SMALL.

Other Mammals

A variety of small- and medium-sized mammal species occurs in all the vegetative communities present in the vicinity of the proposed license area, although not all have been observed on the proposed project area itself. These mammals include the coyote (*Canis latrans*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), bobcat (*Lynx rufus*), badger (*Taxidea taxus*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), skunk (*Mephitis mephitis)*, porcupine

(*Erethizon dorsatum*), bats (*Myotis* spp.), and weasel (*Mustela* spp.) (Powertech, 2009a). Prey species including rodents (mice, rats, voles, shrews, pocket gophers, ground squirrels, squirrels, chipmunks, prairie dogs), jackrabbits (*Lepus* spp.), and cottontails (hares) (*Sylvilagus* spp.) could also inhabit the proposed project area.

Medium-sized mammals, such as rabbits, coyotes, and foxes, could experience some mortality or be temporarily displaced to other habitats during construction activities. Direct mortality or injury of some ground-dwelling small mammal species (e.g., voles, ground squirrels, mice) could be higher than for other wildlife because of their limited mobility and the likelihood they will retreat into burrows if disturbed. They could potentially be impacted by topsoil scraping or staging activities. However, given the limited, noncontiguous areas that will be affected by topsoil-disturbing construction activities (see Table 4.2-1), NRC expects no major changes or reductions in small- or medium-sized mammalian populations. Indirect impacts from accidental spills will be short term and localized to the impact area. The small- and medium-sized mammal species that occur in the proposed project area have a higher reproductive potential than do more vulnerable wildlife species that require large home ranges and occur in lower densities, such as large mammals (BLM, 2009). Construction disturbance associated with vehicles, equipment, noise, and dust will potentially cause wildlife species associated with all habitat types to avoid the area temporarily during construction activities; however, NRC staff expect that the area will not be uninhabitable after construction ends; therefore, the potential impact to other mammals from construction of the proposed Dewey-Burdock ISR Project will be SMALL. Potential construction impacts to black-tailed prairie dogs (*Cynomys ludovicianus*) and swift fox (*Vulpes velox)*, state endangered and state threatened species, respectively, are detailed in SEIS Section 4.6.1.1.1.1.4.

Reptiles and Amphibians

Three amphibian and one reptile species [boreal chorus frog (*Pseudacris triseriata*), Woodhouse's toad (*Bufo woodhousei*), great plains toad (*B. cognatus*), and western painted turtle (*Chrysemys picta*), respectively], which commonly occur in the region, were observed in the western portion of the project area along Beaver Creek where there are no currently planned activities associated with the proposed deep Class V injection well disposal option (Powertech, 2009a). Several other unidentified lizard species were observed during wildlife surveys conducted at the proposed site in 2007 and 2008 (Powertech, 2009a). The proposed project area provides limited habitat for amphibians and turtles due to the lack of aquatic habitat, which is concentrated along Beaver Creek and in old mine pits that make up about 10 ha [24 ac] of the total 14 ha [35 ac] of wetland habitat within the proposed project area. Within the proposed project area, Beaver Creek is a perennial stream and Pass Creek is an ephemeral stream that supports some intermittent habitat. All Beaver Creek and Pass Creek tributaries are ephemeral. During construction activities, reptile and amphibian species will experience impacts similar to those discussed for small- and medium-sized mammal species, which include loss or fragmentation of habitat, displacement, disturbance from noise and human proximity, and increased risk of vehicular collision.

Because the applicant does not plan to disturb water bodies and perennial streams within the proposed project area (Powertech, 2009a), staff expect that aquatic habitat will not be directly affected by the proposed project activities. In addition, SEIS Sections 4.5.1.1.1.1 and 4.5.1.1.1.2 describe mitigative measures in accordance with NPDES permit requirements; these measures will control the amount of pollutants entering surface water bodies, such as streams, wetlands, and lakes. For these reasons, NRC staff conclude potential impact to amphibian and regional turtle species and reptiles that require a water body for survival will be SMALL. Other reptiles, such as lizards and snakes that prefer grassland habitat, may be more susceptible to the potential human disturbances previously described. However, due to the small amount of habitat {about 98 ha [243 ac]} that will be disturbed at any given time during the deep Class V injection well disposal option and low likelihood for direct mortalities, staff do not expect construction impacts to measurably affect any reptile species population. Therefore, the potential impact to reptile species during the construction phase will also be SMALL.

4.6.1.1.1.1.3 Aquatic Ecology

GEIS Section 4.4.5.1 discussed impacts to aquatic species that could be temporarily disturbed by in-stream channel activities and concluded the potential impact will be SMALL. Sediment loads in streams are expected to taper off quickly both in time and distance, and long-term impacts will be SMALL. Additionally, SDDENR standard management practices will help to limit impacts to aquatic life. (NRC, 2009a)

Because of the limited and ephemeral nature of surface water at the proposed Dewey-Burdock ISR Project, the occurrence of aquatic species is also limited. Potential impacts to aquatic species at the proposed project site will occur primarily along Beaver Creek, Pass Creek, scattered stock ponds, and drainages. Beaver Creek is a perennial stream that experiences annual low flow conditions (see SEIS Section 3.6) and does not support sensitive species within the proposed project boundary. Further, EPA lists Beaver Creek as an impaired water body partially due to high dissolved and suspended solids (EPA, 2009). Pass Creek is an ephemeral stream that supports some intermittent habitat. However, Pass Creek does not provide a year-round source of surface water sufficient to maintain a population of aquatic species. The applicant's surface water management plan will limit the loss of aquatic habitat resulting from planned construction activities at the proposed project (Powertech, 2009a).

A baseline level of total uranium was detected in channel catfish during wildlife surveys (SEIS Section 3.6.2). SEIS Section 3.5.1 describes MCL exceedances in surface water samples collected onsite and offsite downstream for gross alpha, uranium, and Ra-226. EPA's national recommended water quality criteria for aquatic life and for human health consumption do not include gross alpha, uranium, or radium (EPA, 2012). No surface water will be diverted, no process water will be discharged into aquatic habitat, and stormwater runoff will be managed through the NPDES permit (as discussed in Section 4.5.1.1). SEIS Section 4.5.2 further describes that EPA requires a Class V UIC permit for deep Class V well injection. EPA will only allow Class V injection if the applicant can demonstrate that liquid waste could be safely isolated in a deep aquifer. In the permitted area, there is no evidence for any hydraulic connection between surface waters and proposed aquifers for the deep Class V injection well disposal option. NRC staff expect planned ISR construction activities, as described in SEIS Section 4.5.1.1, are unlikely to significantly affect surface water quality. Therefore, NRC staff conclude potential impacts to aquatic species and habitats from the construction phase for the deep Class V injection well disposal option will be SMALL.

4.6.1.1.1.1.4 Threatened and Endangered Species

As discussed in GEIS Section 4.4.5.1, if threatened or endangered species are identified on the proposed project site, the potential impact could range from SMALL to LARGE, depending on site conditions. Mitigation plans to avoid and reduce impacts to potentially affected species will be developed. (NRC, 2009a)

The results of wildlife surveys (Powertech, 2009a) have not identified federally listed threatened or endangered species on or within a 1.6-km [1-mi] radius of the proposed Dewey-Burdock ISR Project site; these findings have been confirmed by the FWS (FWS, 2010, 2012b, 2013). NRC staff initially requested information for federally listed species on March 15, 2010 (NRC, 2010c); the FWS provided an initial response on March 29, 2010 (FWS, 2010). NRC staff requested updated information from FWS via e-mail on August 27, 2012; a response was provided the same day (FWS, 2012b). The FWS confirmed the finding made by the applicant that no federal- or state-listed sensitive plant species, endangered or threatened plant species, or designated critical habitats were observed within the proposed project site during baseline wildlife surveys (Powertech, 2009a); therefore, there will be no direct impact to these species (see FWS, 2013). The FWS determination is that the NRC is not required to initiate consultations with FWS under Section 7 of the ESA (FWS, 2013).

SEIS Section 3.6.3 explains that Sprague's pipit (*Anthus spragueii)* could potentially occur in the proposed project area in the upland grassland vegetative community. Based on the information provided in SEIS Section 3.6.3, NRC staff conclude that it is unlikely this species will breed within the proposed project area. In addition, the Sprague's pipit will likely avoid areas near roads, grasslands that have been cultivated, or near the edges of other vegetative community types (FWS, 2011). Because the primary breeding area for this species is north and northeast of the project area and the birds spend winters in the southern half of the United States, NRC staff believe it is reasonable to expect that individual birds may occur in the project vicinity during migration. NRC staff conclude that it is unlikely Sprague's pipit will choose to inhabit the proposed project areas during the proposed ISR facility lifecycle; therefore, direct effects to the species are not expected. NRC staff further conclude that construction activities will not affect the existence of the species' population in the proposed project area.

Whooping cranes *(Grus americana)* currently do not breed in South Dakota; however, the proposed project area is located west of the migration path between Texas and Canada (FWS, 2009). Although construction activities may not directly impact whooping cranes, the potential exists for whooping crane disturbances from proposed mining activities during spring and fall migrations (FWS, 2010). Cranes roost, rest, and forage in relatively shallow wetlands that occur on the proposed project site along Beaver Creek, parts of Pass Creek, mine pits, and depressions, but prefer sites with minimal human disturbance (FWS, 2009). Construction activities at the proposed project may indirectly impact migrating whooping cranes by reducing optimal or preferred resting habitat. NRC staff conclude that migrating whooping cranes will not likely occur at the proposed site based on their traditional migratory pathway (FWS, 2009). If cranes navigate west of the traditional migratory pathway, NRC staff conclude that it is likely cranes will select other appropriate habitat for roosting, resting, and foraging during the proposed ISR facility lifecycle, and that construction activities will not affect the existence of the species' population in the proposed project area.

Bald eagles were observed along Beaver Creek in the western portion of the proposed project area during winter roosting surveys within 1.6 km [1 mi] of the proposed Dewey satellite processing plant (Powertech, 2009a; SDGFP, 2012c). Most recently in 2011, SDGFP confirmed the presence of one active nest along Beaver Creek approximately 1.6 km [1 mi] west of the proposed Dewey satellite plant in a cottonwood tree along Beaver Creek. Active and inactive nests are located within 0.4 km [0.25 mi] of potential Dewey wellfield areas (Powertech, 2009a; SDGFP, 2012a). Although the bald eagle is no longer federally listed as threatened, South Dakota still lists it as a threatened species. As discussed earlier in this chapter, the applicant plans to adhere to regulatory timing and spatial restrictions with regard to construction activities near raptor nests. In addition, the cottonwood gallery and ponderosa pine woodland vegetative communities where the bald eagles are found will not be physically impacted by the proposed project construction or operations (Powertech, 2009a). Therefore, construction will not directly impact bald eagles. However, eagles nesting nearby or migrating through the area may use the proposed Dewey-Burdock site and surrounding lands for foraging during winter months and may not be able to use these lands during construction until the disturbed areas were reclaimed and prey species returned. The bald eagle is protected under the MBTA and the BGEPA, by which the applicant will have to abide. Although these statutes do not provide for habitat protection, disturbance of eagle habitat that directly takes or kills a bald eagle (such as cutting down a nest tree with chicks present) will constitute a violation of the MBTA, as well as the BGEPA.

Black-footed ferrets (*Mustela nigripes*) are not present in the site vicinity at this time (BLM, 2009a; FWS, 2010; SEIS Section 3.6.3). However, the presence of the black-tailed prairie dog (*Cynomys ludovicianus*) in the northwestern corner of the proposed project area provides potentially suitable habitat for the black-footed ferret. Two other prairie dog towns were observed 1.6 km [1 mi] southwest of the proposed project area. The black-tailed prairie dog is a state endangered and BLM sensitive species (see Tables 3.6-7 and 3.6-8). As discussed in SEIS Section 3.6.3, FWS relieved the requirement for black-footed ferret surveys to be conducted in black-tailed prairie dog habitat within the State of South Dakota for the purpose of identifying previously unknown ferret populations; therefore, Powertech did not conduct ferret surveys on the proposed Dewey-Burdock ISR Project site. FWS continues to direct federal agencies to assess whether a proposed action could have an adverse effect on the value of prairie dog habitat as a future reintroduction site for the black-footed ferret. Proposed construction activities may directly impact prairie dogs and habitat for the prairie dog and black-footed ferret within the proposed project boundary that could support populations of these species. Because there have been no occurrences of black-footed ferrets within the proposed project area and the prairie dog colony on the site is likely too small to support and sustain a breeding population of black-footed ferrets (as described in SEIS Section 3.6.3), NRC staff conclude that the proposed project construction will not result in a direct effect on current or future ferret populations.

Potential impacts to sage-grouse, a federal candidate species and BLM sensitive species, were discussed in SEIS Section 4.6.1.1.1.1.2 under Upland Game Birds. Listed threatened or endangered species or candidate animals will not be directly affected by construction activities for the deep Class V injection well option, nor will the habitats of these species' be noticeably altered. Therefore, the NRC staff conclude potential impacts from construction activities on federally listed threatened or endangered species, and candidate or delisted species, will be SMALL.

State and BLM Species of Concern

In addition to the BLM sensitive species listed in Table 3.6-7 that could occur within the proposed project area, the following South Dakota-designated rare animals were observed within the proposed project area during wildlife surveys: long-billed curlew, great blue heron, golden eagle, Cooper's hawk, American white pelican, long-eared owl, merlin, Clark's nutcracker (*Nucifraga Columbiana*), ferruginous hawk, and plains topminnow (*Fundulus sciadicus*) (Powertech, 2009a). State rare and BLM sensitive species are discussed in the following paragraphs.

BLM sensitive species that are found in wetland or grassland/wetland habitats that could occur, but were not observed, during surveys at the proposed site [marbled godwit (*Limosa fedoa*), trumpeter swan (*Plegadis chihi*), willet (*Cataptrophorus semipalmatus*), and Wilson's phalarope (*Phalaropus tricolorl*)] and South Dakota rare animals observed during Dewey-Burdock wildlife surveys (long-billed curlew, great blue heron, and American white pelican in Table 3.6-8) are unlikely to be affected by construction activities because fairly limited suitable habitat exists year round to support large groups or populations of either waterfowl or shorebirds. None of the waterfowl or shorebirds observed during wildlife surveys were breeding; therefore, NRC staff do not expect that proposed construction activities will destabilize sensitive waterfowl or shorebird populations.

Raptors listed as BLM sensitive species that could occur at the proposed site are bald eagle, burrowing owl, ferruginous hawk, golden eagle, peregrine falcon *(Falco peregrines*), and Swainson's hawk (*Buteo swainsoni).* Each of these BLM sensitive species is protected under the MBTA, and the bald and golden eagles are also protected under the BGEPA. Similar to the bald eagle, the peregrine falcon is designated as threatened in South Dakota, but the peregrine falcon was not observed in the proposed project area. The peregrine falcon was once a federally listed species, but it was delisted in 1999. The falcon was presumed to be extirpated from the state by 1980 (USGS, 2006) and is not likely to occur within the proposed project area, although there are recent urban reintroduction efforts to restore the bird to the state (SDGFP, 2012b). Burrowing owls are dependent on large prairie dog towns for food and nesting in western South Dakota (SDGFP, 2005a,b). Several predatory raptor species, such as the ferruginous hawk, feed on prairie dogs and other small vertebrates or burrowing animals found in prairie dog towns. Some raptors, such as the Swainson's hawk, feed primarily on insects. During breeding season, the Swainson's hawk may consume small vertebrates.

State rare raptor species observed in the project area were Cooper's hawk, long-eared owl, and merlin. Each species is also protected under the MBTA. All raptors that occur at the proposed project site will experience potential impacts similar to those described for raptors in SEIS Section 4.6.1.1.1.1.2. Raptors are particularly sensitive to noise and the presence of human activity, which will be heightened during the construction period. As described in SEIS Section 4.6.1.1.1.1.2, injury and mortality from encounters with power lines will be minimized by the applicant's proposed use of raptor deterrent products and following regulatory timing and spatial restrictions with respect to construction activities near raptor nests. The applicant has also committed to follow an FWS-approved raptor monitoring and mitigation plan to minimize conflicts between active nest sites and project-related activities if direct impacts to raptors occur (Powertech, 2009a). Nest abandonment and loss of eggs or fledglings could occur in raptor nests proximate to construction activities, especially during the early nesting period. Because of the presence of raptors within the proposed project area, sensitive and rare raptor species could be disturbed. However, the NRC staff conclude direct impact to raptors is unlikely and the continued existence of the species in the proposed project area will not be threatened due to proposed mitigation measures; these are further detailed in Chapter 6 and include best management practices for monitoring species. The NRC staff conclude the estimated impact on sensitive raptor species during the construction phase for the deep Class V injection well disposal option will be SMALL.

Nongame and migratory birds, such as the Chestnut-collared longspur (*Calcarius ornatus),* dickcissel (*Spiza americana),* and long-billed curlew, may occur within the proposed project area, most likely in the upland grassland vegetative community. The loggerhead shrike (*Lanius ludovicianus)* and blue-grey gnatcatcher (*Polioptila caerulea)* may also occur within the proposed project area, most likely in the shrubland communities. All of these birds are BLM sensitive species and protected by the MBTA. The gnatcatcher and curlew are also rare state species. Potential impacts from construction on the long-billed curlew and nongame and migratory birds are discussed in SEIS Section 4.6.1.1.1.1.2. NRC staff expect that similar potential impacts described in SEIS Section 4.6.1.1.1.1.2, including injury or mortality from vehicles and electrical lines, fragmentation, vegetation conversion, and loss of breeding habitat, for nongame and migratory birds will also potentially impact chestnut-collared longspur, dickcissel, loggerhead shrike, and blue-grey gnatcatcher. For the proposed Dewey Conveyor Project, which is less than 1.6 km [1 mi] from the proposed Dewey-Burdock ISR Project, BLM staff concluded that while some species reliant on grassland habitat could be displaced, the area contains high density, undisturbed grassland and disturbed grassland species will use similar adjacent habitat (BLM, 2009). The staff also conclude that the grassland habitat in the vicinity of the proposed Dewey Burdock project area will temporarily support grassland species of concern that may be disturbed during construction. Further, NRC staff expect applicant mitigation measures, like those described in SEIS Section 4.6.1.1.1.1.2 and Chapter 6, will prevent destabilization of habitat or populations for these species. Therefore, the NRC staff conclude that potential impacts from construction on chestnut-collared longspur, dickcissel, loggerhead shrike, and blue-grey gnatcatcher will be SMALL.

Clark's nutcracker (*Nucifraga columbiana*), a BLM sensitive species and state rare species, is a nongame bird that was observed flying over the proposed project site during wildlife surveys. Nutcrackers prefer conifer forests (South Dakota Birds and Birding, 2012) and will most likely occur in the ponderosa pine woodland vegetative community in the proposed project site. Black-backed woodpecker (*Picoides arcticus),* veery (*Catharus fuscescens)*, and three-toed woodpecker (*Picoides tridactylus)* are all BLM sensitive species that inhabit forested areas such as the ponderosa pine woodland and cottonwood gallery vegetative communities. The red-headed woodpecker (*Melanerpes erythrocephalus),* a BLM sensitive species and state rare species, inhabits the edge of forested areas near open clearings. All of these birds are protected by the MBTA. NRC staff expect that potential impacts to these nongame and migratory birds associated with forest habitats will be less than those potential impacts described for nongame and migratory birds associated with grassland and shrubland habitats because (i) NRC expects that little to no treed areas will be directly disturbed during construction compared to other habitat types that will experience long-term or permanent impacts; (ii) the applicant has stated that no woody corridors will be disturbed by the proposed activities (Powertech, 2009a); and (iii) potential forest habitat is located in the adjacent BHNF dominated by ponderosa pine and other deciduous trees (Chapman, 2004) that could support displaced birds that depend on forest habitats. Therefore, the staff conclude the potential impact on Clark's nutcracker, black-backed woodpecker, veery, three-toed woodpecker, and red-headed woodpecker during the construction phase will be SMALL.

Two mammals, the black-tailed prairie dog (*Cynomys ludovicianus*), a state endangered species and BLM sensitive species, and the swift fox (*Vulpes velox)*, a state threatened species and BLM sensitive species, could potentially occur within the project area. As described earlier in this section and in SEIS Section 3.6.3, a black-tailed prairie dog colony is located proximate to potential wellfields D-WF3 and D-WF4 in the Dewey area and proposed standby land application sites; therefore potential direct impacts could affect prairie dogs if the wellfields and land application sites are used. A 2008 survey reported that the prairie dog populations more than doubled in Custer and Fall River Counties between 2003 and 2008, and that state prairie dog 2008 conservation population goals were met (Kempema, et al., 2009). Because of management programs to protect the species, prairie dog populations in South Dakota are stable where the species occurs in most of the western two-thirds of the state (SDGFP, 2012d). According to SDGFP, private landowners and the public are allowed to shoot prairie dogs on private lands to manage the population in prairie dog towns (SDGFP, 2005b). Therefore, NRC expects that management of prairie dogs will be conducted in accordance with applicant and land owner agreements.

The swift fox is typically found in short mixed grass prairies and preys on prairie dogs in addition to other small mammals and their carcasses, birds, insects, reptiles, fruits, and berries (FWS, 2000a). Swift fox are burrowing animals known to dig their own dens or use the burrows of other animals, including those made by prairie dogs. Because of their association with prairie dogs, swift fox that may occur in the proposed project area could be affected by prairie dog control efforts, thereby limiting available food, shelter, and escape cover for swift fox (FWS, 2000a). Other threats include the fact that swift fox are easily trapped or shot and can experience mortality from vehicle collisions (FWS, 2000a). Swift fox have demonstrated the ability to adapt to prairie-agricultural, sagebrush-grassland, and sagebrush-greasewood habitat types and to not be dependent on prairie dog colonies for their food (FWS, 2000a). For the proposed Dewey Conveyor Project, BLM concluded activities may impact individual prairie dogs and swift foxes or their habitat, but will not cause instability in their populations (BLM, 2009). NRC staff also conclude that, based on the reasons previously described in this section, the potential impacts to these species from the proposed Dewey-Burdock ISR Project construction activities will be SMALL.

The banded killifish (*Fundulus diaphanous),* a BLM sensitive species and state endangered species found in the western part of the state, and the northern redbelly dace (*Phoxinus eos*), a BLM sensitive species and state threatened species, were not observed or expected to occur in western South Dakota or Custer or Fall River Counties (SDGFP, 2012c; Table 3.6-7). As discussed in SEIS Section 3.5.1, with the exception of perennial Beaver Creek, the streams within the proposed project area generally only flow during the wet season in response to snow melt or precipitation events. Beaver Creek and Pass Creek do not provide continuous, stable aquatic habitat to support these aquatic species; therefore, NRC staff predict potential impacts to be SMALL.

Table 3.6-7 lists BLM sensitive amphibians, including frogs, and reptile species, including snakes and turtles, that could occur in the proposed project area. The snapping turtle (*Cheldy serpentine)* will be one of the most likely BLM sensitive turtle species to occur in the area (Bandas, 2004), although snapping turtles were not observed during wildlife surveys. This species can be found in any permanent water body in the state and are rarely seen out of the water except for nesting and basking in the sun (Bandas, 2004). The spiny softshell turtle (*Apalone spinifera*) is a state rare species that prefers highly oxygenated, fast flowing rivers, lakes, and streams, but is also found in impoundments and reservoirs (Somma, 2011; Bandas, 2004). As described in SEIS Section 3.6.1.2.3, the applicant reported a spiny softshell subspecies in Beaver Creek during fish surveys downstream of the proposed project area. Turtles usually spend the winter in rivers, lakes, streams, and reservoirs with muddy or sandy bottoms and require soil exposed to sunlight, often near sand or gravel bars, during late spring or summer for a proper nest environment (Somma, 2011). Common toads and frogs were observed during wildlife surveys, but BLM sensitive amphibian species were not reported. For the same reasons explained in SEIS Section 4.6.1.1.1.1.2, NRC concludes potential impact to these sensitive reptiles and amphibians will be SMALL.

Snakes and lizards are generally less dependent than or nondependent on permanent water bodies compared to amphibians. Snakes and lizards could occur within grassland, shrubland, and sometimes woodland habitats depending on the species. The plains or western hognose snake (*Heterodon nasicus*) is a BLM sensitive species that typically burrows into sandy, gravelly, or floodplain areas, but may also occur in agricultural, shrub, and woodland habitats (WGFD, 2010). The Greater short-horned lizard (*Phrynosoma hernandesi*) is also a burrowing BLM sensitive species that prefers grassland and sagebrush habitats (BLM, 2009). Both of these species are known to be distributed within the region, but were not observed during Dewey-Burdock wildlife surveys. As described in SEIS Section 4.6.1.1.1.1.2, potential impacts to reptiles could include loss or fragmentation of habitat, displacement, disturbance from noise and human proximity, and increased risk of equipment encounters and vehicular collision. In addition, snakes can be unnecessarily killed by humans who think snakes are harmful. For example, the hognose snake resembles the rattlesnake and may invoke undue harm (WGFD, 2010), although it is not venomous and does not typically respond to enemies by biting regardless of their dramatic defense display. Construction activities are not planned during the winter months when these species will be hibernating and less responsive to ground-disturbing activities that may result in loss of life. In addition, due to the sequential development and small amount of land that will be disturbed for construction under the deep Class V injection well disposal option {approximately 98 ha [243 ac]}, staff do not expect construction impacts to measurably affect any reptile species population. Therefore, potential impacts to these sensitive reptile species during the construction phase will also be SMALL.

4.6.1.1.2 Operations Impacts

The potential impact to ecological resources during operations under the deep Class V injection well disposal option at the proposed Dewey-Burdock ISR Project will be consistent with the findings described in the GEIS summarized previously in SEIS Section 4.6. Only minor impacts to vegetative communities will occur because most of the clearing for the ISR facility will have occurred during the construction phase. Invasive and noxious weeds could potentially colonize disturbed areas, but the applicant has committed to monitor and control these. In addition, material spills and failure of settling and holding pond liners or embankment systems could also occur during the operations phase. The applicant has proposed to minimize vehicular access to specific roads and revegetate disturbed areas with an SDDENR- and BLM-approved seed mixture to prevent the establishment of competitive weeds and restore habitat to native species (Powertech, 2009a). There will be less noise and less traffic during the operations phase of the proposed project compared to the construction phase; therefore, the potential to disrupt wildlife populations will be reduced along with a decrease in the probability of vehicular collisions. Wildlife use of areas adjacent to ISR operations will be expected to increase as animals become habituated to site activities. Potential impacts to wildlife, including state and BLM species of concern, during the operations phase will continue to be SMALL because operations will not threaten the continued existence of any particular species in the proposed license area. Leak detection systems, soil monitoring, and spill response plans to remove affected soils and capture released fluids (SEIS Section 4.4.1) will minimize the impact of wildlife exposure to potentially toxic levels of chemicals.

Potential conflicts between active raptor nest sites and operations-related activities, especially the expansion of wellfield areas, will be mitigated by adherence to regulatory timing and spatial restrictions with regard to construction activities near raptor nests.

As described in SEIS Section 2.1.1.1.2.4, the applicant's deep Class V injection well disposal option will require the use of settling and holding ponds. The proposed use of settling and storage ponds presents a potential for wildlife exposure to wastewater solutions. The applicant has proposed predisposal wastewater treatment, including ion-exchange treatment and radium settling, to remove or reduce some of the regulated constituents discharged to the storage ponds (SEIS Sections 2.1.1.1.6.2 and 4.14.1). The proposed wastewater treatment approaches include monitoring the post-treatment water quality to ensure compliance with NRC, EPA, and SDDENR requirements as well as any applicable NRC license conditions (Section 4.14.1). Liquid wastes discharged to settling and holding ponds will be treated to water quality appropriate for discharge injection into permitted Class V (nonhazardous) deep disposal wells (Powertech, 2009a).

To evaluate the potential hazards to wildlife from waste management operations, the NRC staff compared the applicant's estimated concentrations of chemical constituents in the wastewater with aquatic-life and wildlife health effects thresholds. An aquatic life health effects threshold is a concentration of a chemical constituent in water that has been shown to cause health effects in aquatic life based on scientific studies. Selenium, in particular, was identified by the FWS as a constituent of concern in ISR wastewater because of low wildlife health effects thresholds in some sensitive species when compared with concentrations of selenium measured in ISR wastewater (FWS, 2007). The wildlife health effects thresholds described here establish the concentration of a chemical in water that is known to cause health effects in wildlife based on scientific studies.

For this evaluation, the NRC staff compared the applicant's estimated wastewater concentrations with EPA chronic (long-term) exposure-based water quality criteria (guidance) established for the protection of aquatic life (EPA, 2013). The staff found that the estimated concentrations of arsenic and selenium in the injectate the applicant proposes to use exceed the current EPA criteria. Additionally, the applicant's estimated concentrations of selenium exceed levels referenced by FWS (2007) as hazardous to aquatic birds. Based on this comparison, the NRC staff concludes that direct chronic exposure of sensitive species to the applicant's estimated arsenic and selenium concentrations in wastewater (undiluted) could adversely impact exposed individuals. However, NRC staff considers such chronic direct wildlife exposure to undiluted wastewater unlikely because the applicant's proposed wastewater controls (e.g., pond design, leak detection and mitigation, pressure monitoring) and SDDENR permitting requirements will limit direct contact that aquatic life and terrestrial wildlife have with wastewater solutions. The SDDENR controls include limiting access to wastewater with fencing and implementing an avian protection plan for pond operations.

Wastewater storage ponds present an opportunity for wildlife, primarily migratory birds, to have direct contact with wastewater solutions. One detailed wildlife field study of an ISR wastewater irrigation system has been published and observations made in that study identified only limited use of a wastewater storage reservoir by birds (FWS, 2000b). In the event that additional treatment to lower wastewater constituent concentrations or additional access controls for ponds are needed to protect wildlife, SDDENR has the authority to require these actions be implemented by the applicant. In the event that additional treatment to lower wastewater constituent concentrations or additional access controls for ponds are needed to protect wildlife, SDDENR has the authority to require these actions be implemented by the applicant.

Based on the previous assessment, the potential impact to ecological resources (including vegetation, big game, upland game birds, raptors, waterfowl and shorebirds, nongame/migratory birds, other mammals, aquatic species, and sensitive and protected species) during the operations phase for the deep Class V injection well disposal option will be SMALL and less than that experienced during the construction phase. Therefore, NRC staff predict potential impacts to aquatic species will remain SMALL.

4.6.1.1.3 Aquifer Restoration Impacts

Impacts to ecological resources for the Class V injection well disposal option at the proposed Dewey-Burdock ISR Project during aquifer restoration will be consistent with the impact conclusions described in the GEIS, as summarized in SEIS Section 4.6, and consistent with those potential impacts described previously for the construction phase and the operations phase. Because the existing infrastructure from the operations phase will continue to be used during aquifer restoration and the applicant will continue to apply the mitigation measures described previously, the potential impact to ecological resources will be similar to that described for the operations phase. In addition, the applicant's adherence to the BMPs proposed for seasonal noise, vehicular traffic, and human proximity measures will further reduce potential impacts to ecological resources. Therefore, the potential impact to ecological resources (including vegetation, big game, upland game birds, raptors, waterfowl and shorebirds, nongame/migratory birds, other mammals, aquatic species, and protected and sensitive species) during aquifer restoration will be SMALL.

4.6.1.1.4 Decommissioning Impacts

The activities resulting in impacts to ecological resources during the proposed Dewey-Burdock ISR Project decommissioning activities under the Class V injection well disposal option are consistent with the activities described in the GEIS as summarized in SEIS Section 4.6. Impacts to ecological resources during the decommissioning phase will be similar to those experienced during the construction phase with respect to noise, traffic flow, and earthmoving activities. However, the decommissioning phase will temporarily disrupt slightly more natural habitat than will have occurred during the construction phase of the ISR process; this is because of an increase in land-disturbing activities for dismantling, removing, and disposing of facilities, equipment, and excavated contaminated soils. Decommissioning and reclamation activities, as described in SEIS Section 4.2 for land use, will primarily be conducted in the previously disturbed areas of the site in accordance with the NRC-approved decommissioning plan and BLM-approved reclamation plan (BLM, 2012a). Affected areas will be revegetated using a final reclamation seed mix developed through discussions with the landowner and approved by the SDDENR and BLM (Powertech, 2009a; BLM, 2012e).

Little loss of vegetative communities beyond those disturbed during construction will be expected during decommissioning. Piping removal will have the greatest impact on vegetation that had reestablished itself since being disturbed during previous ISR phases. The dismantling of the proposed project facilities, infrastructure, and roads, and reseeding and placement/contouring of soil will have impacts similar in scale to the construction phase. SDDNER recommends that the large-scale mine permit require revegetation success be equivalent to vegetative cover in reference areas, using SDDENR-approved statistical methods. In addition, a post closure bond will be held for 30 years after the reclamation bond is released, in order to help ensure revegetation success. However, final permit conditions may change based on the final determination by the SDDENR hearing board. The decommissioning process will be expected to create increased noise, traffic, and sediment runoff as buildings are taken down and hauled away. During this time, wildlife could either come in conflict with heavy equipment or could move elsewhere due to higher-than-normal noise. As required, the applicant will submit an NRC-approved decommissioning plan and all decommissioning activities will be carried out in accordance with 10 CFR Part 40 and other applicable federal regulatory requirements. Decommissioning of plant facilities at the proposed Dewey-Burdock ISR Project is estimated to take 2 years. Temporarily displaced wildlife could return to the area once decommissioning and reclamation were completed. The applicant's implementation of the previously discussed mitigation measures will further reduce potential impact.

At the proposed Dewey-Burdock ISR Project, the impact from dismantling and decontaminating the central plant, satellite facility, roads, and support facilities will be consistent with the conclusions reached in the GEIS. The potential impacts to ecological resources (including vegetation, big game, upland game birds, raptors, waterfowl and shorebirds, nongame/migratory birds, other mammals, reptiles and amphibians, and protected species) during decommissioning for the deep Class V injection well disposal option will include disturbance of about 98 ha [243 ac] of vegetation, primarily in the upland grassland and greasewood shrubland vegetation communities. Although certain vegetative communities (shrubland) are difficult to reestablish and can take as many as 10 years to achieve full site recovery (WGFD, 2007), the applicant commits to ongoing vegetation reestablishment efforts throughout the ISR facility life cycle. New vegetative growth could be affected by future grazing, droughts, or intense winters, thus reducing the rate of plant productivity and delaying full recovery (WGFD, 2007). For these reasons, NRC staff conclude there will be a MODERATE impact on vegetation from decommissioning and reclamation under the deep Class V injection well disposal option; once vegetation has been reestablished, this impact will be SMALL. Potential impacts to big game, upland game birds, raptors, waterfowl and shorebirds, nongame/migratory birds, other mammals, reptiles and amphibians, and protected species will remain SMALL and comparable to those described for the construction phase. The removal of perimeter fencing will increase big game passage and vegetative forage. As with construction, operations, and aquifer restoration phases, potential impacts to big game during decommissioning will remain SMALL. Potential impact to aquatic species and amphibians will also remain SMALL because of the limited occurrence of surface water, and the applicant's plan to not disturb water bodies located on the proposed project site.

4.6.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not obtained from EPA, the applicant proposes to dispose of liquid waste generated at the proposed Dewey-Burdock ISR Project by land application (see SEIS Section 2.1.1.1.2.4.2). Potential environmental impacts on ecology from construction, operations, aquifer restoration, and decommissioning associated with the land application liquid waste disposal option are discussed in the following sections.

4.6.1.2.1 Construction Impacts

Planned vegetation disturbance for the land application disposal option is provided in Table 4.6-3. Approximately 566 ha [1,398 ac] of land or 13.2 percent of the proposed permit area will be potentially disturbed by activities associated with construction of facilities, pipelines, wellfields, storage ponds, irrigation areas, and access roads (Powertech, 2012a, 2010a). Disturbance to the vegetative communities will include that described in SEIS Section 4.6.1.1.1.1 for construction under the deep Class V injection well disposal option in addition to disturbance from increased pond capacity totaling approximately 55 ha [136 ac] and irrigation areas for potential land application totaling approximately 425.7 ha [1,052 ac]. The same area of BLM land will be disturbed during construction for both the deep Class V injection well and land application disposal options.

Figure 4.6-3 shows the planned facilities and vegetation communities for the land application disposal option. The additional ponds in the Dewey and Burdock areas will be located primarily in the greasewood shrubland and upland grassland vegetative communities. Ponds in the Dewey area will also be located in the silver sagebrush shrubland community just west of Dewey Road. Land application areas in the Dewey area will primarily be located in the greasewood shrubland community and a portion within the upland grassland community. The land application areas in the Burdock area will be located in the greasewood shrubland, upland grassland, big sagebrush shrubland, and silver sagebrush shrubland vegetative communities. Table 4.6-4 provides the amount of disturbance in each vegetation community.

During the construction phase, land application piping and pivot installation will create similar impacts described in SEIS Section 4.6.1.1.1.1 including (i) modification of vegetative structure, species composition, and areal extent of cover types (density); (ii) potential invasion, establishment, and expansion of invasive or nonnative species; (iii) potential soil erosion; (iv) reduction of wildlife habitat and livestock forage; and (v) changes in visual aesthetics.

NRC staff expect the center pivot areas to consist of native vegetation or to be converted into agricultural land where alfalfa or salt-tolerant wheatgrass will be planted and grown (Powertech, 2009b); however, application of liquid waste will not begin until the operations phase. NRC expects the applicant or landowners to use earth-moving equipment to clear and till the soil in preparation for planting crops in the land application areas. The applicant will employ similar mitigative measures previously discussed for the deep Class V injection well option to minimize potential construction impacts to vegetation and habitat during construction for the land application option. NRC staff expect potential impacts to vegetation and wildlife from the increased pond capacity totaling approximately 55 ha [136 ac] will not result in measurably higher impacts to wildlife because of the small amount of additional area that will be disturbed. However, combined with the land application areas (including operating and standby center pivot areas and catchment areas) of approximately 426 ha [1,052 ac], greater impacts to wildlife are expected.

As described in SEIS Section 2.1.1.1.2.4.2, the maximum estimated area for land application is 426 ha [1,052 ac] and includes operating irrigation pivots, standby irrigation pivots, and areas constructed to contain surface stormwater runoff. As described in SEIS Section 4.6, the GEIS evaluated ISR facilities that ranged in facility size from 1,000 to 7,000 ha [2,471 to 17,297 ac] with disturbed area estimates of 49 to 753 ha [120 to 1,860 ac] (NRC, 2009a) and land application of treated wastewater. The GEIS concluded that potential impacts from operations during land application will be small, but the GEIS did not evaluate the impacts of planting crops in the irrigation areas prior to land application activities, which could have a greater impact than conducting land application on native vegetation. Because of the long-term direct impacts of approximately 566 ha [1,398 ac] of native vegetation, of which up to 308 ha [760 ac] may be converted into crops, staff conclude impacts to vegetation will be MODERATE.

BLM-managed lands within the project area are not located within proposed irrigation areas and will not experience any additional direct vegetation modification from irrigation activities under the land application disposal option. The applicant may construct fencing around land application areas to control livestock access, which could indirectly increase livestock grazing

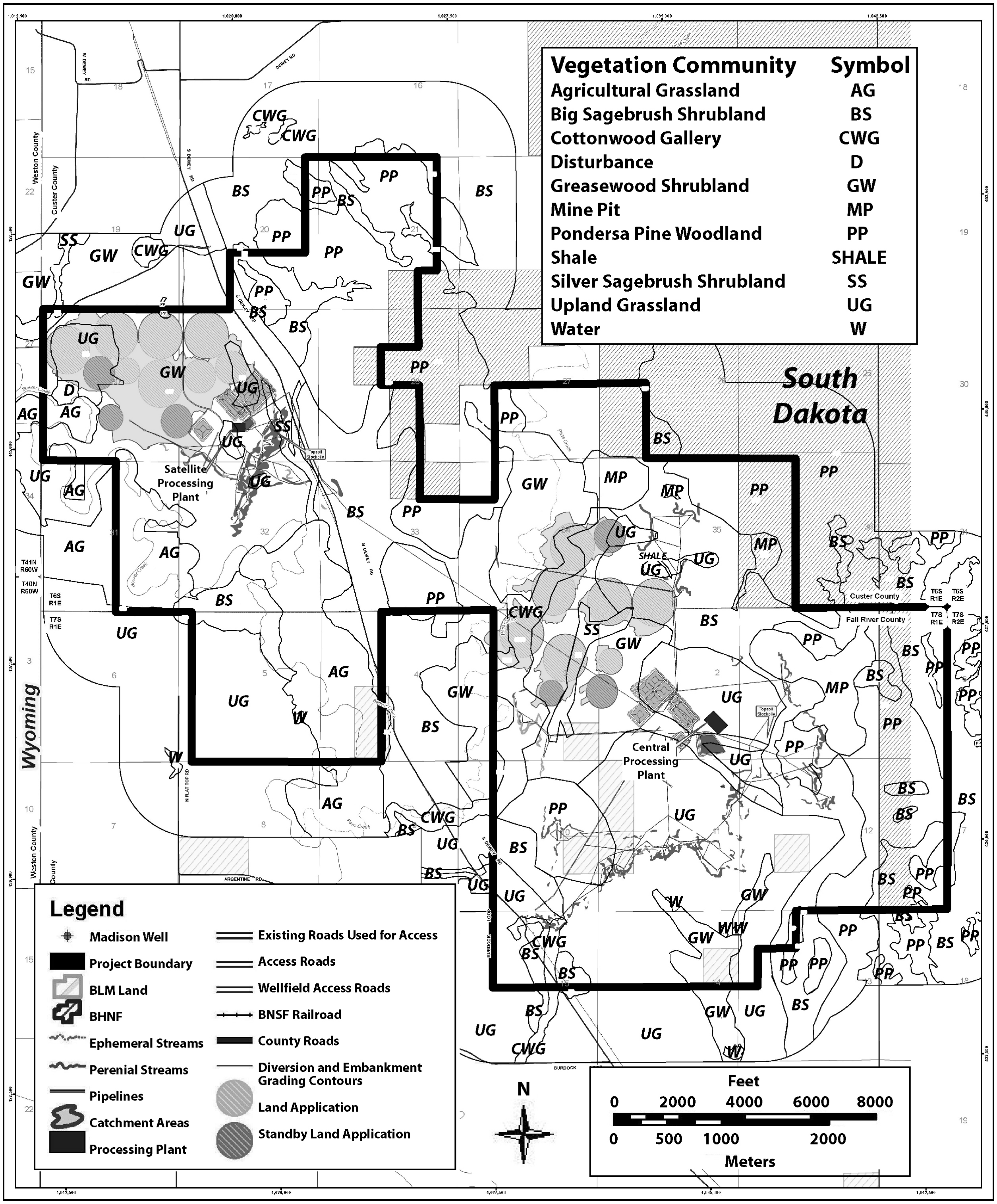

Figure 4.6-3. Map of Dewey-Burdock Planned Facilities and Vegetation Communities for the Land Application Option
Source: Powertech, 2012a

Table 4.6-4. Disturbed Land by Vegetation Type for Dewey-Burdock Land Application Option

Activity	Vegetation Community {Hectares [acres]}							Total Disturbed Area Hectares [acres]
	Big Sagebrush Shrubland	Cottonwood Gallery	Greasewood Shrubland	Mine Pit	Ponderosa Pine Woodland	Silver Sagebrush Shrubland	Upland Grassland	
Site Facilities	0.8 [2]	0	3.2 [8]	0	0.4 [1]	0	5.7 [14]	9.7 [24]
Trunklines	2.4 [6]	0	2.4 [6]	0	1.2 [3]	0.8 [2]	3.2 [8]	10.1 [25]
Access Roads	2.0 [5]	0	2.0 [5]	0.4 [1]	0.8 [2]	0.4 [1]	2.4 [6]	8.5 [21]
Well Fields	8.5 [21]	0	18.2 [45]	2.0 [5]	8.5 [21]	4.4 [11]	15.0 [37]	56.6 [140]
Impound-ments	1.6 [4]	0	20.2 [50]	0	0.4 [1]	3.2 [8]	29.5 [73]	55.0 [136]
Land Application	75.7 [187]	0	267.9 [662]	0	0	6.9 [17]	72.4 [179]	425.7 [1,052]
Totals	90.6 [224]	0	314.4 [777]	2.0 [5]	11.3 [28]	15.8 [39]	128.3 [317]	565.8 [1,398]
Source: Powertech 2012a								

activities on BLM lands, if BLM decides to allow such activities. Because BLM land is considered a public resource and is traditionally used for livestock grazing in this region, NRC staff expect the potential indirect impacts on the vegetation of these BLM lands to be SMALL. Staff also expect that in addition to potential impacts described earlier for the deep Class V injection well option, big game species may experience additional restricted movement due to fencing around land application areas and reduced forage and carrying capacity in the land application areas. However, because the project area is not within big game migration pathways and does not contain critical habitat and because big game species have larger home ranges and are highly mobile, the continued existence of big game species will not be threatened and impacts on big game will be SMALL.

The black-tailed prairie dog colony located within the Dewey area in land application areas could attract black-footed ferrets. The colony supports small- to medium-sized mammals that burrow in the ground, raptors and ground dwelling birds, and reptiles as described in SEIS Sections 4.6.1.1.1.1.2 and 4.6.1.1.1.1.4. Figure 4.6-4 shows the 16-ha [40-ac] areas where raptors nests are located near the proposed project. The potential wellfield areas in SEIS Figure 2.1-6 identify where potential drilling/distruptive activity could occur around each orebody, if a particular orebody were mined. Converting land application areas into cropland during construction under this option will have a greater overall impact on such wildlife than during the construction phase under the deep Class V injection well disposal option due to the additional 481 ha [1,188] of habitat alteration and land disturbance (Table 2.1-8). The removal of sagebrush communities will most impact sagebrush obligate species, such as sage-grouse, sharp-tailed grouse, sage thrasher, and some small mammals. NRC staff expect that prey–predator relationships will be altered within the irrigation areas during construction activities and prey–predator species will leave those areas temporarily during construction activities. Raptors that nest within the proposed project area could abandon their nests. Staff expect some species to return to the area after the irrigation areas are reestablished because the cropland will provide additional nesting sites, cover, and food. Staff also expect that once the crops have been established, some raptors will also return to this area to use the cropland for active hunting.

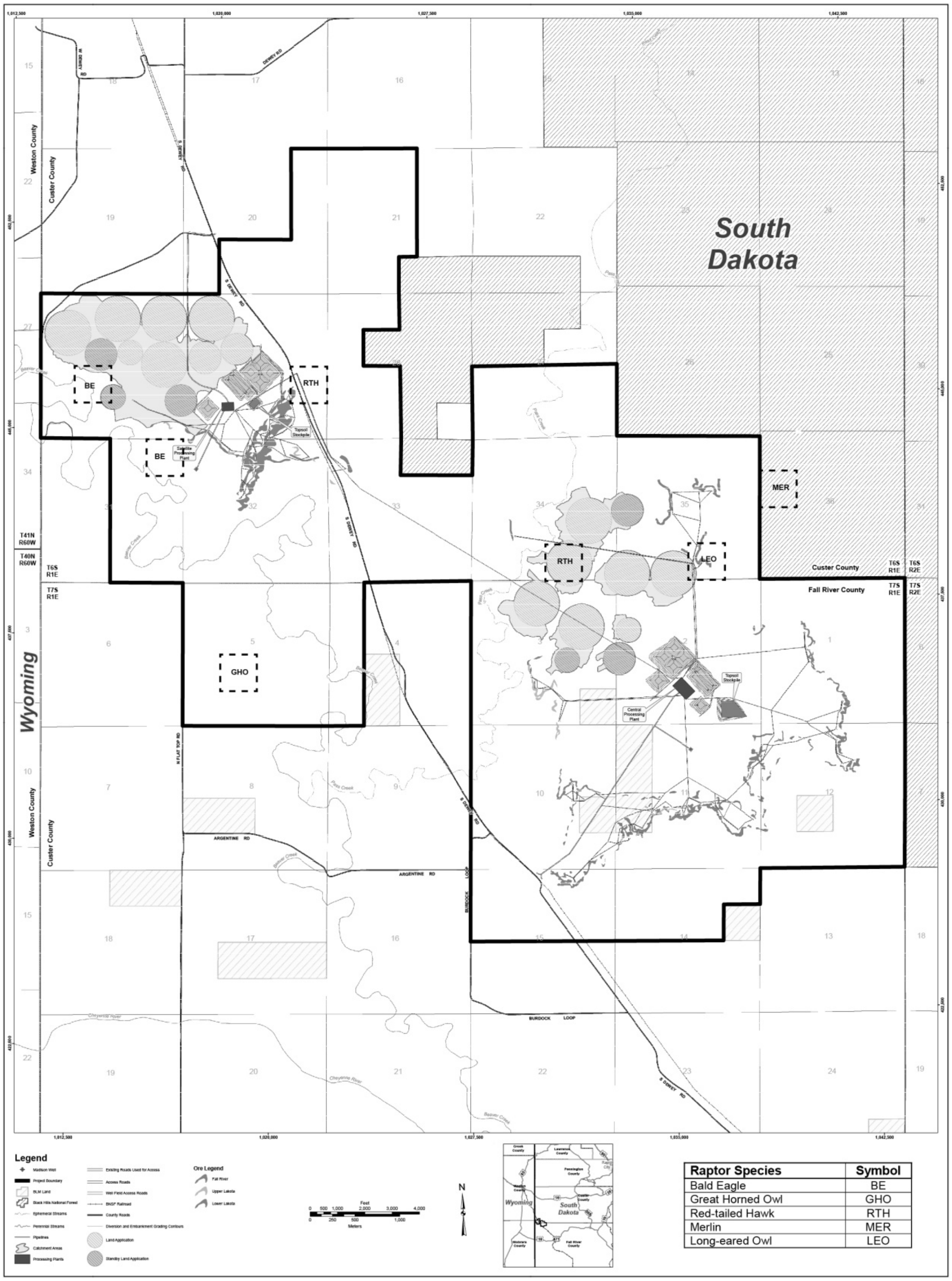

Figure 4.6-4. Map of Raptor Nest Locations in the Dewey-Burdock Project Area and Planned Facilities for the Land Application Option
Source: Powertech, 2012a

Because NRC staff expect the applicant or landowners to disturb the surface soil to plant crops in the irrigation areas, staff also expect an increase in potential soil erosion and sedimentation could impact surface water on and downstream from the site. Land application sites are located within 0.4 km [0.25 mi] of Beaver Creek within the Dewey area; however, ISR construction activities are not expected to significantly affect surface water quality unless irrigation activities cross over into jurisdictional waters. In addition, the applicant has committed to implementing mitigation measures to control erosion, stormwater runoff, and sedimentation (SEIS Section 4.5.1.1). Because the applicant does not plan to disturb any additional water bodies and perennial streams within the proposed project area (Powertech, 2009a), NRC staff expect that aquatic species and amphibians will not be directly affected by construction of land application areas and expect impacts to be SMALL.

NRC staff expect the same mitigation measures will be followed for the land application option that were previously explained for the deep Class V injection well option. NRC staff conclude the additional amount of land that will be disturbed for construction under the land application disposal option is expected to noticeably alter, but not destabilize, the vegetation and important wildlife habitat that occur at the site. Therefore, the potential impact to ecological resources, including vegetation, upland game birds, raptors, waterfowl and shorebirds, nongame/migratory birds, other mammals, reptiles, and some protected and sensitive species, will be MODERATE from construction of the land application option. Because no federally threatened or endangered species are expected to occur in the project area, potential impacts to threatened or endangered species will be SMALL. NRC staff expect that construction impacts will not threaten any species' population or current existence.

4.6.1.2.2 Operations Impacts

Surface disturbance, including the application of waste water, will be the primary change to ecology during the operations phase of the proposed Dewey-Burdock ISR Project under the land application option. Wellfield expansion that will disturb approximately 56.7 ha [140 ac] of land during the operations phase will have similar impacts to vegetation wildlife impacts as expected during the operations phase for the deep Class V injection well option. Disturbance of land application areas (including operating and standby center pivot areas and catchment areas) totaling approximately 426 ha [1,052 ac] will have similar impacts on vegetation and wildlife as impacts expected to vegetation and wildlife during the construction phase of the land application option.

Potential exposure of wildlife to holding/settling pond constituents and potential failure of settling and holding pond liners or embankment systems will increase under the land application waste disposal option due the additional pond capacity. In addition, the GEIS identified the following potential land application impacts from operations related to ecology: (i) reduction in growth of vegetation due to soil salination; (ii) accumulation of contaminants, dissolved solids, and radionuclides in the root zone; and (iii) increased vegetation growth due to the increase of available water (NRC, 2009a).

According to SEIS Chapter 2, the irrigation pivots will operate 24 hours a day and irrigated areas will receive approximately 1,124 Lpm [297 gpm] from March 29 to May 10, approximately 2,472 Lpm [653 gpm] from May 11 to September 24, and approximately 1,124 Lpm [297 gpm] from September 25 to October 31. From November to March, land application will not be used and treated liquid waste will be temporarily stored in ponds located near the Burdock central plant and Dewey satellite facility (Powertech, 2011). Land application activities during operations under this option will have a similar land disturbance impact on wildlife as those expected during the construction phase because of the continuous disturbance from irrigation activities. NRC staff expect that few animals will inhabit the land application areas during continuous irrigation. NRC staff also expect that prey–predator relationships will be altered within the irrigation areas because of seasonal irrigation activities and may not return during the winter season when irrigation activities are not planned. Upland game birds, raptors, waterfowl and shorebirds, nongame and migratory birds, small- and medium-sized mammals, and reptiles will experience direct, long-term habitat loss and reduction in the carrying capacity during the operations phase of the land application option. Staff expect that in general, birds are mobile and able to relocate to other available regional habitat (SEIS Section 4.6.1.1.1.4). Temporary direct impacts to animals and nests could include disturbance from sprayed irrigation water that the wind carries outside of the land application areas.

During the uranium recovery process, the groundwater extracted from the production zone is enriched in uranium and other metals that are typically associated with uranium in nature. In the license application technical report, Tables 4.2-7, 7.3-8 (Powertech, 2009b), and in their state GDP (Powertech, 2012c, Table 5.8-2) the applicant describes the expected radiological constituents and estimated concentrations in wastewater for the proposed land application activities. The radiological constituents include natural uranium, radium-226, thorium-230, and lead-210. At NRC-licensed *in-situ* leach facilities, the licensee is required to monitor and control radiological constituents in effluents to satisfy limits in 10 CFR Part 20, Appendix B, and irrigation areas to maintain levels of radioactive constituents within allowable release standards outlined in 10 CFR Part 40, Appendix A both during and after disposal by land application (NRC, 2009a). As stated in SEIS Section 2.1.1.1.6.2 for radiological emissions, the applicant proposes regular monitoring of air, soil, biomass (i.e., crops and livestock), surface water, and groundwater to identify the presence of NRC- and SDDENR-regulated constituents. The applicant's proposed land application monitoring program is described in SEIS Section 7.5. Monitoring results must be reported to NRC semiannually (see SEIS Chapter 7).

In the license application technical report (Powertech, 2009b, Tables 4.2-7 and 7.3-8) and in its South Dakota GDP (Powertech, 2012c, Table 5.8-2), the applicant described the expected chemical constituents and estimated concentrations in wastewater for the proposed land application activities. The list of chemical constituents includes arsenic, barium, cadmium, chromium, lead, and selenium. The NRC staff evaluated the toxicity of the proposed wastewater solutions and the potential for proposed land application activities to impact wildlife. Selenium, in particular, was identified by the FWS as a constituent of concern in ISR wastewater because of low wildlife health effects thresholds in some sensitive species when compared with concentrations of selenium measured in ISR wastewater (FWS, 2007). The wildlife health effects thresholds described here establish the concentration of a chemical in water that is known to cause health effects in wildlife based on scientific studies.

The NRC staff compared the applicant's estimated wastewater concentrations with EPA chronic (long-term) exposure-based water quality criteria (guidance) established for the protection of aquatic life and found the estimated concentrations of cadmium, chromium, lead, and selenium exceed the EPA criteria. The applicant's estimated concentrations of both cadmium and lead also exceed the acute (short-term) exposure-based EPA water quality aquatic life criteria (EPA, 2013a). Additionally, the applicant's estimated concentrations of selenium exceed levels referenced by FWS (2007) as hazardous to aquatic birds. Based on this comparison, the NRC staff concludes that direct chronic and acute exposure of sensitive species to the applicant's estimated cadmium, lead, and selenium concentrations in wastewater could adversely impact exposed individuals.

However, the NRC staff considers such chronic direct wildlife exposure to undiluted wastewater unlikely because the applicant's proposed wastewater controls (e.g., pond design, spill and leak detection and mitigation, pressure monitoring, runoff control and mitigation) and SDDENR permitting requirements limit direct contact that aquatic life and terrestrial wildlife will have with wastewater solutions. The SDDENR controls include limiting access to wastewater with fencing, implementing an avian protection plan for pond operations, and requiring no-runoff and no-ponding conditions for land application. These controls would limit direct terrestrial wildlife exposures and migration of wastewater to aquatic life habitat areas such as nearby surface water.

Wastewater storage ponds present an additional opportunity for wildlife, primarily migratory birds, to have direct contact with wastewater solutions. The only detailed wildlife field study of an ISR wastewater irrigation system observed only limited use of a wastewater storage reservoir by birds (FWS, 2000b). In the event that additional treatment to lower wastewater constituent concentrations or additional access controls for ponds are needed to protect wildlife, SDDENR has the authority to require these actions be implemented by the applicant.

While direct wastewater exposures will be limited, as noted in the GEIS and draft SEIS, land application could lead to accumulation of trace metal constituents in soils. The NRC staff evaluated the applicant's estimated steady-state soil concentrations of trace metals from proposed land application with published EPA ecological soil screening guidance levels (Eco SSLs) (EPA, 2010). Eco-SSLs were developed to support screening analyses to identify potential ecological concerns at superfund sites that may need further, more detailed evaluation (e.g., ecological risk assessment). While Eco-SSLs were developed for superfund sites, EPA envisions that any federal, state, tribal, or private environmental assessment can use the values to screen soil contaminants (EPA, 2003). The applicant's estimated steady-state soil concentrations of trace metals (Powertech, 2009b, Table 7.3-8) exceeded EPA Eco-SSLs for cadmium, lead, and selenium. This analysis suggests the land application activities described by the applicant have the potential to accumulate specific trace metal constituents in soils at levels that could impact wildlife. Soil constituents can also be taken up in plants. They may remobilize and transport to nearby surface water and shallow groundwater; even though transport of these constituents will involve dilution. In sum, plants, groundwater, and surface water containing concentrations of trace metals provide additional routes of exposure to wildlife.

The SDDENR mine permit will establish monitoring requirements and action levels for trace metal concentrations in soils, vegetation, surface water, and groundwater that are protective of the environment. The SDDENR will review monitoring data and impose corrective actions if action levels are exceeded. Additionally, SDDENR will evaluate the environmental fate and transport of land-applied wastewater in detail (including environmental concentrations, pathways and food chains, bioaccumulation) prior to operation as part of its permitting and oversight processes. If SDDENR finds the waste management activities could impact wildlife, it will impose additional conditions on the applicant to mitigate impacts and protect the environment.

In summary, some of the chemical constituent concentrations in proposed wastewater solutions and in land application area soils estimated by applicant exceed levels known to cause impacts to wildlife. NRC staff conclude that impacts to individual animals are possible even with the practices proposed by the applicant and the SDDENR regulatory controls that will be imposed by permit conditions, which include, monitoring, setting action levels, and requiring corrective actions if those controls do not limit all direct exposures to undiluted wastewater solutions. However, the NRC concludes the direct exposure of wildlife to wastewater solutions will be limited and that, under current regulatory controls, environmental concentrations of wastewater constituents are unlikely to reach levels that would lead to destabilization of wildlife populations.

The NRC staff conclude the overall impact on vegetation, small- to medium-sized mammals, upland game birds, raptors, waterfowl and shorebirds, nongame and migratory birds, and reptiles from operations for the land application liquid waste disposal option will be MODERATE because of the potential for some wildlife exposures to harmful constituents and the planned 8-year operation period that will alter approximately 426 ha [1,052 ac] of vegetation, wildlife distribution, and wildlife habitat. Based on the foregoing analysis, the impacts are expected to noticeably alter important attributes of the terrestrial environment; however, staff do not expect these impacts to threaten the continued existence of any species.

Because the land application option will not disturb any additional water bodies and perennial streams within the proposed project area (Powertech, 2009a), and land application treated wastewater will be controlled to avoid runoff, staff expect that aquatic habitat will not be directly affected by land application activities and potential impacts to aquatic species and amphibians will be SMALL. For the same reasons explained for construction impacts on big game from the land application option, staff expect potential operations impacts to big game from operations during the land application option to be SMALL.

4.6.1.2.3 Aquifer Restoration Impacts

During aquifer restoration, potential impacts to ecological resources for the land application liquid waste disposal option at the proposed Dewey-Burdock ISR Project will remain similar to those described previously for the operations phase. Planned activities using existing infrastructure during the aquifer restoration phase are described in SEIS Section 4.2.1.2.3. NRC staff expect land application activities to continue during the aquifer restoration phase. Because construction and drilling equipment are not used during the aquifer restoration phase, NRC staff expect impacts from human presence, noise, and wildlife mortalities from equipment to decrease compared to human presence, noise, and wildlife mortalities expected during the operations phase. The expected liquid waste flow rates for the entire project will be approximately 2,070 Lpm [547 gpm] during concurrent uranium production and aquifer restoration and approximately 1,892 Lpm [500 gpm] during aquifer restoration alone (SEIS Section 2.1.1.1.4.1.2).

As with the operations phase, impacts to potential land application areas during aquifer restoration will be mitigated by implementing a monitoring program and maintaining levels of radiological contaminants in treated waste water to allowable release limits contained in 10 CFR Part 20, Appendix B (Powertech, 2009a, 2011) and chemical constituents in compliance with state requirements and permit conditions. Considering the potential for some wildlife exposures to harmful constituents and the continued alteration of approximately 426 ha [1,052 ac] of vegetation, wildlife distribution, and wildlife habitat, the NRC staff conclude that the overall potential impacts to vegetation, small- to medium-sized mammals, raptors, upland game birds, waterfowl and shorebirds, nongame and migratory birds, and reptiles will remain MODERATE. Based on the projected magnitude of expected liquid waste flow rates during aquifer restoration relative to operations, the potential impacts to big game, aquatic species, and amphibians during the aquifer restoration phase will not increase beyond those of the operations phase and will therefore be SMALL.

4.6.1.2.4 Decommissioning Impacts

Staff expect the potential ecological impacts of decommissioning for the land application liquid waste disposal option will be similar to those described in SEIS Section 4.6.1.1.4 for the deep Class V injection well disposal option, including increased human presence, noise, and construction and field equipment. In addition to those activities planned for decommissioning under the deep Class V injection well disposal option, irrigation area pipelines, access roads, and larger pond areas will be directly impacted under the land application disposal option as explained in SEIS Section 4.6.1.2.1.

The dismantling of the proposed project facilities, piping, infrastructure, and roads and reseeding and recontouring will have fewer ecological impacts than those experienced during the construction phase due to continuous revegetation efforts during the ISR lifecycle. SDDNER recommends that the large-scale mine permit require (i) the collection of baseline vegetation data within land application areas; (ii) concurrent and interim reclamation in all areas where mining or land disturbance is completed; (iii) that revegetation success be equivalent to vegetative cover in reference areas using SDDENR-approved statistical methods; and (iv) that a post closure bond be held for 30 years after the reclamation bond is released to help ensure revegetation success. However, final permit conditions may change based on the final determination by the South Dakota hearing board. Noise, vehicle and equipment use, and human presence will increase to levels similar to those experienced during the construction phase and for the same expected amount of time (2 years). For these reasons, NRC staff conclude there will be a MODERATE impact on vegetation, small- to medium-sized mammals, raptors, upland game birds, waterfowl and shorebirds, nongame and migratory birds, and reptiles from decommissioning and reclamation under the land application liquid waste disposal option until vegetation has been reestablished and preconstruction wildlife populations return to the area. For the same reasons explained in SEIS Section 4.6.1.1.4, potential impact to big game, aquatic species, and amphibians will remain SMALL from decommissioning under the land application option for the proposed project.

4.6.1.3 Disposal Via Combination of Class V Injection and Land Application

For the combined deep Class V injection well disposal and land application option, land application facilities and infrastructure will be constructed, operated, restored, and decommissioned on an as-needed basis depending on the Class V injection well disposal capacity (Powertech, 2011). For the reasons explained in SEIS Section 4.2.1.3 for operations impacts to land use under the land application option, the significance of impacts that could impact either vegetation or wildlife populations for the combined disposal option will be less than for the land application option but greater than for the deep Class V injection well disposal option, as reflected in Table 4.6-5. Therefore, NRC staff conclude that the ecological impacts of the combined deep Class V injection well and land application disposal option for each phase of the proposed Dewey-Burdock ISR Project will bound the significance of ecological impacts of the deep Class V injection well option and the land application option.

Table 4.6-5. Significance of Ecological Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

	Class V Injection Wells	Land Application	Combined Class V Injection Wells and Land Application*
Construction	SMALL for vegetation, terrestrial, and aquatic species	MODERATE for vegetation, small- to medium-sized mammals, raptors, waterfowl and shorebirds, upland game birds, nongame and migratory birds, and reptiles SMALL for big game, aquatic species, amphibians	SMALL to MODERATE for vegetation, terrestrial, and aquatic species
Operations	SMALL for vegetation, terrestrial, and aquatic species	MODERATE for vegetation, small- to medium-sized mammals, raptors, waterfowl and shorebirds, upland game birds, nongame and migratory birds, and reptiles SMALL for big game, aquatic species, amphibians	SMALL to MODERATE for vegetation, terrestrial, and aquatic species
Aquifer Restoration	SMALL for vegetation, terrestrial, and aquatic species	MODERATE for vegetation, small- to medium-sized mammals, raptors, waterfowl and shorebirds, upland game birds, nongame and migratory birds, and reptiles SMALL for big game, aquatic species, amphibians	SMALL for aquatic species and amphibians; SMALL to MODERATE for vegetation and terrestrial species
Decommissioning	MODERATE before vegetation is reestablished SMALL after vegetation is reestablished	MODERATE before vegetation is reestablished SMALL after vegetation is restablished	MODERATE before vegetation is reestablished SMALL after vegetation is reestablished
*Significance of environmental impact for the combined disposal option is bounded by the significance of environmental impacts for the Class V injection well disposal and land application disposal options.			

4.6.2 No-Action (Alternative 2)

Under the No-Action alternative, there will be no ISR facility construction, operations, aquifer restoration, or decommissioning associated with this project; therefore, there will be no land disturbance from the proposed action that could impact either vegetation or wildlife populations. The area will continue to sustain vegetation communities and wildlife habitat typical of the region, as characterized in SEIS Section 3.6. Land will continue to be used for livestock grazing. Grazing of existing vegetation, particularly the grassland communities, will continue. Wildlife within the proposed license area could be affected by ongoing grazing if species were displaced by cattle populations due to lack of forage and cover; however, there will be no impacts to ecological resources from the proposed Dewey-Burdock ISR Project under the No-Action alternative.

4.7 Air Quality Impacts

As described in GEIS Section 4.4.6, potential environmental impacts to air quality could occur during all phases of the ISR facility lifecycle (NRC, 2009a). Nonradiological air emission impacts primarily involve fugitive road dust from vehicles traveling on unpaved roads and combustion engine emissions from vehicles and diesel equipment. In general, any nonradiological emissions from pipeline system venting, resin transfer, and elution will be expected to be at such low levels that they will be negligible Such emissions were not considered in the analysis. Radon could also be released from well system relief valves, resin transfer, or elution. Potential radiological air impacts, including radon release impacts, are addressed in the Public and Occupational Health and Safety Impacts analyses in SEIS Section 4.13.

Factors NRC staff used in determining the magnitude of the potential impacts are described in GEIS Section 4.4.6 (NRC, 2009a) and include whether (i) the air quality of the site's region of influence (ROI) is in compliance with the National Ambient Air Quality Standards (NAAQS), (ii) the facility can be classified as a major source under the New Source Review or operating (Title V of the Clean Air Act) permit programs, and (iii) the presence of Prevention of Significant Deterioration (PSD) Class I areas within the region could be impacted by emissions from the proposed action.

<u>GEIS Construction Phase Summary</u>

As discussed in GEIS Section 4.4.6.1, fugitive dust and combustion (vehicle and diesel equipment) emissions during land-disturbing activities associated with construction will be expected to be short term and reduced through BMPs (e.g., wetting of roads and cleared land areas to reduce dust emissions). Estimated ISR-construction-phase fugitive dust annual concentrations used in the GEIS are expected to be well below the $PM_{2.5}$ NAAQS. Additionally, particulate, sulfur dioxide, and nitrogen dioxide concentration estimates used in the GEIS are expected to be below PSD Class II allowable increments (1 to 9 percent) and the stricter Class I increments (7 to 84 percent). NRC staff concluded in the GEIS that for NAAQS attainment areas, nonradiological impacts will be SMALL. (NRC, 2009a)

<u>GEIS Operations Phase Summary</u>

GEIS Section 4.4.6.2 stated that operating ISR facilities are not major point source emitters and are not expected to be classified as major sources under the operation (Title V) permitting program. The GEIS states that the primary nonradiological emissions during operations include fugitive dust and combustion products from equipment, maintenance, transport trucks, and other vehicles. Additionally, NRC staff concluded in the GEIS that any nonradiological emissions from pipeline system venting, resin transfer, and elution will be expected to be at such low levels that they will be negligible and were not considered in the analysis. For NAAQS attainment areas, NRC staff concluded in the GEIS that nonradiological air quality impacts will be SMALL. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

As described in GEIS Section 4.4.6.3, because the same infrastructure will be used during the aquifer restoration as during operations, air quality impacts from aquifer restoration will be similar to, or less than, those during operations. Additionally, fugitive dust and combustion emissions from vehicles and equipment during aquifer restoration will be similar to, or less than, the dust and combustion emissions during operations. For NAAQS attainment areas, NRC staff concluded in the GEIS that nonradiological air quality impacts will be SMALL. (NRC, 2009a)

GEIS Decommissioning Phase Summary

As discussed in GEIS Section 4.4.6.4, fugitive dust, vehicle emissions, and diesel emissions during land-disturbing activities from the decommissioning phase will come from many of the same sources as the construction phase. In the short term, emission levels are expected to increase given the activity (i.e., demolishing of process and administrative buildings, excavating and removing contaminated soils, and grading of disturbed areas). However, such emissions will be expected to decrease as decommissioning proceeds, and therefore, overall, impacts will be similar to, or less than, those associated with construction; will be short term; and will be reduced through BMPs (e.g., dust suppression). NRC staff concluded in the GEIS that for NAAQS attainment areas, nonradiological impacts will be SMALL. (NRC, 2009a)

Potential environmental impacts on air quality during construction, operations, aquifer restoration, and decommissioning phases of the proposed Dewey-Burdock ISR Project are discussed in the following sections. The discussion also addresses the impacts on air quality during the peak year. The peak year accounts for the time when all four phases occur simultaneously and represents the highest amount of emissions the proposed action will generate in any 1 year. The applicant identifies 2 years when all four phases will occur simultaneously and 7 years when construction and operation phases will occur simultaneously (Powertech, 2012d). Appendix C describes nonradiological air emissions information for the proposed project including emission inventories and air dispersion modeling.

4.7.1 Proposed Action (Alternative 1)

As described in SEIS Section 3.7.2, the air quality of the Black Hills-Rapid City Intrastate Air Quality Control Region, where the proposed Dewey-Burdock ISR Project is located, is designated as an attainment area for all NAAQS pollutants and is located in a Class II area for PSD designation. The nearest PSD Class I area, Wind Cave National Park, located about 47 km [29 mi] northeast of the proposed Dewey-Burdock ISR Project, is also located in this same air quality control region and is also classified as an attainment area. The attainment status of the air quality surrounding the proposed license area provides a measure of current air quality conditions and affects considerations for allowing new emission sources.

While NRC is responsible for assessing the potential environmental impacts from the proposed action pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended, NRC does not have the authority to develop or enforce regulations to control nonradiological air emissions from equipment licensees use. For the proposed Dewey-Burdock ISR Project, this authority rests with SDDENR. To ensure the air quality of South Dakota is adequately protected, in addition to addressing all NRC regulatory requirements for radiological emissions, NRC applicants and licensees must comply with all applicable state and federal air quality regulatory compliance and permitting requirements.

The applicant submitted an air quality application to SDDENR in November, 2012 (see Table 1.6-1). Based on the information in the application, SDDENR determined that an air permit will not be required and the proposed project will not be subject to PSD requirements (SDDENR, 2013b). SDDENR's review of the applicant's air quality application included an assessment of potential greenhouse gas emissions relative to the 90,718 metric tons [100,000 short tons] standard identified in SEIS Section 3.7.2. This regulatory determination conducted by the SDDENR did not include mobile and fugitive sources as categorized in this SEIS (see Table 2.1-5). Since mobile and fugitive sources compose the majority of the project emissions, NRC staff determined that the SEIS analysis would include mobile and fugitive emission sources, as well as stationary sources. NRC staff will characterize the magnitude of air effluents from the proposed project throughout SEIS Section 4.7.1, in part, by comparing (i) the emission levels to PSD and Title V thresholds and (ii) the modeled concentrations to regulatory standards such as NAAQS. This characterization is meant to provide a context for understanding the magnitude of the proposed project's air effluents, which are mostly from mobile and fugitive sources rather than stationary sources. The NRC analysis in this SEIS is for disclosure purposes and does not document or represent the formal SDDENR determination. This is an important distinction to remember when considering the analysis in this SEIS.

The air impact analysis includes two types of modeling: AERMOD and CALPUFF. The AERMOD dispersion model was used to predict NAAQS and PSD pollutant concentrations and the CALPUFF model was used to generate Air Quality Related Values for Wind Cave National Park. The two types of modeling results and associated analyses will be discussed separately. Additional information concerning the Dewey-Burdock emission inventory, the modeling protocol, and the results for both the AERMOD and CALPUFF analyses is available in the Ambient Air Quality Final Modeling Protocol and Impact Analysis (IML, 2013a).

The model options and approach for the air quality impact assessment selected by NRC staff in this EIS do not completely align with EPA's guidelines on air quality models (40 CFR Part 51, Appendix W). Specifically, deviations from the regulatory default options are utilized. For example, the dry depletion option is used in the AERMOD analysis. The dry depletion option accounts for the partial settling and deposition of PM_{10} particles as the dust plume disperses away from the source. Similarly, the PM_{10} emission is not included in the CALPUFF analysis. NRC determined that it is appropriate to use dry depletion in the AERMOD analysis and exclude PM_{10} from the CALPUFF analysis for three main reasons. First, the nature of the project specific emission supports this decision (i.e., over 99 percent of the fugitive dust emissions are from ground-level emission sources where rapid deposition is expected). Second, modelingusing the regulatory default options can overestimate short-term PM_{10} impacts because the rapid deposition phenomenon is not adequately addressed. Third, EISs for coaland gas development in the western United States address PM_{10} emission in this same manner (TRC Environmental Corporation, 2006; Marquez Environmental Services, Inc., 2010).

SEIS Appendix C Section C.2.3 and Sections 3.2 and 3.9 of the Ambient Air Quality Final Modeling Protocol and Impact Analysis discuss these rationales in greater detail.

The guideline in 40 CFR Part 51, Appendix W is used by EPA, States, and industry to prepare and review new source permits and State Implementation Plan revisions. This guideline recognizes the need to accommodate deviations from default conditions on a case-by-case basis to ensure accuracy. However, the guideline states that such deviations should be fully supported. Staff from EPA, SDDENR, and the Bureau of Land Management participated in the development of the protocol for this SEIS analysis. During the protocol development, EPA in particular expressed a strong preference for the SEIS impact analysis to rely on modeling that did not deviate from regulatory default options. For informational purposes only, at the end of impact assessment for each phase, NRC staff will present the impact analysis using the PM_{10} modeling results that do not implement the AERMOD dry depletion option as well as include the PM_{10} emission in the CALPUFF visibility analysis. However, The NRC staff based its impact analyses (i.e., SMALL, MODERATE, or LARGE) in the SEIS on modeling that deviates from regulatory default options noting the reasons why the staff chose this option.

Expressing the proposed project's emissions in concentrations can help in characterizing the magnitude of the emission levels because thresholds, such as NAAQS and PSD increments, are also expressed in concentrations. The AERMOD dispersion model was used to predict pollutant concentrations at a total of 4,220 receptors that extend in all directions from the project site and fully encompass Wind Cave National Park, the nearest Class I area. Figures 4.7-1 and 4.7-2 display the AERMOD receptor placement (i.e., locations where pollutant concentrations were estimated). The spacing between the receptors is not uniform across the model domain. In general, the receptor spacing is larger as the distance from proposed Dewey-Burdock site increases. The model domain includes fenceline, hot spot grid, intermediate grid, and coarse grid receptors. Fenceline receptors at the proposed Dewey-Burdock site boundary were placed at least every 100 m [109.4 yd] with a receptor placed at each boundary corner. For the hot spot grid, receptors were placed at 100-m [109.4-yd] spacing within a 500-m [546.8-yd] wide corridor along the western and southern portions of the project boundary and along the public road accessing the proposed site. The inclusion of the hot spot grid receptors is based on the initial modeling that predicts that high 24-hour PM_{10} values will be limited to this corridor. The modeling domain consists of two intermediate grids. For the first intermediate grid, receptors were placed at 500-meter [546.8-yard] spacing from the project fenceline outward to a distance of 5 km [3.11 mi] in all directions from the project center. For the second intermediate grid, receptors were placed at 1-km [0.62-mi] spacing from the outer edge of the first intermediate grid in all directions to a distance of 15 km [9.32 mi] from the project center. Figure 4.7-2 displays the receptor placement of project fenceline, hot spot grid, and intermediate grids. The modeling domain consists of two coarse grids. For the first coarse grid, receptors were placed at 5-km spacing [3.11-mi] from the outer edge of the second intermediate grid outward in all directions to a distance of 35 km [21.7 mi] from the project center. For the second coarse grid, receptors were placed at 10-km [6.21-mi] spacing from the outer edge of the first coarse grid in all directions to a distance of 55 km [34.2 mi] from the project center. Figure 4.7-1 displays the receptor placement of the coarse grids as well as the second intermediate grid. In addition, 44 fenceline receptors were placed at roughly uniform spacing around the Wind Cave National Park boundary.

The modeling was conducted for the peak year emission inventory (see Table 2.1-5) and included stationary (see Table 2.1-1), mobile (see Table 2.1-2), and fugitive dust (see Table 2.1-3) sources. Although the modeling was conducted using one year of emission data

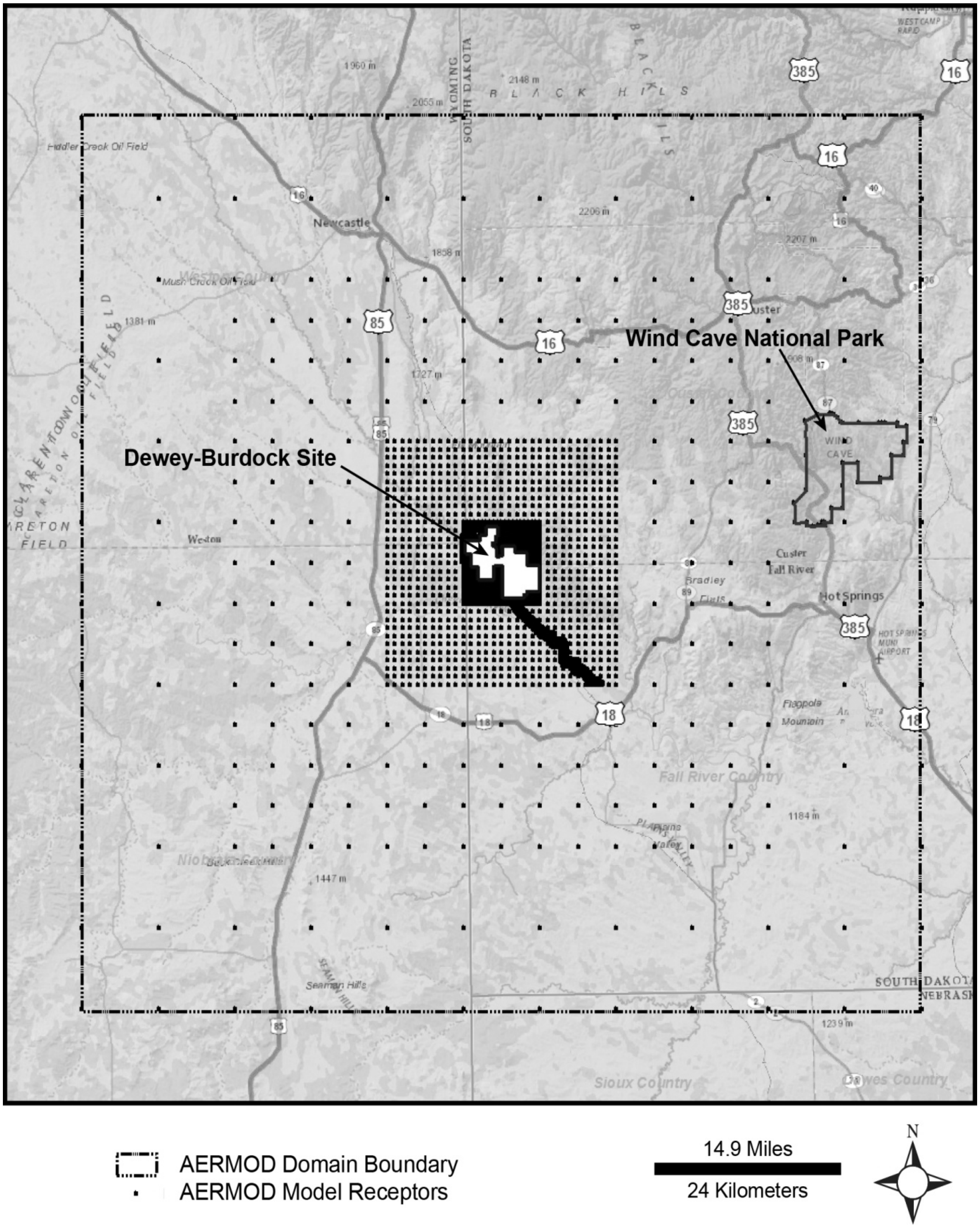

Figure 4.7-1. Macroscale View of Locations Where National Ambient Air Quality Standards and Prevention of Significant Deterioration Air Pollutant Estimates (Concentrations) Were Calculated Using the AERMOD Dispersion Model
Source: Modified From IML (2013a)

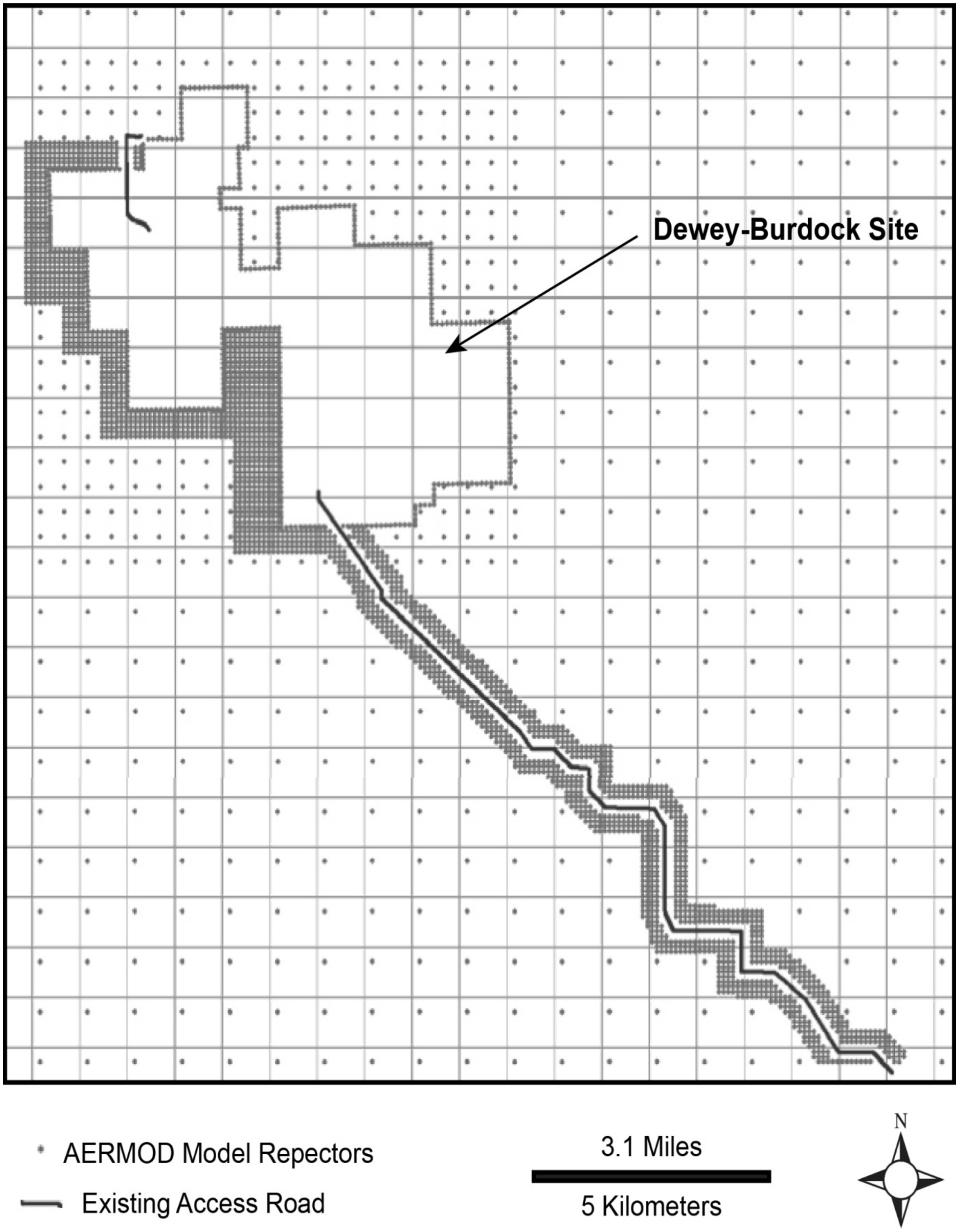

Figure 4.7-2. Microscale View of Locations Where National Ambient Air Quality Standards and Prevention of Significant Deterioration Pollutant Estimates (Concentrations) Were Calculated Using the AERMOD Dispersion Model Source: Modified From IML (2013a)

(i.e., the peak year), the model uses three years of hourly meteorological data. EPA recommends that AERMOD be run with a minimum of three years of meteorological data (IML, 2013a). Table 4.7-1 presents the AERMOD modeling results with respect to the NAAQS and Table 4.7-2 presents the results with respect to the PSD increments. The NAAQS and PSD thresholds are described in SEIS Section 3.7.2. As described in the notes for Table 4.7-1, the model results form for the NO_2 annual and SO_2 3 hour values are not the same as the NAAQS form. The form expresses both the statistic (e.g., maximum, average, 98th percentile, etc.) and the time period (e.g., once per year, over one year, over 3 years, etc.) associated with a value. As described in the notes for Table 4.7-2, none of the model results forms are the same as the PSD increments forms. The lack of continuity between the model results form and the NAAQS and PSD increment forms, as well as the values used to represent project level concentrations, is addressed in SEIS Appendix C, Section C2.3.1. Additional information concerning the emission inventory, AERMOD modeling protocol, and results is available in the Ambient Air Quality Final Modeling Protocol and Impact Analysis (IML, 2013a).

Protection of Class I air quality is not limited to consideration of PSD Class I increments. As described in SEIS Section 3.7.2, the Air Quality Related Values of visibility and acid deposition are also used to characterize the air quality at Class I areas. Evaluation of the impacts on the Air Quality Related Values at Wind Cave National Park was conducted using the CALPUFF model. Figure 4.7-3 identifies the CALPUFF modeling domain. In order to adequately characterize the Air Quality Related Values impacts to Wind Cave National Park, the modeling domain extended 100 km [62 mi] in all directions from the proposed project area, which includes a 50-km [31-mi] buffer around the Class I area to provide meteorological model continuity. Although the modeling domain is large, the 192 model receptors are located only within the Wind Cave National Park itself as shown in Figure 4.7-4. The CALPUFF modeling was conducted for the peak year emission inventory (see Table 2.1-5) and included stationary (see Table 2.1-1), mobile (see Table 2.1-2), and fugitive dust (see Table 2.1-3) sources.

Although the modeling was conducted using one year of emission data (i.e., the peak year), the model uses three years of hourly meteorological data. Modeled emission sources and emission rates are identical to those used in the AERMOD modeling. The visibility impacts are modeled

Table 4.7-1. Nonradiological Concentration Estimates (i.e., AERMOD Modeling Results) From Stationary, Mobile, and Fugitive Sources for the Peak Year* Compared to the National Ambient Air Quality Standards (NAAQS)

Pollutant	Averaging Time	Modeling Results Form†	Modeling Results (ug/m^3)	Background Concentration (ug/m^3)	Total Concentration (ug/m^3)	NAAQS Limit (ug/m^3)	% of NAAQS Limit
Carbon Monoxide	1 hour	Not to be exceeded more than once per year	2101.1	1097.3	3198.4	40000	8.0
	8 hour	Not to be exceeded more than once per year	262.6	315.5	578.1	10000	5.8
Nitrogen Dioxide	1 hour	98^{th} percentile, averaged over 3 years	156.9	5.6	162.5	187	86.9
	Annual	Annual mean‡	3.3	0.4	3.7	100	3.7
Particulate Matter $PM_{2.5}$	24 hour	98^{th} percentile, averaged over 3 years	6.9	10.9	17.8	35	50.9

Table 4.7-1. Nonradiological Concentration Estimates (i.e., AERMOD Modeling Results) From Stationary, Mobile, and Fugitive Sources for the Peak Year* Compared to the National Ambient Air Quality Standards (NAAQS) (Cont'd)

Pollutant	Averaging Time	Modeling Results Form†	Modeling Results (ug/m^3)	Background Concentration (ug/m^3)	Total Concentration (ug/m^3)	NAAQS Limit (ug/m^3)	% of NAAQS Limit
	Annual	Annual mean, averaged over 3 years	1.0	4.8	5.8	12§	48.3
Particulate Matter PM_{10} Initial Run‖	24 hour	Not to be exceeded more than once per year on average over 3 years	187.2	41.0	228.2	150	152.1
Particulate Matter PM_{10} Final Run¶	24 hour	Not to be exceeded more than once per year on average over 3 years	83.6	41.0	124.6	150	83.1
Sulfur Dioxide	1 hour	99th percentile of 1-hour daily maximum concentrations	48.3	15.7	63.9	200	31.9
	3 hour	Not to be exceeded more than once per year#	100.1	20.9	121.0	1300	9.3

Source: Modified from IML (2013a) and Powertech (2013c)
*Peak year accounts for when all four phases occur simultaneously and represents the highest amount of emission.
†the form expresses both the statistic (e.g., maximum, average, or 98th percentile) and the time period (e.g., once per year, over one year, or over 3 years) associated with the numerical value. Unless otherwise noted, the modeling results form and the NAAQS form are the same.
‡Initial modeling form (maximum annual average over a three year period) is not the same as the NAAQS form (maximum annual average over a single year). The value in this table has a form that matches the NAAQS form and was calculated from the initial model result as described in Appendix C Section C2.3.
§The table identifies the primary standard limit. The secondary standard limit is larger (i.e., 15 μg/m^3). Results that meet the primary standard will automatically meet the secondary standard.
‖Initial modeling run without dry depletion for all receptor locations.
¶Final modeling run with dry depletion for the top 50 receptor locations.
#The model result form (the highest value over any single calendar year) is not the same as the prevention of significant deterioration increment form (not to be exceeded more than once per year). The value in this table has a form that matches the NAAQS form and was calculated from the initial model result as described in Appendix C, Section C2.3.

under two scenarios. The first scenario includes the coarse particulate matter (i.e., PM_{10}) when computing the results and the second scenario excludes the PM_{10} from the computation. Project emission of fine particulate matter (i.e., $PM_{2.5}$) is included in both scenarios. The reason for the second scenario is to account for the settling and deposition of heavier particles as the dust plume dissipates from the source. NRC staff will base the impact analyses in this SEIS on the second scenario, which excludes the PM_{10} emissions from the computation. The rationale for the exclusion of the PM_{10} emissions from the computation is presented in Appendix C Section C2.3.1. For information purposes, NRC staff will also present the impact analysis for the first scenario, which includes the PM_{10} emissions in the analysis. The acid deposition impacts are modeled under one scenario using the complete emission inventory. Acid deposition impacts are modeled as the deposition of a variety of compounds containing nitrogen and sulfur. The sulfur dioxide and nitrogen oxides emissions from the proposed project constitute the potential sources of acid deposition.

Table 4.7-2. Nonradiological Concentration Values From Stationary, Mobile, and Fugitive Sources for the Peak Year* Compared to the Prevention of Significant Deterioration (PSD) Increments

Pollutant	Averaging Time	PSD Increment Form†	Class I			Class II		
			Value‡ (μg/m³)	Increment (μg/m³)	Percentage of PSD Increment	Value‡ (μg/m³)	PSD Increment (μg/m³)	Percentage of PSD Increment
Nitrogen Dioxide	Annual	Not to be exceeded during the year at any one location	0.03	2.5	1.2	3.3	25	13.2
Particulate Matter $PM_{2.5}$	24 hour	Not to be exceeded more than once per year at any one location	0.45	2	22.5	7.9	9	87.8
	Annual	Not to be exceeded during the year at any one location	0.03	1	3.0	3	4	75
Particulate Matter PM_{10} Initial Run§	24 hour	Not to be exceeded more than once per year at any one location	8	8	100	187.2	30	624
	Annual	Not to be exceeded during the year at any one location	0.15	4	3.7	9.22	17	54.1
Particulate Matter PM_{10} Final Run‖	24 hour	Not to be exceeded more than once per year at any one location	3.6	8	45	83.126	30	279
	Annual	Not to be exceeded during the year at any one location	0.15	4	3.7	6.1	17	35.9
Sulfur Dioxide	3 hour	Not to be exceeded more than once per year at any one location	1.64	25	6.6	100.1	512	19.5
	24 hour	Not to be exceeded more than once per year at any one location	0.25	5	5	12.6	91	13.8

Table 4.7-2. Nonradiological Concentration Values From Stationary, Mobile, and Fugitive Sources for the Peak Year* Compared to the Prevention of Significant Deterioration (PSD) Increments (Cont'd)

Pollutant	Averaging Time	PSD Increment Form†	Class I Value‡ ($\mu g/m^3$)	Class I Increment ($\mu g/m^3$)	Class I Percentage of PSD Increment	Class II Value‡ ($\mu g/m^3$)	Class II PSD Increment ($\mu g/m^3$)	Class II Percentage of PSD Increment
	Annual	Not to be exceeded during the year at any one location	0.00	2	0	0.6	20	3

Source: Modified from IML (2013a and b) and Powertech (2013c)
*Year accounts for when all four phases occur simultaneously and represents the highest amount of emission the proposed action would generate in any one project year
†Form expresses both the statistic (e.g., maximum, average, 98th percentile, etc) and the time period (e.g., once per year, over 1 year, over 3 years, etc.) associated with the numerical value.
‡None of the forms for the modeling results (see Table C-10) are the same as the PSD increment forms. Values were generated as described in Appendix C, Section C2.3.1 to create numbers appropriate to comparison to PSD increments.
§Initial run without dry depletion for all receptor locations.
‖Final run with dry depletion for the top 50 receptor locations.

Table 4.7-3 presents the visibility analysis results and Table 4.7-4 presents the acid deposition analysis results. NRC staff considers comparing project emission levels to thresholds useful for characterizing the magnitude of the potential impacts. Both tables compare the project specific results to appropriate thresholds. The visibility analysis in Table 4.7-3 specifies a threshold parameter identified by EPA, U.S. Forest Service (USFS), and FWS. This threshold indicates that a visibility impact on a Class I area is considered significant when the source's contribution to visibility impairment, modeled as the 98th percentile of the daily (i.e., 24-hour), results in changes in deciviews that are equal to or greater than the contribution threshold of 0.5 deciviews (IML, 2013a). Expressed in another way, a source can be reasonably anticipated to cause or contribute to visibility impairment if the 98th percentile change in light extinction (i.e., the scattering of light) is greater than 0.5 deciviews.

Two different thresholds are presented in Table 4.7-4 for comparison to the project acid deposition results. The first threshold is a concern threshold, also called the Deposition Analysis Threshold, established by USFS. Below this threshold, deposition impacts from a source are considered negligible (IML, 2013a). The second threshold is the estimated critical loads for Wind Cave National Park. The term critical load describes the threshold of air pollution deposition below which significant harmful effects on sensitive resources in an ecosystem are not expected to occur. The critical load threshold is an emerging guideline to help in the protection of Class I areas. Table 4.7-4 also presents the measured deposition rates at Wind Cave National Park. Additional information concerning these thresholds is available in the Ambient Air Quality Final Modeling Protocol and Impact Analysis (IML, 2013a).

The NRC staff conclude that the site-specific conditions at the proposed Dewey-Burdock ISR Project are not bounded by those described in the GEIS for air quality. The estimated emission levels and associated pollutant concentrations for the proposed project described in SEIS Section 2.1.1.1.6.1.1 are greater than those cited in GEIS Table 2.7-2 (NRC, 2009a). The pollutant with the highest emission level for the proposed action is particulate matter PM_{10} with most being generated in the construction phase (see Table 2.1-3). The GEIS estimates that the construction phase an ISR facility generates an annual fugitive dust concentration of 0.28 $\mu g/m^3$ based on a 10.0 metric ton emission level (NRC, 2009a). This estimate did not categorize the

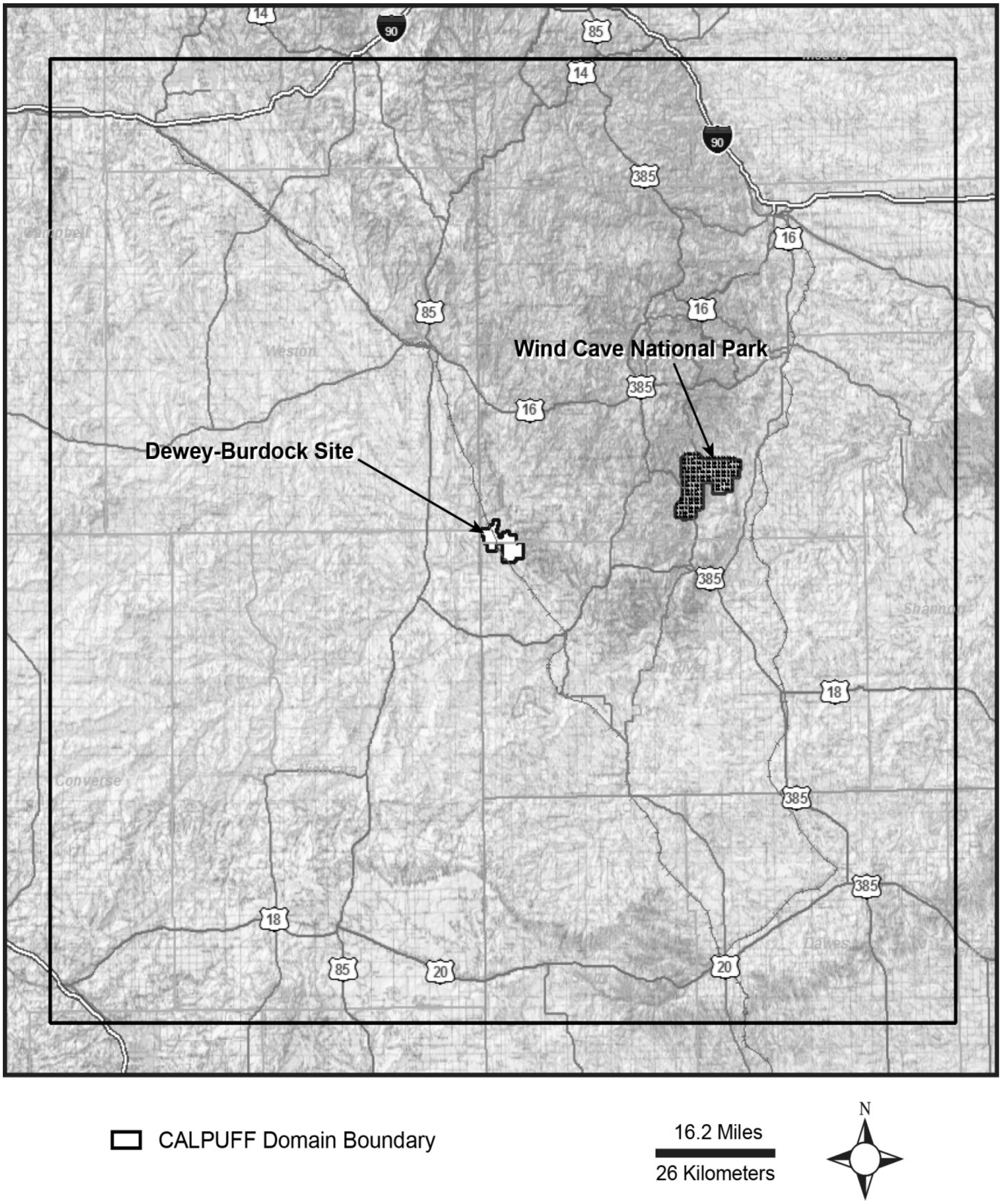

Figure 4.7-3. View of Dewey-Burdock Air Quality Related Values Analysis Domain for the CALPUFF Analysis
Source: Modified From IML (2013a)

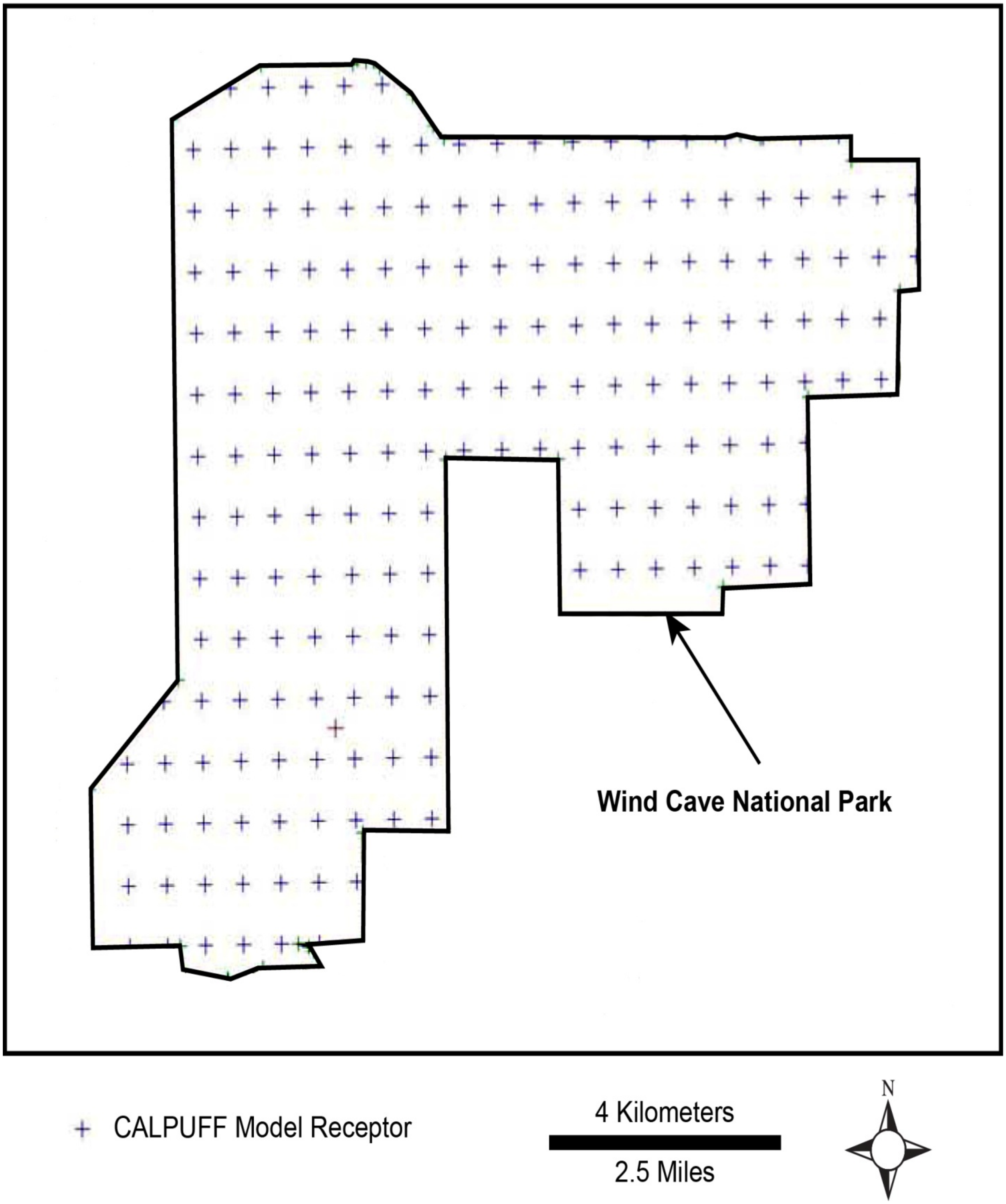

Figure 4.7-4. Locations Where Air Quality Related Values Were Calculated Using the CALPUFF Dispersion Model
Source: Modified From IML (2013a)

Table 4.7-3. Visibility Modeling Results for the Peak Year* at Wind Cave National Park

Scenario	Statistic	Modeled 3-Year Result	Contribution Threshold	Modeled Results 2009	2010	2011
Modeled with Particulate Matter PM_{10}	98th percentile Δdv†	0.35	0.50	0.33	0.31	0.40
	Number of days > 0.5 Δdv	11	NA‡	3	4	4
	Number of days > 1 Δdv	0	NA	0	0	0
	Maximum Δdv	0.83	NA	0.55	0.83	0.58
Modeled without Particulate Matter PM_{10}	98th percentile Δdv note1	0.11	0.50	0.10	0.11	0.12
	Number of days > 0.5 Δdv	0	NA	0	0	0
	Number of days > 1 Δdv	0	NA	0	0	0
	Maximum Δdv	0.20	NA	0.15	0.20	0.15

Source: IML (2013a)
*Peak year accounts for when all four phases occur simultaneously and represents the highest amount of emission the proposed action will generate in any one project year.
†Δdv = change in deciviews
‡NA = not applicable

Table 4.7-4. Total (Wet and Dry) Acid Deposition Modeling Results for the Peak Year* at Wind Cave National Park

Parameter		Sulfur (kg/ha/yr)†	Nitrogen (kg/ha/yr)	Sulfur and Nitrogen (kg/ha/yr)
Modeled Results (3-Year Average)		0.0010	0.0016	0.0026
Concern Threshold (annual)		0.005	0.005	0.010
Wind Cave Nation Park Measurements	2009	1.00	2.72	3.72
	2010	1.16	3.56	4.72
	2011	0.90	2.87	3.77
	3-year average	1.02	3.05	4.07
Estimated Critical Load (Annual)		12	5	17

Source: IML (2013a).
*Peak year accounts for when all four phases occur simultaneously and represents the highest amount of emission the proposed action will generate in any one project year.
†Units only expressed in metric form.

particulates as PM_{10} or $PM_{2.5}$. This SEIS estimates that the construction phase of the proposed Dewey-Burdock project generates an annual PM_{10} concentration of 2.4 μg/m^3 based on a 172 metric ton [190 short ton] emission level and an annual $PM_{2.5}$ concentration of 0.41 μg/m^3 based on a 18.8 metric ton [20.7 short ton] emission level (see Tables 2.1-5, C–9, and C–10). The environmental impacts on air quality for each of the liquid waste disposal options the applicant proposed (i.e., deep well disposal via Class V injection wells, land application, or combined deep well disposal and land application) are discussed in the following sections.

4.7.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant's preferred option for disposal of liquid wastes is deep well disposal via Class V injection wells. Potential environmental impacts on air quality from construction, operations, aquifer restoration, and decommissioning associated with the Class V injection well disposal option at the proposed Dewey-Burdock ISR Project are discussed in the following sections.

4.7.1.1.1 Construction Impacts

To help characterize the magnitude of the proposed project's air effluents, the emission levels are compared to regulatory thresholds, such as the New Source Review program threshold for classification as a major source. The estimated emission levels of NAAQS pollutants for stationary sources for the proposed Dewey-Burdock ISR Project listed in Table 2.1-1 are well below the New Source Review program threshold of 227 metric tons [250 short tons] for classification as a major source as described in SEIS Section 2.1.1.1.6.1.1. The pollutant with the highest stationary source emission level is NO_x at 1.54 metric tons [1.70 short tons]. For the construction phase, all of the estimated annual emission levels of nonradiological pollutants from all sources (i.e., stationary, mobile, and fugitive) were lower than the New Source Review threshold (see Table C–11). The pollutant with the highest emission level is PM_{10} at 172.2 metric tons [189.8 short tons] (see Table 2.1-3). However, for the peak year, the one pollutant emission level that exceeds the New Source Review threshold is PM_{10} at 419.0 metric tons [461.9 short tons] (see Table 2.1-5).

Air emission during the construction phase of the proposed project will consist primarily of combustion emissions and fugitive road dust. The construction phase generates the highest levels of fugitive dust relative to the other phases (see Table 2.1-3). Travel on unpaved roads generates about 84 percent of the PM_{10} emission levels with wind erosion accounting for the remaining 16 percent (see Table 2.1-3). For the mobile combustion emissions, the construction phase generates the highest levels of sulfur dioxide, nitrogen oxides, and carbon monoxide when compared with the other three phases (see Table 2.1-2). For the construction phase combustion emissions, the NAAQS pollutants with the highest emission levels are NO_x and CO (see Table 2.1-2).

The total pollutant concentrations (i.e., the modeling results for the project emissions when added to the background concentration levels) for the initial modeling run reveal that the peak year pollutant concentrations are below the NAAQS, except for the PM_{10} 24-hour estimate (see Table 4.7-1). These concentrations include the stationary sources from Table 2.1-1, the mobile sources from Table 2.1-2, and the fugitive sources from Table 2.1-3. All 50 receptor locations where the PM_{10} 24-hour total pollutant concentration exceeded the NAAQS occur within 500 meters [546.8 yards] of the Dewey-Burdock project boundary and the public road over which commuter traffic accesses the site (IML, 2013a). In fact the receptors with the ten highest PM_{10} 24-hour concentrations occur along the public road rather than the project boundary (IML, 2013a). Fugitive dust sources account for 99.1 percent of the peak year PM_{10} emissions for all sources (see Table C–8). For the construction phase, travel on unpaved roads accounts for 84 percent of the PM_{10} emissions (see Table 2.1-3). This indicates that travel on the unpaved roads is a key source for the fugitive dust estimates. The fact that the exceedences occur for the 24-hour standard and not the annual standard indicates that potential impacts are associated with the short-term time frame.

The initial modeling run for PM_{10} was conducted without implementing the dry depletion option. The AERMOD dry depletion option accounts for the partial settling and deposition of PM_{10} particles as the dust plume disperses away from the source. In simple terms, heavier particles tend to fall out of the air sooner than lighter particles. A more detailed explanation of dry depletion and the rationale for its use in this SEIS is presented in Appendix C Section C2.3.1. NRC staff will base the impact analyses (i.e. SMALL, MODERATE, or LARGE) in this SEIS on the PM_{10} modeling results that implement the dry depletion option (i.e., the final modeling run). For information purposes, NRC staff will also present the impact analysis for the results that do not implement the dry depletion option (i.e., the initial modeling run). However, the impact assessment in this SEIS will not be based on the PM_{10} estimates generated in the initial modeling run. Implementation of the dry depletion option for the final modeling results only changes the PM_{10} estimates. Put another way, the initial modeling results provide the estimates used in the SEIS for all of the pollutants other than PM_{10}. When the modeling implements the dry depletion option, the peak year total concentration for the PM_{10} 24-hour estimate is below the NAAQS (i.e., 83.1 percent) and the estimated peak year total concentrations for all of the pollutants are below the NAAQS ranging between 3.7 and 86.9 percent of the applicable threshold (see Table 4.7.1). As described in Table C–11, the construction phase contribution to the peak year emissions varies between 40.5 and 70.8 percent depending on the particular pollutant. For the construction phase, the total pollutant concentrations for the initial modeling run (i.e. without implementing dry depletion) are below the NAAQS ranging between 2.4 and 78.6 percent of the applicable standard (see Table C–12). This includes the PM_{10} 24-hour estimate which drops from 78.6 percent of the NAAQS to 50.2 percent when dry depletion is implemented (see Table C–12).

While the NAAQS primarily relate to an area's attainment classification (see SEIS Section 3.7.2), the PSD increments relate to pollution levels made by individual projects. The modeling domain for this project included both Class I areas (i.e., Wind Cave National Park) and Class II areas (i.e., all other areas within the domain). Wind Cave National Park is located about 46.7 km [29.0 mi] northeast of the proposed project area, and the predominant wind direction is from the northwest (see Figure 3.7-1). The Class II analysis will be addressed first followed by the Class I analysis.

For the peak year, the estimated PM_{10} 24-hour project level concentration is above the allowable PSD Class II increment for both the initial and final modeling runs (see Table 4.7-2). The estimated project level PM_{10} 24-hour concentration for the final model run is almost three times the PSD Class II increment and the initial modeling result is over six times the PSD Class II increment. The estimated project level concentrations for all of the other pollutants are below the PSD Class II increments ranging between 3 and 87.8 percent of the applicable threshold (see Table 4.7-2). As described in Table C-11, the construction phase contribution to the peak year emissions varies between 40.5 and 70.8 percent depending on the particular pollutant. For the construction phase, the estimated PM_{10} 24-hour project level concentrations for the final modeling run (34.4 $\mu g/m^3$) and initial modeling run (76.9 $\mu g/m^3$) are both above the allowable PSD Class II increment of 30 $\mu g/m^3$. For all of the other pollutants, the estimated project level concentrations for the construction phase are below the applicable PSD Class II increments.

For the peak year, none of the estimated project level concentrations exceed the allowable Class I PSD increments (see Table 4.7-2). For the final modeling run, the project level concentration estimates range between zero and 45 percent of the applicable threshold. If the initial modeling run is considered, this range increases to 100 percent due to the PM_{10} 24-hour project level concentrations. As described in Table C–11, the construction phase contribution to the peak year emissions varies between 40.5 and 70.8 percent depending on the particular pollutant. For the construction phase, all of the estimated project level concentrations are below the applicable PSD Class I thresholds.

NRC staff consideration of the Air Quality Related Values begins with the peak year analysis for the visibility. Table 4.7-3 presents the visibility analysis results both with and without PM_{10} included in the emission inventory. For the modeled results without the PM_{10} included, the 98^{th} percentile of the annual, 24-hour average change in deciviews is less than the contribution threshold for both the 3-year average as well as for each individual year. There are no days during the 3-year model period with a change in light extinction exceeding 0.5 deciviews. For the modeled results with the PM_{10} included, the 98^{th} percentile of the annual, 24-hour average change in deciviews is also less than the contribution threshold for both the three-year average, as well as for each individual year. However, there are eleven days during the 3-year model period with a change in light extinction exceeding 0.5 deciviews. Visibility impacts are not generated for the individual project phases. The analyses with and without PM_{10} both reveal that the annual peak year results are below the threshold. The individual phase results, as a fraction of the peak year results, are also below the threshold. In addition, the visibility result is a value computed from several pollutants with varying contributions rather than just a single pollutant. This complicates any attempt to generate phase specific contribution values.

Table 4.7-4 presents the total (i.e., wet and dry) acid deposition peak year results for the Wind Cave National Park. The modeled results for the 3-year average are below the concern threshold. This will remain true even if all of the modeled emissions occur in a single year. The modeled results when combined with the measured 3-year average at Wind Cave National Park are below the estimated critical load. This will remain true if the modeled results are combined with any of the single year measured averages. Acid deposition impacts are not generated for the individual project phases. The annual peak year results are below the threshold. The individual phase results, as a fraction of the peak year results, will also be below the threshold.

The air emission inventory used in this SEIS incorporates the following mitigation measures the applicant committed to implement (IML, 2013a and Powertech, 2012d):

- Lowering the drill rig engine horsepower from 550 horsepower to 300 horsepower, except for the deep well drill rig.
- Using Tier 1, or higher, drill rig engines and Tier 3, or higher, construction equipment engines.
- Car pooling.
- Water suppression for unpaved roads.

The various tiers refer to a phased program of federal standards that requires newly manufactured engines to generate lower pollutant emission levels. Higher tier numbers correlate with stricter emission standards and lower pollutant levels. Section C2.1 describes how changes in engines used are incorporated into the calculation of the revised emissions inventory. Table C–5 describes the effectiveness (i.e., the percentage of emissions reduction) of the different tier levels based on the associated emission factors. The applicant committed to implement carpooling. Reducing the number of vehicles commuters use results in fewer emissions and lower pollutant levels. Table C–6 described the effectiveness (i.e., the percent that the emissions are reduced) of the carpooling implemented by the applicant. A 60 percent reduction in the fugitive dust emissions associated with travel on unpaved roads within the proposed project boundary is incorporated into the inventory. The watering frequency of more than twice per hour is the basis for using the 60 percent control efficiency. Appendix D of the Ambient Air Quality Final Modeling Protocol and Impact Analysis (IML, 2013a) provides additional details for the project specific watering control of fugitive dust and the 60 percent control efficiency basis. No reduction in the fugitive dust emission associated with travel on the unpaved road outside of the project boundary is incorporated into the emission inventory. The applicant identified other mitigation measures it will implement (see Table 6.2-1); however, these other measures are not incorporated in the calculation of the revised emissions inventory. In addition, the applicant has proposed the following mitigation measures to further reduce and control air emissions (IML, 2013a and Powertech, 2009a):

- Implement standard dust control measures such as speed limits.
- Coordinate dust-producing activities to reduce maximum dust levels.
- Maintain vehicles to meet applicable EPA emission standards.
- Restore and reseed disturbed areas.
- Assist Fall River County in the maintenance and application of dust suppressant on the unpaved road beyond the project boundary.

All phases of the proposed Dewey-Burdock ISR Project will produce greenhouse gas emissions. Table 2.1-6 presents the carbon dioxide emission estimates for the proposed action for each of the four phases and for the various source categories. The only greenhouse gas included in the emission estimates is carbon dioxide. NRC staff consider the exclusion of other greenhouse gases from the inventory acceptable because carbon dioxide is the primary greenhouse gas emitted by the proposed action (IML, 2013a) and the analysis in this SEIS is for disclosure purposes rather than a formal regulatory determination. SEIS Appendix C Section C3 contains additional information on the greenhouse gas emission estimates presented in Table 2.1-6. The estimated carbon dioxide emission level for the stationary sources is lower than the current EPA permitting threshold, as described in SEIS Section 3.7.2. In fact, both the peak year and construction phase emissions levels for all of the sources (i.e., facility, mobile, and electric consumption) are below this threshold. For comparison, the annual estimated greenhouse gas emissions for the peak year from all sources is 38,621 metric tons [42,572 short tons], which is a small fraction of those produced annually in South Dakota {36.5 million metric tons [40.2 million short tons] of gross CO_2e emissions} (Center for Climate Strategies, 2007). NRC staff conclusions concerning potential greenhouse gas impacts are addressed in SEIS Section 5.7 on air quality cumulative effects.

As described in SEIS Section 4.7.1.1, NRC staff will base the impact analyses (i.e. SMALL, MODERATE, or LARGE) in this SEIS using the PM_{10} modeling results that implement the AERMOD dry depletion option (i.e., the final modeling run) and exclude the PM_{10} emissions from the CALPUFF visibility analysis. The proposed action's dispersion modeling results that address fugitive dust emissions as well as emissions from the burning of fossil fuels for the stationary and mobile sources indicate that pollution concentration levels within the modeling domain are generally low. Pollutant concentrations for both the peak year and construction phase only pollutant concentrations are below the NAAQS. All the estimated project level concentrations for both the peak year and construction phase are below the PSD Class II increments, except for the 24-hour PM_{10} values. As described in SEIS Section 4.7.1, the SDDENR formally determined that the project will not be subject to PSD requirements. Therefore, for this analysis, NRC staff consider comparison of project level pollutant concentrations to PSD increments for disclosure purposes (e.g., indicating the type of project level emission the analysis should focus on for potential environmental impacts) rather than a regulatory concern. For both the peak year and construction phase only, all of the estimated project level concentrations are below the PSD Class I increments. Due to the level (i.e., above PSD Class II increments) and nature of these fugitive PM_{10} emissions, there is a potential for noticeable localized dust emissions for only the peak year and construction phase. Short-term, intermittent impacts are possible to the area in and around the site, particularly when vehicles travel on unpaved roads. At times, the fugitive emissions will result in a MODERATE impact on air quality for the peak year and construction phase. For the visibility analyses, the annual modeled peak year results are below the contribution threshold. In fact, there are no individual days over the three year period modeling period with a change in light extinction exceeding 0.5 deciviews. For the acid deposition results, the peak year results are below the contribution threshold. The modeled results when combined with the measured results at the Wind Cave National Park are below the estimated critical load. The individual phase results, as a fraction of the peak year results will be below the visibility and acid deposition thresholds. Due to the level of the visibility and acid deposition results relative to the applicable thresholds, NRC staff conclude that that the peak year and construction phase project emission will result in a SMALL impact on air quality.

The NRC staff conclude that the overall impact to air quality during the construction phase for the Class V injection well disposal option will range from SMALL to MODERATE. The NRC staff reiterate that the peak year represents the greatest project impacts and conclude that the peak year impact will range from SMALL to MODERATE.

For information purposes, NRC staff will also present the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and include the PM_{10} emissions in the CALPUFF analysis. The tables and discussion in the SEIS text already include the information for the initial AERMOD modeling results and inclusion of the PM_{10} emission in the CALPUFF visibility analysis. This discussion will focus on distinctions between the two analyses (i.e., the analysis NRC is using to determine the impact magnitude for this SEIS and the analysis the NRC is presenting for informational purposes only) that could result in a different impact magnitude conclusion.

There is an important distinction between the initial and final AERMOD modeling runs in terms of the results relative to the NAAQS. For the peak year, the total pollutant concentrations for the initial modeling run reveal that the concentrations for each of the NAAQS pollutants are below the NAAQS except for the PM_{10} 24-hour estimate (see Table 4.7-1). Implementation of the dry depletion option for the peak year total concentrations results in this value being below the standard. The NRC will characterize the initial modeling run results for the peak year concentrations as a LARGE impact, if mitigating measures are not incorporated by the applicant. One factor or measure that could reduce concentrations is the incorporation of mitigation into the emission inventory calculation such as water suppression for travel on unpaved roads beyond the boundary of the proposed project. Other factors that can be considered are the implementation of particulate monitoring and an associated contingency plan that identifies steps that will be undertaken, if the monitoring shows that fugitive dust is an issue. In the Ambient Air Quality Final Modeling Protocol and Impact Analysis, the applicant expressed willingness to perform air monitoring. During interactions with the NRC, EPA staff recommended the development of a contingency plan associated with such monitoring. However, NRC staff will not require additional measures be undertaken by the applicant because the impact analyses based on the modeling results implementing the deviations from the default conditions correctly estimate the impact magnitude. NRC suggests that the applicant coordinate with appropriate entities, such as Fall River County, for mitigation to the unpaved public road outside the proposed project boundary, or the SDDENR and EPA for fugitive dust monitoring and associated contingency plans.

Although there is a distinction between the initial and final AERMOD modeling runs for the peak year analysis, this is not an issue for the construction phase analysis because both the initial and final modeling PM_{10} 24-hour results are below the NAAQS. NRC staff acknowledge that, for the visibility analysis that includes PM_{10}, there are eleven days during the three-year modeling period where the change in light extinction exceeds 0.5 deciviews. NRC staff further acknowledge that some may consider a statistic other than the 98th percentile (e.g., the maximum change in deciviews or the number of day greater than a 0.5 change in deciviews) the appropriate value to determine the impact magnitude. However, NRC staff considers the 98th percentile statistic as an appropriate basis for determining the impact magnitude. As a result, there is no difference in impact magnitude between the analyses with and without PM_{10}.

4.7.1.1.2 Operations Impacts

The estimated emission levels of NAAQS pollutants for stationary sources for the proposed action listed in Table 2.1-1 are well below the Title V or operating permit threshold of 90.7 metric tons [100 short tons] for classification as a major source in an attainment area as described in SEIS Section 2.1.1.1.6.1.1. The pollutant with the highest stationary source emission level is NO_x at 1.54 meteric tons [1.70 short tons]. For the operation phase, all of the estimated annual emission levels of nonradiological pollutants from all sources were lower than the operating permit threshold, except for PM_{10} at 138.3 metric tons [152.4 short tons] (see Table 2.1-3 and Table C–11). For the peak year, the only pollutant emission level that exceeds the operating permit threshold is PM_{10} at 419.0 metric tons [461.9 short tons] (see Table 2.1-5).

Air emissions during the operation phase of the proposed Dewey-Burdock ISR Project will consist primarily of combustion emissions and fugitive road dust. Travel on unpaved roads generates about 81 percent of the PM_{10} emission levels with wind erosion accounting for the remaining 19 percent (see Table 2.1-3). For the operations phase combustion emissions, the NAAQS pollutants with the highest emission levels are NO_X and CO (see Table 2.1-2). The construction phase analysis in SEIS Section 4.7.1.1.1 discusses the inclusion of mitigation in the calculation of the emissions inventory and the effectiveness of this mitigation. This information also applies to the operation phase impact analysis. In addition, the applicant has proposed other mitigation measures to further reduce and control air emissions (see Table6.2-1).

The discussion of the peak year project level emissions compared to the NAAQS, Class II PSD increments, and Class I PSD increments presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. As described in Table C–11, the operation phase contribution to the peak year emissions varies between 15.8 and 33.0 percent depending on the particular pollutant. For the operation phase, the total pollutant concentrations for the initial modeling run are below the NAAQS ranging between 1.1 and 68.5 percent of the applicable standard (see Table C–13). This includes the PM_{10} 24-hour estimate, which drops from 68.5 percent of the NAAQS to 45.7 percent when dry depletion is implemented (see Table C–13). The estimated operation phase PM_{10} 24-hour project level concentration for the final modeling run (27.6 µg/m^3) is below the allowable PSD Class II increment, while the initial modeling run value (61.8 µg/m^3) remains above this threshold. For all of the other pollutants, the estimated project level concentrations for the operations phase are below the applicable PSD Class II increments. For the peak year, none of the estimated projected level concentrations for both the initial and final modeling run exceed the applicable Class I PSD increment (see Table 4.7-2). The estimated projected level concentrations for the operation phase, as a fraction of the peak year results, are also below the PSD Class I increments.

As described in SEIS Section 4.7.1.1.1, Air Quality Related Value impacts are not generated for the individual project phases. Instead, the impacts are based on the peak year values. The analysis presented here is a summary of the analysis presented in SEIS Section 4.7.1.1.1. For the visibility analysis, the modeled peak year results with and without the PM_{10} included are both below the contribution threshold. With the PM_{10} emissions included there are eleven days over the three-year period with a change in light extinction that exceeds 0.5 deciviews. The acid deposition peak year results were below the applicable thresholds. The operation phase results, as a fraction of the peak year results, will also be below the applicable visibility and acid deposition thresholds.

The operations phase generates the most overall carbon dioxide emissions relative to the other three phases. Table 2.1-6 presents the carbon dioxide emission estimates for the proposed action for each of the phases and for the various source categories. The annual estimated carbon dioxide emission for the operation phase from all sources (i.e., facility, mobile, and electrical consumption) were 25,466 metric tons [28,072 short tons]. Stationary sources accounted for less than 6 percent of the overall carbon dioxide emissions (Table 2.1-6). These estimated levels of carbon dioxide gas emissions are lower than the current EPA permitting threshold as described in SEIS Section 3.7.2. NRC staff conclusions concerning potential greenhouse gas impacts are addressed in SEIS Section 5.7 on air quality cumulative effects.

As described in SEIS Section 4.7.1.1, NRC staff will base the impact analyses (i.e. SMALL, MODERATE, or LARGE) in this SEIS using the PM_{10} modeling results that implement the AERMOD dry depletion option (i.e., the final modeling run) and excluding the PM_{10} emissions from the CALPUFF analysis. The discussion of the peak year project level impact magnitude presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. The discussion here will focus on the operation phase impact magnitude. The proposed action's dispersion modeling results, that address fugitive dust emissions as well as emissions from the burning of fossil fuels for the stationary and mobile sources associated with the operation phase, indicate that pollution concentration levels within the modeling domain are generally low. For the final modeling run, the operation phase pollutant concentrations are below the applicable NAAQS, Class II PSD increments, and Class I PSD increments. Due to the level of the operation phase pollutant concentrations, NRC staff conclude that the pollutant concentrations when compared to applicable NAAQS and PSD increments will result in a SMALL impact on air quality. For the visibility analyses, the annual modeled peak year results are below the contribution threshold. There are no individual days over the three year period modeling period with a change in light extinction exceeding 0.5 deciviews. For the acid deposition results, the peak year results are below the contribution threshold. The modeled results when combined with the measured results at the Wind Cave National Park are below the estimated critical load. The individual phase results, as a fraction of the peak year results, will be below the visibility and acid deposition thresholds. Due to the level of the visibility and acid deposition results relative to the applicable thresholds, NRC staff conclude that that operation phase project emissions will result in a SMALL impact on air quality.

The NRC staff conclude that the overall impact to air quality during the operation phase for the Class V injection well disposal option will be SMALL. The NRC staff reiterate that the peak year represents the greatest project impacts and, as described in SEIS Section 4.7.1.1.1, conclude that the peak year impact will range from SMALL to MODERATE.

For information purposes, NRC staff will also present the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and include the PM_{10} emissions in the CALPUFF analysis. The tables and discussion in the SEIS text already include the information for the initial AERMOD modeling results and inclusion of the PM_{10} emission in the CALPUFF visibility analysis. This discussion will focus on distinctions between the two analyses (i.e., the analysis NRC is using to determine the impact magnitude for this SEIS and the analysis the NRC is presenting for informational purposes only) that could result in a different impact magnitude conclusion. The discussion of the peak year project level impact magnitude presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. Without additional consideration (e.g., incorporation of additional mitigation into the emission inventory), NRC will characterize the initial modeling run results for the peak year concentrations as a LARGE impact.

When considering the operation phase, there is an important distinction between the initial and final AERMOD modeling runs in terms of the results relative to the Class II PSD increments. The estimated PM_{10} 24-hour project level concentrations for the final modeling run is below the allowable PSD Class II increment, while the estimated PM_{10} 24-hour project level concentration for the initial modeling run value is above this threshold. For the initial modeling run, due to the level (i.e., above PSD Class II increments) and nature of these fugitive PM_{10} emissions, there is a potential for noticeable localized dust emissions for both the peak year and operation phase only. Short-term, intermittent impacts are possible to the area in and around the site, particularly when vehicles travel on unpaved roads. At times, the fugitive emission will result in a MODERATE impact on air quality. This conclusion differs from the final modeling run results analysis, which classifies the PM_{10} 24-hour Class II impacts as SMALL.

4.7.1.1.3 Aquifer Restoration Impacts

Air emissions during the aquifer restoration phase of the proposed Dewey-Burdock ISR Project will consist primarily of combustion emissions and fugitive road dust. For the proposed project, the aquifer restoration phase generates by far the lowest levels of air emission relative to the other three phases. For the aquifer restoration phase combustion emissions, the NAAQS pollutants with the highest emission levels are NO_x and CO (see Table 2.1-2). The construction phase analysis in SEIS Section 4.7.1.1.1 discusses the inclusion of mitigation in the calculation of the emissions inventory and the effectiveness of this mitigation. This information also applies to the aquifer restoration phase impact analysis. In addition, the applicant has proposed other mitigation measures to further reduce and control air emissions (see Table 6.2-1).

The discussion of the peak year project level emission compared to the NAAQS, Class II PSD increments, and Class I PSD increments presented in the construction phase analysis in SEIS

Section 4.7.1.1.1 remains the same. As described in Table C–11, the aquifer restoration phase contribution to the peak year emissions varies between 0.5 and 5.5 percent depending on the particular pollutant. For the aquifer restoration phase, the total pollutant concentrations for the initial modeling run are below the NAAQS ranging between 0.5 and 40.5 percent of the applicable standard (see Table C–14). This includes the PM_{10} 24-hour estimate, which drops from 33.3 percent of the NAAQS to 30.0 percent when dry depletion is implemented (see Table C–14). All of the estimated aquifer restoration phase project level pollutant concentrations, including the PM_{10} 24-hour final modeling run (4.0 $\mu g/m^3$) and initial modeling run (9.0 $\mu g/m^3$) estimates, are below the applicable PSD Class II increments. For the peak year, none of the estimated projected level concentrations for both the initial and final modeling run exceed the applicable Class I PSD increment (see Table 4.7-2). The estimated projected level concentrations for the aquifer restoration phase, as a fraction of the peak results, are also below the PSD Class I increments.

As described in SEIS Section 4.7.1.1.1, Air Quality Related Value impacts are not generated for the individual project phases. Instead, the impacts are based on the peak year values. The analysis presented here is a summary of the analysis presented in SEIS Section 4.7.1.1.1. For the visibility analysis, the modeled peak year results with and without the PM_{10} included are both below the contribution threshold. With the PM_{10} emissions included there are eleven days over the three-year period with a change in light extinction exceeding 0.5 deciviews. The acid deposition peak year results were below the applicable thresholds. The aquifer restoration phase results, as a fraction of the peak year results, will also be below the applicable visibility and acid deposition thresholds.

Overall, the total carbon dioxide emissions from the aquifer restoration phase are about three times lower than the operations phase (see Table 2.1-6). Most of the aquifer restoration phase carbon dioxide gas emissions are attributed to indirect electrical consumption (Table 2.1-6). The estimated aquifer restoration phase levels of carbon dioxide emission from all sources is lower than the current EPA permitting threshold as described in SEIS Section 3.7.2. NRC staff conclusions concerning potential greenhouse gas impacts are addressed in SEIS Section 5.7 on air quality cumulative effects.

As described in SEIS Section 4.7.1.1, NRC staff will base the impact analyses (i.e. SMALL, MODERATE, or LARGE) in this SEIS using the PM_{10} modeling results that implement the AERMOD dry depletion option (i.e., the final modeling run) and excluding the PM_{10} emissions from the CALPUFF analysis. The discussion of the peak year project level impact magnitude presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. The discussion here will focus on the aquifer restoration phase impact magnitude. The proposed action's dispersion modeling results that address fugitive dust emissions as well as emissions from the burning of fossil fuels for the stationary and mobile sources associated with the aquifer restoration phase indicate that pollution concentration levels within the modeling domain are low. For the final modeling run, the aquifer restoration phase pollutant concentrations are below the applicable NAAQS, Class II PSD increments, and Class I PSD increments. Due to the level of the aquifer restoration phase pollutant concentrations, NRC staff conclude that the pollutant concentrations when compared to applicable NAAQS and PSD increments will result in a SMALL impact on air quality. For the visibility analyses, the annual modeled peak year results are below the contribution threshold. There are no individual days over the three year period modeling period with a change in light extinction exceeding 0.5 deciviews. For the acid deposition results, the peak year results are below the contribution threshold. The modeled results when combined with the measured results at the Wind Cave National Park are below the estimated critical load. The individual phase results, as a fraction of the peak year results, will be below the visibility and acid deposition thresholds. Due to the level of the visibility and acid deposition results relative to the applicable thresholds, NRC staff concludes that the aquifer restoration phase project emission will result in a SMALL impact on air quality.

The NRC staff conclude that the overall impact to air quality during the aquifer restoration phase for the Class V injection well disposal option will be SMALL. The NRC staff reiterate that the peak year represents the greatest project impacts and, as described in SEIS Section 4.7.1.1.1, conclude that the peak year impact will range from SMALL to MODERATE.

For information purposes, NRC staff will also present the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and include the PM_{10} emissions in the CALPUFF analysis. The tables and discussion in the SEIS text already include the information for the initial AERMOD modeling results and inclusion of the PM_{10} emission in the CALPUFF visibility analysis. This discussion will focus on distinctions between the two analyses (i.e., the analysis NRC is using to determine the impact magnitude for this SEIS and the analysis the NRC is presenting for informational purposes only) that could result in a different impact magnitude conclusion. The discussion of the peak year project level impact magnitude presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. Without additional consideration (e.g., incorporation of additional mitigation into the emission inventory), NRC will characterize the initial modeling run results for the peak year concentrations as a LARGE impact. When considering the aquifer restoration phase, there are no distinctions between the two analyses that will result in a difference in impact magnitude conclusions.

4.7.1.1.4 Decommissioning Impacts

Air emissions during the decommissioning phase of the proposed Dewey-Burdock ISR Project will consist primarily of combustion emissions and fugitive road dust. For the decommissioning phase combustion emissions, the NAAQS pollutants with the highest emission levels are NO_x and CO (see Table 2.1-2). The construction phase analysis in SEIS Section 4.7.1.1.1 discusses the inclusion of mitigation in the calculation of the emissions inventory and the effectiveness of this mitigation. This information also applies to the aquifer restoration phase impact analysis. In addition, the applicant has proposed other mitigation measures to further reduce and control air emissions (see Table 6.2-1).

The discussion of the peak year project level emission compared to the NAAQS, Class II PSD increments, and Class I PSD increments presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. As described in Table C–11, the decommissioning phase contribution to the peak year emissions varies between 12.1 and 21.2 percent depending on the particular pollutant. For the decommissioning phase, the total pollutant concentrations for the initial modeling run are below the NAAQS, ranging between 1.0 and 53.7 percent of the applicable standard (see Table C–15). This includes the PM_{10} 24-hour estimate, which drops from 53.7 percent of the NAAQS to 39.1 percent when dry depletion is implemented (see Table C–15). The estimated decommissioning phase PM_{10} 24-hour project level concentrations for the final modeling run (17.6 $\mu g/m^3$) are below the allowable PSD Class II increment, while the initial modeling run value (39.5 $\mu g/m^3$) remains above this threshold. For all of the other pollutants, the estimated project level concentrations for this phase are below the applicable PSD Class II increments. For the peak year, none of the estimated projected level concentrations for both the initial and final modeling run exceeds the applicable Class I

PSD increment (see Table 4.7-2). The estimated projected level concentrations for the decommissioning phase, as a fraction of the peak year results, are also below the PSD Class I increments.

As described in SEIS Section 4.7.1.1.1, Air Quality Related Value impacts are not generated for the individual project phases. Instead, the impacts are based on the peak year values. The analysis presented here is a summary of the analysis presented in SEIS Section 4.7.1.1.1. For the visibility analysis, the modeled peak year results with and without the PM_{10} included are both below the contribution threshold. With the PM_{10} emissions included there are eleven days over the three-year period with a change in light extinction exceeding 0.5 deciviews. The acid deposition peak year results were below the applicable thresholds. The decommissioning phase results, as a fraction of the peak year results, will also be below the applicable visibility and acid deposition thresholds.

All phases of the proposed Dewey-Burdock ISR Project generate carbon dioxide, with the operations phase producing the most. Overall, the total carbon dioxide emissions from the decommissioning phase are about 8 times lower than the operations phase (see Table 2.1-6). The estimated decommissioning phase level of carbon dioxide emissions from all sources is lower than the current EPA permitting threshold described in SEIS Section 3.7.2. NRC staff conclusions concerning potential greenhouse gas impacts are addressed in SEIS Section 5.7 on air quality cumulative effects.

As described in SEIS Section 4.7.1.1, NRC staff will base the impact analyses (i.e. SMALL, MODERATE, or LARGE) in this SEIS on PM_{10} modeling results that implement the AERMOD dry depletion option (i.e., the final modeling run) and exclude the PM_{10} emissions from the CALPUFF analysis. The discussion of the peak year project level impact magnitude presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. The discussion here will focus on the decommissioning phase impact magnitude. The proposed action dispersion modeling results addressing fugitive dust emissions as well as emissions from the burning of fossil fuels for the stationary and mobile sources associated with the decommissioning phase indicate that pollution concentration levels within the modeling domain are generally low. For the final modeling run, the decommissioning phase pollutant concentrations are below the applicable NAAQS, Class II PSD increments, and Class I PSD increments. Due to the level of the decommissioning phase pollutant concentrations, NRC staff conclude that the pollutant concentrations when compared to applicable NAAQS and PSD increments will result in a SMALL impact on air quality. For the visibility analyses, the annual modeled peak year results are below the contribution threshold. There are no individual days over the three year modeling period with a change in light extinction exceeding 0.5 deciviews. For the acid deposition results, the peak year results are below the contribution threshold. The modeled results when combined with the measured results at Wind Cave National Park are below the estimated critical load. The individual phase results, as a fraction of the peak year results, will be below the visibility and acid deposition thresholds. Due to the level of the visibility and acid deposition results relative to the applicable thresholds, NRC staff conclude that the decommissioning phase project emission will result in a SMALL impact on air quality.

The NRC staff conclude that the overall impact to air quality during the decommissioning phase for the Class V injection well disposal option will be SMALL. The NRC staff reiterate that the peak year represents the greatest project impacts and, as described in SEIS Section 4.7.1.1.1, conclude that the peak year impact will range from SMALL to MODERATE.

For information purposes, NRC staff will also present the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and include the PM_{10} emissions in the CALPUFF analysis. The tables and discussion in the SEIS text already include the information for the initial AERMOD modeling results and inclusion of the PM_{10} emission in the CALPUFF visibility analysis. This discussion will focus on distinctions between the two analyses (i.e., the analysis NRC is using to determine the impact magnitude for this SEIS and the analysis the NRC is presenting for informational purposes only) that could result in a different impact magnitude conclusion. The discussion of the peak year project level impact magnitude presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. Without additional consideration (e.g., incorporation of additional mitigation into the emission inventory), NRC will characterize the initial modeling run results for the peak year concentrations as a LARGE impact.

When considering the decommissioning phase, there is an important distinction between the initial and final AERMOD modeling runs in terms of the results relative to the Class II PSD increments. The estimated PM_{10} 24-hour project level concentrations for the final modeling run is below the allowable PSD Class II increment, while the estimated PM_{10} 24-hour project level concentration for the initial modeling run value is above this threshold. For the initial modeling run, due to the level (i.e., above PSD Class II increments) and nature of these fugitive PM_{10} emissions, there is a potential for noticeable localized dust emissions for the decommissioning phase. Short-term, intermittent impacts are possible to the area in and around the site, particularly when vehicles travel on unpaved roads. At times, the fugitive emission will result in a MODERATE impact on air quality. This conclusion is different from the final modeling run results analysis, which classifies the PM_{10} 24-hour Class II impacts as SMALL.

4.7.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not obtained from EPA, the applicant proposes to dispose of liquid waste generated at the proposed Dewey-Burdock ISR Project by land application (see SEIS Section 2.1.1.1.2.4.2). Potential environmental impacts on air quality from construction, operations, aquifer restoration, and decommissioning associated with the land application liquid waste disposal option are discussed in the following sections. The discussion also addresses the impacts on air quality during the peak year when all four phases occur simultaneously.

4.7.1.2.1 Construction Impacts

When examining combustion emissions, the land application liquid waste disposal option will not require the drilling of up to eight Class V deep disposal wells. The percentage of combustion emission from drill rigs (excluding the deep well rig) ranges from 45 to 70 percent depending on the pollutant (see Table C–2). However, the drilling of eight Class V deep disposal wells constitutes no more than one half of 1 percent of the construction phase emissions for any single NAAQS pollutant. NRC staff conclude that the elimination of drilling the Class V deep disposal wells will result in a very small reduction in the NAAQS pollutant emissions generated.

The source that generates the majority of remaining combustion emissions is the construction and drilling field equipment (see Table C–2). As detailed in Table 4.2-1, the land application option will result in more land being disturbed than in the deep well disposal option. Specifically, the land application will require 425.7 ha [1,052 ac] of irrigation area and an additional 41.6 ha [103 ac] for impoundments. These types of land disturbances, particularly the addition of irrigation areas, will not be expected to generate many air emissions from the use of construction or field equipment. The amount of land disturbed for wellfields, access roads, trunkline installation, and site buildings is identical for the deep well disposal and land application options. These types of land disturbances will be associated with the generation of air emissions from construction and field equipment use. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option will result in a very small increase in the NAAQS pollutants generated from combustion emission sources other than the drilling rigs.

For combustion emissions, NRC staff do not expect to see any appreciable difference in the overall NAAQS emission levels between the land disposal option and the deep well disposal option. Therefore, the magnitude of the air quality impacts will be expected to the same for the two disposal options for both the construction phase and the peak year (i.e., all phases combined).

The land application option analysis for greenhouse gases will mirror the NAAQS pollutant analyses because the combustion emission sources for the NAAQS pollutants and the greenhouse gases are the same. Using the same rationale as the NAAQS pollutant analysis, NRC staff do not expect to see any appreciable difference in the overall greenhouse gas emission levels between the land disposal option and the deep well disposal option for the construction phase. The impact analysis for greenhouse gases is addressed in SEIS Section 5.7 on air quality cumulative effects.

Fugitive emissions are generated by both travel on unpaved roads and wind erosion of disturbed land. For the construction phase, travel on unpaved roads is the main source of fugitive emissions. As described in Table 4.2-1, the land application option will not require more access roads to be constructed. Furthermore, the land application option will not require additional land for wellfield or facility construction. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option will result in a very small change in fugitive emissions from travel on unpaved roads.

The amount of fugitive emissions from wind erosion is a function of the amount of disturbed land. The two liquid waste disposal options vary in the amount of land disturbed and, therefore, the amount of fugitive dust generated. As described in Table 2.1-4, the annual mass flow emission rate estimates from wind erosion varied little over the project lifetime with the deep well and land application options generating 10.1 metric tons [11.1 short tons] and 29.7 metric ton [32.7 short tons] of PM_{10}, respectively. When considered in conjunction with the fugitive emissions from unpaved roads, the peak year land application option will generate about 5 percent more PM_{10} emissions and about 7 percent more $PM_{2.5}$ than the deep well disposal option. When wind erosion emissions are considered in conjunction with fugitive emissions from unpaved roads, the construction phase land application option will generate about 10 percent more PM_{10} emissions and about 14 percent more $PM_{2.5}$ than the deep well disposal option.

Although there is some difference in the overall fugitive dust emission levels between the two disposal options, the impact magnitude will be expected to be similar. Therefore, the analyses presented for the deep well disposal option will still apply.

As mentioned earlier in this section, the magnitude of the air quality impacts will be expected to be the same for the two disposal options for both the construction phase and the peak year (i.e., all phases combined). The low level of combustion emissions will result in a SMALL impact on air quality. At times, fugitive emissions will result in a MODERATE impact on air quality from localized dust emissions that are short term and intermittent in nature. The NRC staff conclude that the overall impact on air quality during the construction phase for the land application disposal option will range from SMALL to MODERATE.

For informational purposes, NRC staff will also present the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and include the PM_{10} emissions in the CALPUFF analysis. The only difference between the two analyses (i.e., the analysis NRC is using to determine the impact magnitude for the SEIS and the analysis the NRC is presenting for informational purposes only) for the peak year and construction phase only impact assessment is that NRC staff will characterize the initial modeling run results for the peak year concentrations as a LARGE impact based on the PM_{10} 24-hour emission levels. The magnitude of the difference in the PM_{10} emission levels between the two disposal options will not be expected to change this impact assessment.

4.7.1.2.2 Operation Impacts

For the operations phase, combustion emissions for NAAQS pollutants are basically evenly divided between the light duty vehicles and the construction and drilling field equipment (see Table C–2). As detailed in Table 4.2-1, the land application option will result in more land being disturbed than in the deep well disposal option. Specifically, the land application will require 425.7 ha [1,052 ac] of irrigation area and an additional 41.6 ha [103 ac] for impoundments. These types of land disturbances, particularly the addition of irrigation areas, will not be expected to generate many air emissions from the use of construction or field equipment. The amount of land disturbed for wellfields, access roads, trunkline installation, and site buildings is identical for the deep well disposal and land application options. These types of land disturbances will be more associated with the generation of air emissions from construction and field equipment use. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option will result in a very small increase in the NAAQS pollutants generated from combustion emission sources.

For combustion emissions, NRC staff do not expect to see any appreciable difference in the overall NAAQS emission levels between the land disposal option and the deep well disposal option. Therefore, the magnitude of the air quality impacts will be expected to the same for the two disposal options for the operation phase.

The land application option analysis for greenhouse gases will mirror the NAAQS pollutant analyses because the combustion emission sources for the NAAQS pollutants and the greenhouse gases are the same. Using the same rationale as the NAAQS pollutant analysis, NRC staff do not expect to see any appreciable difference in the overall greenhouse gas emission levels between the land disposal option and the deep well disposal option for the operation phase. The impact analysis for greenhouse gases is addressed in SEIS Section 5.7 on air quality cumulative effects.

Fugitive emissions are generated by both travel on unpaved roads and wind erosion of disturbed land. For the operation phase, travel on unpaved roads is the main source of fugitive emissions. As described in Table 4.2-1, the land application option will not require more access roads to be constructed. Furthermore, the land application option will not require additional land for wellfield or facility construction. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option will result in a very small change in fugitive emissions from travel on unpaved roads.

The amount of fugitive emissions from wind erosion is a function of the amount of disturbed land. The two liquid waste disposal options vary in the amount of land disturbed and, therefore, the amount of fugitive dust generated. As described in Table 2.1-4, the annual mass flow emission rate estimates from wind erosion varied little over the project lifetime with the deep well and land application options generating 10.1 metric tons [11.1 short tons] and 29.7 metric ton [32.7 short tons] of PM_{10}, respectively. When wind erosion emissions are considered in conjunction with fugitive emissions from unpaved roads, the operation phase land application option will generate about 12 percent more PM_{10} emissions and about 17 percent more $PM_{2.5}$ than the deep well disposal option.

Although there is some difference in the overall fugitive dust emission levels between the two disposal options, the impact magnitude will be expected to be similar. Therefore, the analyses presented for the deep well disposal option will still apply.

As mentioned earlier in this section, the magnitude of the air quality impacts will be expected to the same for the two disposal options for the operation phase. The NRC staff conclude that the operation phase pollutant concentrations when compared to applicable NAAQS, PSD increments, visibility thresholds, and acid deposition thresholds will result in a SMALL impact on air quality. The NRC staff conclude that the overall impact on air quality during the operation phase for the land application disposal option will be SMALL.

For informational purposes, NRC staff will also present the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and include the PM_{10} emissions in the CALPUFF analysis. The only difference between the two analyses (i.e., the analysis NRC is using to determine the impact magnitude for the SEIS and the analysis the NRC is presenting for informational purposes only) for the operation phase impact assessment is that NRC staff will characterize the initial modeling run results as MODERATE at times because of the PM_{10} 24-hour concentrations relative to the PSD Class II increment. The magnitude of the difference in the PM_{10} emission levels between the two disposal options will not be expected to change this impact assessment.

4.7.1.2.3 Aquifer Restoration Impacts

For the aquifer restoration phase, combustion emissions are limited to light duty vehicles (see Table C–2). As detailed in Table 4.2-1, the land application option will result in more land being disturbed than in the deep well disposal option. Specifically, the land application will require 425.7 ha [1,052 ac] of irrigation area and an additional 41.6 ha [103 ac] for impoundments. These types of land disturbances, particularly the addition of irrigation areas, will not be expected to generate much change in air emissions from light duty vehicles. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option will result in a very small increase in the NAAQS pollutants generated from combustion emission sources.

For combustion emissions, NRC staff do not expect to see any appreciable difference in the overall NAAQS emission levels between the land disposal option and the deep well disposal option. Therefore, the magnitude of the air quality impacts will be expected to the same for the two disposal options for the aquifer restoration phase.

The land application option analysis for greenhouse gases will mirror the NAAQS pollutant analysis because the combustion emission sources for the NAAQS pollutants and the greenhouse gases are the same. Using the same rationale as the NAAQS pollutant analysis, NRC staff do not expect to see any appreciable difference in the overall greenhouse gas emission levels between the land disposal option and the deep well disposal option for the aquifer restoration phase. The impact analysis for greenhouse gases is addressed in SEIS Section 5.7 on air quality cumulative effects.

Fugitive emissions are generated by both travel on unpaved roads and wind erosion of disturbed land. For the aquifer restoration phase, wind erosion generates more fugitive emissions than travel on unpaved roads. As described in Table 4.2-1, the land application option will not require more access roads to be constructed. Furthermore, the land application option will not require additional land for wellfield or facility construction. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option will result in a very small change in fugitive emissions from travel on unpaved roads.

The amount of fugitive emissions from wind erosion is a function of the amount of disturbed land. The two liquid waste disposal options vary in the amount of land disturbed and, therefore, the amount of fugitive dust generated. As described in Table 2.1-4, the annual mass flow emission rate estimates from wind erosion varied little over the project lifetime with the deep well and land application options generating 10.1 metric tons [11.1 short tons] and 29.7 metric ton [32.7 short tons] of PM_{10}, respectively. When wind erosion emissions are considered in conjunction with fugitive emissions from unpaved roads, the aquifer restoration phase land application option will generate about 46 percent more PM_{10} emissions and about 51 percent more $PM_{2.5}$ than the deep well disposal option.

Although there is some difference in the overall fugitive dust emission levels between the land disposal option and the deep well disposal option, the impact magnitude will be expected to be similar. Therefore, the analyses presented for the deep well disposal option will still apply.

As mentioned earlier in this section, the magnitude of the air quality impacts will be expected to be the same for the two disposal options for the aquifer restoration phase. The NRC staff conclude that the aquifer restoration phase pollutant concentrations when compared to applicable NAAQS, PSD increments, visibility thresholds, and acid deposition thresholds will result in a SMALL impact on air quality. The NRC staff conclude that the overall impact on air quality during the aquifer restoration phase for the land application disposal option will be SMALL.

For informational purposes, NRC staff will also present the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and include the PM_{10} emissions in the CALPUFF visibility analysis. When considering the aquifer restoration phase, there are no distinctions between the two analyses (i.e., the analysis NRC is using to determine the impact magnitude for the SEIS and the analysis the NRC is presenting for informational purposes only) that will result in a difference in impact magnitude conclusions. NRC staff conclude that the aquifer restoration phase pollutant concentrations when compared to applicable NAAQS, PSD increments, visibility thresholds, and acid deposition thresholds will result in a SMALL impact on air quality. The magnitude of the difference in the emission levels between the two disposal options will not be expected to change this impact assessment.

4.7.1.2.4 Decommissioning Impacts

For the decommissioning phase, the majority of the combustion emissions are from the construction and drilling field equipment. As detailed in Table 4.2-1, the land application option will result in more land being disturbed than in the deep well disposal option. Specifically, the land application will require 425.7 ha [1,052 ac] of irrigation area and an additional 41.6 ha [103 ac] for impoundments. Reclaiming the additional disturbed land, particularly the impoundments, could result in a slight increase in the emissions from construction and drilling field equipment. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option will result in a very small increase in the NAAQS pollutants generated from combustion emission sources.

For combustion emissions, NRC staff do not expect to see any appreciable difference in the overall NAAQS emission levels between the land disposal option and the deep well disposal option. Therefore, the magnitude of the air quality impacts will be expected to the same for the two disposal options for the decommissioning phase.

The land application option analysis for greenhouse gases will mirror the NAAQS pollutant analysis because the emission sources for the NAAQS and greenhouse gases are the same. Using the same rationale as the NAAQS pollutant analysis, NRC staff do not expect to see any appreciable difference in the overall greenhouse gas emission levels between the land disposal option and the deep well disposal option for the decommissioning phase. The impact analysis for greenhouse gases is addressed in SEIS Section 5.7 on air quality cumulative effects.

Fugitive emissions are generated by both travel on unpaved roads and wind erosion of disturbed land. For the decommissioning phase, travel on unpaved roads is the main source of fugitive emissions. As described in Table 4.2-1, the land application option will not require more access roads to be constructed. Furthermore, the land application option will not require additional land for wellfield or facility construction. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option will result in a very small change in fugitive emissions from travel on unpaved roads.

The amount of fugitive emissions from wind erosion is a function of the amount of disturbed land. The two liquid waste disposal options vary in the amount of land disturbed and, therefore, the amount of fugitive dust generated. As described in Table 2.1-4, the annual mass flow emission rate estimates from wind erosion varied little over the project lifetime with the Class V deep injection well and land application options generating 10.1 metric tons [11.1 short tons] and 29.7 metric ton [32.7 short tons] of PM_{10}, respectively. When wind erosion emissions are considered in conjunction with fugitive emissions from unpaved roads, the decommissioning phase land application option will generate about 18 percent more PM_{10} emissions and about 23 percent more $PM_{2.5}$ than the deep well disposal option.

Although there is some difference in the overall fugitive dust emission levels between the two disposal options, the impact magnitude will be expected to be similar. Therefore, the analyses presented for the deep well disposal option will still apply.

As mentioned earlier in this section, the magnitude of the air quality impacts will be expected to be the same for the two disposal options for decommissioning phase. The NRC staff conclude that the decommissioning phase pollutant concentrations when compared to applicable NAAQS and PSD increments will result in a SMALL impact on air quality. The NRC staff conclude that the overall impact on air quality during the decommissioning phase for the land application disposal option will be SMALL.

For informational purposes, NRC staff will also present the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and include the PM_{10} emissions in the CALPUFF analysis. The only difference between the two analyses (i.e., the analysis NRC is using to determine the impact magnitude for the SEIS and the analysis the NRC is presenting for informational purposes only) for the decommissioning phase impact assessment is that NRC staff will characterize the initial modeling run results as MODERATE at times because of the PM_{10} 24-hour concentrations relative to the PSD Class II increment. The magnitude of the difference in the PM_{10} emission levels between the two disposal options will not be expected to change this impact assessment.

4.7.1.3 Disposal Via Combination of Class V Injection and Land Application

If a permit for Class V injection wells is obtained from EPA but the capacity of the wells is insufficient to dispose of all liquid wastes generated at the proposed Dewey-Burdock ISR Project, the applicant has proposed to dispose of liquid waste by a combination of Class V injection wells and land application (see SEIS Section 2.1.1.1.2.4.3). For the combined option, land application facilities and infrastructure will be constructed, operated, restored, and decommissioned on an as-needed basis depending on the deep well disposal capacity (Powertech, 2011).

The potential environmental impacts from fugitive dust emissions for all of the phases will be greater for the land application option because of the increased wind erosion emission levels caused by the increased amount of land disturbed. When considering the combustion emissions, the main difference between the two disposal options is the emissions from the deep well rig used to drill the Class V wells. The land application option eliminates this particular source. This distinction will only affect the construction phase because this is where all of the drill rig emissions occur. For the combustion emissions, the potential environmental impacts for the construction phase will be greater for the Class V injection well option because of the additional drill rig emissions. For the remaining three phases, the combustion emissions will be basically the same for both disposal options.

For the combined option, the air emissions associated with the development of all the Class V injection disposal wells will be supplemented with the emissions associated with the development, at some level, of the irrigation areas and increased pond capacity. Fugitive dust emissions for all four phases will include the additional contribution of the wind erosion from the increased land disturbance from the land application option. The construction phase will include the combustion emissions from the deep well drill rig. Therefore, NRC staff conclude that the environmental impacts of the combined option for the construction, operation, aquifer restoration, and decommissioning phases of the proposed Dewey-Burdock ISR Project will be greater than either the Class V deep injection well option or the land application option. However, for each phase of the proposed project, the changes in air emissions levels will be subtle and not result in any distinctions concerning the magnitude of the environmental impacts (Table 4.7-5). NRC staff concludes this will also be the case when the impact analysis uses the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and includes the PM_{10} emissions in the CALPUFF visibility analysis.

Table 4.7-5. Significance of the Air Quality Environmental Impacts for the Proposed Liquid Waste Disposal Options for Each Phase* of the Proposed Dewey-Burdock *In-Situ* Recovery Project

	Class V Injection Wells	Land Application	Combined Class V Injection Wells and Land Application
Construction	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Operations	SMALL	SMALL	SMALL
Aquifer Restoration	SMALL	SMALL	SMALL
Decommissioning	SMALL	SMALL	SMALL

*The peak year (i.e., when all four phases occur simultaneously) impacts will range between SMALL to MODERATE.

4.7.2 No Action (Alternative 2)

Under this alternative, there will be no change in the air quality at this site or at any surrounding receptors. The Black Hills-Rapid City Intrastate Air Quality Control Region currently meets the NAAQS, and it is expected that this area will continue to meet the NAAQS based on the current land use.

4.8 Noise Impacts

NRC staff concluded in GEIS Section 4.4.7 that the noise impact at an ISR facility may range from SMALL to MODERATE during all four phases of an ISR project, depending on the distance between the nearest resident and the activities occurring at the ISR facility (NRC, 2009a). Noise may also impact wildlife in the vicinity of the ISR facility. These impacts will be from the operation of equipment such as trucks, bulldozers, and compressors; from either commuting worker traffic or material and waste shipments; and from operation of the wellfields, central processing plant, satellite plant, and associated equipment. For workers at an ISR facility, administrative and engineering controls will be used to maintain noise levels in work areas below Occupational Safety and Health Administration (OSHA) regulatory limits (29 CFR 1910.95) and will be further mitigated by use of personal hearing protection.

GEIS Construction Phase Summary

Potential noise impacts will be greatest during construction of an ISR facility. The use of drill rigs, heavy trucks, bulldozers, and other equipment used to construct and operate wellfields, drill wells, construct access roads, and build the processing facilities will generate noise exceeding undisturbed background levels. Noise levels are expected be higher during daylight hours when construction is more likely to occur and more noticeable in proximity to the operating equipment. For individuals living in the vicinity of the site, ambient noise levels will return to background at distances more than 305 m [1,000 ft] from the construction activities. Wildlife will be expected to avoid areas where noise-generating activities occur, although continuous elevated noise levels may reduce the breeding success of certain wildlife (e.g., sage-grouse). Overall, these types of noise impacts will be SMALL, given the use of hearing controls for workers and the expected distance of nearest residents to the site. Traffic noise during construction (e.g., commuting workers; truck shipments to and from the facility, and construction equipment such as trucks, bulldozers, and compressors) is expected to be localized and limited to highways in the vicinity of the site, access roads within the site, and roads in the wellfields. The relative short-term increase in noise levels from passing traffic will be SMALL for the larger roads, but could be MODERATE for lightly traveled rural roads through smaller communities. (NRC, 2009a)

GEIS Operations Phase Summary

During ISR operations, noise-generating activities will occur mainly indoors within the central uranium processing facilities; therefore, offsite sound levels will be reduced during the operations phase. Wellfield equipment (e.g., pumps, compressors) will be contained within structures (e.g., header houses, satellite facilities), thus limiting the propagation of noise to offsite individuals. Traffic noise from commuting workers, truck shipments to and from the facility, and facility equipment will be localized and limited to highways in the vicinity of the site, access roads within the proposed license area, and wellfield roads. Relative short-term increases in noise levels from traffic will be SMALL for the larger roads, but could be MODERATE for lightly traveled rural roads through smaller communities. Thus, NRC staff concluded in the GEIS that potential impacts from noise during the operations phase may range from SMALL to MODERATE. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

General noise levels during aquifer restoration will be expected to be similar to, or less than, noise levels during operations. The noise from pumps and other wellfield equipment contained within buildings will reduce sound levels to offsite receptors. The existing operational infrastructure will be used, and traffic volume will be less than during the construction and operations phases. NRC staff concluded in the GEIS the potential impact from noise during aquifer restoration will range from SMALL to MODERATE, depending on the location of the nearest resident. (NRC, 2009a)

GEIS Decommissioning Phase Summary

General noise levels generated during decommissioning and reclamation will be similar to the noise generated during construction. Equipment used to dismantle buildings and milling equipment, remove potentially contaminated soils, or grade the surface as part of reclamation activities will generate audible noise at above-background levels. This noise will be temporary, and when decommissioning and reclamation activities are completed, noise levels will return to baseline, with occasional noise from longer term monitoring activities. Like the construction phase, the noise level will be greater during daylight hours when decommissioning and reclamation are more likely to occur and most noticeable in proximity to the operating equipment. Given the likely distance to nearby residents {i.e., greater than 305 m [1,000 ft]}, NRC staff concluded in the GEIS that noise will not be discernible to offsite residents or communities. Therefore, NRC staff concluded in the GEIS that the impact from noise generated during decommissioning may range from SMALL to MODERATE. (NRC, 2009a)

The potential site-specific environmental impacts from noise during construction, operations, aquifer restoration, and decommissioning of the proposed Dewey-Burdock ISR Project are described in the following sections.

4.8.1 Proposed Action (Alternative 1)

As described in SEIS Section 3.8, the majority of existing ambient noise (i.e., background noise) in the vicinity of the proposed Dewey-Burdock ISR Project site will be generated by traffic from U.S. Highway 18 and State Highway 89 (see Figure 3.3-1) and freight/coal trains from the Burlington Northern Santa Fe railroad (see Figure 3.2-1). Dwellings within and in the vicinity of the proposed site that may be impacted by noise generated by ISR activities are listed in Table 3.2-1 and shown in Figure 3.2-1. Edgemont, South Dakota (population 774), is the closest community to the proposed site, approximately 21 km [13 mi] to the south-southeast (see Figure 1.1-1). Other towns within 80 km [50 mi] of the proposed project area include Hot Springs and Custer, South Dakota, and Newcastle, Wyoming. As discussed in SEIS Section 3.6.3, no federally listed threatened or endangered species are known to occur within the proposed project area. However, five raptor nests were observed within the proposed project area and two raptor nests were observed within 1.6 km [1 mi] of the proposed project area during applicant surveys. As described in SEIS Section 3.6.1.2.2, one active bald eagle nest (a state-listed species) was reported in 2011 within the proposed project area along Beaver Creek, about 1.6 km [1 mi] west of the proposed Dewey satellite facility. The nearest recreational areas that may be impacted by noise are parcels of the BHNF bordering the proposed project area to the east and northeast and the Buffalo Gap National Grassland located about 4.8 km [3 mi] south of the project boundary.

As described in SEIS Section 2.1.1.1.2.4, options for liquid waste disposal at the proposed Dewey-Burdock ISR Project are (i) Class V deep injection wells, (ii) land application, or (iii) combined Class V deep injection wells and land application. The environmental impacts from noise for each of the waste disposal options are discussed in the following sections.

4.8.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant's preferred option for disposal of liquid wastes is deep well disposal via Class V injection wells. EPA is currently reviewing the applicant's UIC permit application for Class V injection wells. The locations of the first four Class V injection wells are shown in Figure 2.1-10.

4.8.1.1.1 Construction Impacts

As noted in SEIS Section 2.1.1.1.2, the construction phase of the proposed Dewey-Burdock ISR Project will involve the use of heavy equipment to create and improve road surfaces, transport supplies, excavate foundations, erect buildings, and install wells and pipelines in the wellfields. Equipment such as bulldozers, graders, tractor trailers, excavators, cranes, and drill rigs will create noise that will be audible above background noise levels. For the Class V injection well disposal option, additional noise will be generated by the installation of the Class V injection wells. Noise will also be generated by heavy equipment used to construct pipelines to transport liquid waste from the processing facilities to the Class V injection wells. Construction of processing facilities, pipelines, access roads, ponds, Class V injection wells, and wellfields is expected to be completed within 2 years (see Figure 2.1-1), followed by phased construction of additional wellfields during the operations phase.

Expected noise levels generated during construction activities at the Dewey-Burdock site will be most noticeable in proximity to operating equipment, such as drill rigs, heavy trucks, and bulldozers. Mitigation measures that the applicant will implement to minimize noise impacts include avoiding construction activities during the night, using sound abatement controls on operating equipment and facilities, and using personal hearing protection for workers in any high noise areas (Powertech, 2009a). These mitigation measures will ensure that noise levels remain below guidelines for offsite receptors [e.g., 55-decibel daytime guideline to protect against activity interference and annoyance (EPA, 1974)] and below OSHA regulatory limits for workers in 29 CFR 1910.95.

As described in SEIS Section 3.2, two permanently occupied dwellings (Putnam residence and Beaver Creek Ranch Headquarters), one vacant dwelling (Spencer residence), and one seasonally occupied dwelling (Daniel residence) are located within the proposed project area (see Figure 3.2-1). All of these onsite dwellings are located more than 1.6 km [1.0 mi] from proposed processing facilities and Class V injection wells in the Dewey and Burdock areas. The permanently occupied Beaver Creek Ranch Headquarters and Putnam residence are located approximately 0.8 km [0.5 mi] west and 1.3 km [0.8 mi] south of proposed wellfields in the Dewey area (see Figure 3.2-1). These distances are greater than the 305-m [1,000-ft] radius for noise from construction activities to return to background ambient noise levels (NRC, 2009a). However, the seasonally occupied Daniel residence is located within 305 m [1,000 ft] of defined wellfield areas B-WF6 and B-WF7 in the Burdock area (see Figure 2.1-6). Therefore, the Daniel residence is expected to experience short-term (1 to 2 years) noise above background levels during construction activities associated with development of these wellfields.

All offsite residential receptors are located more than 1.6 km [1.0 mi] from proposed processing facilities and deep Class V injection wells in the Dewey and Burdock areas. The nearest offsite residential receptors are located approximately 1.3 km [0.8 mi] south (Kennobie residence) and 1.3 km [0.8 mi] southwest (Peterson residence) of proposed wellfields in the Burdock area (see Figure 3.2-1). This distance also exceeds the 305-m [1,000-ft] radius for noise from construction activities to return to background ambient noise levels (NRC, 2009a). In addition, because of decreasing noise levels with distance, construction activities will have only SMALL and temporary noise impacts for nearby communities (e.g., Edgemont, Hot Springs, Custer, and Newcastle) and recreational areas (e.g., BHNF and Buffalo Gap National Grassland).

Truck transport of construction materials will be the primary noise source that may potentially affect the public. The incremental increase in construction-related noise due to traffic on the heavily traveled public roadways in the area (e.g., U.S. Highway 18 and State Highway 89) will not be expected to be noticeable. Traffic noise along Dewey Road from Edgemont to the Dewey-Burdock site will increase during construction activities due to workers commuting to and from the job site and truck shipments to and from the facilities during daylight hours. As described in SEIS Section 3.8, the maximum sound levels from heavy trucks (70 dBA) traveling along Dewey Road will diminish to approximately 57 dBA at a distance of approximately 480 m [1,575 ft] from the source. At distances beyond 480 m [1,575 ft] from Dewey Road, it is assumed that sound levels generated by heavy trucks will be approximately 40 dBA. Based on typical land uses within and surrounding the project site (e.g., rangeland, wildlife habitat, and recreation), sound levels ranging from 40 to 57 dBA are within Federal Highway Administration (FHWA) noise abatement criteria established in 23 CFR Part 772. These criteria are described in Table 3.8-1. In addition, Dewey Road is a lightly traveled county road with few residences, and increases in noise levels associated with passing heavy truck traffic during the construction phase will be short term (1 to 2 years; see Figure 2.1-1).

Elevated noise levels associated with construction activities may affect wildlife behavior (Federal Highway Administration, 2004; Brattstrom and Bondello, 1983; BLM, 2008). As noted in GEIS Section 4.4.7.1, wildlife is expected to avoid areas where noise-generating activities are ongoing (NRC, 2009a). However, raptors are particularly sensitive to noise and the presence of human activity, which will be heightened during the construction phase. As noted in SEIS Section 4.6.1.1.1.1.2, the bald eagle, red-tailed hawk, American kestrel, and northern harrier were the most commonly seen raptor species in the proposed project area and will be the primary raptor species impacted by project activities. These species are not imperiled with the exception of the bald eagle, which is a state-threatened species (SDGFP, 2010c). Direct impacts to raptor species from noise will include displacement, increased potential for nest abandonment and reproductive failure, and potential reduction in prey populations. To reduce noise impacts to raptors, the applicant has committed to adhering to FWS and SDGFP seasonal noise, vehicular traffic, and human proximity guidelines during the construction phase of the proposed project (see SEIS Section 4.6.1.1.1.1.2). The applicant will adhere to regulatory timing and spatial restrictions with regard to construction activities near raptor nests (Powertech, 2009a). Furthermore, the applicant has committed to follow an FWS-approved raptor monitoring and mitigation plan to reduce conflicts between active nest sites and project-related activities if direct impacts to raptors occurs (Powertech, 2009a).

With the exception of the seasonally occupied Daniel residence in the Burdock area, noise levels associated with project-related construction activities will not impact onsite or offsite residential receptors. Residents at the Daniel residence will experience noise levels above background due to heavy equipment use associated with the development of wellfields B-WF6 and B-WF7. However, these noise levels will be short term (1 to 2 years for each wellfield) and the residence will not be occupied year round. Implementation of mitigation measures, such as using sound abatement controls on operating equipment and facilities and using personal hearing protection for workers in high noise areas, will ensure that noise levels remain within guidelines for offsite receptors and workers. Noise levels associated with project-related transportation activities on Dewey Road leading to and from the site will be within FHWA noise abatement criteria at a distance of 480 m [1,575 ft] or greater and will be temporary (1 to 2 years). Noise impacts to raptors will be mitigated by adhering to FWS and SDGFP seasonal noise guidelines, adhering to regulatory timing and spatial restrictions with regard to construction activities near raptor nests, and following an FWS-approved raptor monitoring and mitigation plan. Therefore, the NRC staff concludes that the overall site-specific impacts from noise during construction for the Class V injection well disposal option will be SMALL.

4.8.1.1.2 Operations Impacts

The potential impact from onsite-generated noise during the operations phase of the proposed Dewey-Burdock ISR Project will be less than during the construction phase because fewer pieces of heavy machinery will be used. However, a variety of mechanical equipment (e.g., generators; pumps; air compressors; and heating, ventilation, and air conditioning systems) at the Burdock central processing plant, at the Dewey satellite facility, and in the wellfields will generate noise during the operations phase. Equipment such as pumps used to recover uranium from the pregnant lixiviant and dryers used to process and package the uranium slurry into yellowcake will be contained within the processing buildings, thus limiting the propagation of noise to onsite and offsite receptors. In the wellfields, pumps and compressors used for injection, recovery, and transfer of lixiviant will be contained within header houses. Likewise, pumps and compressors used to inject liquid wastes into deep disposal wells will be contained within locked buildings constructed around the wells (Powertech, 2010a). Mitigation measures, such as the use of sound abatement controls on operating equipment in processing facilities and wellfields, will further reduce the propagation of noise to onsite and offsite receptors. Noise impacts to workers during operations will be mitigated by the use of personal hearing protection in areas where noise levels exceed OSHA exposure limits in 29 CFR 1910.95 (Powertech, 2009a).

As noted in the previous section, the seasonally occupied Daniel residence is within 305 m [1,000 ft] of proposed wellfields B-WF6 and B-WF7 in the Burdock area (see Figure 2.1-6). Therefore, the Daniel residence may experience noise above background levels during activities associated with operations in these wellfields. Because wellfields will be developed and operated sequentially, these potential noise levels will be short term (1 to 2 years for each wellfield; see SEIS Section 2.1.1.1). In addition, the Daniel residence will not be occupied year round.

Heavy truck traffic associated with transporting uranium-loaded resins to and from the central processing plant and shipments of yellowcake will result in temporary noise. Shipments of yellowcake will be infrequent (see SEIS Section 2.1.1.1.7) and will have only a SMALL impact on noise levels on Dewey Road and highways in the vicinity of the site (e.g., U.S. Highway 18 through Edgemont). Traffic noise from commuting workers on highways in the vicinity of the site and on Dewey Road leading to and from the site will increase during operations when facilities are experiencing peak employment. However, because of the remote location of the site and lack of sensitive receptors leading to the site, noise impacts from passing traffic during operations will be SMALL.

As noted previously, there will be less noise from heavy equipment during the operations phase of the proposed project compared to the construction phase; therefore, the potential for noise to disrupt wildlife will be reduced. During operations, wildlife is anticipated to avoid areas where noise-generating activities are ongoing (NRC, 2009a). Potential noise-related impacts to active raptor nests due to operations-related activities will continue to be mitigated by adherence to timing and spatial restrictions within specified distances of active raptor nests as determined by appropriate regulatory agencies (e.g., FWS, SDGFP, and BLM) (Powertech, 2009a).

In summary, much of the noise generated during the operations phase of the proposed project will be contained within buildings and structures. Because of decreasing noise levels with distance, noise from operation activities will have no impact on residents, communities, or recreational areas that are located more than 305 m [1,000 ft] from specific noise-generating activities (NRC, 2009a). As noted previously, the seasonally occupied Daniel residence is located within 305 m [1,000 ft] of proposed wellfields B-WF6 and B-WF7 in the Burdock area and may experience noise above background levels during activities associated with operations in these wellfields. Because wellfields will be developed and operated sequentially (see SEIS Section 2.1.1.1), potential noise levels above background at the Daniel residence will be short term (1 to 2 years for each wellfield). In addition, the Daniel residence will not be occupied year round. Noise levels to onsite and offsite receptors will be mitigated by use of sound abatement controls on operating equipment, adherence to OSHA regulatory limits, and use of personal hearing protection. Heavy truck traffic associated with yellowcake shipments will be infrequent and result in only short-term noise on local roads and highways. Noise impacts to raptors will continue to be mitigated by adhering to FWS and SDGFP seasonal noise guidelines, adhering to regulatory timing and spatial restrictions with regard to construction activities near raptor nests, and following an FWS-approved raptor monitoring and mitigation plan (Powertech, 2009a). Therefore, the NRC staff conclude that the overall site-specific impacts from noise during operations for the Class V injection well disposal option will be SMALL.

4.8.1.1.3 Aquifer Restoration Impacts

NRC staff conclude that noise generated during the aquifer restoration phase of the proposed Dewey-Burdock ISR Project will either be similar to, or less than, noise generated during the operations phase. Pumps and compressors used to inject liquid wastes generated by aquifer restoration activities into Class V injection wells will be contained within locked buildings constructed around the wells (Powertech, 2010a). Noise from traffic will be limited to delivery of supplies and workers traveling to and from the site; therefore, there will be fewer vehicular trips than during the operations phase. In the wellfields, compressors and pumps will be the largest contributors to noise, but will be operated only for a relatively short daytime duration. Although potential noise generation during aquifer restoration is expected to be of short duration, aquifer restoration activities will continue over much of the life of the proposed project as operations are completed in sequentially developed wellfields (see Figure 2.1-1).

Because the amount of equipment used and the volume of traffic will be less than during the operations phase, noise impacts during aquifer restoration will remain SMALL. Furthermore, because of decreasing noise levels with distance, aquifer restoration activities and associated traffic will be expected to have only SMALL and temporary noise impacts for residences, communities, or sensitive areas that are located more than 305 m [1,000 ft] from specific noise-generating activities (NRC, 2009a). The seasonally occupied Daniel residence, which is located within 305 m [1,000 ft] of proposed wellfields B-WF6 and B-WF7 in the Burdock area may experience noise above background levels during activities associated with aquifer restoration. Because wellfields will be operated and restored sequentially, potential noise levels above background at the Daniel residence will be short term (1 to 2 years for each wellfield). In addition, the Daniel residence will not be occupied year round. Noise impacts to workers during aquifer restoration will be mitigated by adherence to OSHA noise regulations, and wildlife is anticipated to avoid areas where noise-generating activities are ongoing (NRC, 2009a). Potential noise-related impacts to active raptor nest sites will continue to be mitigated by adherence to timing and spatial restrictions within specified distances of active raptor nests as determined by appropriate regulatory agencies (e.g., FWS, SDGFP, and BLM) and by following an FWS-approved raptor monitoring and mitigation plan (Powertech, 2009a). Therefore, NRC staff conclude that the potential impact from noise during aquifer restoration for the Class V injection well disposal option will be SMALL.

4.8.1.1.4 Decommissioning Impacts

The noise generated during decommissioning of the proposed Dewey-Burdock ISR Project will be similar to or less than that generated during the construction phase. The sources of noise will include earthmoving, excavation, and building demolition activities. In the wellfields, the greatest source of noise will be from equipment used during plugging and abandonment of production, injection, and monitoring wells. Cement mixers, compressors, and pumps will be the largest contributors to noise, but will be operated only for a relatively short daytime duration. Fewer shipments to and from the proposed site will occur as decommissioning progresses, resulting in less noise from traffic. Because of decreasing noise levels with distance, decommissioning activities and associated traffic will be expected to have only SMALL and temporary noise impacts for residences, communities, or sensitive areas that are located more than 305 m [1,000 ft] from specific noise-generating activities (NRC, 2009a). The seasonally occupied Daniel residence, which is located within 305 m [1,000 ft] of proposed wellfields B-WF6 and B-WF7 in the Burdock area, may experience noise above background levels during activities associated with decommissioning in these wellfields. However, potential noise levels above background at the Daniel residence during wellfield decommissioning will be temporary and the Daniel residence will not be occupied year round. Noise impacts to workers during decommissioning will be mitigated by adherence to OSHA noise regulations, and wildlife is expected to avoid areas where noise generating activities are ongoing (NRC, 2009a). Potential noise-related impacts between active raptor nest sites and decommissioning activities will continue to be mitigated by adherence to timing and spatial restrictions within specified distances of active raptor nests as determined by appropriate regulatory agencies (e.g., FWS, SDGFP, and BLM) and by following an FWS-approved raptor monitoring and mitigation plan (Powertech, 2009a). Therefore, NRC staff conclude that the potential impact from noise during decommissioning for the Class V injection well disposal option will be SMALL.

4.8.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not obtained from EPA, the applicant will dispose of liquid waste generated at the proposed Dewey-Burdock ISR Project by land application (see SEIS Section 2.1.1.1.2.4.2). The locations of land application areas for this disposal option are shown in Figure 2.1-12. Potential environmental impacts from noise during construction, operations, aquifer restoration, and decommissioning for the land application option are discussed in the following sections.

4.8.1.2.1 Construction Impacts

For the land application disposal option, noise impacts to onsite and offsite human receptors and wildlife from the use of heavy equipment to create and improve road surfaces, transport supplies, excavate foundations, erect buildings, and install wells and pipelines during the construction phase will be similar to those described in SEIS Section 4.8.1.1.1 for the Class V injection well disposal option. However, additional noise will be generated by heavy equipment used to construct (i) pipelines that transport the liquid waste from the processing facilities to land application areas and (ii) catchment areas adjacent to land application areas to control stormwater runoff. To minimize noise impacts due to construction activities in land application areas, the same mitigation measures described in SEIS Section 4.8.1.1.1 will be implemented. These mitigation measures will include using sound abatement controls on operating equipment and facilities, avoiding construction activities during the night, and using personal hearing protection for workers operating heavy equipment (Powertech, 2009a). The applicant will limit worker exposure to noise in accordance with OSHA regulations in 29 CFR 1910.95.

In addition to the seasonally occupied Daniel residence, which is located within 305 m [1,000 ft] of proposed wellfields B-WF6 and B-WF7 in the Burdock area, the permanently occupied Beaver Creek Ranch Headquarters is located within 305 m [1,000 ft] of land application areas in the Dewey area. Because of its proximity to land application areas, residents at the Beaver Creek Ranch Headquarters may be impacted by noise associated with construction of pipelines and catchment areas in proposed land application areas in the Dewey area. Therefore, onsite receptors at both the Daniel residence and the Beaver Creek Ranch Headquarters may experience short-term (1 to 2 years) noise levels above background during construction phase activities if land application is implemented to dispose of liquid wastes.

With the exception of the Stodart residence (see Figure 3.2-1), all offsite residences are located more than 1.6 km [1.0 mi] from proposed land application areas. The Stodart residence is located approximately 0.8 km [0.5 mi] northwest of land application areas in the Dewey area. This distance is greater than the 305-m [1,000-ft] radius for noise from construction activities to return to background noise levels (NRC, 2009a).

With the exception of the seasonally occupied Daniel residence in the Burdock area and the Beaver Creek Ranch Headquarters in the Dewey area, noise levels associated with project-related construction activities will not impact onsite or offsite residential receptors. Residents at the Daniel residence and Beaver Creek Ranch Headquarters will experience noise levels above background due to heavy equipment use associated with the development of wellfields B-WF6 and B-WF7 in the Burdock area and land application areas in the Dewey area. However, these noise levels will be short term (1 to 2 years). Implementation of mitigation measures, such as using sound abatement controls on operating equipment and facilities and using personal hearing protection for workers in high noise areas, will ensure that noise levels remain within guidelines for offsite receptors and workers. Noise levels associated with project-related transportation activities on Dewey Road leading to and from the site will be within FHWA noise abatement criteria at distances of 480 m [1,575 ft] or greater and will be temporary (1 to 2 years). Noise impacts to raptors at the proposed project will be mitigated by adhering to FWS and SDGFP seasonal noise guidelines, locating all planned facilities outside of BLM recommended buffer zones of all raptor nests, and following an FWS-approved raptor monitoring and mitigation plan (Powertech, 2009a). Therefore, the NRC staff conclude that the overall site-specific impacts from noise during construction for the land application disposal option will be SMALL.

4.8.1.2.2 Operations Impacts

For the land application disposal option, noise impacts to onsite and offsite human receptors and wildlife generated by mechanical equipment at the processing facilities and wellfields and by heavy truck and commuter traffic during the operations phase of the project will be similar to those described in SEIS Section 4.8.1.1.2 for the Class V injection well disposal option. Additional noise will be generated by pumps and the motors or engines used to drive irrigation pivots in land application areas. Noise levels generated by irrigation equipment in land application areas may be substantially reduced by installing exhaust and inlet silencers on engines, using electric motor drives instead of internal combustion engines, and erecting acoustic barriers to block the line of hearing from the exhaust engine and inlet toward the receptors (either human or wildlife) to be protected from noise.

As noted in the previous section, the seasonally occupied Daniel residence is located within 305 m [1,000 ft] of proposed wellfields B-WF6 and B-WF7 in the Burdock area and the Beaver Creek Ranch Headquarters is located within 305 m [1,000 ft] of proposed land application areas in the Dewey area (see Figure 2.1-6). Therefore, these residences may experience noise above background levels during activities associated with wellfield and land application operations. Because wellfields will be developed and operated sequentially, potential noise levels above background due to wellfield operations will be short term (1 to 2 years for each wellfield). In addition, land application areas will not be operated year round. As described in SEIS Section 2.1.1.1.6.2, treated wastewater will be applied to the land during the growing season (approximately April through October). Beyond the growing season, land irrigation will be conducted as conditions permit, relying on evaporation to remove water from soils.

Much of the noise generated during the operations phase of the project will be contained within buildings and structures. Because of decreasing noise levels with distance, noise from operation activities will have no impact on residents, communities, or recreational areas that are located more than 305 m [1,000 ft] from specific noise-generating activities (NRC, 2009a). As noted previously, residents at the seasonally occupied Daniel residence and the Beaver Creek Ranch Headquarters may experience noise above background levels during activities associated with operations in wellfields B-WF6 and B-WF7 and land application areas in the Dewey area. Because wellfields will be developed and operated sequentially (see SEIS Section 2.1.1.1), potential noise levels above background at the Daniel residence will be short term (1 to 2 years for each wellfield). In addition, the Daniels residence will not be occupied year round. Likewise, residents at the Beaver Creek Ranch Headquarters will only be exposed to noise from nearby land application areas during the growing season (approximately April through October). Noise levels to onsite and offsite receptors will be further mitigated by use of sound abatement controls on operating equipment, adherence to OSHA regulatory limits, and use of personal hearing protection. Heavy truck traffic associated with yellowcake shipments will be infrequent and result in only short-term noise on local roads and highways. During operations, wildlife is expected to avoid areas where noise-generating activities are ongoing (NRC, 2009a). Noise impacts to raptors at the proposed project will continue to be mitigated by adhering to FWS and SDGFP seasonal noise guidelines and by following an FWS-approved raptor monitoring and mitigation plan (Powertech, 2009a). Therefore, the NRC staff conclude that the overall site-specific impacts from noise during operations for the land application disposal option will be SMALL.

4.8.1.2.3 Aquifer Restoration Impacts

For the land application liquid waste disposal option, noise generated during the aquifer restoration phase of the proposed Dewey-Burdock ISR Project will either be similar to, or less than, noise generated during the operations phase. Noise levels generated by irrigation equipment in land application areas may be substantially reduced by installing exhaust and inlet silencers on engines, using electric motor drives instead of internal combustion engines, and erecting acoustic barriers to block the line of hearing from the exhaust engine and inlet toward the receptors (either human or wildlife). Noise from traffic will be limited to delivery of supplies and workers traveling to and from the site; therefore, there will be fewer vehicular trips than during the operations phase. In the wellfields, compressors and pumps will be the largest contributors to noise, but will be operated only for a relatively short daytime duration. Although potential noise generation during aquifer restoration in each wellfield is expected to be of short duration, aquifer restoration activities will continue over much of the life of the project as operations are completed in sequentially developed wellfields (see Figure 2.1-1).

Because the amount of equipment used and the volume of traffic will be less than during the operations phase, noise impacts during aquifer restoration will remain SMALL. Furthermore, because of decreasing noise levels with distance, aquifer restoration activities and associated traffic will be expected to have only SMALL and temporary noise impacts for residences, communities, or sensitive areas that are located more than 305 m [1,000 ft] from specific noise-generating activities (NRC, 2009a). Residents at the seasonally occupied Daniel residence and the Beaver Creek Ranch Headquarters may experience noise above background levels during activities associated with aquifer restoration activities in wellfields B-WF6 and B-WF7 and land application areas in the Dewey area. Because wellfields will be developed and operated sequentially (see SEIS Section 2.1.1.1), potential noise levels above background at the Daniel residence will be short term (1 to 2 years for each wellfield). In addition, the Daniel residence will not be occupied year round. Likewise, residents at the Beaver Creek Ranch Headquarters will only be exposed to noise from nearby land application areas during the growing season. Noise impacts to workers during aquifer restoration will be mitigated by adherence to OSHA noise regulations, and wildlife is anticipated to avoid areas where noise-generating activities are ongoing (NRC, 2009a). Potential noise-related impacts between active raptor nest sites and aquifer restoration activities will continue to be mitigated by adherence to timing and spatial restrictions within specified distances of active raptor nests as determined by appropriate regulatory agencies (e.g., FWS, SDGFP, and BLM) (Powertech, 2009a). Therefore, the potential impact from noise during aquifer restoration for the land application disposal option will be SMALL.

4.8.1.2.4 Decommissioning Impacts

The noise generated during decommissioning of the proposed Dewey-Burdock ISR Project will be similar to or less than that generated during the construction phase. The sources of noise will include earthmoving, excavation, and building demolition activities. In the wellfields, the greatest source of noise will be from equipment used during plugging and abandonment of production, injection, and monitoring wells. Cement mixers, compressors, and pumps will be the largest contributors to noise, but will be operated only for a relatively short daytime duration. Fewer shipments to and from the proposed site will occur as decommissioning progressed, resulting in less noise from traffic. Because of decreasing noise levels with distance, decommissioning activities and associated traffic will be expected to have only SMALL and temporary noise impacts for residences, communities, or sensitive areas that are located more than 305 m [1,000 ft] from specific noise-generating activities (NRC, 2009a). The seasonally occupied Daniel residence and the Beaver Creek Ranch Headquarters may experience noise above background levels during activities associated with decommissioning activities in wellfields B-WF6 and B-WF7 and land application areas in the Dewey area. However, potential noise levels above background at the Daniel residence and the Beaver Creek Ranch Headquarters during decommissioning will be temporary. In addition, the Daniel residence will not be occupied year round. Noise impacts to workers during decommissioning will be mitigated by adherence to OSHA noise regulations, and wildlife is expected to avoid areas where noise-generating activities are ongoing (NRC, 2009a). Potential noise-related impacts between active raptor nest sites and decommissioning activities will continue to be mitigated by adherence to timing and spatial restrictions within specified distances of active raptor nests as determined by appropriate regulatory agencies (e.g., FWS, SDGFP, and BLM) (Powertech, 2009a). Therefore, NRC staff conclude that the potential impact from noise during decommissioning for the land application disposal option will be SMALL.

4.8.1.3 Disposal Via Combination of Class V Injection and Land Application

If a permit for Class V injection wells is obtained from EPA but the capacity of the wells is insufficient to dispose of all liquid wastes generated at the proposed Dewey-Burdock ISR Project, the applicant will dispose of liquid waste by a combination of Class V injection wells and land application (see SEIS Section 2.1.1.1.2.4.3). For the combined Class V injection well disposal and land application option, land application facilities and infrastructure will be constructed, operated, restored, and decommissioned on an as-needed basis depending on the Class V injection well disposal capacity (Powertech, 2011). As described in SEIS Sections 4.8.1.1 and 4.8.1.2, many project-related noise impacts to onsite and offsite receptors will be similar for either the Class V injection well or land application disposal options. However, for the land application option, additional noise will be generated by construction of land application facilities and infrastructure (e.g., irrigation areas, pipelines, and ponds for liquid waste storage during nonirrigation periods) and operation of center pivot irrigation systems. In comparison, for the Class V injection well disposal option, additional noise will be generated by construction of four to eight Class V injection wells (see SEIS Section 2.1.1.1.2.4.1). During operations, pumps and compressors used to inject liquid wastes into Class V injection wells will be contained within buildings constructed around the wells (Powertech, 2010a), which will reduce noise impacts to onsite and offsite residents and workers. Therefore, the environmental noise impacts of liquid waste disposal by land application for all phases of the ISR process will be greater than for liquid waste disposal by Class V well injection. Furthermore, because only a portion of land application facilities and infrastructure will be constructed, operated, and decommissioned, the significance of environmental noise impacts for the combined disposal option will be less than for the land application option alone. Therefore, NRC staff conclude that the environmental noise impacts of the combined Class V injection well and land application option for each phase of the proposed project will be bounded by the significance of environmental noise impacts of the Class V injection well option and the land application option as summarized in Table 4.8.1.

4.8.2 No Action (Alternative 2)

Under the No-Action alternative, there will be no change to the sound levels either within the proposed license area or to surrounding receptors. While natural resource exploration activities will continue and could potentially expand in the future, they will typically be of short duration and will involve few vehicles and no permanent, noise-emitting infrastructure. The natural setting of the proposed project area and the continuation of ongoing natural resource exploration activities will result in sound levels remaining at ambient levels.

4.9 Historic and Cultural Resources Impacts

As discussed in GEIS Section 4.4.8, potential environmental impacts on historic and cultural resources may occur during all phases of an ISR facility's lifecycle (NRC, 2009a). Loss of and damage to historic, cultural, and archaeological resources may result from land disturbance as part of construction, operations, aquifer restoration, and decommissioning activities. In addition, the introduction of new visual, auditory, or other sensory elements has the potential to impact the integrity of historic properties.

Table 4.8-1. Significance of Environmental Noise Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

	Class V *Injection* Wells	Land Application	Combined Class V Injection Wells and Land Application*
Construction	SMALL	SMALL	SMALL
Operations	SMALL	SMALL	SMALL
Aquifer Restoration	SMALL	SMALL	SMALL
Decommissioning	SMALL	SMALL	SMALL
*Significance of environmental impact for the combined disposal option is bounded by the significance of environmental impacts for the Class V injection well and land application disposal options.			

GEIS Construction Phase Summary

As discussed in GEIS Section 4.4.8.1, the potential impacts during ISR facility construction may include loss of or damage to historic and cultural resources due to excavation and earthmoving activities. An NRC licensee condition that requires the stoppage of work upon discovery of undocumented historic or cultural resources may be imposed. Such a condition will require notification of the appropriate federal, tribal, and state agencies to implement mitigation measures. NRC staff concluded in the GEIS that potential impacts to historic and cultural resources from construction will be SMALL to LARGE depending on whether historic and cultural resources are present within the project area. Mitigation measures identified in the licensee's management plan or site specific Memorandum of Agreement (MOA) or Programmatic Agreement (PA) could reduce an adverse impact to a historic or cultural resource by reducing the adverse effect on a historic property. (NRC, 2009a)

GEIS Operations Phase Summary

As discussed in GEIS Section 4.4.8.2, it is expected potential impacts to historic and cultural resources from operations will be less than during construction, because less land disturbance occurs during this phase. Additionally, conditions in the NRC license typically require the licensee to stop work upon discovery of previously undocumented historic or cultural resources and to notify the appropriate federal, tribal, and state agencies to implement mitigation measures. For these reasons, NRC staff determined in the GEIS that potential impacts to historic and cultural resources from ISR operations will be SMALL. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

In GEIS Section 4.4.8.3, NRC staff determined that potential impacts to historic and cultural resources from aquifer restoration are expected to be similar to, or less than, potential impacts from operations. Aquifer restoration activities are generally limited to the existing infrastructure and previously disturbed areas (e.g., access roads, central processing plant). Additionally, typical conditions in the NRC license regarding the discovery of previously undocumented historic or cultural resources will remain in effect and could minimize potential adverse impacts. For these reasons, NRC staff concluded in the GEIS that the potential impacts from aquifer restoration on historic and cultural resources will be SMALL. (NRC, 2009a)

GEIS Decommissioning Phase Summary

GEIS Section 4.4.8.4 discussed potential impacts from decommissioning to historic and cultural resources. Decommissioning and reclamation activities will focus on those areas that have been disturbed; therefore, historic and cultural resources within the potential area of effect will already be known. For these reasons, NRC staff determined in the GEIS the potential impacts to historic, cultural, and archaeological resources during decommissioning and reclamation will be SMALL. (NRC, 2009a)

The potential impacts to historic and cultural resources from construction, operations, aquifer restoration, and decommissioning for the proposed Dewey-Burdock ISR Project are discussed in the following sections.

4.9.1 Proposed Action (Alternative 1)

Potential impacts on historic and cultural resources at the proposed Dewey-Burdock ISR Project will be linked to the physical structures and infrastructure associated with the proposed action. As described in SEIS Section 2.1.1.2, a central processing plant in the Burdock area, a satellite facility in the Dewey area, access roads, wellfields, pipelines, surface impoundments, and potential land irrigation areas will be constructed at the proposed project site. As described in SEIS Section 3.9.1.2, the area of potential effects (APE) for the review of historic and cultural resources at the proposed Dewey-Burdock ISR Project is defined as the area that will be directly or indirectly impacted by construction, operation, aquifer restoration, and decommissioning activities. The APE for the proposed project coincides with the extent of potential ground disturbance resulting from proposed facility construction and operations. The introduction of new visual and auditory elements also has the potential to diminish the integrity of historic properties in the project area.

The extent of the APE for facility construction and operations at the proposed project will depend on the disposal option used to dispose of liquid waste. The applicant is proposing options for liquid waste disposal that include deep well disposal via Class V injection wells, land application, or a combination of both methods (see SEIS Section 2.1.1.1.2.4). The APE for facility construction and operations for all the liquid waste disposal options totals 1,067 ha [2,637 ac] (see Figure 3.9-1). This area includes a 969-ha [2.394-ac] buffer zone surrounding 98.3-ha [243-ac] of projected disturbance areas for the plant facilities, wellfields, ponds, roads, and pipelines. If land application is used for liquid waste disposal, the APE for facility construction and operations will include an additional maximum area of approximately 506 ha [1,250 ac] surrounding proposed land application areas (see Figure 3.9-1).

The introduction of new visual effects is expected to have the greatest potential to diminish the integrity of historic properties in the project area. The extent of the APE for visual impacts includes areas within a 4.8-km [3-mi] radius of the central processing plant in the Burdock area and the satellite processing facility in the Dewey area (see Figure 3.9-1). The central processing plant and satellite processing facility will be the tallest buildings constructed at the proposed Dewey-Burdock ISR Project site (Powertech, 2009a). Based on proposed locations of the central processing plant and the satellite processing facility, the APE for visual impacts will extend a maximum of 2.33 km [1.45 mi] from the eastern project boundary in the Burdock area and a maximum of 2.7 km [1.7 mi] from the western project boundary in the Dewey area (see SEIS Figure 3.9-1).

The potential impacts on historic and cultural resources for each of the applicant-proposed liquid waste disposal options (i.e., disposal via Class V injection wells, disposal via land application, or disposal via combination of Class V injection wells and land application) are discussed in the following sections.

4.9.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant's preferred disposal option for liquid waste is deep well disposal via Class V injection wells. Potential impacts on historic and cultural resources from construction, operations, aquifer restoration, and decommissioning associated with the Class V injection well disposal option at the proposed Dewey-Burdock ISR Project are discussed in the following sections.

4.9.1.1.1 Construction Impacts

As discussed in the SEIS Section 4.2.1.1.1, a total of 98.3 ha [243 ac] or 2.3 percent of the proposed permit area will be potentially disturbed by activities associated with construction of site buildings, pipelines, wellfields, ponds, and access roads for the Class V injection well disposal option (Powertech, 2010a). As described previously, the APE for facility construction and operations for the Class V injection well disposal option totals 1,067 ha [2,673 ac] as illustrated in Figure 3.9-1. This area includes a 969-ha [2,394-ac] buffer zone surrounding the 98.3-ha [243-ac] area of projected land disturbance.

As part of the environmental review of historic and cultural resources, the NRC evaluated the results of historic and cultural resource surveys conducted at the proposed Dewey-Burdock ISR Project site (see SEIS Section 3.9.3). These surveys included: (i) a Level III cultural resource investigation conducted as part of prelicense application activities; (ii) a tribal cultural survey; and (iii) a visual impacts assessment. In addition to the visual impacts assessment, NRC evaluated whether the proposed project has the potential to introduce new auditory changes to the project area that could impact historic properties located within or outside the limits of proposed ground disturbance.

In making recommendations on the eligibility of historic properties for the National Register for Historic Places (NRHP), NRC applies the criteria found in the National Historic Preservation Act (NHPA) implementing regulations at 36 CFR 60.4(a)–(d). The criteria are: (A) association with significant events in history; (B) association with the lives of persons significant in the past; (C) embodiment of distinctive characteristics of type, period, or construction; and (D) sites or places that have yielded or are likely to yield important information (ACHP, 2012). The NRC NRHP eligibility determinations and impact assessment for cultural and historic properties identified at the Dewey-Burdock site are discussed in the sections below.

<u>Level III Cultural Resource Investigations</u>

As described in SEIS Section 3.9.3.1, NRC staff reviewed Level III cultural resource investigations and evaluative testing reports prepared by the Archaeology Laboratory, Augustana College (ALAC) on behalf of the applicant for the Dewey-Burdock site (Kruse, et al., 2008; Palmer and Kruse, 2008; Palmer 2008, 2009, 2012). More than 200 archaeological sites were recorded during archeological field investigations. One-hundred and forty-nine (149) sites were recommended as ineligible for listing in the NRHP. Seventy-nine (79) of these sites consisted of isolated finds lacking physical integrity or context. Approximately 140 ineligible sites were mostly prehistoric sites located on high disturbed and eroded landforms and have little potential to possess intact, significant buried cultural deposits. Sites that are not eligible for listing in the NRHP are not expected to be impacted by activities associated with facility construction and operations. Therefore, NRC staff expects SMALL impacts to these sites during the construction phase for the Class V injection well disposal option.

Based on archaeological field investigations, a total of 18 historic properties within the proposed project area are listed or recommended as eligible for listing in the NRHP. Table 4.9-1 lists these sites, as well as the NRC NRHP-eligibility determinations, the locations of eligible sites within the APE affected by facility construction and operations, the NRC assessment of the significance of impact, and NRC management recommendations. The South Dakota State Historic Presevation Office (SD SHPO) concurred on the NRC determination of sites eligible to

Table 4.9-1. U.S. Nuclear Regulatory Commission (NRC) Determination of National Register of Historic Places (NRHP)-Eligibility and Impact Analysis for Historic Properties Within the Proposed Project Area Listed in NRHP or Recommended as Eligible for Listing in the NRHP (DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

StateSite Number	Description	NRC's NRHP Determination	Location with Respect to the Area of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation
Historic District 90000949- Edna and Ernest Young Ranch	This historic district covers 52.6 ha [130 ac] and is located approximately 4.8 km [3 mi] south of Dewey and south of Beaver Creek. The area of significance is exploration/settlement during 1900–1924 and 1925–1949. There are 13 contributing buildings, one contributing structure, and one non-contributing structure.	Eligible, Criteria A and C	Outside APE	SMALL; no impact anticipated	Listed in the NRHP in 1990. National Register Historic District will be avoided.
Bakewell Ranch (Structure CU00000050)	The Bakewell Ranch is located within the Edna and Ernest Young Ranch National Register Historic District.	Eligible, Criteria A and C	Outside APE	SMALL; no impact anticipated	Listed on the NRHP. Historic property will be avoided.
Log Barn (Structure CU02500002)	Log barn at the Richardson Homestead was found eligible for listing on NRHP in April 2012 under Criteria A.	Eligible, Criterion A	Wiithin APE for LA	LARGE potential impact	Site is located approximately 76 m [250 ft] south of land application areas. The site will be fenced off to ensure avoidance.
39CU0271	Native American and Archaic artifact scatter and occupation site on a ridge slope with a cairn feature.	Eligible, Criterion D	Within APE for DDW and LA	LARGE potential impact	Site is located approximately 61 m [200 ft] east of proposed wellfield areas. Site will be avoided.
39CU0577	Native American/ Euroamerican/ Occupation site; artifact scatter.	Eligible, Criterion D	Outside APE	SMALL; no impact anticipated	Site will be avoided.
39CU0578	Euroamerican/Native American Historic dump and occupation site located on a ridge slope.	Eligible, Criterion D	Outside APE	SMALL; no impact anticipated	Site will be avoided.
39CU0584	Native American occupation site and burial (affiliation unknown) on a ridge slope.	Eligible, Criterion D	Outside APE	SMALL; no impact anticipated	Site will be avoided.
39CU0586	Native American and Late Archaic occupation site on a ridge crest.	Eligible, Criterion D	Outside APE	SMALL; no impact anticipated	Site will be avoided.

Table 4.9-1. U.S. Nuclear Regulatory Commission (NRC) Determination of National Register of Historic Places (NRHP)-Eligibility and Impact Analysis for Historic Properties Within the Proposed Project Area Listed in NRHP or Recommended as Eligible for Listing in the NRHP (Cont'd) (DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

StateSite Number	Description	NRC's NRHP Determination	Location with Respect to the Area of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation
39CU0588	Native American occupation site on a ridge crest.	Eligible, Criterion D	Outside APE	SMALL; no impact anticipated	Site will be avoided.
39CU0590	Native American artifact scatter on a ridge saddle.	Eligible, Criterion D	Outside APE	SMALL; no impact anticipated	Site will be avoided.
39CU0593	Native American and Euroamerican occupation and artifact scatter on a hillslope.	Eligible, Criterion D	Outside APE	SMALL; no impact anticipated	Site will be avoided.
39CU2000	Historic Railroad.	Eligible, Criteria A and C	Within APE for DDW and LA	LARGE potential impact	Site crosses proposed wellfield areas. Site will be avoided.
39CU2733	Native American hearth and artifact scatter on a ridge slope.	Eligible, Criterion D	Outside APE	SMALL; no impact anticipated	Site will be avoided.
39CU2735	Archaic- Prehistoric occupation site.	Eligible, Criterion D	Outside APE	SMALL; no impact anticipated	Site will be avoided.
39CU2738	Native American occupation site on a ridge crest.	Eligible, Criterion D	Outside APE	SMALL; no impact anticipated	Site will be avoided.
39CU3592	Native American artifact scatter and hearth site.	Eligible, Criterion D	Within APE for DDW and LA	LARGE potential impact	Site is located within a proposed wellfield area south of the Dewey satellite facility. Site will be fenced off to ensure avoidance.
39FA1941	Native American artifact scatter and hearth site.	Eligible, Criterion D	Within APE for DDW and LA	LARGE potential impact	Site is located approximately 91 m [300 ft] east of the proposed Burdock central processing plant and is within a proposed wellfield area. Site will be avoided or mitigated as necessary.
39FA2000	Historic Railroad.	Eligible, Criteria A and C	Within APE for DDW and LA	LARGE potential impact	Site crosses proposed wellfield areas. Site will be avoided.

the NRHP in Table 4.9-1 (SD SHPO, 2012, 2014). Avoidance of historic properties is the goal during development and production phases of the proposed project (Powertech, 2009a). Archaeological and tribal monitors are expected to be present during ground disturbing activities in order to protect known historic properties (Powertech, 2009a). The 18 historic properties currently listed or recommended eligible for listing in the NRHP are discussed next. Sites 39CU0577, 39CU0578, 39CU0586, 39CU0588, 39CU2733, 39CU2738, and 39CU0590 are Native American occupation sites. Site 39CU2735 is an Archaic occupation site. Site 39CU0593 contains both Native American and Euroamerican components, with artifact scatters extending down a hillslope. Site 39CU0584 is a Native American occupation site and burial (affiliation unknown) located on a ridge slope. Each of these sites is recommended as eligible for listing in the NRHP (Kruse, et al., 2008). However, all are located outside the APE for facility construction and operations. Because these properties are not threatened by site activities and will be avoided, no impacts to these sites are anticipated.

The Edna and Ernest Young Ranch Historic District (90000949) and the Bakewell Ranch (CU0000050) within this historic district are listed on the NRHP and were described in detail in SEIS Section 3.9.3.1.2. The properties are located south of Beaver Creek in the northwestern part of the project area, southwest of the proposed wellfield areas in the Dewey area. These properties are located outside the APE for facility construction and operations and will be avoided. Therefore, no potential impacts to these historic properties from ground disturbing activities are anticipated.

Five historic properties (39CU3592, 39CU0271, 39FA1941, 39CU2000, and 39FA2000) may be impacted by proposed construction activities associated with the Class V injection well disposal option. These sites are described next.

Site 39CU3592 is a Native American artifact scatter and hearth site located within a proposed wellfield area south of the Dewey satellite facility. NRC staff has recommended that a buffer zone and protective fencing be erected around 39CU3592 to ensure this historic property is not adversely impacted during project activities. The applicant committed to protect this property by establishing a buffer zone and installing protective fencing around the site (Powertech, 2012e).

Site 39CU0271 is an Archaic occupation site with 238 associated hearth features and a cairn feature. Site 39CU0271 is located to the east of a proposed monitoring well ring in the Dewey area. NRC staff recommend avoidance of site 39CU271 and the applicant committed to avoid this site (Powertech, 2012e). During the tribal cultural survey, site 39CU0271 was visited and recorded but the tribes did not provide an eligibility recommendation for this site. The Tribal Cultural Survey is discussed later in this section.

Site 39FA1941 is an Archaic artifact scatter and hearth site located on a ridgetop, east of the proposed Burdock central processing plant. The southern portion of this site lies within a proposed wellfield area. NRC staff recommend avoidance of site 39FA1941 and the applicant committed to avoid this site and if necessary to mitigate impacts (Powertech, 2012e). If avoidance of this historic property is not possible, NRC staff recommend a treatment plan for mitigation and data recovery measures be developed by the applicant in consultation with the NRC, SD SHPO, BLM, and tribal representatives.

Sites 39CU2000 and 39FA2000 are historic properties containing 1889 portions of the Burlington Northern Railroad, which runs the length of the project area. Site 39CU2000 crosses proposed wellfield areas east of the proposed Dewey satellite facility. Additionally, a portion of site 39FA2000 crosses a proposed wellfield area located southwest of the Burdock central processing plant. NRC staff recommends avoidance of the railroad segments and the applicant has committed to avoid these historic properties (Powertech, 2012e).

One historic property (CU02500002; a log barn structure) may be impacted by proposed construction activities associated with land application disposal. Site CU02500002 is discussed in SEIS Section 4.9.1.2.1.

As described in SEIS Section 3.9.3.1.1, sixty-eight (68) recorded archaeological sites within the proposed project area have not been evaluated for NRHP eligibility. NRC treats unevaluated archaeological sites as eligible for listing in the NRHP under Criterion D. Assessments of unevaluated archaeological sites containing burial and cairn features, as well as unevaluated archaeological sites that may be impacted by ground disturbance activities are discussed next.

As discussed in SEIS Sections 3.9.3.1.1, historic and ethnographic evidence indicate cairn features served as markers for trails, camps, burials, caches, and ceremonial centers. Sites containing burial or cairn features are protected by law in South Dakota, pursuant to South Dakota Codified Law 34-27. Unevaluated sites with burials or cairn features that were identified and recorded during archaeological field investigations are listed in Table 4.9-2 along with NRC NRHP-eligibility determinations, the locations of eligible sites within the APE affected by facility construction and operations, the NRC assessment of the significance of impacts, and NRC management recommendations.

As noted previously, NRC considers unevaluated sites eligible for listing in the NRHP under Criterion D. NRC staff recommend avoidance of unevaluated sites pending further evaluation to determine NRHP eligibility.

Site 39FA1902 is a historic site with a possible Euroamerican burial located approximately 152 m [500 ft] west of the proposed Burdock central processing plant and will not be disturbed by project construction or operational activities. As described in SEIS Section 3.9.3.1.2, this site contains a historic bridge structure (FA00000151). Because the site has not been evaluated for eligibility for listing on the NRHP, the applicant has committed to avoid this site by means of a buffer zone and protective fencing (Powertech, 2012f). During the tribal cultural survey, site 39FA1902 was identified as of no interest to the Northern Cheyenne and Northern Arapaho tribes (see SEIS Section 3.9.3.2.2). Representatives of both tribes examined the possible gravesite and determined it most likely did not have a tribal affiliation because modern materials including broken concrete were among the stones marking the location.

During tribal cultural surveys of the Dewey-Burdock site, five of the unevaluated archaeological sites listed in Table 4.9-2 (39CU3620, 39FA1862, 39FA1881, 39FA1890, and 39FA1927) were visited, recorded, and recommended eligible for listing in the NRHP under one or more criteria of eligibility (see Table 3.9-5). The following section (Tribal Cultural Survey) provides the NRC NRHP-eligibility determination, the significance of impact, and management recommendations for these five sites based on information from the tribal cultural survey. Four unevaluated burial and cairn sites listed in Table 4.9-2 (39CU0530, 39CU3564, 39CU3587, and 39FA1863) are located outside the APE for facility construction and operations for the Class V injection well disposal option and, therefore, potential impacts to these sites are not anticipated. One unevaluated site listed in Table 4.9-2 (39CU3584) is located within the APE for facility construction and operations for the land application disposal option. Site 39CU3584 is discussed in SEIS Section 4.9.1.2.1.

Table 4.9-2. U.S. Nuclear Regulatory Commission (NRC) Determination of National Register of Historic Places (NRHP)-Eligibility and Impact Analysis for Unevaluated Sites Containing Burial and Cairn Features Identified During Archaeological Field Investigations. (DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

StateSite Number	Description	NRC's NRHP Determination*	Location with Respect to the Area of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation
39CU0530	Cairn site	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoidance
39CU3564	Cairn site	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoidance
39CU3584	Cairn site	Unevaluated	Within APE for LA	LARGE potential impact	Avoidance
39CU3587	Two historic Euroamerican burials	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoidance
39CU3620	Cairn site	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoidance
39FA1862	Cairn site with stone circles	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoidance
39FA1863	Cairn site with stone circles	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoidance
39FA1881	Cairn site	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoidance
39FA1890	Cairn site	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoidance
39FA1902	Historic site with Euroamerican burial	Unevaluated	Outside APE	SMALL; no impact anticipated	Euroamerican burial site is located approximately 152 m [500 ft] west of the proposed Burdock central processing plant. Site will be protected by a buffer zone and fencing.
39FA1927	Cairn site	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoidance

*Unevaluated sites are considered eligible for listing on the NRHP under Criterion D pending further evaluation.

As described in SEIS Section 3.9.3.1.1, several unevaluated archaeological sites are located within or adjacent to the APE for facility construction and operations and, therefore, could be potentially impacted by ISR activities. These unevaluated archaeological sites are listed in Table 4.9-3 along with NRC's NRHP eligibility determination, the location of eligible sites within the APE affected by facility construction and operations, the NRC assessment of the significance of impacts, and NRC management recommendations.

Table 4.9-3. U.S. Nuclear Regulatory Commission (NRC) Determination of National Register of Historic Places (NRHP)-Eligibility and Impact Analysis on Unevaluated Sites Identified During Archaeological Field Investigations Within the APE for Facility Construction and Operations. (DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

StateSite Number	Description	NRC's NRHP Determination*	Location with Respect to Area of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation
39CU0554	Artifact scatter	Unevaluated	Within APE for DDW and LA	LARGE potential impact	Site will undergo further evaluative testing. Avoid until testing is completed.
39CU0558	Artifact scatter	Unevaluated	Within APE for DDW and LA	LARGE potential impact	Site will undergo further evaluative testing. Avoid until testing is completed.
39CU0653	Artifact scatter	Unevaluated	Within APE for LA	LARGE potential impact	Site will undergo further evaluative testing. Avoid until testing is completed.
39CU3603	Artifact scatter, hearth	Unevaluated	Within APE for DDW and LA	LARGE potential impact	Site will undergo further evaluative testing. Avoid until testing is completed.
39CU3615	Artifact scatter	Unevaluated	Within APE for LA	LARGE potential impact	Site will undergo further evaluative testing. Avoid until testing is completed.
39CU3624	Artifact scatter	Unevaluated	Adjacent to APE for DDW and LA	LARGE potential impact	Site will undergo further evaluative testing. Site will be avoided.
39FA0096	Historic cabin	Unevaluated	Within APE for DDW and LA	LARGE potential impact	Site will undergo further evaluative testing. Avoid until testing is completed
39FA0274	Artifact scatter	Unevaluated	Within APE for DDW and LA	LARGE potential impact	Site will undergo further evaluative testing. Avoid until testing is completed.
39FA0556	Artifact scatter	Unevaluated	Within APE for DDW and LA	LARGE potential impact	Site will undergo further evaluative testing. Avoid until testing is completed.
39FA0740	Artifact scatter	Unevaluated	Adjacent to APE for LA	LARGE potential impact	Site will undergo further evaluative testing. Avoid until testing is completed.
39FA0777	Artifact scatter	Unevaluated	Adjacent to APE for LA	LARGE potential impact	Site will undergo further evaluative testing. Avoid until testing is completed.
39FA0778	Historic farmstead	Unevaluated	Within APE for DDW and LA	LARGE potential impact	Site will undergo further evaluative testing and mitigation, as necessary. Avoid until testing is completed.

Table 4.9-3. U.S. Nuclear Regulatory Commission (NRC) Determination of National Register of Historic Places (NRHP)-Eligibility and Impact Analysis on Unevaluated Sites Identified During Archaeological Field Investigations Within the APE for Facility Construction and Operations (Cont'd). (DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

StateSite Number	Description	NRC's NRHP Determination*	Location with Respect to Area of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation
39FA1880	Artifact scatter	Unevaluated	Adjacent to APE for DDW and LA	LARGE potential impact	Site will undergo further evaluative testing. Avoid until testing is completed.
39FA1920	Artifact scatter	Unevaluated	Adjacent to APE for DDW and LA	LARGE potential impact	Site will undergo further evaluative testing. Site will be protected by fencing and avoided.

*Unevaluated sites are considered eligible for listing on the NRHP under Criterion D pending further evaluation.

Site 39FA0778 is an historic farmstead located near the center of the proposed Burdock central processing plant footprint. NRC staff recommends that construction activities be delayed until evaluative testing is completed and a determination of eligibility for listing on the NRHP is made. The applicant committed to further evaluative testing of site 39FA0778 and implementation of mitigation measures, as necessary (Powertech, 2012e,f).

Site 39FA0096, located at the south-central portion of the proposed project area, is a large occupation site with components that may date from the Paleolithic through the Historic period. As discussed in SEIS Section 3.9.3.1.1, Area 8 is a historic component of this multi-component site. Evaluative testing of the prehistoric component of site 39FA0096 demonstrated the prehistoric component is a deflated surface scatter of artifacts and hearths and therefore not eligible for listing on the NRHP, under Criterion D (Palmer and Kruse, 2012; BLM, 2012f). However, preliminary information gathered through consultation with the tribes indicates Areas 1 and 6 at site 39FA0096 have the potential to be of religious and cultural significance to the tribes because of the large size of these areas and the number of hearth features identified.

During the tribal cultural survey, site 39FA0096 was visited, recorded, and recommended as eligible for listing in the NRHP under Criterion A (see Table 3.9.5). Tribal consultation regarding the nature of the features and cultural deposits located at site 39FA0096 and the cultural importance of the site is ongoing. As described in SEIS Section 3.9.3.1.1, a small portion of site 39FA0096 extends onto BLM surface lands. Therefore, BLM requested that site 39FA0096 be designated as "unevaluated" until further information is obtained to support a Criterion A eligibility determination (BLM, 2014). Therefore, NRC staff considers site 39FA0096 as "unevaluated" pending further evaluation by BLM staff. Until evaluation is completed, BLM will require the site boundaries be avoided by all project-related activities with a standard 61 m [200 ft] buffer surrounding the site boundary.

Sites 39CU0554, 39CU0558, 39CU3624, 39FA0274, 39FA0556, 39FA1880, and 39FA1920 are artifact scatters within or adjacent to proposed wellfield areas. Sites 39CU0554, 39FA0274, and 39FA0556 are located within proposed wellfield areas in the Burdock area and site 39CU0558 is located within proposed wellfied areas in the Dewey area. Site 39CU3624 is located south of

Pass Creek and is less than 30.5 m [100 ft] north of a proposed wellfield area in the Burdock area. The applicant has committed to avoid site 39CU3624 (Powertech, 2012e). Site 39FA1880 is located approximately 30.5 m [100 ft] south of a proposed wellfield area in the Burdock area. Site 39FA1920 is located at the southeast corner of the project area and is approximately 30.5 m [100ft] south of a proposed wellfield area in the Burdock area. The applicant committed to protect this property by installing protective fencing around the site (Powertech, 2012e). NRC staff recommend that these unevaluated sites undergo further evaluative testing. Until testing is completed, avoidance of these sites is recommended.

Site 39CU3603 is an artifact scatter and hearth site located within the right of way of a proposed pipeline connecting the Burdock central processing plant and the Dewey satellite facility. NRC staff recommend that this site undergo further evaluative testing. Until testing is completed, avoidance of site 39CU3603 is recommended.

Sites 39CU0653, 39CU3615, 39FA0740, and 39FA0777 are artifact scatters within or adjacent to land applications areas. Sites 39CU0653 and 39CU3615 are located within land application areas in the Burdock area. Site 39FA0740 is located approximately 3.05 m [10 ft] southwest of land application areas in the Burdock area and site 39FA0777 is located approximately 3.05 [10 ft] southeast of land application areas in the Burdock area. NRC staff recommend that these sites undergo further evaluative testing and that the sites be avoided until testing is completed.

Archaeological investigations did not identify other sites (unevaluated, NRHP-listed, or NRHP-eligible) within or in the vicinity of construction impact areas for the Class V injection well disposal option. Based on its review and evaluation of archaeological field investigations, NRC concludes 15 historic properties may experience LARGE potential impacts because they are located within or adjacent to the APE for facility construction and operations for the deep Class V injection well disposal option. Included are five properties eligible for listing in the NRHP (see Table 4.9-1) and ten unevaluated properties considered eligible for listing in the NRHP, under Criterion D (see Table 4.9-3).

The applicant stated the overall goal during development and production of the proposed project is the avoidance of archaeological sites (Powertech, 2009a, Section 3.8.1). As discussed previously, the applicant has committed to protect historic and unevaluated sites by avoidance or for certain sites by constructing protective fencing (Powertech, 2012e,f). In addition, construction personnel will be notified of the location of historic properties and unevaluated sites prior to any ground-disturbing activities (Powertech, 2009a). By license condition, the applicant is required to stop any work resulting in the discovery of previously unknown cultural artifacts (NRC, 2013; License Condition 9.8). All newly discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and BLM to proceed. The use of archaeological and tribal monitors to protect known historic properties was proposed during ground disturbing activities (Powertech, 2009a). The NRC staff is currently developing a PA with all consulting parties to develop measures to avoid, minimize, or mitigate sites that could be impacted such as those listed in Table 4.9-1 and 4.9-3). A license condition to ensure successful implementation of any agreement made in the PA will lessen the impacts to historic properties from this undertaking (NRC, 2013; License Condition 9.8). Based on implementation of mitigation measures and management recommendations documented here and within the PA, potential impacts to historic properties and unevaluated sites identified during archaeological field investigations are not anticipated.

Tribal Cultural Survey

SEIS Section 3.9.3.2.2 presents the results of tribal cultural surveys and NRHP-eligibility recommendations for previously recorded archaeological sites, as well as newly discovered tribal sites described by the Tribal Historic Preservation Officers (THPOs) for the Northern Cheyenne Tribe, the Northern Arapaho Tribe, the Cheyenne and Arapaho Tribes of Oklahoma, and the Crow Nation. Sites identified during the tribal cultural survey with management recommendations are detailed in a tribal cultural survey report included as Appendix F of this SEIS.

Previously Recorded Archaeological Sites

Tribal survey teams recorded 81 cultural features within the boundaries of 24 known archaeological sites. Tribal survey teams also provided specific recommendations on four (4) archaeological sites that were investigated without identifying new cultural features. Tribal survey teams collectively recommended that 17 known archaeological sites be considered as eligible for listing in the NRHP under one or more eligibility criteria. A summary of these recommendations is provided in Table 3.9-5. NRHP-eligibility recommendations were not provided by tribes for other known archaeological sites.

The NRC NRHP-eligibility determinations, the NRC assessment of the significance of impacts, and management recommendations for known archaeological sites identified during the tribal cultural surveys are summarized in Table 4.9-4. In assessing the significance of impacts to these sites, NRC considered its NRHP-eligibility determinations and the locations of eligible sites within the APE affected by facility construction and operations. In cases where the tribes did not make recommendations for known archaeological sites, NRC used data from the Level III cultural resources investigations to make NRHP-eligibility determinations, assessments of significance of impacts, and management recommendations.

Table 4.9-4. U.S. Nuclear Regulatory Commission (NRC) Determination of National Register of Historic Places (NRHP)-Eligibility and Impact Analysis for Previously Recorded Archaeological Sites Also Identified During Tribal Cultural Surveys
(DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

State Site Number	Tribal Survey Number(s)	Tribal Features	NRC's NRHP Determination*	Location with Respect to Area of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation/ Comments
39CU0251	TS096	Stone Circle	Not Eligible	Within APE for DDW and LA	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.

Table 4.9-4. U.S. Nuclear Regulatory Commission (NRC) Determination of National Register of Historic Places (NRHP)-Eligibility and Impact Analysis for Previously Recorded Archaeological Sites Also Identified During Tribal Cultural Surveys (Cont'd) (DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

State Site Number	Tribal Survey Number(s)	Tribal Features	NRC's NRHP Determination*	Location with Respect to Area of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation/ Comments
39CU0271	TS019 TS035 TS130	Cairn; Possible Gravesite; Earth Paint	Eligible Criterion D	Within APE for DDW and LA	LARGE potential impact	Tribes recorded site but did not make eligibility recommendations. Site is located approximately 61 m [200 ft] east of proposed wellfield areas. Site will be avoided as possible gravesite.
39CU0459	TS108-111	Cairn; stone circle; fasting/prayer circles	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance. The boundary for 39CU0459 also includes two smaller artifact scatters: 39CU0461 and 39CU0528. Tribes recommended site eligible under Criteria A and C†
39CU0584	TS043-046, TS053, TS132-140	possible medicine wheel, 4 directions marker, burial, fasting site, cairns, stone circle, hearth	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoid as possible gravesite. Tribes recommended site eligible under Criteria A and C†
39CU3567	TS031-033, TS141	3 stone circles, scattered hearth	Eligible Criterion A	Within APE for LA	LARGE potential impact	Avoidance with no less than 300 m [984 ft] protective barrier. Tribes recommended site eligible under Criteria A and D†
39CU3572	TS034	Stone circles; possible medicine wheel	Not eligible	Within APE for DDW and LA	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
39CU3574	TS021-022	stone circle, scraper	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
39CU3576	TS020	tested cobble	Not eligible	Within APE for LA	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
39CU3584	TS025-027, TS-029	cairn alignment, stone circle	Unevaluated	Within APE for LA	LARGE potential impact	Avoidance. Tribes recorded site but did not make eligibility recommendations.

Table 4.9-4. U.S. Nuclear Regulatory Commission (NRC) Determination of National Register of Historic Places (NRHP)-Eligibility and Impact Analysis for Previously Recorded Archaeological Sites Also Identified During Tribal Cultural Surveys (Cont'd) (DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

State Site Number	Tribal Survey Number(s)	Tribal Features	NRC's NRHP Determination*	Location with Respect to Area of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation/ Comments
39CU3593	TS055	Cairn	Not eligible	Within APE for DDW and LA	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
39CU3596	TS054	disturbed	Not eligible	Within APE for DDW and LA	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
39CU3600	TS114-115	2 fasting/prayer circles	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance Tribes recommended site eligible under Criteria A and C†
39CU3602	TS119	scattered hearth	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance
39CU3604	TS121-122	fasting/prayer circles	Eligible Criterion A	Within APE for DDW and LA	LARGE potential impact	Avoidance Tribes recommended site eligible under Criteria A and C†
39CU3607	TS116-117	chert core & flake	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance
39CU3620		Cairn, Prayer/ fasting circle	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance. Partly located on USFS property. Possibly associated with TS106 and TS107. Tribes recommended site eligible under Criteria A and C†
39FA0096	TS001, TS004, TS013	hearth, earth paints	Unevaluated	Within APE for DDW and LA	LARGE potential impact	Site will undergo further evaluative testing. Avoid until testing is completed. Tribes recommended site eligible under Criteria A
39FA1862	TS112-113	stone circles	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance. Located outside license boundary
39FA1881		cairn	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance Tribes recommended site eligible under Criteria A and D†

Table 4.9-4. U.S. Nuclear Regulatory Commission (NRC) Determination of National Register of Historic Places (NRHP)-Eligibility and Impact Analysis for Previously Recorded Archaeological Sites Also Identified During Tribal Cultural Surveys (Cont'd) (DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

State Site Number	Tribal Survey Number(s)	Tribal Features	NRC's NRHP Determination*	Location with Respect to Area of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation/ Comments
39FA1890	TS012	2 Cairns	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance
39FA1902		Artifact Scatter; Well/cistern; Burial, Road	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoid as possible gravesite. No interest to tribes.
39FA1922	TS014-017	3 stone circles, possible medicine wheel	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoidance. Located on BLM property.
39FA1923	TS018, TS142-143	2 cairns	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoidance. Located on BLM property.
39FA1926	TS067-074, TS076-078	6 stone circles	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance Tribes recommended site eligible under Criteria A, C, and D†
39FA1927		6 cairns	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance
39FA1952	TS123-124	scattered hearth, flake	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance
39FA1962	TS056-060	cairn, stone circles	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
39FA1964	TS099-105	2 hearths, alignment, 4 fasting/prayer circles	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.

*Unevaluated sites are considered eligible for listing on the NRHP under Criterion D pending further evaluation.
†SD SHPO concurred with NRC's Criterion A NRHP-eligibility determinations for previously recorded archaeological sites listed above (SD SHPO, 2014). However, SD SHPO indicated that submission of additional information will be required to evaluate tribal NRHP-eligibility recommendations under Criteria C and D for previously recorded archaeological sites (SD SHPO, 2014).

As described in SEIS Seciton 3.9.3.2.2, the tribal survey teams recommended sites 39CU3602, 39CU3607, 39FA0096, 39FA1890, 39FA1862 (outside APE), and 39FA1952 as eligible for listing in the NRHP under Criterion A. Sites 39CU0459, 39CU0584, 39CU3600, 39CU3604, and 39CU3620 were recommended eligible under criteria A and C. Sites 39CU3567, 39FA1881, and 39FA1927 were recommended eligible under criteria A and D. Site 39FA1926 was recommended eligible under criteria A, C, and D. The tribes recommended avoidance for all sites recommended eligible for listing in the NRHP (see Appendix F of this SEIS). SD SHPO indicated that submission of additional information will be required to assess tribal

NRHP-eligibility recommendations under Criteria C and D for the previously recorded archaeological sites listed above (SD SHPO, 2014).

As described previously, tribal consultation regarding the nature of the features and cultural deposits located at site 39FA0096 and the cultural importance of the site is ongoing. Because the site is partially located on BLM property, BLM requested that the site be designated as “unevaluated” until its NRHP eligibility is evaluated by BLM staff (BLM, 2014). Therefore, NRC staff considers site 39FA0096 as “unevaluated” pending further evaluation. Until evaluation is completed, BLM will require the site boundaries be avoided by all project-related activities with a standard 61 m [200 ft] buffer surrounding the site boundary.

In addition, tribal survey teams recommended two (2) sites (39FA1922 and 39FA1923) located on BLM property as NRHP-eligible (see SEIS Section 3.9.3.2.2). Site 39FA1922 was recommended as eligible under Criteria A, C, and D and site 39FA1923 was recommended as eligible under Criteria A and C. Because the sites are located on BLM property, BLM requested that these sites be designated as “unevaluated” until their NRHP eligibility is evaluated by BLM staff (BLM, 2014). Therefore, NRC staff considers sites 39FA1922 and 39FA1923 as “unevaluated” pending further evaluation by BLM staff. Until evaluation is completed, BLM will require the site boundaries be avoided by all project-related activities with a standard 61 m [200 ft] buffer surrounding the site boundary.

No NRHP-eligibility recommendations were offered by tribal survey teams for sites 39CU0251, 39CU0271, 39CU3572, 39CU3574, 39CU3576, 39CU3584, 39CU3593, 39CU3596, 39FA1962, and 39FA1964. NRC has determined site 39CU0271 is eligible for listing in the NRHP under Criterion D (see Table 4.9-1). The site is located approximately 61 m [200 ft] east of proposed wellfield areas and will be avoided. Site 39CU3584 is an unevaluated cairn site located within a land application area and is considered eligible for listing in the NRHP under Criterion D (see Table 4.9-2). Site 39CU3584 is discussed in SEIS Section 4.9.1.2.1. NRC considers the remaining sites with no NRHP eligibility recommendations as being “not eligible” for listing in the NRHP.

Site 39FA1902 was specifically identified as being of no interest to the Northern Cheyenne and Northern Arapaho tribes. Site 39FA1902 marks the location of a historic artifact scatter and a possible gravesite; it is likely an historic homestead. Northern Cheyenne and Northern Arapaho representatives examined the possible gravesite and because of the presence of broken concrete among the stones, they determined it was not likely of tribal origin. NRC considers site 39FA1902 unevaluated and, therefore, should be treated as eligible for listing in the NRHP under Criterion D (see Table 4.9-2). The applicant committed to installing protective fencing around the Euroamerican burial site identified on site 39FA1902 before undertaking land disturbing activities in the area (Powertech, 2012f).

Tribal Sites: New Discoveries

A total of 47 new discoveries were recorded as a result of the tribal cultural survey. A summary of tribal NRHP-eligibility recommendations for these sites is provided in Table 3.9.6. The NRC NRHP-eligibility determinations, the NRC assessment of the significance of impacts, and management recommendations for new sites identified during the tribal cultural surveys are summarized in Table 4.9-5 and discussed below. In assessing the significance of impact to these sites, NRC considered its NRHP-eligibility determinations and the location of the site with respect to the APE for facility construction and operations.

Table 4.9-5. U.S. Nuclear Regulatory Commission (NRC) Determination of NRHP Eligibility and Impact Analysis for New Discoveries Identified and Recorded During Tribal Cultural Surveys (DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

Tribal Survey Number(s)	Tribal Features	NRC's NRHP Determination*	Location with Respect to Are of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation/ Comments
TS002	Stone circle	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance
TS003	Buffalo bones	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS005	Flake	Not eligible	Within APE for DDW and LA	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS006	Cairn	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoid as gravesite Tribes recommended site eligible under Criteria A, C, and D†
TS007-011	Stone circle; alignment	Eligible Criterion A	Within APE for DDW and LA	LARGE potential impact	Avoid with no less than a 300 m [984 ft] protective buffer. Tribes recommended site eligible under Criteria A and D†
TS023	Burial	Not eligible	Outside APE	SMALL; no impact anticipated	Avoid as possible gravesite. Tribes recorded site but did not make eligibility recommendations.
TS024	Stone circle	Unevaluated	Outside APE	SMALL; no impact anticipated	Outside license boundary. Tribes recorded site but did not make eligibility recommendations.
TS028	Stone circles (3); campsite; ceremonial site	Not eligible	Within APE for LA	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS030	stone circle	Not eligible	Within APE for LA	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS036	Small cairn or marker	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS037	Small cairn	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS040	Ceremonial site	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance Tribes recommended site eligible under Criteria A and C†
TS041-042	Ceremonial site	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance Tribes recommended site eligible under Criteria A and C†

Table 4.9-5. U.S. Nuclear Regulatory Commission (NRC) Determination of NRHP Eligibility and Impact Analysis for New Discoveries Identified and Recorded During Tribal Cultural Surveys (Cont'd) (DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

Tribal Survey Number(s)	Tribal Features	NRC's NRHP Determination*	Location with Respect to Are of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation/ Comments
TS047	Ceremonial site	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance Tribes recommended site eligible under Criteria A and C†
TS048	bBial	Not eligible	Outside APE	SMALL; no impact anticipated	Avoid as possible gravesite. Tribes recorded site but did not make eligibility recommendations.
TS049	Burial	Not eligible	Outside APE	SMALL; no impact anticipated	Avoid as possible gravesite. Tribes recorded site but did not make eligibility recommendations.
TS050	Burial	Not eligible	Outside APE	SMALL; no impact anticipated	Avoid as possible gravesite. Tribes recorded site but did not make eligibility recommendations.
TS051	Fasting site	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS052	Stone circle	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS061	Stone circle	Unevaluated	Outside APE	SMALL; no impact anticipated	Site will be avoided. Located just outside license boundary.
TS062	Effigy	Unevaluated	Outside APE	SMALL; no impact anticipated	Located 600 m [1,968 ft] outside license boundary
TS063	No identification	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS064	Stone circle	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS065	Fasting site	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS066	Cairn	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS075	Cairn	Unevaluated	Outside APE	SMALL; no impact anticipated	Located 60 m [196 ft] outside license boundary.
TS079	Stone circle	Unevaluated	Outside APE	SMALL; no impact anticipated	Located 230 m [754 ft] outside license boundary.
TS080-089, TS098	Alignment and Arc; ceremonial site; pipe ceremony location	Eligible Criterion A	Within APE for DDW and LA	LARGE potential impact	Avoidance Tribes recommended site eligible under Criteria A and C†
TS090	Cairn	Not eligible	Outside APE	SMALL; no impact anticipated	Located outside but near 39CU3622. Tribes recorded site but did not make eligibility recommendations.

Table 4.9-5. U.S. Nuclear Regulatory Commission (NRC) Determination of NRHP Eligibility and Impact Analysis for New Discoveries Identified and Recorded During Tribal Cultural Surveys (Cont'd) (DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

Tribal Survey Number(s)	Tribal Features	NRC's NRHP Determination*	Location with Respect to Are of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation/ Comments
TS091	Ceremonial site	Not eligible	Outside APE	SMALL; no impact anticipated	Located outside but near 39CU3621. Tribes recorded site but did not make eligibility recommendations.
TS092	Cairn	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS093	Possible cairn	Not eligible	Within APE for DDW and LA	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS094	Cairn	Not eligible	Within APE for DDW and LA	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS095	Disturbed cairn (modern survey marker)	Not eligible	Within APE for DDW and LA	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS097	Cairn	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS106	Fasting circle	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Located on U.S. Forest Service (USFS) property 40 m [131 ft] outside license boundary. Possibly associated with 39CU3620. Tribes recommended site eligible under Criteria A and C†
TS107	Possible gravesite and fasting circle	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Located on USFS property 60 m [196 ft] outside license boundary. Avoid as possible gravesite. Possibly associated with 39CU3620. Tribes recommended site eligible under Criteria A and C†
TS118	Hearth	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance
TS120	Hearth	Eligible Criterion A	Within APE for DDW and LA	LARGE potential impact	Avoidance
TS125	Burial	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoid as possible gravestie. Located on U.S. Bureau of Land Management (BLM) property 60 m [196 ft] outside license boundary
TS126	Staff	Unevaluated	Outside APE	SMALL; no impact anticipated	Located on BLM property180 m [590 ft] outside license boundary
TS127	Fasting site	Unevaluated	Outside APE	SMALL; no impact anticipated	Located on BLM property 200 m [656 ft] outside license boundary

Table 4.9-5. U.S. Nuclear Regulatory Commission (NRC) Determination of NRHP Eligibility and Impact Analysis for New Discoveries Identified and Recorded During Tribal Cultural Surveys (Cont'd) (DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

Tribal Survey Number(s)	Tribal Features	NRC's NRHP Determination*	Location with Respect to Are of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation/ Comments
TS128	Fasting site	Unevaluated	Outside APE	SMALL; no impact anticipated	Located on BLM property 200 m [656 ft] outside license boundary
TS129	Fasting site/ring	Unevaluated	Outside APE	SMALL; no impact anticipated	Located on BLM property 290 m [951 ft] outside license boundary
TS131	Possible grave	Not eligible	Outside APE	SMALL; no impact anticipated	Avoid as possible gravesite. Tribes recorded site but did not make eligibility recommendations.
TS144	Cairn	Not Eligible	Within APE for DDW and LA	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS145	Prayer/ offering location	Unevaluated	Within APE for DDW and LA	LARGE potential impact	Site location was not recorded by GPS but is known to be within an 32.4-ha [80-ac] parcel. Would require relocation to assess potential for site avoidance. Tribes recommended site eligible under Criterion D†

*Unevaluated sites are considered eligible for listing on the NRHP under Criterion D pending further evaluation.
†SD SHPO concurred with NRC's Criterion A NRHP-eligibility determinations for newly discovered tribal sites listed above (SD SHPO, 2014). However, SD SHPO indicated that submission of additional information will be required to evaluate tribal NRHP-eligibility recommendations under Criteria C and D for newly discovered tribal sites (SD SHPO, 2014).

Twelve (12) of the 47 newly discovered cultural features were identified outside the license boundary. These features include five (5) discoveries on private land (TS024, TS061, TS062, TS075, TS079), five (5) discoveries on BLM property (TS125, TS126, TS127, TS128, TS129), and two (2) discoveries on U.S. Forest Service property (TS106, TS107). TS106 and TS107 were recommended as eligible for listing in the NRHP under criteria A and C. No eligibility recommendations were provided for the other 10 cultural features or sites. NRC considers these 10 sites as "unevaluated" and eligible for listing in the NRHP under Criterion D pending further evaluation.

Thirty-five (35) of the 47 new discoveries were identified within the project's license boundary. Ten (10) of these tribal sites were recommended as eligible for listing on NRHP under one or more eligibility criteria. TS002, TS118, TS120 were recommended as eligible under Criterion A. TS145 is recommended as eligible under Criterion D. TS007-011 is recommended as eligible under criteria A and D. TS040, TS041-TS042, TS047, and TS080-T089, TS098 are recommended as eligible under criteria A and C. TS006, a gravesite, is recommended as eligible under criteria A, C, and D. The tribes recommended avoidance for all sites recommended eligible for listing in the NRHP (see Appendix F of this SEIS). SD SHPO indicated that submission of additional information will be required to assess tribal NRHP-eligibility recommendations under Criteria C and D for the newly discovered tribal sites listed above (SD SHPO, 2014).

NRHP recommendations were not provided for 25 of the 44 new discoveries recorded within the project license boundary (TS003, TS005, TS023, TS028, TS030, TS036, TS037, TS048, TS049, TS050, TS051, TS052, TS063, TS064, TS065, TS066, TS090, TS091, TS092, TS093, TS094, TS095, TS097, TS131, and TS144). Where no NHRP eligibility recommendations were offered by the tribes for new discoveries within the project's license boundary, NRC assumed the tribal site to be "not eligible" for listing on NRHP. These sites included locations identified as artifact finds, animal bone concentrations, stone circles, cairns, and possible fasting sites. NRC notes that five specific tribal sites included in this group were identified during the field survey as possible gravesites (TS023, TS048, TS049, TS050, and TS131). NRC recommends avoidance of these sites due to the potential for human remains to be present even though tribes and NRC may not consider these locations eligible for listing in the NRHP.

Based on its review and evaluation of tribal cultural surveys, NRC concludes that two previously recorded archaeological sites (39CU3604 and 39FA0096), two tribal sites represented by single survey numbers (TS120 and TS145), and two tribal sites represented by multiple survey numbers (TS007-011 and TS080-089, TS098) may experience LARGE potential impacts due to their location within the APE for facility construction and operations for the deep Class V injection well disposal option (see Tables 4.9-4 and 4.9-5). Sites 39CU3604, TS210, TS007-011, and TS080-089, TS098 have been recommended eligible for listing in the NRHP under one or more eligibility criteria. As previously described, NRC staff considers sites 39FA0096 as "unevaluated" pending further evaluation. SD SHPO recommended that site TS145 be designated "unevaluated" until further information is obtained to support a Criterion D eligibility determination (SD SHPO, 2014). Therefore, NRC staff considers site TS145 as "unevaluated' pending further evaluation. Avoidance is recommended for all of these sites.

Potential impacts to previously recorded archaeological and tribal sites identified during the tribal cultural surveys will be reduced through mitigation strategies developed during NHPA Section 106 consultations. As discussed in SEIS Section 1.7.3.5, consultation involving NRC, the applicant, SD SHPO, BLM, and interested Indian tribes is being conducted to determine what measures can be used to avoid, minimize, or mitigate adverse impacts to historic properties that may be impacted by site activities. Before beginning construction activities at the proposed project site, an agreement between NRC, SD SHPO, BLM, ACHP, interested Native American tribes (tribal government or designated THPO), the applicant, and other interested parties will be developed in accordance with 36 CFR 800.14(b)(2). The agreement will outline the mitigation process for each affected resource identified at the site pursuant to 36 CFR 800.6. Therefore, potential impacts to previously recorded archaeological sites and newly discovered tribal sites identified during tribal cultural surveys are not anticipated.

Visual Impacts Assessment

As described in SEIS Section 3.9.3.3, the NRC staff completed an assessment of potential visual impacts on historic properties (i.e., properties of any type listed in or considered eligible for listing in the NRHP). NRC's assessment of visual impacts included historic properties situated within a 4.8-km [3-mi] radius of the tallest or most prominent building within each processing facility. The tallest building within each processing facility is the satellite facility (SF) in the Dewey area and the central processing plant (CPP) in the Burdock area.

NRC staff compiled a list of 31 historic properties that are either listed on the NRHP or considered eligible for listing on the NRHP under criteria A and/or C due in part to their integrity of setting and are also located within a 4.8-km [3-mi] radius of the SF in the Dewey area and the

CPP in the Burdock area (Table 4.9-6). Historic properties considered eligible for the NRHP solely under Criterion D were not evaluated for potential visual impacts because integrity of setting is not often considered a contributing characteristic for properties considered eligible on the basis of their historic information contents (i.e., Criterion D). The group of 31 historic sites evaluated for visual impacts includes one NRHP-listed historic district, the Edna and Ernest Young Ranch (90000949) also known as the Bakewell Ranch (CU00000050). The Young Ranch historic district includes several contributing ranch buildings including the principal residence. A nearby homestead district, known as the Richardson Homestead (CU00000052), includes one individually eligible log barn (CU02500002). Other NRHP-eligible properties include one historic bridge (Beaver Creek Bridge, FA00000111), and 28 sites that include 19 archaeological sites and 9 tribal sites.

Table 4.9-6. U.S. Nuclear Regulatory Commission (NRC) Determination of National Register of Historic Places (NRHP) Eligibility and Impact Analysis for Historic Properties Included in the Visual Impacts Assessment. (SF=Dewey Satellite Facility; CPP=Burdock Central Processing Plant)

State Property Number	Tribal Survey Number(s)	NRC's NRHP Determination	Facilities Visible From Property	Distance to Nearest Visible Facility	Mitigating Considerations	Significance of Impact	Recommended Action/ Comments
Bakewell Ranch (CU00000050)/ Edna and Ernest Young Ranch Historic District (90000949)		Eligible, Criterion A	SF only	1.6 km [1.0 mi]	None	MODERATE; no adverse visual impact	Minimize visual effect of building with low profile design and compatible exterior color to avoid potential adverse effect
Building 1 (CU02500002) at the Richardson Homestead (CU00000052)		Eligible, Criterion A	CPP only	2,25 km [1.4 mi]	Diminished integrity of overall homestead	MODERATE; no adverse visual impact	
Beaver Creek Bridge (24020020)		Eligible Criterion C	Neither	4.5 km [2.8 mi]	None	SMALL; no visual impact	
39CU0459	TS108-111	Eligible, Criterion A	Both	2.7 km [1.7 mi] (SF)	Other modern intrusions	MODERATE; no adverse visual impact	
39CU0584	TS043-046, TS053, TS132-140	Eligible, Criteria A, D	SF only	2.25 km [1.4 mi]	Viewshed obstructed by tree cover	SMALL; no visual impact	Maintain existing tree cover
39CU2000		Eligible, Criteria A, C	Both	0.8 km [0.5 mi] (SF)	Setting is confined to narrow corridor along railroad	MODERATE; no adverse visual impact	
39CU3567	TS031-033, TS141	Eligible, Criterion A	SF only	0.96 km [0.6 mi]	Other modern intrusions	MODERATE; no adverse visual impact	
39CU3600	TS114-115	Eligible, Criterion A	CPP only	3.1 km [1.9 mi]	Other modern intrusions	MODERATE; no adverse visual impact	
39CU3602	TS119	Eligible, Criterion A	SF only	2.25 km [1.4 mi]	Viewshed obstructed by tree cover	SMALL; no visual impact	Maintain existing tree cover
39CU3604	TS121-122	Eligible, Criterion A	Both	2.9 km [1.8 mi]	Other modern intrusions	MODERATE; no adverse visual impact	

Table 4.9-6. U.S. Nuclear Regulatory Commission (NRC) Determination of National Register of Historic Places (NRHP) Eligibility and Impact Analysis for Historic Properties Included in the Visual Impacts Assessment (Cont'd). (SF=Dewey Satellite Facility; CPP=Burdock Central Processing Plant)

State Property Number	Tribal Survey Number(s)	NRC's NRHP Determination	Facilities Visible From Property	Distance to Nearest Visible Facility	Mitigating Considerations	Significance of Impact	Recommended Action/ Comments
39CU3607	TS116-117	Eligible, Criterion A	SF only	2.6 km [1.6 mi]	Viewshed obstructed by tree cover	SMALL; no visual impact	Maintain existing tree cover
39CU3620		Eligible, Criterion A	CPP only	3.4 km [2.1 mi]	Viewshed obstructed by tree cover	SMALL; no visual impact	Maintain existing tree cover
39FA0096	TS001, TS004, TS013	Unevaluated	Both	1.4 km [0.9 mi]	Viewshed obstructed by tree cover; Other modern intrusions	MODERATE; no adverse visual impact	Maintain existing tree cover Included in visual impacts assessment because Tribes considered site eligible under Criterion A
39FA1862	TS112-113	Eligible, Criterion A	SF only	2.9 km [1.8 mi] (SF)	Other modern intrusions	MODERATE; no adverse visual impact	
39FA1881		Eligible, Criterion A	CPP only	1.3 km [0.8 mi]	Partially screened by topography; other modern intrusions	MODERATE; no adverse visual impact	
39FA1890	TS012	Eligible, Criterion A	Neither	-	None	SMALL; no visual impact	
39FA1922	TS014-017	Unevaluated	Neither	-	None	SMALL; no visual impact	Included in visual impacts assessment because Tribes considered site eligible under Criterion A
39FA1923	TS018, TS142-143	Unevaluated	Neither	-	None	SMALL; no visual impact	Included in visual impacts assessment because Tribes considered site eligible under Criterion A
39FA1926	TS067-074, TS076-078	Eligible, Criterion A	Neither	-	None	SMALL; no visual impact	
39FA1927		Eligible, Criterion A	Neither	-	None	SMALL; no visual impact	
39FA1952	TS123-124	Eligible, Criterion A	SF only	2.4 km [1.5 mi]	Other modern intrusions	MODERATE; no adverse visual impact	
39FA2000		Eligible, Criteria A, C	Both	0.8 km [0.5 mi] (SF)	Setting is confined to narrow corridor along railroad	MODERATE; no adverse visual impact	
	TS002	Eligible, Criterion A	CPP only	0.96 km [0.6 mi]	Other modern intrusions	MODERATE; no adverse visual impact	

Table 4.9-6. U.S. Nuclear Regulatory Commission (NRC) Determination of National Register of Historic Places (NRHP) Eligibility and Impact Analysis for Historic Properties Included in the Visual Impacts Assessment (Cont'd). (SF=Dewey Satellite Facility; CPP=Burdock Central Processing Plant)

State Property Number	Tribal Survey Number(s)	NRC's NRHP Determination	Facilities Visible From Property	Distance to Nearest Visible Facility	Mitigating Considerations	Significance of Impact	Recommended Action/ Comments
	TS006	Eligible, Criterion A	CPP only	1.9 km [1.2 mi]	Other modern intrusions	MODERATE; no adverse visual impact	
	TS007-0011	Eligible, Criterion A	CPP only	0.64 km [0.4 mi]	Other modern intrusions	MODERATE; no adverse visual impact	
	TS040	Eligible, Criterion A	Both	2.25 km [1.4 mi]	Partially screened by timber; other modern intrusions	MODERATE; no adverse visual impact	Maintain existing tree cover
	TS041-042	Eligible, Criterion A	Both	2.25 km [1.4 mi]	Partially screened by timber; other modern intrusions	MODERATE; no adverse visual impact	Maintain existing tree cover
	TS047	Eligible, Criterion A	CPP only	5.9 km [3.7 mi]	Distance between site and facility > 4.8 km [3 mi]	SMALL; no visual impact	
	TS080-089, TS098	Eligible, Criterion A	CPP only	0.64 km [0.4 mi]	Mostly screened by topography; other modern intrusions	MODERATE; no adverse visual impact	
	TS118	Eligible, Criterion A	SF only	2.4 km [1.5 mi]	Viewshed obstructed by tree cover	SMALL; no visual impact	Maintain existing tree cover
	TS120	Eligible, Criterion A	SF only	2.0 km [1.25 mi]	Other modern intrusions	MODERATE; no adverse visual impact	

Only one historic property located outside the license boundary was included in this review. The Beaver Creek Bridge (Structure FA00000111) is located southwest of the project boundary but falls within the 4.8-km [3-mi] radius for the central processing plant. Two rock art sites in Fall River County (39FA2530, 39FA2531) fell just outside the 4.8-km [3-mi] range for the central processing plant. No other NRHP-listed or eligible properties were identified outside the license boundary.

NRC staff used a Geographic Information System (GIS)-based Line of Sight (LOS) analysis to determine whether the proposed processing facilities would be visible from the vantage point of each individual historic property. This analytical approach uses GIS software to estimate the viewshed surrounding each historic property. It uses variation in elevation and ground terrain to determine whether a direct line of sight exists between two points, in this case a line-of-sight between the historic property and each of the two processing facilities. The analysis produces a map of the area with visible portions of the landscape shaded to illustrate what portions would be visible. While this approach is useful for showing where elevated terrain will interfere with or block the view of the facilities, it does not account for other types of potential visual obstructions such as trees or buildings. It does however provide a quantitative means to determine if a potential visual effect is present (i.e., if one or both of the processing facilities would be visible from the vantage point of each historic property). NRC's determination of impact and NRC's assessment of the magnitude of that impact is then based on consideration of the LOS data, the type of historic property involved, and the distance between the historic property and the proposed processing facility.

Based on the LOS analysis, NRC calculates that the proposed project will have a SMALL visual impact on 12 of the 31 historic properties included in this study (Table 4.9.6). Neither of the facilities will be visible from six (6) historic properties (Beaver Creek Bridge-24-020-020; 39FA1890, 39FA1922, 39FA1923, 39FA1926, 39FA1927). One (1) historic property (TS047) is located in area where at least one facility would be visible, but at a distance of 5.9 km [3.7 mi] that is greater than the estimated 4.8-km [3-mi] range considered to have potential effect. Five (5) other historic properties (39CU0584, 39CU3602, 39CU3607, 39CU3620, TS118) are located in areas where the local terrain would permit a view of at least one facility; however, in each instance the viewshed in the direction of the proposed facility is obstructed by existing tree cover. As long as the existing tree cover is not altered by the proposed project, NRC has concluded that the existing conditions warrant a finding of a SMALL visual impact.

A total of 19 historic properties have been assessed as having potential visual impacts based the results of the LOS analysis. The NRC considered the significance of a site, qualities that contribute to the significance of sites, and environmental factors and conditions in assessing sites. The NRC concluded modern intrusions, such as public roads, an active railroad corridor, several modern residences and farms, and former open pit mines diminished the qualities of setting, feeling and association of 15 archaeological and tribal cultural properties with potential visual effects (39CU0459, 39CU3567, 39CU3600, 39CU3604, 39FA0096, 39FA1862, 39FA1881, 39FA1952, TS002, TS006, TS007-011, TS040, TS041-042, TS080-089/098, TS120). NRC concluded the introduction of new visual changes to the viewsheds of the Bakewell Ranch (CU00000050)/Edna and Ernest Young Ranch Historic District (NRIS #90000949) and the Burlington Northern Railroad (39CU2000 and 39FA2000) will have minimal effect based on distances from the properties. NRC also judged that new visual changes to the viewshed of the Richardson Log Barn (CU02500002) will be minimal due to the diminished integrity of the abandoned building and the surrounding homestead property (CU00000052). Based on these assessments, NRC staff has concluded that the proposed project will have MODERATE visual impacts on this group of 19 historic properties.

It is important to note that these assessments of impact are based on current designs for the processing facilities, existing topography, and other environmental conditions including tree cover. Other project activities such as grading for project construction or clearing of vegetation could result in changes to the immediate surroundings of individual historic properties that could increase the potential for adverse impacts. Therefore, unanticipated changes in these conditions may warrant reconsideration of these assessments.

Auditory Impact Assessment

This assessment considers whether the proposed project will have the potential to introduce new auditory changes that could impact historic properties within or outside the limits of proposed ground disturbance. NRC staff concluded in the GEIS that activities associated with construction and operations at ISR facilities will not introduce significant audible elements to the project area (NRC, 2009a). NRC's assessment of auditory impacts included the 31 historic properties that are either listed on the NRHP or considered eligible for listing on the NRHP under criteria A and/or C due in part to their integrity of setting and are also located within a 4.8-km [3-mi] radius of the SF in the Dewey area and the CPP in the Burdock area

(Table 4.9-6). As discussed previously, historic properties considered eligible for the NRHP solely under Criterion D were not evaluated for potential visual impacts because integrity of setting is not often considered a contributing characteristic for properties considered eligible on the basis of their historic information contents (i.e., Criterion D).

NRC concluded in the GEIS that impacts from noise will be greatest during the construction and decommissioning phases of an ISR project due to noise generated by earthmoving, excavation, building construction, and demolition activities (NRC, 2009a). Noise levels decrease with distance from the source and NRC determined that noise impacts will be SMALL for residences, communities, and sensitive areas that are located more than 305 m [1,000 ft] from specific noise-generating activtives (NRC, 2009a). None of the historic properties included in this assessment are located closer than 640 m [2,100 ft] from the nearest processing facility, which exceeds the estimated 305 m [1,000 ft] zone for potential auditory impacts. Therefore, NRC staff conclude that potential auditory impacts on historic properties during the construction phase for the deep Class V injection well disposal option will be SMALL.

Construction Impacts Conclusion

The NRC environmental review of historic and cultural resources is based on analyses of historic and cultural resource investigations (Kruse, et al., 2008; Palmer and Kruse, 2008; Palmer 2008, 2009, 2012); tribal cultural surveys (SEIS Appendix F); visual and auditory impact assessments conducted by NRC staff; and commitments made by the applicant to implement mitigation measures for potentially impacted sites. Based on results of the environmental review, NRC staff conclude that the potential impacts to historic and cultural resources during the construction phase of the proposed project for the Class V injection well disposal option will range from SMALL to LARGE.

4.9.1.1.2 Operations Impacts

As discussed in the GEIS, it is expected that potential impacts to historic and cultural resources from operations will be less than during construction, because less land disturbance occurs during this phase (NRC, 2009a). In addition, there will be minimal impacts from facility operations or maintenance on identified historic and cultural resources because any potential impacts to these sites will be mitigated prior to facility construction. Potential visual and auditory impacts on historic properties at the proposed project site will be the same as described in Section 4.9.1.1.1 (potential visual impacts will range from SMALL to MODERATE and potential auditory impacts will be SMALL). If there is a discovery of historic and cultural resources during routine maintenance activities, the applicant is required by license condition to stop work (NRC, 2013; License Condition 9.8). The discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and BLM to proceed. For these reasons, the potential impacts to historic and cultural resources during the operations phase for the Class V injection well disposal option will be SMALL to MODERATE.

4.9.1.1.3 Aquifer Restoration Impacts

As discussed in the GEIS, it is expected that aquifer restoration impacts to historic and cultural resources will be similar to, or less than, potential impacts from operations (NRC, 2009a). Aquifer restoration activities are generally limited to the existing infrastructure and previously disturbed areas (e.g., access roads, satellite facility, and central processing plant). Potential impacts to identified historic and cultural resources will have been mitigated prior to facility construction. Potential visual and auditory impacts on historic properties at the proposed project site will be the same as described in Section 4.9.1.1.1 (potential visual impacts will range from SMALL to MODERATE and potential auditory impacts will be SMALL). If there is a discovery of historic and cultural resources during routine maintenance activities, the applicant is required by license condition to stop work and notify NRC, SD SHPO, and BLM (NRC, 2013; License Condition 9.8). The discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and BLM to proceed. Therefore, the potential impacts to historic and cultural resources during the aquifer restoration phase for the Class V injection well disposal option will be SMALL to MODERATE.

4.9.1.1.4 Decommissioning Impacts

As discussed in the GEIS, decommissioning and reclamation activities will be limited to previously disturbed areas, and historic and cultural resources within the APE will already be known (NRC, 2009a). There will be minimal impacts on historic and cultural resources because potential impacts to identified historic properties will have been mitigated. Identified historic sites will have been avoided from the construction phase through the decommissioning phase. Until processing facilities and infrastructure is dismantled and removed, potential visual and auditory impacts on historic properties at the proposed project site will be the same as described in Section 4.9.1.1.1 (potential visual impacts will range from SMALL to MODERATE and potential auditory impacts will be SMALL). Potential visual impacts will be reduced to SMALL after processing facilities are dismantled and removed. If historic and cultural resources are encountered during decommissioning and reclamation activities, the applicant is required by license condition to stop work and notify NRC, SD SHPO, and BLM (NRC, 2013; License Condition 9.8). The discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and BLM to proceed. Therefore, the overall potential impacts to historic and cultural resources during decommissioning for the Class V injection well disposal option will be SMALL.

4.9.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not obtained from EPA, the applicant proposes to dispose of liquid waste generated at the proposed Dewey-Burdock ISR Project by land application (see SEIS Section 2.1.1.1.2.4.2). The potential impacts on historic and cultural resources during construction, operations, aquifer restoration, and decommissioning associated with the land application liquid waste disposal option are discussed in the following sections.

4.9.1.2.1 Construction Impacts

As noted in SEIS Section 4.9.1, if land application is used for liquid waste disposal, the APE for facility construction and operations will include an additional maximum area of approximately 506 ha [1,250 ac] surrounding proposed land application areas (see Figure 3.9-1). As with the Class V injection well disposal option, mitigation measures, such as limiting construction of new access and secondary roads, will minimize surface disturbance (Powertech, 2009a) during this option and will limit potential impacts to historic and cultural resources.

As discussed in SEIS Section 4.9.1.1.1, as part of the environmental review of historic and cultural resources, the NRC evaluated the results of historic and cultural resource surveys conducted at the proposed Dewey-Burdock ISR Project site (see SEIS Section 3.9.3). These surveys included (i) a Level III cultural resource investigation conducted as part of prelicense application activities; (ii) a tribal cultural survey; and (iii) a visual impacts assessment. In addition to the visual impacts assessment, NRC evaluated whether the proposed project has the potential to introduce new auditory changes to the project area that may impact historic properties located within or outside the limits of proposed ground disturbance. NRC's NRHP eligibility determinations and assessment for cultural and historic properties identified at the Dewey-Burdock site that may be impacted by the land application disposal option are discussed in the sections below.

Level III Cultural Resource Investigation

As described in SEIS Section 4.9.1.1.1, archaeological field investigations identified a total of 18 historic properties within the proposed project area that are listed or recommended as eligible for listing in the NRHP. These sites are listed in Table 4.9-1 along with the NRC NRHP-eligibility determinations, the locations of eligible sites within the APE affected by facility construction and operations, NRC assessment of the significance of impact, and NRC management recommendations. With the exception of site CU02500002, the impacts of construction activities and recommended mitigation measures for these sites are expected to be identical to those described in SEIS Section 4.9.1.1.1 for the Class V injection well disposal option.

Site CU02500002 is a log barn structure located approximately 76 m [250 ft] south of proposed land application areas in the Burdock area. Site CU02500002 is part of the Richardson Homestead (CU00000052), which contains three other standing structures (CU02500001, CU02500003, and CU02500004). SD SHPO indicated that all four standing structures at the Richardson Homestead are related and should be considered as a district (SD SHPO, 2014). In this context, SD SHPO recommended that the Richardson Homestead be considered eligible under Criterion A. In addition, SD SHPO recommended that the archaeological component of the Richardson Homestead represented by site 39CU3619 be considered "unevaluated" until additional information is submitted (SD SHPO, 2014). NRC recommends that the NRHP-eligibility of sites CU00000052 (Richardson Homestead) and 39CU3619 be further evaluated during development of a PA associated with ongoing Section 106 consultation activities.

Site CU02500002 (the log barn structure) is located within the APE for facility construction and operations for the land application option. NRC recommended and the applicant committed to creating a buffer zone and erecting protective fencing around the perimeter of the log barn structure to minimize potential impacts during construction (Powertech, 2012e). If avoidance is not possible, NRC recommends that the structure be mitigated through Historic American Buildings Survey (HABS) level documentation.

As noted in SEIS Section 3.9.3.1.1, historic and ethnographic evidence indicate that cairn features may have served as markers for trails, camps, burials, caches, and ceremonial centers for Native American tribes. Unevaluated sites with burials or cairn features are listed in Table 4.9-2 along with the NRC NRHP-eligibility determinations, the locations of eligible sites within the APE affected by facility construction and operations, NRC assessment of the significance of impact, and NRC management recommendations (see SEIS Section 4.9.1.1.1). NRC considers unevaluated archaeological sites eligible for listing in the NRHP under Criterion D. With the exception of site 39CU3584, impacts of construction activities and recommended mitigation measures for these sites are expected to be identical to those described in SEIS Section 4.9.1.1.1 for the Class V injection well disposal option. Cairn site 39CU3584 is located within a proposed land application area at the Dewey site. As described in SEIS Section 3.9.3.1.1, site 39CU3584 underwent archaeological testing and was recommended ineligible for listing in the NRHP under Criteria D, based on a lack of diagnostic artifacts and intact cultural deposits (Kruse, et al., 2008; Palmer and Kruse, 2012). SD SHPO recommended that site 39CU3584 be considered unevaluated for listing on the NRHP until all eligibility criteria have been determined (SD SHPO, 2012). Site 39CU3584 was visited and recorded during tribal cultural surveys; however, the tribes offered no NRHP recommendations for this site (see SEIS Section 3.9.3.2.2). NRC recommends avoidance of site 39CU3584 and considers this site eligible for listing in the NRHP under Criterion D pending further evaluation. With the exception of 39CU3584, no other unevaluated cairn sites are located within proposed construction impact areas for the land application disposal option.

As described in SEIS Section 3.9.3.1.1, several unevaluated archaeological sites are located within or adjacent to the APE for facility construction and operations and, therefore, could be potentially impacted by ISR activities. These unevaluated archaeological sites are listed in Table 4.9-3 along with the NRC NRHP-eligibility determinations, the locations of eligible sites within the APE affected by facility construction and operations, NRC assessment of the significance of impact, and NRC management recommendations. NRC considers unevaluated archaeological sites eligible for listing in the NRHP under Criterion D. As discussed in SEIS Section 3.9.3.1.1, unevaluated sites 39CU0653, 39CU3615, 39FA0740, and 39FA0777 are artifact scatters within or adjacent to land applications areas. With the exception of these sites, impacts and recommended mitigation measures to ensure that unevaluated sites are not impacted by construction activities will be identical to those described in SEIS Section 4.9.1.1.1 for the Class V injection well disposal option. Sites 39CU0653 and 39CU3615 are located within land application areas in the Burdock area. Site 39FA0740 is located approximately 3.05 m [10 ft] southwest of land application areas in the Burdock area and site 39FA0777 is located approximately 3.05 [10 ft] southeast of land application areas in the Burdock area. NRC staff recommend that these sites undergo further evaluative testing to determine their eligibility for listing in the NRHP. Until testing is completed, avoidance of these sites is recommended.

Archaeological investigations have not identified other unevaluated or NRHP-eligible sites within or in the vicinity of construction impact areas for the land application disposal option. Based on its review and evaluation of archaeological field investigations, NRC concludes that six (6) historic properties could experience LARGE potential impacts due solely to their location within or adjacent to the APE for facility construction and operations for the land application disposal option. This includes one (1) property eligible for listing in the NRHP (CU02500002) and five (5) unevaluated properties considered eligible for listing in the NRHP under Criterion D pending further evaluation (39CU3584, 39CU0653, 39CU3615, 39FA0740, and 39FA0777).

The applicant stated the overall goal during development and production of the proposed project is the avoidance of archaeological sites (Powertech, 2009a, Section 3.8.1). As discussed previously, the applicant has committed to protect historic and unevaluated sites by avoidance or in some cases constructing protective fencing to ensure avoidance (Powertech, 2012e, f). In addition, construction personnel will be advised of the location of historic properties and unevaluated sites prior to any ground-disturbing activities (Powertech, 2009a). By license condition, the applicant is required to stop any work resulting in the discovery of previously unknown cultural artifacts (NRC, 2013; License Condition 9.8). All newly discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and BLM to proceed. The use of archaeological and tribal monitors to protect known historic properties was proposed during ground disturbing activities (Powertech, 2009a). The NRC staff is currently developing a PA with all consulting parties to develop measures to avoid, minimize, or mitigate sites that could be impacted such as those listed in Tables 4.9-1 and 4.9-3). A license condition to ensure successful implementation of any agreement made in the PA will lessen the impacts to historic properties from this undertaking (NRC, 2013, License Condition 9.8). Based on implementation of mitigation measures and management recommendations documented here and within the PA, potential impacts to historic properties and unevaluated sites identified during archaeological field investigations are not anticipated.

Tribal Cultural Survey

SEIS Section 3.9.3.2.2 presents the results of tribal cultural surveys and eligibility recommendations for recorded archaeological sites and newly discovered tribal sites provided by the THPOs for the Northern Cheyenne Tribe, the Northern Arapaho Tribe, the Cheyenne and Arapaho Tribes of Oklahoma, and the Crow Nation. Sites identified during the tribal cultural survey with management recommendations are included as Appendix F of this SEIS.

The NRC NRHP-eligibility determinations, assessment of significance of impact, and management recommendations for known archaeological sites and newly discovered tribal sites identified during the tribal cultural surveys are presented in Tables 4.9-4 and 4.9-5, respectively. In assessing the significance of impact to these sites, NRC considered its NRHP eligibility determination and the location of the site with respect to the APE for facility construction and operations. With the exception of site 39CU3567, impacts and recommended mitigation measures to ensure that these sites are not impacted by construction activities will be identical to those described in SEIS Section 4.9.1.1.1 for the Class V injection well disposal option. Site 39CU3567 is a previously recorded archaeological site that could experience LARGE potential impacts due to its location within the APE for facility construction and operations for the land application option (see Table 4.9-4). Tribal survey teams recommended avoidance of this site with no less than a 300 m [964 ft] protective buffer.

Potential impacts to known archaeological and newly discovered tribal sites identified during the tribal cultural surveys will be reduced through mitigation strategies developed during National Historic Preservation Act (NHPA) Section 106 consultations. As discussed in SEIS Section 1.7.3.5, consultation involving NRC, the applicant, SD SHPO, BLM, and interested Indian tribes is being conducted to determine what measures can be used to avoid, minimize, or mitigate adverse impacts to historic properties that may be impacted by site activities. Before beginning construction activities at the proposed project site, an agreement between NRC, SD SHPO, BLM, ACHP, interested Native American tribes (tribal government or designated THPO), the applicant, and other interested parties will be developed in accordance with 36 CFR 800.14(b)(2). The agreement will outline the mitigation process for each affected resource identified at the site pursuant to 36 CFR 800.8(c)(1)(v). Therefore, potential impacts to previously recorded archaeological sites and newly discovered tribal sites identified during tribal cultural surveys are not anticipated.

Visual Impact Assessment

As described in SEIS Section 3.9.3.3, NRC staff completed an assessment of the proposed project's potential to have visual impacts on historic properties (i.e., properties of any type listed in or considered eligible for listing in the NRHP). As discussed in SEIS Section 4.9.1.1.1, NRC's assessment of visual impacts included 31 historic properties that are either listed on the NRHP or considered eligible for listing on the NRHP under criteria A and/or C due in part to their integrity of setting. They are also located within a 4.8-km [3-mi] radius of the SF in the Dewey area and the CPP in the Burdock area (Table 4.9-6). Historic properties eligible for the NRHP solely under Criterion D were not evaluated for potential visual impacts because integrity of setting is not a contributing characteristic for these types of properties eligible for their historic information contents (i.e., Criterion D).

NRC staff used a GIS-based LOS analysis to determine whether the proposed processing facilities would be visible from the vantage point of each individual historic property. The Dewey SF and the Burdock CPP will be situated at identical locations for both the land application and Class V injection well disposal options. Therefore, potential visual and auditory impacts to historic properties for the land application option will be identical to those described in SEIS Section 4.9.1.1.1 for the Class V injection well disposal option. Based on the LOS analysis, NRC calculates that the proposed project will have a SMALL visual impact on 12 of the 31 historic properties included in this study (Table 4.9.6) and a MODERATE visual impact on 19 historic properties included in the visual impact assessment (see SEIS Section 4.9.1.1.1 and Table 4.9-6).

Auditory Impact Assessment

NRC concluded in the GEIS that impacts from noise will be greatest during the construction and decommissioning phases of an ISR project due to noise generated by earthmoving, excavation, building construction, and demolition activities (NRC, 2009a). Noise levels decrease with distance from the source and NRC determined that noise impacts will be SMALL for residences, communities, and sensitive areas that are located more than 305 m [1,000 ft] from specific noise-generating activtives (NRC, 2009a). NRC's assessment of auditory impacts included the 31 historic properties that are either listed on the NRHP or considered eligible for listing on the NRHP under criteria A and/or C due in part to their integrity of setting and are also located within a 4.8-km [3-mi] radius of the SF in the Dewey area and the CPP in the Burdock area (Table 4.9-6). None of the historic properties included in this assessment are located closer than 640 m [2,100 ft] from the nearest processing facility, which exceeds the estimated 305 m [1,000 ft] zone for potential auditory impacts. Therefore, NRC staff conclude that potential auditory impacts on historic properties during the construction phase for the land application disposal option will be SMALL.

Construction Impacts Conclusion

The NRC environmental review of historic and cultural resources is based on analyses of historic and cultural resource investigations ((Kruse, et al., 2008; Palmer and Kruse, 2008; Palmer 2008, 2009, 2012); tribal cultural surveys (SEIS Appendix F); visual and auditory impact assessments conducted by NRC staff; and commitments made by the applicant to implement mitigation measures for potentially impacted sites. Based on results of the environmental review, NRC staff conclude that the potential impacts to historic and cultural resources during the construction phase of the proposed project for the land application disposal option will range from SMALL to LARGE.

4.9.1.2.2 Operations Impacts

As discussed in the GEIS, it is expected that potential impacts to historic and cultural resources from operations will be less than during construction, because less land disturbance occurs during this phase (NRC, 2009a). In addition, there will be minimal impacts from facility operations or maintenance on identified historic and cultural resources because any potential impacts to these sites will be mitigated prior to facility construction. Potential visual and auditory impacts on historic properties at the proposed project site will be the same as described in Section 4.9.1.2.1 (potential visual impacts will range from SMALL to MODERATE and potential auditory impacts will be SMALL). If there is a discovery of historic and cultural resources during routine maintenance activities, the applicant is required by license condition to stop work (NRC, 2013; License Condition 9.8). The discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and BLM to proceed. For these reasons, the potential impacts to historic and cultural resources during the operations phase for the land application disposal option will be SMALL to MODERATE.

4.9.1.2.3 Aquifer Restoration Impacts

As discussed in the GEIS, it is expected that aquifer restoration impacts to historic and cultural resources will be similar to, or less than, potential impacts from operations (NRC, 2009a). Aquifer restoration activities are generally limited to the existing infrastructure and previously disturbed areas (e.g., access roads, satellite facility, and central processing plant). Potential impacts to identified historic and cultural resources will have been mitigated prior to facility construction. Potential visual and auditory impacts on historic properties at the proposed project site will be the same as described in Section 4.9.1.2.1 (potential visual impacts will range from SMALL to MODERATE and potential auditory impacts will be SMALL). If there is a discovery of historic and cultural resources during routine maintenance activities, the applicant is required by license condition to stop work and notify NRC, SD SHPO, and BLM (NRC, 2013; License Condition 9.8). The discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and BLM to proceed. Therefore, the potential impacts to historic and cultural resources during the aquifer restoration phase for the land application disposal option will be SMALL to MODERATE.

4.9.1.2.4 Decommissioning Impacts

As discussed in the GEIS, decommissioning and reclamation activities will focus on previously disturbed areas, and historic and cultural resources within the APE will already be known (NRC, 2009a). There will be minimal impacts on historic and cultural resources because potential impacts to identified historic properties will have been mitigated. Identified historic sites will have been avoided from the construction phase through the decommissioning phase. Until processing facilities and infrastructure is dismantled and removed, potential visual and auditory impacts on historic properties at the proposed project site will be the same as described in Section 4.9.1.2.1 (potential visual impacts will range from SMALL to MODERATE and potential auditory impacts will be SMALL). Potential visual impacts will be reduced to SMALL after processing facilities are dismantled and removed. If historic and cultural resources are encountered during decommissioning and reclamation activities, the applicant is required by license condition to stop work and notify NRC, SD SHPO, and BLM (NRC, 2013; License Condition 9.8). The discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and

BLM to proceed. Therefore, the overall potential impacts to historic and cultural resources during decommissioning for the land application disposal option will be SMALL.

4.9.1.3 Disposal Via Combination of Class V Injection and Land Application

If a permit for Class V injection wells is obtained from EPA but the capacity of the wells is insufficient to dispose of all liquid wastes generated at the proposed Dewey-Burdock ISR Project, the applicant has proposed to dispose of liquid waste by a combination of deep well disposal using Class V injection wells and land application (see SEIS Section 2.1.1.1.2.4.3). In order to implement the combined option, land application facilities and infrastructure will be constructed, operated, restored, and decommissioned on an as-needed basis, depending on the disposal capacity Class V injection wells (Powertech, 2011). Increased land disturbance and added access restrictions associated with the addition of irrigation areas and increased pond capacity for storage during nonirrigation periods will result in different environmental impacts for the combined option. Specifically, the potential environmental impacts of liquid waste disposal by land application for all phases of the ISR process will be greater than for liquid waste disposal by Class V injection wells (see SEIS Table 4.2.1). However, because only a portion of land application facilities and infrastructure (e.g., irrigation areas and storage ponds) will be constructed, operated, and decommissioned, the impacts to historic and cultural resources for the combined disposal option will be less than for the land application option, but greater than for the Class V injection well disposal option. Therefore, NRC staff conclude that the potential impacts on historic and cultural resources of the combined Class V injection well and land application disposal option for each phase of the proposed Dewey-Burdock ISR Project will be no greater than the impacts of the Class V injection well option and the land application option as summarized in Table 4.9-7.

4.9.2 No-Action (Alternative 2)

Under the No-Action alternative, no ISR facility will be constructed or operated at the proposed Dewey-Burdock ISR Project. Therefore, no historic properties will be affected by the No-Action alternative. The potential impacts associated with current land activities, such as, cattle ranching and recreation will continue.

Table 4.9-7. Significance of Historic and Cultural Resources Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

	Class V Injection Wells	Land Application	Combined Class V Injection Wells and Land Application*
Construction	SMALL to LARGE	SMALL to LARGE	SMALL to LARGE
Operations	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Aquifer Restoration	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Decommissioning	SMALL	SMALL	SMALL
*Significance of impacts on historic and cultural resources for the combined disposal option is bounded by the significance of impacts on historic and cultural resources for the Class V injection well and land application disposal options.			

4.10 Visual and Scenic Resources Impacts

As discussed in GEIS Section 4.4.9, potential visual and scenic impacts from an ISR facility in the Nebraska-South Dakota-Wyoming Uranium Milling Region may occur during all phases of the ISR facility lifecycle. These impacts will come primarily from the use of equipment such as drill rigs; dust and other emissions from such equipment; construction of central and satellite plants and storage structures and site and wellfield access roads; land clearing and grading activities; and lighting for nighttime operations. Such impacts may be mitigated by rolling topography, the use of color considerations for structures, and dust suppression techniques. (NRC, 2009a)

<u>GEIS Construction Phase Summary</u>

Visual impacts during construction can result from the presence of equipment (e.g., drill rig masts, cranes), dust and diesel emissions from construction equipment, and hillside and roadside cuts. Depending on the location of an ISR facility relative to viewpoints, such as highways, facility construction and of drill rigs may be visible. For nighttime operations, the drill rigs will be lighted, thus creating a visual impact on elevated areas. Most impacts will be temporary as equipment is moved and will be mitigated by BMPs (e.g., dust suppression). Additionally, because these sites are located in sparsely populated areas with rolling topography, most visual impacts during construction will not be visible from more than about 1 km [0.6 mi]. Therefore, NRC staff concluded in the GEIS that visual and scenic impacts from operations will be SMALL. (NRC, 2009a)

<u>GEIS Operations Phase Summary</u>

Visual impacts during operations will be less than those from construction because the wellfield surface infrastructure will have a low profile, and most piping and cables will be buried. The tallest structures will be expected to include the central processing plant {9 m [30 ft] in height} and power lines {6 m [20 ft] in height}. Because ISR sites are typically located in sparsely

populated areas with generally rolling topography, most visual impacts during operations will be limited to a distance of not more than about 1 km [0.6 mi]. The irregular layout of wellfield surface structures, such as wellhead protection and header houses, will further reduce visual contrast. BMPs, design (e.g., painting buildings), and landscaping techniques will be used to mitigate potential visual impact. Therefore, NRC staff concluded in the GEIS that visual and scenic impacts from operations will be SMALL. (NRC, 2009a)

<u>GEIS Aquifer Restoration Phase Summary</u>

Aquifer restoration activities will be expected to take place some years after the facility has been in operation, and restoration activities will use in-place infrastructure. As a result, potential visual impacts will be similar to those experienced during operations. Mitigation measures (e.g., dust suppression) may be used to further reduce visual and scenic impacts. Therefore, potential impacts from aquifer restoration will be SMALL. (NRC, 2009a).

<u>GEIS Decommissioning Phase Summary</u>

Because similar equipment will be used and similar activities conducted, potential visual impacts during decommissioning will be similar to those experienced during construction. The greatest potential visual impacts during decommissioning will be temporary as equipment is moved from place to place and mitigated by BMPs (e.g., dust suppression). Additionally, visual impacts will be low, because these sites are expected to be located in sparsely populated areas of the Nebraska-South Dakota-Wyoming Uranium Milling Region, and the impacts will diminish as decommissioning activities decrease and disturbed surfaces become re-vegetated. NRC licensees are required to conduct final site decommissioning and reclamation under an approved site reclamation plan, with the goal of returning the landscape to preconstruction conditions. While some roadside cuts and hill slope modifications may persist beyond decommissioning and reclamation, NRC staff concluded in the GEIS that visual and scenic impacts from decommissioning will be SMALL. (NRC, 2009a)

Potential environmental impacts on visual and scenic resources from construction, operations, aquifer restoration, and decommissioning of the proposed Dewey-Burdock ISR Project are discussed in the following sections.

4.10.1 Proposed Action (Alternative 1)

The BLM Visual Resource Management (VRM) classification of landscapes (BLM, 1984, 1986) was considered in assessing the significance and management objectives of visual impacts. As described in GEIS Section 3.4.9, most of the landscape in the Nebraska-South Dakota-Wyoming Uranium Milling Region is identified as VRM Class III or Class IV (BLM, 2000). These classes are based on a combination of scenic quality, sensitivity levels, and distance zones (BLM, 1984, 1986). This classification allows for an activity to contrast with basic elements of the characteristic landscape to a moderate extent for a Class III designation or to a much greater extent for a Class IV designation.

As described in SEIS Section 3.10, the applicant classified the project area and the 3.2-km [2-mi] area surrounding the project area as VRM Class IV (Powertech, 2009a). The objective of this class is to provide management for activities that might require major modifications of the existing character of the landscape (BLM, 1986). The level of change permitted for this class is the least restrictive and can be high. Some VRM Class II areas have been identified around Devil's Tower National Monument and BHNF along the Wyoming-South Dakota border (BLM, 2000). VRM Class II allows an activity to contrast with basic elements of the characteristic landscape to a limited extent. However, these VRM Class II areas are more than 80 km [50 mi] from the proposed project area. As previously discussed, PSD Class I areas require more stringent air quality standards that can affect visual impacts (see SEIS Section 4.7). The nearest PSD Class I area is located at Wind Cave National Park, approximately 47 km [29 mi] east of the proposed Dewey-Burdock site. Other recreational areas in the broader region include Jewel Cave National Monument and Mount Rushmore National Memorial, managed by the U.S. Department of the Interior. These recreational areas are located approximately 37 km [23 mi] north and 71 km [44 mi] northeast of the proposed project, respectively (see Figure 3.2-2). In addition, the SDGFP-managed George S. Mickelson Trail parallels State Highway 89 between Custer, South Dakota, and U.S. Highway 18 connecting Edgemont to Hot Springs and comes within approximately 27 km [17 mi] of the proposed project area.

4.10.1.1 Disposal Via Class V Injection Wells

The applicant's preferred option for disposal of liquid wastes is deep well disposal via Class V injection wells (see SEIS Section 2.1.1.1.2.4). EPA is currently reviewing the applicant's UIC permit application for Class V injection wells. The applicant-proposed locations of the first four

Class V injection wells are shown in Figure 2.1-10. Potential environmental impacts on visual and scenic resources for the Class V injection well disposal option are discussed in the following sections.

4.10.1.1.1 Construction Impacts

Visual impacts related to facilities construction at the proposed Dewey-Burdock ISR Project will include addition of access roads, overhead electrical lines, processing facilities (central processing plant and satellite facility buildings), storage ponds, wellhead covers, header houses, piping, and ancillary buildings (Powertech, 2009a). Additional visual impacts related to facilities construction associated with the Class V injection well disposal option will include the construction of four to eight Class V injection wells. After construction, buildings will be constructed around the Class V injection wells to limit access (see SEIS Section 4.2.1.1.1).

During construction, most impacts to visual resources at the proposed Dewey-Burdock site will result from well development, when drilling rig masts contrast with the general topography. Approximately 646 wells will be installed during initial wellfield development, and approximately 406 wells will be installed annually over the operational life of the proposed project (Powertech, 2010b). Multiple drill rigs will likely be operating during wellfield construction. In addition, four to eight Class V deep injection wells will be drilled and developed for liquid waste disposal. Visual impacts from drilling activities will be temporary. Once a well is completed and conditioned for use, the drill rig will be moved to a new location to drill the next hole. In the wellfields, wellheads will be covered to prevent freezing and protect the wells. These covers will be low structures {1–2 m [3–6 ft] high} and will present only a slight contrast to the existing landscape. Unless the topography is extremely flat and void of vegetation, these structures will not be visible from distances of 1 km [0.6 mi] or more.

Visual and scenic impacts from land disturbance associated with facilities construction at the proposed Dewey-Burdock site will be short term (1 to 2 years; see Figure 2.1-1). The applicant has indicated that temporarily impacted areas will be reclaimed after construction is complete and debris created during construction will be removed as soon as possible (Powertech, 2009a). Roads and structures will be more long lasting, but will be removed and reclaimed after operations cease. The applicant proposes to minimize the potential impacts to visual and scenic resources by selecting building materials and paint that complement the natural environment (Powertech, 2009a). Construction and placement of structures and roads will consider the landscape topography to conceal wellheads, plant facilities, access roads, and areas of disturbance from public vantage points. Standard dust control measures (e.g., water application, speed limits, and coordinating dust-producing activities) will be implemented to reduce visual impacts from fugitive dust (Powertech, 2009a). The applicant is also considering other measures to mitigate the potential visual and scenic resource impacts, including using exterior lighting only where needed to accomplish facility tasks, limiting the height of exterior lighting units, and using shielded or directional lighting to limit lighting only to areas where it is needed (Powertech, 2009a).

As discussed previously, the proposed project site is located more than 16 km [10 mi] from the PSD Class I area at Wind Cave National Park, VRM Class II regions, and other recreational areas in the surrounding region. Therefore, the visual and scenic impacts associated with ISR construction at the proposed project will be consistent with the predominant VRM Class III and IV designations for the Nebraska-South Dakota-Wyoming Milling Region (BLM, 2000; NRC, 2009a). Based on the remote location of the proposed project site, the short-term nature of construction activities, and the mitigation measures that will be used to reduce potential visual and scenic impacts the NRC staff conclude that visual and scenic impacts from ISR facilities and equipment during construction activities for the Class V injection well disposal option will be SMALL.

4.10.1.1.2 Operations Impacts

Most of the pipes and cables associated with wellfield operations at the Dewey-Burdock ISR Project will be buried at least 1.5 m [5 ft] below grade to protect them from freezing, and they will not be visible during operations (Powertech, 2009a). The applicant will sequentially phase in wellfields as the uranium reserves are defined (Powertech, 2009a); therefore, there will not be a large expanse of land undergoing development at one time. Because wellhead covers will typically be low {1–2 m [3–6 ft]} structures and there is no active drilling in operating wellfields, the overall visual impact of an operating wellfield will be the same as or less than from construction.

The central processing plant, satellite facility, header houses, Class V injection well buildings, access roads, and overhead powerlines at the project will be the main operational facilities and infrastructure affecting the visual landscape. The visibility of aboveground facilities and infrastructure will depend on the location of the observer, intervening topography, and distance. The construction and placement of aboveground structures will consider the topography to conceal plant facilities, infrastructure, and roads from public vantage points (Powertech, 2009a). In addition, building materials and paint will be selected to complement the natural environment. As discussed in SEIS Section 4.7, standard dust control measures (e.g., water application and speed limits) will be implemented, which will reduce visual impacts from fugitive dust during operations activities (Powertech, 2009a).

The proposed project site is located more than 16 km [10 mi] from the PSD Class I area at Wind Cave National Park, VRM Class II regions, and recreational areas in the surrounding region. Therefore, the visual impacts associated with operations will be consistent with the predominant VRM Classes III and IV for the region (BLM, 2000; NRC, 2009a). Because construction of aboveground structures will consider topography to conceal plant facilities and infrastructure and mitigation measures (e.g., water application to control fugitive dust) will be implemented to reduce impacts to visual and scenic resources, NRC staff conclude that the visual and scenic impacts from operations for the Class V injection well disposal option will be SMALL.

4.10.1.1.3 Aquifer Restoration Impacts

Much of the same equipment and infrastructure used during the operational period of the project will be employed during aquifer restoration, so impacts to the visual landscape will be similar to those during operations. Because there is no active drilling, potential visual impacts during aquifer restoration are expected to be less than those during construction and of short duration. As with construction and operations, the visual impacts associated with aquifer restoration will be consistent with the predominant VRM Classes III and IV for the region (BLM, 2000; NRC, 2009a). No modifications to either scenery or topography will occur during restoration. Standard dust control measures (e.g., water application and speed limits) will be implemented to further reduce the overall visual and scenic impacts of aquifer restoration (Powertech, 2009a). Therefore, NRC staff conclude that the visual and scenic impacts from aquifer restoration for the Class V injection well disposal option will be SMALL.

4.10.1.1.4 Decommissioning Impacts

When project operations and aquifer restoration are complete at the proposed Dewey-Burdock site, the applicant will return all lands disturbed by the ISR facility to their preoperational land use of livestock grazing and wildlife habitat unless the state justifies and approves an alternative use (e.g., the landowner may request to retain structures and roads for further use) (Powertech, 2009a). Reclamation will return the landscape to baseline contours and will reduce the visual impact by removing buildings and associated infrastructure. After reclamation activities are completed, there will be no restrictions on surface use. Prior to final site decommissioning, the applicant will submit a decommissioning plan to NRC, in accordance with 10 CFR Part 40.

During decommissioning and reclamation activities, temporary impacts to the visual environment will be similar to or less than those during the construction phase. Equipment used to dismantle buildings and milling equipment, remove any contaminated soils, or grade the surface as part of reclamation activities will generate temporary visual contrasts. In the wellfields, the greatest source of visual contrast will be from equipment used when production, injection, and monitor wells are plugged and abandoned. Temporary visual contrasts associated with the Class V injection well disposal option will include the dismantling of buildings housing the Class V injection wells and the plugging and abandonment of the wells. Visual and scenic resources may be affected by fugitive dust emissions from decommissioning activities. The applicant will implement dust suppression measures (e.g., water application and speed limits) to reduce dust emissions (Powertech, 2009a). Once decommissioning and reclamation activities are complete, the visual landscape will be returned to baseline conditions, with the potential exception of equipment related to longer term monitoring activities. Therefore, the NRC staff conclude that the visual and scenic impacts from decommissioning for the Class V injection well disposal option will be SMALL.

4.10.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not obtained from EPA, the applicant will dispose of liquid waste generated at the proposed Dewey-Burdock ISR Project by land application (see SEIS Section 2.1.1.1.2.4.2). The locations of land application areas for this disposal option are shown in Figure 2.1-12. Potential environmental impacts on visual and scenic resources during construction, operations, aquifer restoration, and decommissioning for the land application option are discussed in the following sections.

4.10.1.2.1 Construction Impacts

As with the Class V injection well disposal option, visual impacts related to facilities construction for the land application option at the proposed Dewey-Burdock ISR Project will include addition of access roads, overhead electrical lines, processing facilities (central processing plant and satellite facility buildings), storage ponds, wellhead covers, header houses, piping, and ancillary buildings (Powertech, 2009a). Additional visual impacts related to facilities construction for the land application option will include the addition of center pivot irrigation systems in land application areas. As described in SEIS Section 2.1.1.1.2.4.2, the Dewey area will contain five 20.23-ha [50-ac] pivots, two 10.12-ha [25-ac] pivots, and one 6.1-ha [15-ac] pivot. The Burdock area will contain six 20.23-ha [50-ac] pivots and one 6.1-ha [15-ac] pivot. In addition, each area will contain 26.3 ha [65 ac] of pivots on standby.

Similar to the Class V injection well disposal option, visual and scenic impacts associated with facilities construction for the land application option at the proposed site will be short term (1 to 2 years) and minimized by mitigation measures. Applicant-proposed mitigation measures to reduce visual impacts include (i) reclaiming temporary impacted areas after construction and removing debris; (ii) removing and reclaiming roads and structures after operations cease; (iii) selecting building materials and paint that complement the natural environment; (iv) considering landscape topography to conceal wellheads, plant facilities, access roads, and center pivot irrigation systems; and (v) implementing standard dust suppression techniques to reduce visual impacts of fugitive dust (Powertech, 2009a). The applicant is also considering other measures to mitigate the potential visual and scenic resource impacts, including using exterior lighting only where needed to accomplish facility task, limiting the height of exterior lighting units, and using shielded or directional lighting to limit lighting only to areas where it is needed (Powertech, 2009a).

During construction of facilities and infrastructure for the land application option, most impacts to visual resources at the proposed site will result from development of wellfields (as described in SEIS Section 4.10.1.1.1 for the Class V injection well disposal option) and the placement of center pivot irrigation systems. Visual impacts of center pivot irrigation systems will last over the life of proposed project. Center pivot irrigation systems will not be visible to individuals on heavily traveled public roadways in the area (e.g., U.S. Highway 18 and State Highway 89). However, proposed land application areas in the Dewey area are within 1 km [0.6 mi] of Dewey Road (see Figure 2.1-12), and therefore center pivots in the Dewey area will be visible to travelers along Dewey Road.

As discussed previously, the proposed Dewey-Burdock site is located more than 16 km [10 mi] from the PSD Class I area at Wind Cave National Park, VRM Class II regions, and other recreational areas in the surrounding region. Therefore, the visual and scenic impacts associated with ISR construction at the proposed project will be consistent with the predominant VRM Class III and IV designations for the Nebraska-South Dakota-Wyoming Milling Region (BLM, 2000; NRC, 2009a). Center pivot irrigation systems in proposed land application areas in the Dewey area will be visible to travelers on Dewey Road; however, Dewey Road is a lightly traveled county road with few residences. In 2009, the estimated average daily traffic count on Dewey Road was 25 vehicles (BLM, 2009). Based on the remote location of the proposed project site, the short-term nature of the construction activities and the mitigation measures that will be used to reduce potential visual and scenic impacts, the NRC staff conclude that visual and scenic impacts from ISR construction activities for the land application disposal option will be SMALL.

4.10.1.2.2 Operations Impacts

For the land application liquid waste disposal option, the central processing plant, satellite facility, header houses, access roads, overhead powerlines, and center pivot irrigation systems will be the main operational facilities and infrastructure affecting the visual landscape at the proposed site. As with the Class V injection well disposal option, most of the pipes and cables associated with wellfield operations at the project will be buried at least 1.5 m [5 ft] below grade to protect them from freezing, and they will not be visible during operations (Powertech, 2009a). The applicant proposes to sequentially phase in wellfields as the uranium reserves are defined (Powertech, 2009a); therefore, there will not be a large expanse of land undergoing development at one time. Because wellhead covers will typically be low {1–2 m [3–6 ft]} structures and there is no active drilling in operating wellfields, the overall visual impact of an operating wellfield will be the same as or less than from construction. As noted in the previous section, center pivot irrigation systems will not be visible to individuals on heavily traveled public roadways in the area (e.g., U.S. Highway 18 and State Highway 89). However, due to the proximity of proposed land application areas in the Dewey area to Dewey Road, center pivots will be visible to travelers along Dewey Road (see Figure 2.1-12). As noted in the previous section, Dewey Road is a lightly traveled county road with few residences. In 2009, the estimated average daily traffic count on Dewey Road was 25 vehicles (BLM, 2009).

The visibility of aboveground facilities and infrastructure will depend on the location of the observer, intervening topography, and distance. The construction and placement of aboveground structures will consider the topography to conceal plant facilities, infrastructure, center pivots in potential land application areas, and roads from public vantage points (Powertech, 2009a). In addition, building materials and paint will be selected to complement the natural environment. As discussed in SEIS Section 4.7, standard dust control measures (e.g., water application and speed limits) will be implemented, which will reduce visual impacts from fugitive dust during operations activities (Powertech, 2009a).

The proposed Dewey-Burdock site is located more than 16 km [10 mi] from the PSD Class I area at Wind Cave National Park, VRM Class II regions, and recreational areas in the surrounding region. Therefore, the visual impacts associated with operations will be consistent with the predominant VRM Classes III and IV for the region (BLM, 2000; NRC, 2009a). Center pivot irrigation systems in proposed land application areas in the Dewey area will be visible to travelers on Dewey Road; however, Dewey Road is a lightly traveled county road with few residences. Based on the remote location of the project site, the use of topography to conceal plant facilities and infrastructure, and mitigation measures (e.g., water application to control fugitive dust) that will be implemented to reduce impacts to visual and scenic resources, NRC staff conclude that the visual and scenic impacts from operations for the land application disposal option will be SMALL.

4.10.1.2.3 Aquifer Restoration Impacts

Much of the same equipment and infrastructure used during the operational period of the project will be employed during aquifer restoration, so impacts to the visual landscape will be similar to those during operations. Because there is no active drilling, potential visual impacts during aquifer restoration are expected to be less than those during construction and of short duration. As with construction and operations, the visual impacts associated with aquifer restoration will be consistent with the predominant VRM Classes III and IV for the region (BLM, 2000; NRC, 2009a). Neither scenery nor topography will be modified during restoration. Standard dust control measures (e.g., water application and speed limits) will be implemented to further reduce the overall visual and scenic impacts of aquifer restoration (Powertech, 2009a). Therefore, NRC staff conclude that the visual and scenic impacts from aquifer restoration for the land application disposal option will be SMALL.

4.10.1.2.4 Decommissioning Impacts

Prior to final site decommissioning, the applicant will submit a decommissioning plan to NRC, in accordance with 10 CFR Part 40. During decommissioning and reclamation, temporary impacts to the visual environment will be similar to or less than those during the construction phase. Equipment used to dismantle buildings and milling equipment, remove any contaminated soils, or grade the surface as part of reclamation activities will generate temporary visual contrasts. In the wellfields, the greatest source of visual contrast will be from equipment used when production, injection, and monitor wells are plugged and abandoned. Temporary visual contrasts associated with the land application disposal option will include the dismantling and removal of center pivot irrigation systems in land application areas. Visual and scenic resources may be affected by fugitive dust emissions from decommissioning activities. The applicant will implement dust suppression measures (e.g., water application and speed limits) to reduce dust emissions (Powertech, 2009a). Once decommissioning and reclamation activities are complete, the visual landscape will be returned to baseline conditions, with the potential exception of equipment related to longer term monitoring activities. Therefore, the NRC staff conclude that the visual and scenic impacts from decommissioning for the land application disposal option will be SMALL.

4.10.1.3 Disposal Via Combination of Class V Injection and Land Application

If a permit for Class V injection wells is obtained from EPA but the capacity of the wells is insufficient to dispose of all liquid wastes generated at the proposed Dewey-Burdock ISR Project, the applicant will dispose of liquid waste by a combination of Class V deep injection wells and land application (see SEIS Section 2.1.1.1.2.4.3). For the combined Class V injection well and land application disposal option, land application facilities and infrastructure will be constructed, operated, restored, and decommissioned on an as-needed basis depending on the Class V injection well disposal capacity (Powertech, 2011). Because of the placement of center pivot irrigation systems in proposed land application areas, the potential visual impacts of liquid waste disposal by land application for all phases of the ISR process will be greater than for liquid waste disposal by Class V well injection (see SEIS Section 4.10.1.2). Furthermore, because only a portion of the center pivot irrigation systems will be constructed, operated, and decommissioned for the combined disposal option, the significance of visual impacts for the combined disposal option will be less than for the land application option. Therefore, NRC staff conclude that visual and scenic impacts of the combined Class V injection well and land application disposal option for each phase of the proposed will be bounded by the significance of visual and scenic impacts of the Class V injection well option and the land application option as summarized in Table 4.10.1.

4.10.2 No Action (Alternative 2)

Under the No-Action alternative, no ISR facility will be constructed and there will be no change to the existing visual and scenic resources at the proposed Dewey-Burdock Project site. No additional structures or uses associated with the proposed project will be introduced from the

Table 4.10-1. Significance of Visual and Scenic Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

	Class V Injection Wells	Land Application	Combined Class V Injection Wells and Land Application*
Construction	SMALL	SMALL	SMALL
Operations	SMALL	SMALL	SMALL
Aquifer Restoration	SMALL	SMALL	SMALL
Decommissioning	SMALL	SMALL	SMALL
*Significance of environmental impact for the combined disposal option is bounded by the significance of environmental impacts for the Class V injection well and land application disposal options.			

proposed action to affect the existing viewscapes, and the existing scenic quality will remain unchanged (BLM VRM Classes III and IV, as defined in SEIS Section 3.10). Natural resource exploration activities and cattle grazing will continue in the area.

4.11 Socioeconomics Impacts

Socioeconomic impacts are defined in terms of changes to the demographic and economic characteristics and social conditions of a region. For example, the number of jobs created by a proposed action could affect regional employment, income, and expenditures. Job creation is characterized by two types: (i) construction-related jobs, which are transient, short in duration, and less likely to have a long-term socioeconomic impact on the region and (ii) operation-related jobs in support of facility operations, which have a greater potential for permanent, long-term socioeconomic impacts in a region.

GEIS Section 4.4.10 describes the socioeconomic impacts expected during the ISR facility lifecycle (NRC, 2009a). Potential environmental impacts to socioeconomics could occur during

all phases of the facility's lifecycle. The GEIS socioeconomic analysis for the Nebraska-South Dakota-Wyoming Uranium Milling Region was based on 2000 U.S. Census Bureau (USCB) data. The socioeconomic analysis presented in this SEIS for the proposed Dewey-Burdock Project ROI is based on 2010 USCB data. Though specific numbers will differ between the 2000 and 2010 USCB data, the NRC analysis of socioeconomics presented in GEIS Section 4.4.10 remains valid for the proposed Dewey-Burdock ISR Project as explained in the following sections and expected impacts will be similar in scale to NRC staff conclusions in the GEIS.

4.11.1 Proposed Action (Alternative 1)

As discussed in SEIS Section 3.11, the analysis for the proposed action focuses on the impacts of constructing, operating, restoring the aquifer, and decommissioning the proposed ISR facility in Custer and Fall River Counties in South Dakota and Weston County in Wyoming. The applicant expects to directly employ 86 workers during construction and 84 workers during operations of the proposed project (Powertech, 2009a). A smaller number of workers are expected to be involved in aquifer restoration and decommissioning activities (Powertech, 2010a). The applicant expects nine workers to be directly involved in aquifer restoration activities and nine workers to be directly involved in decommissioning activities. The workforce for each phase of the proposed Dewey-Burdock ISR Project is not expected to change in number or skill level based on the liquid waste disposal option that the applicant will ultimately implement (Powertech, 2009a, 2010a). In other words, the number of skilled and unskilled workers required for construction, operations, aquifer restoration, and decommissioning for the Class V injection well disposal option, the land application disposal option, or the combined Class V injection well and land application disposal option will be the same. Therefore, NRC staff conclude that the demands of the workforce on existing public and social services, housing, and infrastructure (schools, utilities, local finance) will be similar regardless of the liquid waste disposal option the applicant implements. Socioeconomic impacts from construction, operations, aquifer restoration, and decommissioning of the proposed Dewey-Burdock ISR Project are discussed in the following sections.

4.11.1.1 Construction Impacts

In GEIS Section 4.4.10.1, NRC staff discussed the potential impacts to socioeconomics from construction of an ISR facility. These impacts will result predominantly from employment at an ISR facility and demands on the existing public and social services, tourism/recreation, housing, infrastructure (schools, utilities), and the local workforce. In the GEIS, NRC staff estimated total peak construction employment at an ISR facility to be about 200 people, including company employees and local contractors. During surface facility and wellfield construction, local contractors will generally be used (e.g., drillers, construction workers), as available, and local building materials and building supplies will be used to the extent practical. NRC staff also estimated an additional 140 indirect jobs may be created to support the construction of an ISR facility. Indirect jobs represent employees hired by producers of materials, equipment, and services that are used on the project. (NRC, 2009a)

In the GEIS, NRC staff assumed that most construction workers will choose to live in larger communities with access to more services. However, NRC staff expected that some construction workers will commute from outside the county to the construction site and that skilled employees (e.g., engineers, accountants, managers) will come from outside the local workforce. The potential also exists that some of these employees will temporarily relocate to the proposed project area and contribute to the local economy through purchasing goods and services and through paying taxes. Depending on where the workforce and supplies come from, the GEIS determined that potential impacts to towns and communities, in terms of housing and employment structure, may be SMALL to MODERATE. Given the expected short duration of construction activities (12 to 18 months), families are not expected to relocate closer to the site. For this reason, potential impacts to education and use of local services was determined to be SMALL. (NRC, 2009a)

Construction of the proposed Dewey-Burdock ISR Project is expected to last for 2 years (see Figure 2.1-1) and employ 86 people (Powertech, 2009a). In addition, 45 indirect jobs are expected to be created to support construction of the proposed project (Powertech, 2009a). Based on the smaller number of required construction workers for the proposed project (86 workers) when compared to the ISR construction workforce estimated in the GEIS (200 workers), the NRC staff conclude that the site-specific impacts of constructing the proposed project will be smaller than the impacts described in the GEIS.

Because of the small relative size of the ISR construction workforce, the overall potential impacts to socioeconomics from construction of the proposed Dewey-Burdock ISR Project will be SMALL. The following subsections describe the construction impacts related to demographics, income, housing, employment rate, local finance, education, and health and social services for the proposed project.

4.11.1.1.1 Demographics

A workforce of 86 employees engaged directly in construction activities is expected during the construction phase of the Dewey-Burdock ISR Project (Powertech, 2009a). An additional 45 indirect jobs are expected to be created to support construction activities for a total of 131 people (Powertech, 2009a). Construction of the buildings, initial wellfields, and waste disposal systems for the proposed project is anticipated to take 2 years (see Figure 2.1-1). Construction workers are likely to locate in nearby communities such as Edgemont and Hot Springs in Fall River County, Custer in Custer County, and Newcastle in Weston County.

Based on housing data presented in SEIS Section 3.11.3, all of the counties have available housing to manage increases in population. Likewise, based on school enrollment and student-teacher ratio data presented in SEIS Section 3.11.6, schools have available capacities to manage increases in population. Furthermore, as described in SEIS Section 3.11.7, surrounding communities have adequate health and social services to serve increases in population. Due to the short duration of construction, the expected 86 construction workers and 45 supporting personnel will have a short-term impact on public services and community infrastructure in surrounding communities.

Increases in population will have the greatest impact on small communities close to the proposed project site, such as Edgemont (population 774). The construction workforce will be made up predominantly of skilled trades (e.g., carpenters, electricians, welders, plumbers) and unskilled workers sourced from nearby communities and counties. The applicant will preferentially source the labor force for construction from within the surrounding region to mitigate any burden on public services and community infrastructure in the nearby towns (Powertech, 2009a). Further, due to the short duration of construction (2 years estimated), construction workers with families will be less likely to relocate their entire families to the region, thus minimizing impacts from an outside workforce. Therefore, the NRC staff conclude that the impacts to demographics on nearby communities such as Edgemont, Custer, Hot Springs, and Newcastle during the construction phase will be SMALL.

4.11.1.1.2 Income

The applicant has estimated a construction workforce of 86 employees (Powertech, 2009a). Construction of the proposed project will preferentially draw upon the labor force within the region before going outside the region (Powertech, 2009a). Construction workers will likely come from nearby communities such as Edgemont, Hot Springs, and Custer in Custer and Fall River Counties and from Newcastle in Weston County, Wyoming. As noted previously, the construction workforce will be made up predominantly of skilled trades and unskilled workers. It is expected that the construction workforce will be paid at rates typical of the region. Income information including median household income and per capita income for Fall River, Custer, and Weston Counties is presented in SEIS Section 3.11.2. Because the construction workforce will be paid at rates typical of the region, the NRC staff conclude that the overall impacts to income during the construction phase of the proposed project will be SMALL.

4.11.1.1.3 Housing

The number of construction workers will cause a short-term increase in the demand of temporary (rental) housing units in Fall River, Custer, and Weston Counties. Based on 2010 USCB housing information, the vacancy rate is 21.9 percent (919 vacant units) in Fall River County, 21.4 percent (992 vacant units) in Custer County, and 14.5 percent (512 vacant units) in Weston County (see SEIS Section 3.11.3). Hence, any changes in employment will have little to no noticeable effect on the availability of housing in Custer, Fall River, and Weston Counties. Due to the short duration of construction activities (2 years), the number of construction workers (86 workers), and the availability of housing in the region, there will be little or no employment-related housing impacts. Therefore, the impact of the proposed action on housing availability will be SMALL.

4.11.1.1.4 Employment Structure

Construction of the proposed Dewey-Burdock ISR Project will create employment opportunities for 86 construction workers, with the potential of up to 45 jobs being generated to support this activity in the local economy. As described in SEIS Section 3.11.4, total 2012 county labor forces were estimated to be 3,660 for Fall River County, 4,390 for Custer County, and 3,308 for Weston County (SDDOL, 2012; WDWS, 2012). Unemployment rates in 2012 were 4.7, 4.0, and 5.1 percent in Fall River, Custer, and Weston Counties, respectively (SDDOL, 2012; WDWS, 2012). Because of the short duration (2 years) and small size of the construction workforce (86 workers), the effect on employment in the region will be SMALL.

4.11.1.1.5 Local Finance

Construction of the proposed ISR facility at the Dewey-Burdock ISR Project site will generate some tax revenue in the local economy through the purchase of goods and services as well as contribute to increased county and state tax revenues through an increased tax base. As described in SEIS Section 3.11.5, the majority of state revenue in South Dakota is generated from a 4 percent statewide sales and use tax (SDDRR, 2011). Towns in South Dakota may also impose up to a 1 percent sales and use tax on various sales including lodging, restaurant meals, alcoholic beverages, and admissions to places of entertainment and up to a 2 percent sales and use tax on all products and services subject to the state sales or use tax (SDDRR, 2011). Sales and use tax revenues totaled $6.6 million for Custer County and $5.4 million for Fall River County in 2011. The tax revenues are based on the 4 percent state sales and use tax on gross sales of $165 million for Custer County and $134 million for Fall River County (SDDRR, 2012). Weston County has a 5 percent sales and use tax (4 percent state base tax and a 1 percent optional county tax) and a 4 percent lodging tax (Wyoming Department of Revenue, 2010). Sales and use tax revenues totaled $11.2 million for Weston County in 2011. Smaller towns, such as Edgemont, experiencing increased population/public service demand may not receive a proportionate level of tax increase, because sales tax revenue is more likely to increase in larger communities, such as Custer and Hot Springs. Because of the short duration of construction (2 years) and small size of the construction workforce (86 workers) in relation to the total labor forces in Fall River, Custer, and Weston Counties (see previous section), construction of the proposed ISR facility at the Dewey-Burdock site will have a SMALL impact on local finances.

4.11.1.1.6 Education

If the construction workforce for the Dewey-Burdock ISR Project and their families secure local housing, an increased demand for schools will occur. However, construction workers are less likely to relocate their entire families to the region, especially given the relative short duration (2 years) of construction activities. Based on school enrollment and student–teacher ratio data presented in SEIS Section 3.11.6, school districts have available capacities to manage increases in school-aged children relocating to the area. The NRC staff concludes that the overall impacts on educational services during the construction phase of the proposed project will be SMALL.

4.11.1.1.7 Health and Social Services

The construction workforce is expected to cause only a small short-term increase in the demand for doctors, hospitals, social services, and police during the construction phase of the proposed

Dewey-Burdock ISR Project. Due to the short duration of construction (2 years maximum), construction workers with families will be less likely to relocate their entire families to the region, thus minimizing impacts on health and social services. As presented in SEIS Section 3.11.7, towns surrounding the proposed project have adequate medical facilities; social services; and police, fire, and emergency medical services to accommodate workers and their families. Local governments are expected to have the capacity to effectively plan for and manage the increased demands on health and social services because population increases will be small (86 construction workers). Therefore, impacts to health and social services during the construction phase of the proposed project will be SMALL.

4.11.1.2 Operations Impacts

GEIS Section 4.4.10.2 describes employment levels during ISR facility operations and assumes 50 to 80 workers will support this phase of the ISR lifecycle. Use of local contract workers and local building materials will diminish, because drilling and facility construction will diminish. Revenues will be generated from federal, state, and local taxes on the facility and the uranium produced. Employment types are expected to be more technical during operations, and as a result, the majority of the operational workforce is expected to be staffed from outside the region, particularly during initial operations. According to the GEIS, effects on community services (e.g., education, health care, utilities, shopping, and recreation) during facility operations will be similar to effects experienced during construction, except fewer people will be employed for a longer duration. Overall, NRC staff determined in the GEIS that potential impacts to socioeconomics from operations will be SMALL to MODERATE. (NRC, 2009a)
The operations phase of the proposed Dewey-Burdock ISR Project is expected to last for 8 years and employ 84 workers (Powertech, 2009a). In addition, 36 indirect jobs are expected to be created to support operations of the proposed project (Powertech, 2009a). The operations phase will impact the local economy through creating jobs, purchasing local goods and services, and increasing county and state tax revenues. Severance tax on the uranium extracted will also be collected at the state level and will contribute to the State of South Dakota general fund. Because the anticipated size of the ISR operations workforce (84 payroll employees) is only slightly larger than the 50 to 80 employees analyzed in the GEIS, the NRC staff conclude that the site-specific impacts of operating the proposed project will be comparable to the impacts described in the GEIS. The following subsections describe the operations impacts related to demographics, income, housing, employment rate, local finance, education, and health and social services.

4.11.1.2.1 Demographics

A peak workforce of 84 employees engaged directly in operations activities will be expected during the operations phase of the proposed Dewey-Burdock ISR Project (Powertech, 2009a). Although about equal to the construction workforce (86 employees), the operations workforce is expected to stay in the area longer (approximately 8 years) and so will be more likely to secure permanent or semi-permanent housing in the area than the construction workforce. The operations phase will require a number of specialized workers, such as plant managers, technical professionals, and skilled tradesmen. As described in GEIS Section 4.4.10.2, because of the highly technical nature of ISR operations (requiring professionals in the areas of health physics, chemistry, laboratory analysis, geology and hydrogeology, and engineering), the majority (approximately 70 percent) of the workforce during operations is expected to be staffed from outside the region (NRC, 2009a). Therefore, up to 59 personnel (86 employees × 0.7) for the operations phase of the proposed project could be sourced from outside the local area. The remaining workforce will most likely come from the local labor pool. The increase in population during the operations phase will spur additional job creation to serve the larger population. The applicant has estimated that an additional 36 indirect jobs are expected during the operations phase of the project (Powertech, 2009a).

Because of the small size of the operations workforce (84 workers) and the potential addition of 36 (indirect) workers in support of facility operations, demographic conditions in Custer, Fall River, and Weston Counties are not likely to change. The combined effect of 84 to 120 new jobs in the region (assuming that all of the direct and indirect workers will relocate to the ROI) constitutes less than 1 percent of the current combined civilian labor force in Custer, Fall River, and Weston Counties (see SEIS Section 3.11.4). Therefore, the impact on demographic conditions will be SMALL.

4.11.1.2.2 Income

Operations at the proposed project will create skilled positions such as project managers, plant operators, lab technicians, and drilling contractors. These skilled workers will command salaries that provide income levels equal to or higher than the average local and statewide income levels. The total annual payroll for the proposed project is estimated at $5,600,000 (Powertech, 2009a). The average annual salary for all full-time employees will be roughly $66,700. This is more than the South Dakota median household income of $46,369 and the Wyoming median household income of $53,802 (see SEIS Section 3.11.2). This is also above the Fall River County median household income of $35,833, the Custer County median household income of $46,743, and the Weston County median household income of $53,853 (see SEIS Section 3.11.2). Therefore, the proposed project will have a positive effect on local average annual incomes during ISR facility operations. However, because the operations workforce (84 workers) is small in comparison to the combined labor force in Custer, Fall River, and Weston Counties (see SEIS Section 3.11.4), overall impacts to local income during ISR facility operations will be SMALL.

4.11.1.2.3 Housing

Housing demand is anticipated to increase during operations. The operations workforce is expected to stay in the area longer, approximately 8 years (see Figure 2.1-1), and so will be more likely to secure permanent or semi-permanent housing in the area than the construction workforce. Most workers moving into the area will relocate to the surrounding towns of Edgemont, Custer, Hot Springs, and Newcastle. Discussions with officials of the Edgemont Chamber of Commerce and Custer County Economic Development Committee indicated that housing in the towns of Edgemont and Custer will be available to accommodate the projected operations workforce (NRC, 2009c). Vacancy rates are currently high (14.5 to 22 percent) in Custer, Fall River, and Weston Counties (see SEIS Section 3.11.3), and the added workforce will have little impact on the housing inventory. Because of the small size of both the operations workforce (84 workers) and the workforce indirectly supporting facility operations (36 workers), impacts to housing during ISR operations at the proposed project will be SMALL.

4.11.1.2.4 Employment Structure

As previously discussed, ISR facility operations at the proposed Dewey-Burdock ISR Project will generate 84 new jobs, such as project managers, plant operators, lab technicians, and drill contractors. Most skilled positions are likely to be filled by people moving into the area rather than providing employment opportunities for people living in nearby communities. As described in GEIS Section 4.4.10.2, because of the highly technical nature of ISR operations (requiring professionals in the areas of health physics, chemistry, laboratory analysis, geology and hydrogeology, and engineering), the majority (approximately 70 percent) of the workforce during operations is expected to be staffed from outside the region. The proposed project will provide some jobs to the local labor pool to support ISR facility operations. However, because the number of skilled workers drawn from areas outside of the ROI will be relatively small (e.g., 84 workers × 0.7 = 59 workers), ISR facility operations at the proposed project will not noticeably affect employment rates in Custer, Fall River, and Weston Counties. Therefore, the impact on the employment structure will be SMALL.

4.11.1.2.5 Local Finance

Tax revenue will profit Fall River and Custer Counties through the projected 8-year operations phase. Personal property tax will be applied to the value of all equipment the project uses. In addition, a state mineral severance tax will be applied to the milled uranium. The State of South Dakota collects the severance tax and returns 50 percent of the tax to the county where the mineral was produced (see SEIS Section 8.3). A county *ad valorem* tax for production will also contribute to local government revenue. The counties and municipalities will indirectly benefit from increased sales tax revenue from the increased population and resultant demand for goods and services. Because the operations workforce (84 workers) is small in relation to the total labor forces in Fall River and Custer Counties (see SEIS Section 3.11.4), the tax-revenue impact from ISR facility operations on local taxing jurisdictions in Fall River and Custer Counties will be positive and SMALL to MODERATE.

4.11.1.2.6 Education

The added population associated with the additional 86 workers and their families relocating during operations may have an impact on local public schools and education-related services. The average family size in South Dakota is 2.43 (USCB, 2012). Assuming a two-parent family, a conservative upper estimate for the number of school-aged children that may relocate to the ROI will be 40 children of various ages. The potential increase in school-aged children will likely be split between the seven school districts in the ROI (see SEIS Section 3.11.5). The five closest school districts are Edgemont, Custer, Hot Springs, Weston County #1, and Weston County #7. Compared to the South Dakota statewide student–teacher ratio of 13.4:1, the Edgemont and Custer student–teacher ratios are low (10:1 and 12:1, respectively) and will not be significantly affected (SDDOE, 2010). The Hot Springs student–teacher ratio of 14:1 is slightly above the statewide ratio. Compared to the Wyoming statewide student–teacher ratio of 12.4:1, the Weston County #1 and Weston County #7 student–teacher ratios are low (11:1 and 10:1, respectively) and will not be significantly affected (Wyoming Department of Education, 2010). Comprising various ages and spread across schools and classrooms in the 5 closest school districts (kindergarten and grades 1 through 12), the small number of children (40) will not likely have a noticeable effect on student-teacher ratios. In addition, city and county planners indicated that the schools could accommodate an increase in the number of students (NRC, 2009c). The impact on schools and education-related service during the ISR facility operations phase will be SMALL.

4.11.1.2.7 Health and Social Services

A small increase in demand will be expected for health and social services during the operations phase of the proposed Dewey-Burdock ISR Project from workers and their families relocating to the ROI. These operational impacts are not expected to differ significantly from those during the construction phase of the ISR facility. Therefore, the small additional increase in demand that will occur for the operations phase will likely already have been met during the construction phase. Discussions with city and county planners indicated that current and planned upgrades to health care and hospitals in the region could accommodate projected increases in population (NRC, 2009c). Further, by license condition, NRC staff will require the applicant to coordinate emergency response activities with local authorities, fire departments, medical facilities, and other emergency services before operations begin (NRC, 2013). The applicant will be required to document the coordination activities and maintain the documentation onsite. Impacts to health and social services during operations will remain SMALL.

4.11.1.3 Aquifer Restoration Impacts

NRC staff determined in GEIS Section 4.4.10.3 that the socioeconomic impact from aquifer restoration will be similar to impacts experienced during ISR facility operations. This is because the level of employment and demand on services will not change. NRC staff concluded in the GEIS the potential impacts to socioeconomics will be SMALL. (NRC, 2009a)

Socioeconomic impacts from the aquifer restoration process at the proposed Dewey-Burdock site will be similar to those experienced during ISR facility operations. Initial aquifer restoration of wellfields will be conducted in conjunction with the operations phase and will not require additional workers with specialized skills (Powertech, 2009a). An aquifer restoration workforce of nine direct employees has been estimated for the proposed project (Powertech, 2010a). Because aquifer restoration will be short term [i.e., extending 4 to 5 years after operations cease (Powertech, 2009a)], workers performing aquifer restoration activities will likely be sourced from the operations phase workforce and any additional workers will likely be drawn from the local area. Impacts on demographics; income; housing; employment; tax revenue; and health, social, and educational services will remain unchanged because it is likely that workers taken from the operations workforce will have already relocated their families to the area and temporary workers will not relocate their families to the area. Therefore, the overall socioeconomic impact of aquifer restoration will be SMALL.

4.11.1.4 Decommissioning Impacts

GEIS Section 4.4.10.3 discusses the potential socioeconomic impacts of decommissioning. Decommissioning and reclamation activities (e.g., dismantling surface structures, removing pumps, plugging and abandoning wells, and reclaiming and recontouring the ground surface) will likely draw on a skill set similar to the ISR facility construction workforce. Decommissioning activities will be expected to be short in duration (24 to 30 months), and so employment will be temporary. Impacts to employment structure and housing are expected to be similar to those for construction, due to similar employment levels. NRC staff determined in the GEIS that overall, potential impacts to socioeconomics from decommissioning will be SMALL to MODERATE. (NRC, 2009a)

Final decommissioning of wellfields, the central processing plant, and the satellite facility at the proposed Dewey-Burdock ISR Project is expected to take 2 years (Powertech, 2009a). A workforce of nine employees engaged directly in these activities has been estimated (Powertech, 2010a). Decommissioning activities for the proposed project could impact the demand for housing and local infrastructure, as well as health, social, and educational services if new workers relocate their families to the local area. However, due to the size of the expected workforce needed for decommissioning (nine direct employees), these impacts will be SMALL and further reduced if a number of the ISR facility operations and aquifer restoration employees remain to assist in the decommissioning activities.

4.11.2 No-Action (Alternative 2)

Under the No-Action alternative, the ISR facility will not be constructed or operated at the proposed Dewey-Burdock site. Socioeconomic conditions in Custer and Fall River Counties in South Dakota and Weston County in Wyoming will not change under the No-Action alternative. Potential benefits from the proposed project, such as job creation and contribution to local, regional, and state revenues, will not occur under the No-Action alternative.

4.12 Environmental Justice Impacts

As required by Title VI of the Civil Rights Act of 1964, federal agencies must consider whether their actions may cause disproportionately negative impacts on minority or low-income populations. Executive Order 12898 (59 FR 7629) (1994), “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” requires similar analysis.

In response to Executive Order 12898, the Commission issued a Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions (69 FR 52040). The Policy Statement explains that “The Commission is committed to the general goals set forth in Executive Order 12898, and strives to meet those goals as part of its NEPA review process.”

In 1997, the CEQ provided the following guidance relevant to determining when an agency’s actions may disproportionately affect certain populations:

> Disproportionately High and Adverse Human Health Effects. Adverse health effects are measured in risks and rates that could result in latent cancer fatalities, as well as other fatal or nonfatal adverse impacts on human health. Adverse health effects may include bodily impairment, infirmity, illness, or death. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant (as defined by NEPA) and appreciably exceeds the risk or exposure rate for the general population or for another appropriate comparison group. (CEQ, 1997)
>
> Disproportionately High and Adverse Environmental Effects. A disproportionately high environmental impact that is significant (as defined by NEPA) refers to an impact or risk of an impact on the natural or physical environment in a low-income or minority community that appreciably exceeds the environmental impact on the larger community. Such effects may include ecological, cultural, human health, economic, or social impacts. An adverse environmental impact is an impact that is determined to be both harmful and significant (as defined by NEPA). In assessing cultural and aesthetic

> environmental impacts, impacts that uniquely affect geographically dislocated or dispersed minority or low-income populations or American Indian tribes are considered. (CEQ, 1997)

The following environmental justice analysis assesses whether issuing a license for the proposed Dewey-Burdock ISR facility might cause disproportionately high and adverse human health or environmental effects on minority and low-income populations. In assessing the effects, the following CEQ (1997) definitions of minority individuals, minority populations, and low-income populations were used:

> Minority individuals. Individuals who identify themselves as members of the following population groups: Hispanic or Latino, American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, or two or more races meaning individuals who identified themselves on a Census form as being a member of two or more races, for example, Hispanic and Asian.
>
> Minority populations. Minority populations are identified when (i) the minority population of an affected area exceeds 50 percent or (ii) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.
>
> Low-income population. Low-income populations in an affected area are identified with the annual statistical poverty thresholds from the Census Bureau's Current Population Reports, Series PB60, on Income and Poverty.

4.12.1 Analysis of Impacts

Methodology

NRC addresses environmental justice matters for license reviews through (i) identifying minority and low-income populations that may be affected by the proposed construction and operations of the proposed Dewey-Burdock ISR facility and (ii) examining any potential human health or environmental effects on these populations to determine whether these effects may be disproportionately high and adverse.

In January and February 2010, the NRC staff published an advertisement in six newspapers circulated near the proposed project area (Rapid City Journal, Edgemont Herald Tribune, Custer Chronicle, Hot Springs Star, Lakota Country Times, and the Native Sun) to inform the public and solicit comments on the proposed action. As part of information gathering, the NRC staff also contacted potentially interested Native American tribes, local authorities, and public interest groups in person, by email, and by telephone.

The 2010 Census provides race and poverty characteristics in Custer and Fall River Counties in South Dakota and Weston County in Wyoming, which are the counties potentially affected by the proposed project. For the year 2010, Table 4.12-1 shows the percentage of people living in poverty and minority populations in the United States, South Dakota and Wyoming, and in Custer, Fall River, and Weston Counties. The table also includes the census tracts and block groups in these counties. Note that poverty data from the 2010 Census are not yet available at the block group level.

Table 4.12-1. Percent Living in Poverty and Percent Minority in 2010

Geographic Unit	Percent Living in Poverty	Percent Minority
United States	13.8	36.3
South Dakota	13.7	15.3
Custer County	9.7	7.2
Custer County Census Tract 9651	8.0	6.6
Block Group 1	NA	7.5
Block Group 2	NA	3.9
Block Group 3	NA	3.9
Custer County Census Tract 9652	12.9	8.4
Block Group 1	NA	7.1
Block Group 2	NA	4.2
Block Group 3	NA	12.6
Fall River County	17.4	12.6
Fall River County Census Tract 9641	13.4	8.7
Block Group 1	NA	5.1
Block Group 2	NA	6.1
Block Group 3	NA	13.6
Fall River County Census Tract 9642	20.5	15.2
Block Group 1	NA	10.0
Block Group 2	NA	12.1
Block Group 3	NA	16.0
Wyoming	9.8	14.1
Weston County	7.9	6.2
Weston County Census Tract 9511	7.7	5.7
Block Group 1	NA	5.0
Block Group 2	NA	6.3
Weston County Census Tract 9513	8.1	6.6
Block Group 1	NA	6.5
Block Group 2	NA	3.4
Block Group 3	NA	7.7

Source: USCB (2012)
NA = Not available

Impact Analysis

In 2010, the populations of Custer, Fall River, and Weston Counties were 8,216, 7,094, and 7,208, respectively (USCB, 2012). In 2010, 15.3 percent of the South Dakota population and 14.1 percent of the Wyoming population was classified as minority (Table 4.12-1). The percentage of the population classified as minority in Custer, Fall River, and Weston Counties was 7.2, 12.6, and 6.2 percent, respectively, which is below the state minority population percentages. The minority population in census tracts in Custer and Fall River Counties potentially affected by the proposed Dewey-Burdock ISR Project ranged from 6.6 to 15.2 percent which is at or below the state average of 15.3. The minority population in block groups in Custer and Fall River Counties ranged from 3.9 to 16 percent. In Weston County, the minority population in the census tracts potentially affected by the proposed project ranged from

5.7 to 6.6 percent, which is below the Wyoming state average of 14.1 percent. The minority population in block groups in Weston County ranged from 3.4 to 7.7 percent.

As described in SEIS Section 3.11.1 and summarized in Table 3.11-1, the population in Fall River County fell approximately 5 percent between 2000 and 2010, in comparison to approximately 9 and 13 percent gains in Weston and Custer Counties over the same period, respectively. Weston County's population is expected to grow at a similar rate of approximately 9 percent over the next decade (WDAI, 2011). The populations of Fall River and Custer Counties are expected to remain relatively constant through 2020 (Brooks, 2008).

Demographic information on race and ethnicity in 2000 and 2010 for Custer, Fall River, and Weston Counties is provided in Table 4.12-2. Since 2000, minority populations have increased by 0.6 percent (111 persons) in Custer County, 1.9 percent (98 persons) in Fall River County, and 1.0 percent (100 persons) in Weston County. In Custer and Weston Counties, most of this increase was due to an influx of Hispanic or Latinos (72 persons in Custer County and 79 persons in Weston County). In Fall River County, the increase was due to an influx of Black or African Americans (18 persons), American Indian and Alaska Natives (24 persons), and Hispanic or Latinos (29 persons).

The U.S. population living below the poverty level was identified as 13.8 percent in 2010 (Table 4.12-1). In South Dakota and Wyoming, the populations living below the poverty level were 13.7 and 9.8 percent, respectively. The percentage of people living below the poverty level in Custer, Fall River, and Weston Counties is 9.7, 17.4, and 7.9, respectively. The percentage of people living below the poverty level within the census tracts surrounding the proposed Dewey-Burdock ISR Project ranged from 7.7 to 20.5 percent (Table 4.12-1).

As described in SEIS Section 3.11.2 and summarized in Table 3.11-3, the median household income for South Dakota and Wyoming in 2010 was $46,369 and $53,802, respectively. In

Table 4.12-2. Demographic Profile Comparison of the 2000 and 2010 Population in Custer and Fall River Counties, South Dakota, and Weston County, Wyoming

Population Category	Custer County		Fall River County		Weston County	
	2000	2010	2000	2010	2000	2010
Race (Percent of Total Population, Not Hispanic or Latino)						
White	93.4	92.8	89.3	87.4	94.8	93.8
Black/African American	0.3	0.2	0.3	0.6	0.1	0.2
American Indian, Alaskan Native	3.1	2.8	6.1	6.7	1.3	1.2
Asian	0.2	0.3	0.2	0.4	0.2	0.3
Native Hawaiian, Pacific Islander	0.0	0.0	0.1	0.0	0.0	0.0
Some other race	0.4	0.0	0.3	0.0	0.9	0.0
Two or More Races	1.9	1.7	2.5	2.6	1.5	1.4
Ethnicity						
Hispanic or Latino (number of people)	110	182	130	159	137	216
Percent of total population	1.5	2.2	1.7	2.2	2.1	3.0
Minority Population (Including Hispanic or Latino Ethnicity)						
Total minority population	481	592	797	895	346	446
Percent minority	6.6	7.2	10.7	12.6	5.2	6.2
Source: USCB, 2012						

South Dakota, 8.7 percent of families live below the federal poverty threshold (the 2012 federal poverty threshold is $23,050 for a family of four). In Wyoming, 6.2 percent of families live below the federal poverty threshold. Custer and Weston Counties had similar median household incomes ($46,743 and $53,853, respectively) and a lower percentage of families living below the poverty level (4.3 percent and 5.8 percent, respectively) than the state average (see Table 3.11-3). Fall River County had a lower median household income ($35,833) and a higher percentage of families living below the poverty level (11.4 percent) than the state average (see Table 3.11-3).

If the percentage for either minority or low-income population in block groups significantly exceeds that of the state or county percentage, environmental justice will have to be considered in greater detail (NRC, 2003a). As a general matter, NRC staff consider differences greater than 20 percentage points to be significant (NRC, 2003a, Appendix C). Additionally, if either the minority or low-income population percentage exceeds 50 percent, environmental justice will have to be considered in greater detail. The percentages of minority populations living in the affected block groups do not significantly exceed the percentage of minority populations recorded at the state and county. No significant minority populations were identified as residing near the proposed Dewey-Burdock ISR Project. Therefore, NRC staff conclude that there will be no disproportionately high or adverse impacts to minority populations from the proposed project. As noted previously, low-income data from the 2010 Census at the block group level is not yet available. However, the percentages of the population living in poverty at the census tract level do not significantly exceed the percentage of low-income populations recorded at the state or county level. In addition, the percentage of families living below the poverty level in the affected counties does not significantly exceed the percentage of families living in poverty at the state level. Therefore, NRC staff conclude that it is realistic to expect that low-income percentages for the counties at the block group level will not be an environmental justice concern.

The closest population to the proposed Dewey-Burdock ISR Project that could be impacted by environmental justice concerns is the Pine Ridge Indian Reservation located approximately 80 km [50 mi] to the east in Shannon County, South Dakota. Communities within the Pine Ridge Indian Reservation include the towns of Oglala and Pine Ridge. Based on 2010 USCB data, these towns have both minority [greater than 95 percent Native American (Oglala Sioux Tribe)] and low-income populations (USCB, 2012).

This environmental justice impact analysis evaluates the potential for disproportionately high and adverse human health and environmental effects on minority and low-income populations that could result from the proposed action. Adverse health effects are measured in terms of the risk and rate of fatal or nonfatal adverse impacts on human health. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant and exceeds the risk or exposure rate for the general population or for another appropriate comparison group. Disproportionately high environmental effects refer to impacts or risk of impact on the natural or physical environment in a minority or low-income community that are significant and appreciably exceed the environmental impact on the larger community.

Disproportionately high effects may include biological, cultural, economic, or social impacts (CEQ, 1997). Some of these potential effects have been identified in the resource areas discussed in SEIS Chapter 4. For example, ground-disturbing activities during the construction phase of the proposed ISR facility could disproportionately affect cultural and historic resources important to Native American populations. On the other hand, minority and low-income populations, such as Native American tribes, are subsets of the general public residing around the proposed Dewey-Burdock ISR Project site. All populations, regardless of their status, will be exposed to the same health and environmental effects associated with construction, operations, aquifer restoration, and decommissioning activities at the Dewey-Burdock site.

4.12.2 Proposed Action (Alternative 1)

Potential impacts to minority and low-income populations due to the construction, operations, and decommissioning of the proposed ISR facility and aquifer restoration at the Dewey-Burdock site will mostly consist of environmental and socioeconomic effects (e.g., noise, dust, traffic, employment, housing, and cultural impacts). Noise and dust impacts will be short term and limited to onsite activities. Minority and low-income populations residing along site access roads could experience increased commuter vehicle traffic during shift changes. As construction and operations employment increases at the proposed project site, employment opportunities for minority and low-income populations may also increase. Increased demand for housing during peak construction could disproportionately affect low-income populations. According to the latest census information, 2,423 vacant housing units in the census tracts in Custer, Fall River, and Weston Counties will be potentially affected by the proposed project (Table 4.12-3). Based on this information and the analysis of human health and environmental impacts presented in this chapter, there will not be disproportionately high and adverse impacts to minority and low-income populations from the construction, operations, and decommissioning of the proposed ISR facility and aquifer restoration at the Dewey-Burdock site.

As described in GEIS Section 6.4, Native American tribes in the Black Hills region believe that preserving and maintaining access to sacred lands is essential to both cultural and spiritual aspects of traditional Native American societies of the northern plains. Protection of the cultural and historic resources as well as the spiritual value of the land (e.g., identification of traditional cultural properties) within the proposed Dewey-Burdock ISR Project area will be addressed through NHPA Section 106 consultation process as described in SEIS Section 4.9.1. Mitigation measures to minimize adverse impacts to cultural and historic resources will be developed in consultation with the applicant, NRC, SD SHPO, Native American tribes (Tribal government or designated THPO), and other government agencies (e.g., BLM, Archaeological Research

Table 4.12-3. Housing in Custer and Fall River Counties, South Dakota, and Weston County, Wyoming, in 2010

Geographic Unit	Total Housing Units	Vacant Units
Custer County	4,628	992
Custer County Census Tract 9651	3,173	715
Custer County Census Tract 9652	1,455	277
Fall River County	4,191	919
Fall River County Census Tract 9641	1,940	649
Fall River County Census Tract 9642	2,251	270
Weston County	3,533	512
Weston County Census Tract 9511	1,584	262
Weston County Census Tract 9513	1,949	250
Source: USCB, 2012		

Center). The Section 106 consultation process provides an avenue for potentially affected Native American tribes to become consulting parties with regard to heritage interests related to the proposed project site. Potential impacts to sites of religious or cultural significance to tribes will be reduced through mitigation strategies developed during Section 106 consultations.

As part of addressing environmental justice associated with license reviews, NRC also analyzed the risk of radiological exposure through the consumption patterns of special pathway receptors, including subsistence consumption of fish, native vegetation, surface waters, sediments, and local produce; absorption of contaminants in sediments through the skin; and inhalation of plant materials. The special pathway receptors analysis is important to the environmental justice analysis because consumption patterns may reflect the traditional or cultural practices of minority and low-income populations in the area.

Subsistence Consumption of Fish and Wildlife

Executive Order 12898 (59 FR 7629) directs federal agencies, whenever practical and appropriate, to collect and analyze information on the consumption patterns of populations that rely principally on fish and wildlife for subsistence and to communicate the risks of these consumption patterns to the public. For this SEIS, NRC considered whether there were any means for minority or low-income populations to be disproportionately affected by examining impacts to traditional lifestyle special pathway receptors. Special pathways that were considered included the potential levels of contaminants in native vegetation, crops, soils and sediments, surface water, fish, and game animals on or near the proposed Dewey-Burdock site. Potential impacts to minority and low-income populations will mostly consist of radiological effects; however, radiation doses from ISR facility operations will be expected to be well below regulatory limits as described in SEIS Section 4.13. As described in GEIS Section 6.4, the land in the area of the Black Hills has historically provided sustenance to many Native American tribes by way of fishing, hunting, and plant food gathering. The results of background radiological monitoring of soils and sediments, surface water, livestock, fish, and vegetation at the proposed Dewey-Burdock Project site are described in SEIS Sections 3.12.1 and 3.6.2. In general, the results of the radiological monitoring indicate that radionuclide concentrations in soils and sediments and surface water were often elevated in abandoned open pit surface mine areas in the eastern and northeastern parts of the Burdock area. In addition, surface water samples from Beaver Creek and the Cheyenne River often exceeded EPA-regulated MCLs for radionuclides (e.g., uranium, gross alpha, Ra-226, and Pb-210) in drinking water as established in 40 CFR Part 141. In general, radionuclide concentrations in vegetation and fish were present at low concentrations and radionuclide concentrations in local livestock were at or below the lower limits of detection.

As described in SEIS Section 4.2, fencing will be installed in areas of active ISR operations such as wellfields, processing plants, and possible land application areas. This will limit hunting within the permitted boundary of the Dewey-Burdock ISR Project area. Limits on hunting will continue over the operational life of the project. However, substantial land surrounding the 4,282-ha [10,580-ac] project site will remain open to big game hunting and therefore the impacts to hunting on Native American tribes will be SMALL. The applicant's SWMP will limit adverse impacts on aquatic habitat and species within the proposed project area resulting from planned construction and operational activities (Powertech, 2009a). As discussed in SEIS Section 4.5.1.1.2, no surface water will be diverted, no process water will be discharged into aquatic habitat, and stormwater runoff will be managed through the applicant's NPDES permit. Therefore, potential impacts to aquatic species and habitats will be SMALL.

To mitigate exposure or health risks associated with contaminants reaching the food chain in potential land application areas, the applicant proposes treating liquid wastes applied to potential land application areas so that they meet NRC release limit criteria for radionuclides in 10 CFR Part 20, Appendix B (Standards for Protection Against Radiation) (Powertech, 2009a, 2011). During decommissioning of the proposed project, seeded soil will be returned to areas from which it was removed and contoured to blend with the natural terrain. At the end of decommissioning all lands will be returned to their preextraction use of livestock grazing and wildlife habitat.

Based on this information and the analysis of human health and environmental impacts presented in this SEIS, the proposed action will not have disproportionately high and adverse human health and environmental effects on Native American and other traditional lifestyle pathway receptors in the vicinity of the Dewey-Burdock project area. The impacts to Native American tribes will, for the most part, be no different than those other populations experience within the vicinity of the project area. Mitigation strategies will be developed through the ongoing Section 106 consultation for impacts to sites of religious or cultural significance to the tribes (see SEIS Section 4.9.1).

4.12.3 No-Action (Alternative 2)

Under the No-Action alternative, the ISR facility will not be constructed and operated at the proposed Dewey-Burdock ISR Project site. The relative conditions affecting minority and low-income populations in the vicinity of the proposed project site will remain unchanged. Therefore, there will be no disproportionately high or adverse impacts to minority and low-income populations from this alternative.

4.13 Public and Occupational Health and Safety Impacts

As described in GEIS Section 4.4.11, potential radiological and nonradiological impacts from ISR activities may occur during all phases of the ISR facility's lifecycle (NRC, 2009a). These impacts may occur during normal operations where proposed activities are executed as planned or during potential accident conditions when unplanned events can generate additional hazards. Additionally, the potential hazards and associated impacts can be either radiological or nonradiological. Therefore, the impact analysis in this section evaluates the radiological and nonradiological potential public and occupational health and safety impacts for normal and accident conditions in each phase of the ISR facility lifecycle.

GEIS Construction Phase Summary

Standard construction safety practices will address nonradiological worker safety during ISR facility construction. Construction emissions will be primarily from fugitive dust and diesel-powered construction equipment exhausts. Fugitive dust generated from construction activities and vehicle traffic will be of short duration, and because the average natural levels of radioactivity in soils are low, it will not result in a radiological dose to workers and the public. Diesel emissions from construction equipment will also be of short duration and readily dispersed into the atmosphere. For these reasons, NRC staff concluded in the GEIS that potential impacts to public and occupational health and safety from construction will be SMALL. (NRC, 2009a)

GEIS Operations Phase Summary

Potential public and occupational radiological impacts from normal operations may result from (i) exposure to radon gas from the wellfields, (ii) ion-exchange resin transfer operations, and (iii) venting during processing activities. Workers may also be exposed to airborne uranium particulates from dryer operations and maintenance activities. Potential public exposures to radiation may occur from the same radon releases and uranium particulate releases (i.e., from facilities without vacuum dryer technology). Both worker and public radiological exposures are addressed in NRC regulations at 10 CFR Part 20, which require licensees to implement an NRC-approved radiation protection program. NRC periodically inspects those programs to ensure compliance. Measured and calculated doses for workers and the public are commonly only a fraction of regulatory limits. For these reasons, NRC staff concluded in the GEIS that potential radiological impacts to workers and the public from operations will be SMALL. (NRC, 2009a)

Nonradiological worker safety at ISR facilities will be addressed through occupational health and safety regulations and practices (NRC, 2009a). The potential impact from nonradiological accidents includes high consequence chemical release events (e.g., of ammonia) that may expose workers and nearby populations. However, NRC staff concluded that the likelihood of such a release will be low, based on historical operating experience at NRC-licensed facilities, primarily because operators follow chemical safety and handling protocols. Therefore, NRC staff concluded in the GEIS that radiological and nonradiological impacts from accidents during operations may range from SMALL to MODERATE. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

Activities occurring during aquifer restoration will overlap similar activities occurring during operations (e.g., operation of wellfields, wastewater treatment and disposal). Therefore, the potential impact on public and occupational health and safety will be bounded by the operational impacts. In the GEIS, NRC staff also stated that the reduction of some operational activities (e.g., yellowcake production and drying, remote ion-exchange) as aquifer restoration proceeded will be expected to limit the relative magnitude of potential worker and public health and safety hazards. NRC staff concluded in the GEIS that the overall impacts to workers and the public from aquifer restoration will be SMALL. (NRC, 2009a)

GEIS Decommissioning Phase Summary

During decommissioning, the degree of potential impact decreases as hazards are reduced or removed, soils and facility structures are decontaminated, and lands are restored to preoperational conditions. To ensure the safety of workers and the public during decommissioning, NRC requires ISR licensees to submit a decommissioning plan for review and approval. NRC will then periodically inspect the facility to ensure that the decommissioning plan is implemented properly. The plan includes details of the radiation safety program that is implemented during decommissioning activities. The plan is developed to minimize health and safety hazards and to be compliant with worker and public dose limits in 10 CFR Part 20, Subparts C and D limits. An approved plan will also provide “as low as reasonably achievable” (ALARA) provisions under 10 CFR Part 20, Subpart B to further ensure best safety practices are being used to minimize radiation exposures (see SEIS Section 3.12.3). Adequate protection of workers and the public during decommissioning will therefore be ensured through NRC review and approval of the applicant’s decommissioning plan, license conditions, inspection, and enforcement. Based on the NRC review and approval of the applicant's decommissioning plan, the NRC application of any site-specific license conditions, and NRC inspection and enforcement actions to ensure compliance with NRC radiation safety requirements, NRC staff concluded in the GEIS the potential public and occupational health and safety impacts for decommissioning will be SMALL. (NRC, 2009a)

4.13.1 Proposed Action (Alternative 1)

As described in SEIS Section 2.1.1.1.2.4, the applicant has proposed to dispose of liquid wastes by deep well disposal via Class V injection wells, land application, or combined deep well disposal via Class V injection wells and land application. The environmental impacts on public and occupational health and safety for each of the liquid waste disposal options are discussed in the following sections.

4.13.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant's preferred option for disposal of liquid wastes is deep well disposal via Class V injection wells. Potential environmental impacts to public and occupational health and safety from construction, operations, aquifer restoration, and decommissioning associated with the Class V injection well disposal option are discussed in the following sections.

4.13.1.1.1 Construction Impacts

As described in SEIS Section 2.1.1.1.2, construction activities at the Dewey-Burdock ISR Project will include clearing and grading for roads, building foundations and surface impoundments, drilling wells, trenching, laying pipelines, and assembling buildings. Construction activities for the Class V injection well disposal option will also involve the installation of four to eight Class V injection wells (see SEIS Section 2.1.1.1.2.4.1). The important radiation exposure pathways during the construction phase will be through direct exposure, inhalation or ingestion of radionuclides during well construction, construction activities that disturbed soils, and fugitive dust from vehicular traffic. These activities are equivalent to the activities analyzed in GEIS Section 4.4.11.

Drilling wells at the proposed project will use a common technique known as mud rotary drilling (see SEIS Section 2.1.1.1.2.3.5). This technique uses fluid moving through a drill stem, out the drill bit, and back to the surface between the drill stem and host rock. When the fluid returns to the surface, it passes through a trough to a mud pit, where the cuttings settle out and the fluid is recycled down the borehole. Residual cuttings and drilling fluids are typically held in the mud pit after drilling and construction activities are completed (NRC, 2009a). Because the cuttings are taken from very near and within the ore deposits, they have the potential to be more contaminated than soil samples at the surface. Depending on state and local regulations, such mud pits are backfilled and graded or are alternatively emptied and cleaned, and residual solids and liquids transported and disposed of offsite (NRC, 2006). After well drilling is completed at the proposed project, the applicant proposes to redeposit the excavated subsoil in the mud pit followed by topsoil application and grading, usually within 30 days of the initial excavation of the mud pit (Powertech, 2009a).

As described in SEIS Section 3.12.1, the average concentration of radionuclides measured in the soil at the proposed Dewey-Burdock site is low. With outliers removed, the mean Ra-226 concentration of surface soils in surface mine areas and the broader permit area was 0.048 Bq/g [1.3 pCi/g]. Fugitive dust generated from construction activities will be of short duration (1 to 2 years; see Figure 2.1-1), and because the average levels of radioactivity in soils are low, inhalation of fugitive dust will not result in a radiological dose to workers and the public. In addition, the applicant has proposed to implement standard dust control measures, such as water application and speed limits, to reduce and control fugitive dust emissions (Powertech, 2009a). Therefore, NRC staff estimate that the direct exposure, inhalation, or ingestion of fugitive dust will not result in a radiological dose to workers and the general public during the construction phase of the proposed project. The applicant calculated the amount of radon released from wellfield development using methods described in NUREG–1748 (NRC, 2003a). Using conservative estimates, the applicant calculated a release rate of 1.35×10^6 disintegrations per second/yr [3.6×10^{-5} Ci/yr] (Powertech, 2009a). This represents a negligible fraction of the amount of radon generated during operations as described in SEIS Section 4.13.1.1.2) and will result in a radiological dose that is well below the 10 CFR Part 20 occupational and public dose limits of 0.05 Sv/yr [5 rem/yr] and 1 mSv/yr [100 mrem/yr], respectively. Based on the low average concentration of radionuclides in soils at the proposed site, the proposed mitigation measures that will be implemented to control fugitive dust, and the negligible amount of radon that will be released during wellfield development, the NRC staff conclude that the radiological impacts to workers and the general public from the construction phase for the Class V injection well disposal option will be SMALL.

The potential nonradiological air quality impacts from fugitive dust and diesel emissions are evaluated in SEIS Section 4.7.1. Construction equipment will be diesel powered and will emit diesel exhaust, which includes small particles (PM_{10}). The impacts and potential human exposures from these emissions will be SMALL because the releases are usually short and are readily dispersed into the atmosphere. The potential impacts to air quality from proposed diesel emissions, including comparisons with health-based standards, are detailed in SEIS Section 4.7.1. In SEIS Section 4.7.1.1, NRC staff concluded that implementation of mitigation measures will result in fugitive dust emission levels that will not destabilize the air quality of the local area nor change the current attainment status of the air quality surrounding the proposed site areas. However, despite the use of controls, short-term and intermediate fugitive dust emissions are possible when vehicles travel on unpaved roads. The NRC staff conclude that short-term and intermediate MODERATE impacts from fugitive dust are possible, but because average air quality is expected to remain in compliance with ambient standards, the overall impacts will be SMALL. The applicant's compliance with federal and state occupational safety regulations will limit the potential nonradiological impacts of fugitive dust and diesel emissions to levels acceptable for workers and the public. Based on the foregoing analysis, NRC staff conclude that overall nonradiological impacts on workers and the general public from the construction phase for the Class V injection well disposal option will be SMALL.

4.13.1.1.2 Operations Impacts

4.13.1.1.2.1 Radiological Impacts From Normal Operations

As discussed in GEIS Section 4.2.11.2.1, some amount of radioactive materials will be released to the environment during normal ISR operations. The potential impact from these releases can be evaluated by the MILDOS-AREA computer code (MILDOS), which Argonne National Laboratory developed for calculating offsite facility radiation doses to individuals and populations. MILDOS uses a multi-pathway analysis for determining external dose; inhalation dose; and dose from ingestion of soil, plants, meat, milk, aquatic foods, and water. The primary radionuclide of interest at an ISR facility is Rn-222. MILDOS uses a sector-average Gaussian plume dispersion model to estimate downwind concentrations. This model typically assumes minimal dilution and provides conservative estimates of downwind air concentrations and doses to human receptors.

GEIS Section 4.2.11.2.1 presented historical data for ISR operations, providing a range of estimated offsite doses associated with six current or former ISR facilities. For these operations, doses to potential offsite exposure (human receptor) locations range between 0.004 mSv [0.4 mrem] per year for the Crow Butte facility in Nebraska and 0.32 mSv [32 mrem] per year for the Irigaray facility in Johnson County, Wyoming. Each value is well below the 10 CFR Part 20 annual radiation public dose limit of 1 mSv/yr [100 mrem/yr] (NRC, 2009a).

GEIS Section 4.2.11.2.1 also provides a summary of doses to occupationally exposed workers at ISR facilities. As stated, doses will be similar regardless of the facility's location and are well within the 10 CFR Part 20 annual occupational dose limit of 0.05 Sv [5 rem] per year. The largest annual average dose to a worker at a uranium recovery facility over a 10-year period [1994–2006] was 0.007 Sv [0.7 rem]. More recently, the maximum total dose equivalents reported for 2005 and 2006 were 0.00675 and 0.00713 Sv [0.675 and 0.713 rem]. Similarly, the average and maximum worker exposure to radon and radon daughter products ranged from 2.5 to 16 percent of the occupational exposure limit of 4 working-level months. NRC staff concluded in the GEIS that the radiological impacts to workers during normal operations at ISR facilities will be SMALL.

At the proposed Dewey-Burdock site, planned ISR facility design and operations for the Class V injection well disposal option are consistent with the projects analyzed in the GEIS. To mitigate radiological exposure to workers, the applicant will (i) install ventilation designed to limit worker exposure to radon; (ii) install gamma exposure rate monitors, air particulate monitors, and radon daughter product monitors to verify that expected radiation levels are met; and (iii) conduct work area radiation and contamination surveys to help prevent and limit the spread of contamination (Powertech, 2009a). The applicant's airborne radiation monitoring program is further described in SEIS Section 7.2.1.

GEIS Section 4.2.11.1.2 noted that radon gas is emitted from ISR wellfields and processing facilities during operations and is the only radiological airborne effluent during normal operations for facilities using vacuum dryer technology (NRC, 2009a). The applicant plans to dry yellowcake using a rotary vacuum dryer (Powertech, 2009a). Therefore, during normal operations, emissions other than radon are not expected.

In its environmental report, the applicant evaluated the potential consequences of radiological emissions at the proposed Dewey-Burdock ISR Project (Powertech, 2009a, Section 4.14.2). Sources of radon emanation the applicant identified and modeled included land application of treated wastewater, wellfield operations, central processing plant operations, and resin transfers in the satellite facility (Powertech, 2009a). The applicant described its implementation of the computer code MILDOS that was used to model radiological impacts on human and environmental receptors (e.g., air and soil) using site-specific data that included Rn-222 release estimates, meteorological and population data, and other parameters. The estimated radiological impacts from routine site activities were compared to applicable public dose limits in 10 CFR Part 20 {1 mSv/yr [100 mrem/yr]}, as well as to baseline radiological conditions (see SEIS Section 3.12.1).

The NRC review of the applicant's radiological impact modeling (Powertech, 2009a, 2011) independently verified that appropriate exposure pathways were modeled and reasonable input parameters were used. The applicant also listed the origin of the input parameters and provided justification for their use. The applicant described the source terms, and the NRC staff review concluded that the source terms represented operations at full capacity and consisted of ISR operations at two wellfields, releases from the central plant and the satellite plant, and releases from one center pivot land irrigation area in the Dewey area and three center pivot land irrigation areas in the Burdock area. The applicant calculated the total effective dose equivalent (TEDE) at the site boundary in 16 compass directions each from the central plant and the satellite facility, 7 residences, and the town of Edgemont (a total of 40 locations).

Results of the applicant's modeling (Powertech, 2011) indicated that the maximum TEDE of 0.06 mSv/yr [6.0 mrem/yr] is located southeast of the Dewey satellite facility within the proposed project boundary (Figure 4.13-1). The applicant's calculations also demonstrated that land application sources accounted for 80 percent of the TEDE at this location (Powertech, 2009a). Therefore, for the Class V injection well disposal option, the maximum TEDE located southeast of the Dewey satellite facility within the proposed project boundary will be 20 percent of 0.06 mSv/yr [6.0 mrem/yr] or 0.012 mSv/yr [1.2 mrem/yr]. This dose is 1.2 percent of the 10 CFR Part 20 public dose limit of 1 mSv/yr [100 mrem/yr]. Thus, the 10 CFR Part 20 public dose limit is not exceeded at any property boundary.

The maximum TEDE at a residence was 0.0448 mSv/yr [4.48 mrem/yr] at Spencer Ranch located approximately 2 km [1.25 mi] northwest of the proposed central processing plant in the Burdock area (see location AMS-02 in Figure 4.13-1). The applicant's calculations also demonstrated that land application sources accounted for 62 percent of the TEDE at the most highly exposed residence (Powertech, 2009a). Therefore, for the Class V injection well disposal option, the maximum TEDE at the Spencer Ranch residence will be 38 percent of 0.0448 mSv/yr [4.48 mrem/yr] or 0.017 mSv/yr [1.7 mrem/yr]. This is 1.7 percent of the 10 CFR Part 20 public dose limit of 1 mSv/yr [100 mrem/yr]. Hence, the TEDE at nearby receptor locations will not exceed the public dose limit.

Because Rn-222 is the only radionuclide emitted during normal operations, the public dose requirements in 40 CFR 190.10 and the 0.1 mSv/yr [10 mrem/yr] constraint rule in 10 CFR 20.1101 do not apply. However, even if 100 percent of the Rn-222 contained in production fluids was released to the atmosphere (instead of 10 percent as assumed in the applicant's calculations), the TEDE and Rn-222 air concentrations at residential receptor locations surrounding the facility will be less than the 1 mSv [100 mrem] public dose limit and the Rn-222 effluent concentration limit, respectively. Therefore, radiological dose impacts to the public from normal operations will be SMALL.

In summary, for the Class V injection well disposal option, potential radiation doses to occupationally exposed workers and members of the public during normal operations will be SMALL. Calculated radiation doses from the releases of radioactive materials to the environment are small fractions of the limits in 10 CFR Part 20 that have been established for the protection of public health and safety. In addition, the applicant is required to implement an NRC-approved radiation protection program to protect occupational workers and ensure that radiological doses are ALARA. The applicant's radiation protection program includes commitments for implementing management controls, engineering controls, radiation safety training, radon monitoring and sampling, and audit programs (Powertech, 2011).

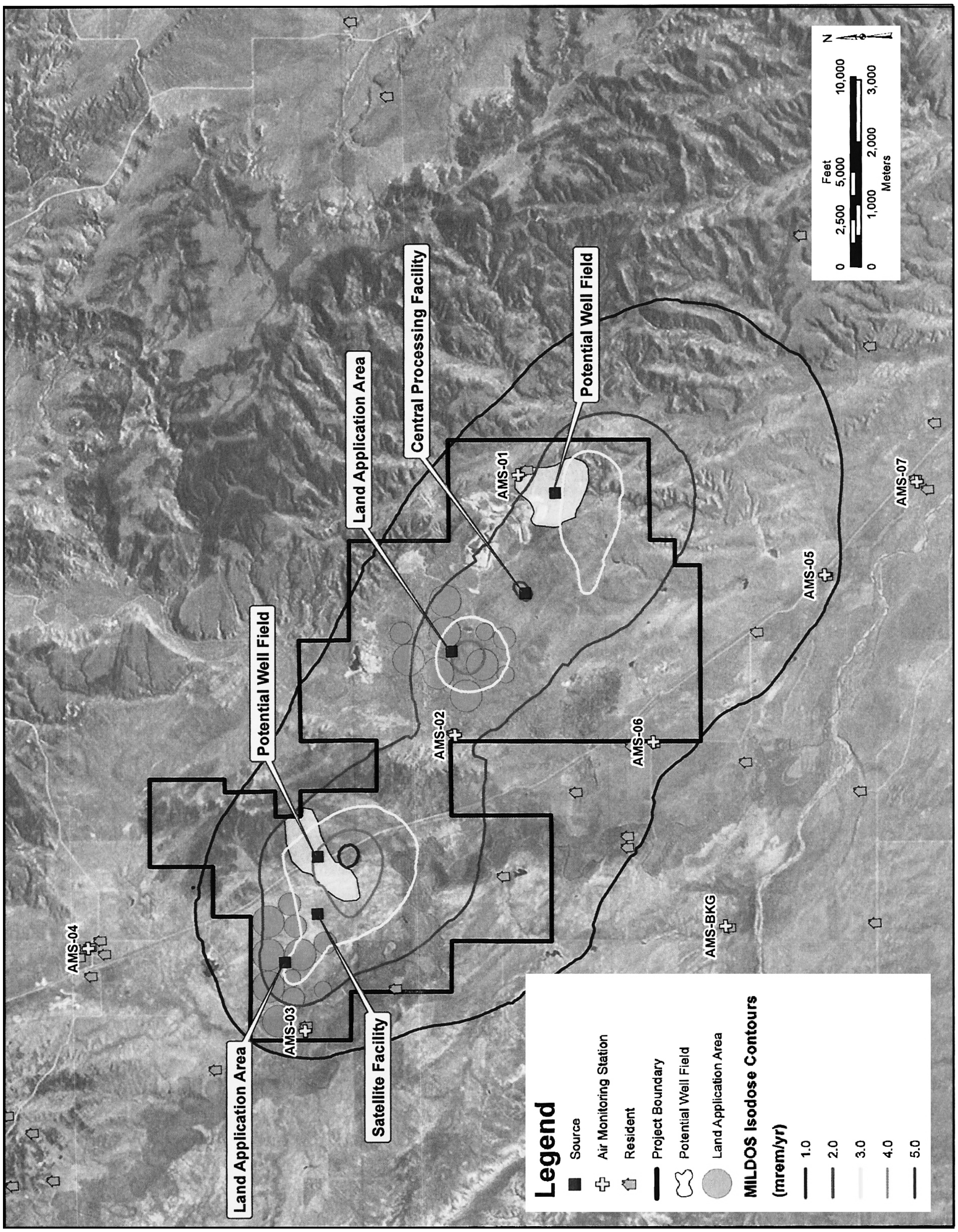

Figure 4.13-1. Map SHowing Isodose Contours Obtained From MILDOS Modeling at the Proposed Dewey-Burdock *In-Situ* Recovery Project Site Source: Modified From Powertech (2011)

4.13.1.1.2.2 Radiological Impacts from Accidents

GEIS Section 4.2.11.2.2 describes and evaluates numerous accident scenarios that may result in impacts to public health and safety and identifies mitigation measures for each accident scenario. Radiological accident risks may involve processing equipment failures leading to yellowcake slurry spills, or radon gas or uranium particulate releases. NRC staff state in the GEIS that consequences of these accidents to workers and the public are generally low, with the exception of a dryer explosion, which may result in a worker dose exceeding NRC limits (NRC, 1980). However, the likelihood of such an accident is low, due to design considerations and operational monitoring, and therefore NRC staff considered the risk also to be low.

GEIS Section 4.2.11.2.2 also noted that in addition to accident mitigation measures, other measures will be in place to protect workers and members of the public. Employee personnel dosimetry programs are required. As part of worker protection, respiratory protection programs will be in place, as well as bioassay programs that detect uranium intake in employees. Contamination control programs will be in place, which involve surveying personnel, clothing, and equipment prior to their removal to an unrestricted area.

As described in GEIS Section 4.2.11.2.2, a radiological hazard assessment (Mackin, et al., 2001) considered three types of accidents, representing the sources containing the higher levels of radioactivity for all aspects of operations:

- Thickener failure or spill
- Pregnant lixiviant and loaded resin spills (radon release)
- Yellowcake dryer accident release

In addition, SEIS Section 4.3.1.2 evaluates the impacts of shipping uranium-loaded exchange resins from the Dewey satellite facility to the Burdock central processing plant.

The following discussion presents an overview of the accident scenarios, as evaluated in the GEIS, along with site-specific application to the proposed Dewey-Burdock ISR Project. Table 4.13-1 summarizes the potential dose to workers and the public from the accident scenarios using data adapted from the GEIS.

<u>Thickener Failure and Spill</u>. Thickeners are used to concentrate the yellowcake (U_3O_8) slurry before it is transferred to the dryer or packaged for offsite shipment. Yellowcake may be inadvertently released to the atmosphere through a thickener failure or spill. The accident scenario evaluated in GEIS Section 4.2.11.2.2 assumed a tank or pipe leak that releases 20 percent of the thickener outside of the processing building. The analyses included a variety of wind speeds, stability classes, release durations, and receptor distances. A minimum receptor distance of 500 m [1,640 ft] was selected because it was found to be the shortest distance between a processing facility and an urban development for current operating ISR

Table 4.13-1. Generic Accident Dose Analysis for *In-Situ* Recovery Operations

Accident Scenario	Maximum Dose to Workers	Maximum Dose to Public
Thickener spill	50 mSv [5,000 mrem]	0.25 mSv [25 mrem]
Pregnant lixiviant, resin spill	13 mSv [1,300 mrem]	<0.13 mSv [13 mrem]
Yellowcake dryer release	0.088 Sv [8.8 rem] Generic <0.01 Sv [1 rem]	<1 mSv [100 mrem]
Data adapted from the GEIS (NRC, 2009a)		

facilities. Offsite, unrestricted doses from such a U_3O_8 spill could result in a dose of 0.25 mSv [25 mrem], or 25 percent of the annual public dose limit of 1 mSv [100 mrem] with negligible external doses based on sufficient distance between the facility and receptor (NRC, 2009a). Because the nearest onsite resident is located 1 km [0.6 mi] south of the proposed wellfields in the Dewey area and the nearest offsite resident is located 0.64 km [0.4 mi] south of the proposed permit boundary and 1.45 km [0.9 mi] from proposed wellfields in the Burdock area, the potential dose from a similar accident scenario involving a thickener failure or spill at the proposed project will be even less.

The applicant also discussed the accident analysis of a catastrophic tank failure involving a yellowcake thickener (Mackin, et al., 2001) as a worst-case accident scenario (Powertech, 2010a). The applicant's analysis was based on an accident described in Mackin, et al. (2001) that involved a thickener containing 278 m^3 [73,500 gal] of yellowcake slurry. The applicant's proposed yellowcake thickener is sized to contain 143 m^3 [37,800 gal] of yellowcake slurry. Two yellowcake thickener vessels are planned for the central processing plant for a combined capacity of 286 m^3 [75,600 gal]. The plan for the central processing plant at the proposed project also includes a 15.2-cm [6-in]-high concrete containment curb (Powertech, 2011). The capacity of the curbed area will be 304 m^3 [80,308 gal]; it will contain the entire contents of both thickeners in the event both thickeners failed simultaneously and spilled their entire contents onto the floor of the central processing plant before the contents flowed into floor sumps (Powertech, 2011). The sumps will provide additional temporary containment capacity. The total containment capacity of curbs and sumps at the proposed project will exceed 200 percent of the largest liquid-containing tank or vessel in the central processing plant (Powertech, 2011). Based on the design of the central plant, a catastrophic yellowcake thickener spill at the proposed project will be similar in volume to that evaluated in Mackin, et al. (2001) but will be contained in the central plant structure. Therefore, potential doses to the public will be smaller and well within the annual public dose limit of 1 mSv [100 mrem].

As discussed in GEIS Section 4.2.11.2.2, doses to unprotected workers inside the facility from a thickener failure or spill have the potential to exceed the annual dose limit of 0.05 mSv [5 mrem] if timely corrective measures are not taken. In addition, the applicant is required to implement an NRC-approved radiation protection program to protect occupational workers and ensure that radiological doses are ALARA. The applicant's radiation protection program includes commitments for implementing management controls, radiation safety training, radon monitoring and sampling, and audit programs (Powertech, 2011). These protection measures, along with engineering controls such as concrete curbs and sumps to contain process spills at the central processing plant, will reduce worker exposures and the resulting doses to a small fraction of those evaluated.

Pregnant Lixiviant and Loaded Resin Spills. Process equipment (ion-exchange columns, drying and packing facilities) will be located on curbed concrete pads to prevent any liquids from exiting the building via spills or leaks and contaminating the outside environment (NRC, 2009a). The total containment capacity of curbs and sumps at the proposed project will exceed 200 percent of the largest liquid-containing tank or vessel in the central processing plant (Powertech, 2011). The primary radiation source for liquid releases within the facility will be the resulting airborne radon (Rn-222) released from the liquid or resin tank spill.

The radon accident release scenario assumes a pipe or valve of the ion-exchange system, containing pregnant lixiviant, develops a leak and releases (almost instantaneously) all present Rn-222 at a high activity level {2.96×10^7 Bq/m^3 [8×10^5 pCi/L]}. For a 30-minute exposure, the dose to a worker located inside the central plant performing light activities without respiratory protection was calculated to be 13 mSv [1,300 mrem], which is below the 10 CFR Part 20 occupational annual dose limit. The analysis did not evaluate public dose; however, because atmospheric transport offsite will reduce the airborne levels by several orders of magnitude, any dose to a member of the public will be less than the 1 mSv [100 mrem] public dose limit of 10 CFR Part 20 (see Table 4.13-1). The applicant's radiation protection program's controls and monitoring measures will be expected to minimize the magnitude of any such release and further reduce the consequences of this type of accident. Typical control and monitoring measures will include radiation and occupational monitoring, respiratory protection, engineering controls, standard operating procedures for spill response and cleanup, and worker training in radiological health and emergency response (Powertech, 2011).

The applicant also described an accident involving a process tank failure (Powertech, 2009a). The applicant indicated that the central processing plant at the proposed project will be designed to control and confine liquid spills from tanks should they occur. The central plant building structure will be designed with a 15.2-cm [6-in] concrete curb designed to contain liquid spills from the leakage or rupture of a process vessel and will direct any spilled solution to a floor sump (see SEIS Section 2.1.1.1.2.1). The floor sump system will be designed to direct any spilled solutions back into the plant process circuit or to the waste disposal system. As noted previously, the total containment capacity of curbs and sumps at the proposed project will exceed 200 percent of the largest liquid-containing tank or vessel in the central processing plant (Powertech, 2011). Bermed areas, tank containments, and/or double-walled tanks are designed to perform a similar function for any process chemical vessels located outside the central plant building (Powertech, 2009a).

Yellowcake Dryer Accident Release. Dryers used to produce yellowcake powder from yellowcake slurry are another source of accidental release of radionuclides. A multiple-hearth dryer is capable of releasing yellowcake powder inside the processing building as a result of an explosion. This scenario was evaluated in GEIS Section 4.2.11.2.2 to establish a bounding condition for other accident scenarios involving dryers. The analysis in the GEIS assumes that about 4,309 kg [9,500 lb] of uranium yellowcake is released within the building area housing the dryer and that 1 kg [2.2 lb] is subsequently released as an airborne effluent to the outside atmosphere as a 100 percent respirable powder. Due to the nature of the material, most of the yellowcake will rapidly fall out of airborne suspension. For the occupationally exposed worker using respiratory protection, which is the normal mode during dryer access and drum-filling operations, the dose was calculated to be 0.088 Sv [8.8 rem], which exceeds the annual occupational dose limit of 0.05 Sv [5 rem] established in 10 CFR Part 20. The amount assumed to remain airborne and to be transported outside the building for atmospheric dispersion to an offsite location will be 1 kg [2.2 lb] of yellowcake. The rapid fallout within the building and the atmospheric dispersion will significantly reduce the exposure to members of the public to about 6.5×10^{-4} Sv [65 mrem] (NRC, 1980), which is less than the 10 CFR Part 20 public dose limit of 1 mSv [100 mrem].

The applicant proposes to use a rotary vacuum dryer with heat-transfer fluid that circulates through the dryer shell (Powertech, 2009a). This configuration separates the heater combustion source from the dryer itself, thereby mostly eliminating the possibility of an explosion, which is the initiating event for the assumed catastrophic failure and significant release of dryer radioactive content. Additionally, NRC will require the applicant to have emergency response procedures in place to mitigate worker exposures. Emergency training drills, dosimetry, respiratory protection, contamination control, and decontamination will all be required elements of the applicant's radiation protection program that will further reduce the consequences of a dryer accident.

Accident Analysis Conclusions. In the unlikely event of an unmitigated accident, and depending on the type of accident, potential doses to workers may result in a MODERATE impact to occupational health and safety. However, there will be only a SMALL impact to public health and safety. Typical protection measures, such as radiation and occupational monitoring, respiratory protection, standard operating procedures for spill response and cleanup, and worker training in radiological health and emergency response, will be required as a part of the applicant's NRC-approved radiation protection program (Powertech, 2011). These procedures and plans will reduce the radiological consequences to workers from accidents. Therefore, NRC staff conclude that the overall radiological impacts from accidents for the Class V injection well disposal option will be SMALL.

4.13.1.1.2.3 Nonradiological Impacts from Normal Operations

GEIS Section 4.2.11.2.4 identifies the various chemicals, hazardous and nonhazardous, that are typically used at ISR facilities. The GEIS also identifies the typical quantities of these chemicals that are used. The use of hazardous chemicals at ISR facilities is controlled under several regulations that are designed to provide adequate protection to workers and the public. The primary regulations applicable to use and storage include the following:

- 40 CFR Part 68, Chemical Accident Prevention Provisions. This regulation lists regulated toxic substances and threshold quantities for accidental release prevention.
- 29 CFR 1910.119, OSHA Standards (which includes Process Safety Management). This regulation lists highly hazardous chemicals, including toxic and reactive materials that have the potential for a catastrophic event at or above the threshold quantity.
- 40 CFR Part 355, Emergency Planning and Notification. This regulation lists extremely hazardous substances and their threshold planning quantities for the development and implementation of emergency response procedures. A list of reportable quantity values is also provided for reporting releases.
- 40 CFR 302.4, Designation, Reportable Quantities, and Notification–Designation of Hazardous Substances. This regulation lists Comprehensive Environmental Response, Compensation, and Liability Act hazardous substances compiled from the Clean Water Act, Clean Air Act, RCRA, and the Toxic Substances and Control Act.

Chemicals will be utilized at the proposed Dewey-Burdock ISR Project during the extraction process and during restoration of groundwater quality (see SEIS Section 2.1.1.1.3). The hazardous chemicals and their associated protective provisions expected to be used at the proposed project are as follows:

- Sodium chloride (NaCl) and sodium bicarbonate ($NaHCO_3$)—Systems utilizing these chemicals will be designed to industry standards. These chemicals will be stored in tanks inside the central processing plant.

- Barium chloride ($BaCl_2$)—Systems utilizing these chemicals will be designed to industry standards. Barium chloride will be stored in tanks inside a metal building adjacent to the radium settling and storage ponds.

- Hydrochloric acid (HCl) and sulfuric acid (H_2SO_4)—Due to the quantities that will be used, reporting will be required under 40 CFR 302.4. The hydrochloric acid and sulfuric acid storage tanks will be located away from other process tanks to prevent accidental mixing with other chemicals.

- Hydrogen peroxide [50 percent (H_2O_2)]—Because the concentration will be <52 percent, no additional regulatory protective measures will be required. Bulk storage tanks for the hydrogen peroxide will be located outside the central processing plant.

- Carbon dioxide (CO_2)—Carbon dioxide will be stored adjacent to the plant facilities. Floor-level ventilation and low-point carbon dioxide monitors will be installed to prevent a buildup of carbon dioxide in occupied areas.

- Oxygen (O_2)—Oxygen will be stored near, but a safe distance from, plant facilities or within wellfield areas. The oxygen storage facility will be designed to meet industry standards contained in National Fire Protection Association 50—(National Fire Protection Association, 2001). Procedures will be developed for releases or fires in the oxygen system.

- Sodium hydroxide (NaOH)—Systems utilizing NaOH will be designed to industry standards and stored in tanks outside the central processing plant.

- Diesel, gasoline, and bottled gases—Systems utilizing these chemicals will be designed to industry standards. All bulk quantities of these chemicals will be stored outside of plant facilities. All gasoline and diesel storage tanks will be above ground and within secondary containment structures that are designed and constructed to meet EPA requirements. In addition, gasoline and diesel storage tanks must comply with SDDENR requirements in ARSD 74:56:01 and 74:56:03.

The typical onsite quantities for some of these chemicals may exceed the regulated, minimum reporting quantities and trigger an increased level of regulatory oversight regarding possession (type and quantities), storage, use, and disposal practices (NRC, 2009a). Storage of these chemicals must comply with EPA-administered Superfund Amendments and Reauthorization Act (SARA) Title III reporting requirements. Compliance with applicable regulations reduces the likelihood of a release, which may result in injury or illness to an exposed worker. Because chemicals used in the ISR process are stored and used in or near plant facilities and wellfields, offsite impacts of a chemical spill will be SMALL and do not typically pose a significant risk to the public. Workers involved in a response and cleanup to a chemical spill may experience MODERATE impacts if the proper emergency and cleanup procedures and worker training were not available or were inadequate. Risk assessments completed in NUREG/CR–6733 (Mackin, et al., 2001) identified anhydrous ammonia and bulk acid (sulfuric and hydrochloric) storage as the chemicals with the greatest potential for impacts to occupational and public safety.

In general, the handling and storage of chemicals at the proposed project will follow standard industrial safety practices. The applicant has committed to developing and implementing standard operating procedures regarding receiving, storing, handling, and disposing of chemicals (Powertech, 2009a). The applicant is also required to comply with EPA, SDDENR, and OSHA regulations regarding inspections and the industrial and environmental safety aspects associated with the use of chemicals. South Dakota OSHA regulates the industrial safety aspects associated with the use of hazardous chemicals. At the proposed project site, bulk chemicals will be stored in areas at a distance from the processing facilities, which will minimize the risk to public and worker health and safety (Powertech, 2009a). As described in SEIS Section 2.1.1.1.2.1, bulk storage tanks for process chemicals, such as sulfuric acid, hydrochloric acid, sodium hydroxide, and hydrogen peroxide, will be outside the central processing plant in concrete secondary containment basins designed to contain 110 percent of the tank volume plus withstand a 25-year, 24-hour storm event. The secondary containment basins will be separate from the containment basins for other chemical systems. The types and quantities of chemicals (hazardous and nonhazardous) identified for use at the proposed project are consistent with those evaluated in the GEIS. The information the applicant provided regarding chemicals does not give NRC any reason to question the GEIS conclusions regarding potential impacts to public or occupational health and safety. Therefore, NRC staff conclude that the nonradiological impacts during normal operations for the Class V injection well disposal option will be SMALL.

4.13.1.1.2.4 Nonradiological Impacts from Accidents

The risks from accidents associated with the use of the typical hazardous and nonhazardous chemicals for ISR operations are not different from those for other typical industrial applications. Potential nonradiological accidents impacts include high consequence chemical release events (e.g., of ammonia) involving both workers and nearby populations. In GEIS Section 4.2.11.2.2, NRC staff state that the likelihood of such release events will be low based on historical operating experience at NRC-licensed facilities, primarily due to operators following commonly applied chemical safety and handling protocols. NRC staff concluded in the GEIS that nonradiological impacts due to accidents will be expected to be SMALL offsite and potentially MODERATE for workers involved in accident response and cleanup.

GEIS Appendix E, Hazardous Chemicals, provides an accident analysis for the more hazardous chemicals. This accident analysis indicates that chemicals commonly used at ISR facilities can pose a serious safety hazard if not properly handled. The GEIS does not evaluate potential hazards to workers or the public due to specific types of high consequence, low probability accidents (e.g., a fire or large magnitude sudden release of chemicals from a major tank rupture or piping system rupture). The application of common safety practices for handling and use of chemicals is expected to decrease the likelihood of these high consequence events. The spills of reportable quantities from chemical bulk storage areas must be reported to SDDENR in accordance with ARSD Chapter 74:34 (Regulated Substance Discharges) and to EPA in accordance with 40 CFR Part 302 (Comprehensive Environmental Response, Compensation, and Liability Act). These procedures and reporting requirements will mitigate the impacts of an accident involving hazardous and nonhazardous chemicals.

The types and quantities of chemicals (hazardous and nonhazardous) to be used at the proposed project do not differ from those evaluated in the GEIS. Nor is there any new or significant information that conflicts with the conclusions drawn in the GEIS regarding the potential nonradiological impacts on public and occupational health and safety from chemical accidents. Offsite impacts involving hazardous and nonhazardous chemicals will be SMALL and do not typically pose a significant risk to the public. Workers involved in a response and cleanup could experience MODERATE impacts, but training requirements and adherence to established procedures will reduce the impact to SMALL. Based on the foregoing analysis and the GEIS conclusions, for the Class V injection well disposal option at the proposed Dewey-Burdock ISR Project, the impacts from potential accidents for both occupationally exposed workers and members of the public will be SMALL.

4.13.1.1.3 Aquifer Restoration Impacts

For the Class V injection well disposal option, the proposed aquifer restoration activities are similar to activities that will take place during operations (e.g., operation of wellfields, wastewater treatment and disposal). Therefore, the potential impact on public and occupational health and safety will be expected to be similar to the operational impacts. The reduction or elimination of some operational activities (e.g., yellowcake production and drying, remote ion-exchange) will further limit potential worker and public health and safety hazards. The radiation doses associated with restoration are included in the operations assessment in Section 4.13.1.1.2.1. Similarly, nonradiological hazards during aquifer restoration are assessed in Section 4.13.1.1.2.3. Accident consequences will be expected to be smaller than those evaluated in Sections 4.13.1.1.2.2 and 4.13.1.1.2.4. Therefore, for the Class V injection well disposal option, aquifer restoration will be expected to have a localized SMALL occupational impact on workers (primarily from radon gas) and to the general public.

4.13.1.1.4 Decommissioning Impacts

Prior to decommissioning, the applicant will have to submit a decommissioning plan for NRC review and approval at least 12 months before any decommissioning activities begin. The plan will need to include the types of safety information described in the GEIS. The applicant will also be required to comply with any site-specific, NRC-established license conditions. Additionally, the applicant will be subjected to NRC safety inspections during the course of decommissioning activities.

The applicant’s proposal does not contain any new or significant information that questions the conclusions in the GEIS regarding potential impacts to public and occupational health and safety from decommissioning. The majority of safety issues that are addressed during decommissioning involve radiological hazards at the facility (NRC, 2009a). Removal of nonradiological hazardous chemicals will be conducted in accordance with applicable state and federal hazardous waste disposal and occupational health and safety requirements. Following decommissioning, the site could be released for unrestricted use in conformance with NRC license conditions and the dose criteria for site release in 10 CFR Part 40, Appendix A. The criteria in 10 CFR Part 40, Appendix A limit the dose from radiological contamination that may exist at the site after decommissioning is completed to levels that are sufficiently low to protect public health and safety.

Assuming NRC review and approval of the applicant’s decommissioning plan, the applicant’s compliance with any applicable license conditions, and regular NRC inspection and enforcement activities, the anticipated impact from decommissioning for the Class V injection well disposal option will be short term and SMALL.

4.13.1.2 Disposal Via Land Application

If the applicant does not obtain a permit for Class V injection wells from EPA, it proposes to dispose of liquid waste by land application (see SEIS Section 2.1.1.1.2.4.2). The locations of land application areas are shown in Figure 4.13-1. The following sections discuss how the land application option could potentially affect health and safety during various phases of the ISR lifecycle.

4.13.1.2.1 Construction Impacts

Construction activities and the potential impact on occupational health and safety for the land application liquid waste option will be similar to those for the Class V injection well disposal option. Instead of installing four to eight Class V injection wells, the land application option will require the installation of irrigation areas and equipment (e.g., center pivot irrigation systems) and the placement and construction of additional infrastructure (e.g., storage ponds for non-irrigation periods).

For the land application option, the important radiation exposure pathways during construction will be the same as for the Class V injection well disposal option. These pathways will include direct exposure, inhalation, or ingestion of radionuclides during well construction; construction activities that disturb soils; and fugitive dust from vehicular traffic. As described in SEIS Section 4.13.1.1.1, the average concentrations of radionuclides in soils at the proposed Dewey-Burdock site are low. Standard dust control measures, such as water application and speed limits, will be implemented to control fugitive dust, and well development during the construction phase will release a negligible fraction of the amount of radon generated during operations. Therefore, NRC staff conclude that for the land application option the radiological impacts to worker and the general public during the construction phase will be SMALL.

As described in SEIS Section 4.13.1.1.1, the nonradiological impacts and potential human exposures from diesel equipment emissions during construction will be SMALL because the releases are usually of short duration and are readily dispersed into the atmosphere. Section 4.7.1 details the potential impacts to air quality from diesel emissions, including comparisons to health-based standards. Furthermore, as described in SEIS Section 4.7.1.1, NRC staff concluded that despite use of dust control measures, short-term and intermediate MODERATE impacts from fugitive dust are possible, but average air quality is expected to comply with ambient air standards. The NRC staff therefore conclude that overall, for the land application option, the nonradiological impacts on workers and the general public during the construction phase will be SMALL.

4.13.1.2.2 Operations Impacts

4.13.1.2.2.1 Radiological Impacts From Normal Operations

For the land application liquid waste option, the potential impacts on public and occupational health and safety during operations will be similar to the impacts for the Class V injection well disposal option described in SEIS Section 4.13.1.1.2.1. Radon gas is the only radiological airborne effluent emitted during normal operations at ISR wellfields and at processing facilities that use vacuum dryer technology. Because the applicant plans to dry yellowcake using a rotary vacuum dryer (see SEIS Section 2.1.1.1.6.1.2), emissions other than radon during normal operations are not expected.

The applicant used the MILDOS computer code to model sources of radon emission, including land application of treated wastewater, wellfield operations, central processing plant operations, and resin transfers in the satellite facility (Powertech, 2009a, 2011). As discussed in SEIS

Section 4.13.1.1.2.1, NRC reviewed the applicant's radiological impact modeling and verified that appropriate exposure pathways were modeled and reasonable input parameters were used.

Results of the applicant's modeling (Powertech, 2011) indicated that the maximum TEDE of 0.06 mSv/yr [6.0 mrem/yr] is located southeast of the Dewey satellite facility within the proposed project boundary (Figure 4.13-1). This dose is 6 percent of the 10 CFR Part 20 public dose limit of 1 mSv/yr [100 mrem/yr]. Thus, the 10 CFR Part 20 public dose limit is not exceeded at any property boundary. The applicant's calculations also demonstrate that land application sources accounted for 80 percent of the TEDE at this location (Powertech, 2009a).

The maximum TEDE at a residence was 0.0448 mSv/yr [4.48 mrem/yr] at Spencer Ranch, located approximately 2 km [1.25 mi] northwest of the proposed central processing plant in the Burdock area (see location AMS-02 in SEIS Figure 4.13-1). This is 4.48 percent of the 10 CFR Part 20 public dose limit of 1 mSv/yr [100 mrem/yr]. Therefore, the TEDE at nearby receptor locations will not exceed the public dose limit. The applicant's calculations also demonstrate that land application sources accounted for 62 percent of the TEDE at the most highly exposed residence (Powertech, 2009a).

Because Rn-222 is the only radionuclide emitted during normal operations, the public dose requirements in 40 CFR 190.10 and the 0.1 mSv/yr [10 mrem/yr] constraint rule in 10 CFR 20.1101 do not apply. However, even if 100 percent of the Rn-222 contained in production fluids was released to the atmosphere (instead of 10 percent as assumed in the applicant's calculations), the TEDE and Rn-222 air concentrations at the calculated receptor locations surrounding the facility will be less than the 1 mSv [100 mrem] public dose limit and the Rn-222 effluent concentration limit, respectively. Therefore, radiological dose impacts to the public from normal operations will be SMALL.

In summary, for the land application option, potential radiation doses to occupationally exposed workers and members of the public during operations will be SMALL. Calculated radiation doses from the releases of radioactive materials to the environment are small fractions of the limits of 10 CFR Part 20 that have been established for the protection of public health and safety.

4.13.1.2.2.2 Radiological Impacts From Accidents

For the land application option, the types of accidents that could occur and their radiological impacts will be identical to those described in SEIS Section 4.13.1.1.2.2 for the Class V injection well disposal option. Therefore, the discussion of accident scenarios and the site-specific analysis in SEIS Section 4.13.1.1.2.2 for the Class V injection well disposal option applies equally to the land application option. Based on the discussion presented in SEIS Section 4.13.1.1.2.2, in the unlikely event of an unmitigated accident and depending on the type of accident, potential doses to workers at the proposed Dewey-Burdock ISR Project may result in a MODERATE impact to occupational health and safety, while doses to the general public will result in only a SMALL impact to public health and safety. However, typical protection measures, such as radiation and occupational monitoring, respiratory protection, standard operating procedures for spill response and cleanup, and worker training in radiological health and emergency response, will be required as a part of the applicant's NRC-approved Radiation Protection Program (Powertech, 2011). These procedures and plans will reduce the radiological consequences to workers from accidents. Therefore, NRC staff conclude that for the land application option, the overall radiological impacts from accidents will be SMALL.

4.13.1.2.2.3 Nonradiological Impacts From Normal Operations

For the land application option, the types and quantities of chemicals (hazardous and nonhazardous) and the related impacts during operations will be the same as those described in SEIS Section 4.13.1.1.2.3 for the Class V injection well disposal option. The discussion of the chemicals used in the ISR process, handling and storage of these chemicals, and regulations designed to protect workers and the public in SEIS Section 4.13.1.1.2.3 for the Class V injection well disposal option applies equally to the land application option. The applicant must implement standard operating procedures regarding receiving, storing, handling, and disposing of chemicals and is required to comply with EPA, SDDENR, and OSHA regulations regarding inspections and the industrial and environmental safety aspects associated with the use of chemicals.

The types and quantities of chemicals (hazardous and nonhazardous) identified for use at the proposed Dewey-Burdock ISR Project are consistent with those evaluated in the GEIS. There is no new or significant information that changes the GEIS conclusions regarding potential impacts to public or occupational health and safety. Therefore, for the land application option, the nonradiological impacts during normal operations will be SMALL.

4.13.1.2.2.4 Nonradiological Impacts from Accidents During Operations

For the land application option, the risks from accidents associated with the use of typical hazardous and nonhazardous chemicals are no different than those described in SEIS Section 4.13.1.1.2.4 for the Class V injection well disposal option. As described in SEIS Section 4.13.1.1.2.4, an accident analysis provided in GEIS Appendix E indicates that certain hazardous chemicals used at ISR facilities can pose a serious safety hazard if not properly handled. The applicant has committed to following standards put in place by relevant regulatory agencies and industries for handling and managing hazardous chemicals (Powertech, 2009b).

The types and quantities of chemicals (hazardous and nonhazardous) to be used at the proposed Dewey-Burdock ISR Project do not differ from those evaluated in the GEIS. There is no new or significant information that changes the conclusions in the GEIS regarding potential nonradiological impacts on health and safety from chemical accidents. Offsite impacts involving hazardous and nonhazardous chemicals will be SMALL and do not typically pose a significant risk to the public. Workers involved in a response and cleanup may experience MODERATE impacts, but training requirements and adherence to established procedures will reduce the impact to SMALL. Based on the foregoing analysis and the GEIS conclusions, for the land application option, the impacts from potential accidents for both occupationally exposed workers and members of the public will be SMALL.

4.13.1.2.3 Aquifer Restoration Impacts

For the land application option, the proposed aquifer restoration activities are similar to activities during operations (e.g., operation of wellfields, wastewater treatment and disposal in land application areas). Therefore, the potential impacts on public and occupational health and safety will be expected to be similar to the operational impacts. The reduction or elimination of some operational activities (e.g., yellowcake production and drying, remote ion-exchange) will further limit the relative magnitude of potential worker and public health and safety hazards. The radiation doses associated with restoration are included in the operations assessment in Section 4.13.1.2.2.1. Similarly, nonradiological hazards during aquifer restoration are assessed in Section 4.13.1.2.2.3. Accident consequences will be expected to be smaller than those evaluated in Sections 4.13.1.2.2.2 and 4.13.1.2.2.4. Accordingly, for the land application option, a localized SMALL occupational impact to workers (primarily from radon gas) and to the general public will be expected during the aquifer restoration phase.

4.13.1.2.4 Decommissioning Impacts

For the land application option, decommissioning procedures and activities will be similar to those described in SEIS Section 4.13.1.1.4 for the Class V injection well disposal option. Prior to decommissioning the proposed Dewey-Burdock ISR Project, the applicant will need to submit a decommissioning plan that includes the types of safety information described in the GEIS. The applicant will also need to comply with any site-specific, NRC-established license conditions. Additionally, the applicant will be subjected to NRC safety inspections during the course of decommissioning activities.

Typically, the initial decommissioning steps include removal of hazardous chemicals; this will be conducted in accordance with applicable state and federal hazardous waste disposal and occupational health and safety requirements. Following decommissioning, the site could be released for unrestricted use in conformance with the conditions of the NRC license and the dose criteria for site release in 10 CFR Part 40, Appendix A. The criteria in 10 CFR Part 40, Appendix A limit the dose from radiological contamination that may exist at the site after decommissioning is completed to levels that are sufficiently low to protect public health and safety.

The applicant’s proposal does not contain any new or significant information that changes the GEIS’s conclusions regarding potential impacts to public and occupational health and safety. The applicant will be required to submit a detailed decommissioning plan for NRC approval at least 12 months before decommissioning activities begin. With the combination of NRC review and approval of the plan, and compliance with any applicable license conditions and regular NRC inspection and enforcement activities, the anticipated impact from decommissioning for the land application option at the proposed project will be short-term and SMALL.

4.13.1.3 Disposal Via Combination of Class V Injection and Land Application

If a permit for Class V injection wells is obtained from EPA but the capacity of the wells is insufficient to dispose of all liquid wastes, the applicant proposes to use a combination of deep well disposal via Class V injection wells and land application (see SEIS Section 2.1.1.1.2.4.3). For the combined disposal option, land application facilities and infrastructure will be constructed, operated, restored, and decommissioned on an as-needed basis depending on the Class V injection well disposal capacity (Powertech, 2011). Based on the discussions in SEIS Sections 4.13.1.1 and 4.13.1.2, the potential impacts to occupational and public health and safety will be similar regardless of whether Class V injection well disposal or land application is used, except for radiological impacts from normal operations. As described in SEIS Sections 4.13.1.1.2.1 and 4.13.1.2.2.1, the 10 CFR Part 20 public dose limit of 1 mSv/yr [100 mrem/yr] will not be exceeded at the project boundary or nearby receptor locations under either the Class V injection well disposal option or the land application option during normal operations. Calculated maximum TEDEs were 0.012 mSv [1.2 mrem/yr] for the Class V injection well disposal option and 0.06 mSv/yr [6 mrem/yr] for the land application option. Calculated maximum TEDEs at a residence were 0.017 mSv/yr [1.7 mrem/yr] for the Class V injection well disposal option and 0.0448 mSv/yr [4.48 mrem/yr] for the land application option. Because only a portion of land irrigation areas will be operated for the combined disposal option, maximum calculated TEDEs are expected to lie between or be bounded by the maximum TEDEs calculated for the Class V injection well disposal option and the land application option. Therefore, the 10 CFR Part 20 public dose limit will not be exceeded at the project boundary or nearby receptor locations for the combined disposal option. Thus, NRC staff conclude that during the operations phase, the radiological impacts to occupational and public health and safety for the combined disposal option will be SMALL. In addition, as noted previously, the potential impacts to occupational and public health and safety for all other phases of the proposed project will be SMALL regardless of whether Class V injection well disposal or land application is used. Therefore, NRC staff conclude that during all other phases the radiological and nonradiological impacts to occupational and public health and safety for the combined disposal option will be SMALL, as summarized in Table 4.13-2.

4.13.2 No-Action (Alternative 2)

Under the No-Action alternative, there will be no occupational exposure. There will be no additional radiological exposures to the general public from project-related effluent releases, and there will be no impact on long-term environmental radiological conditions. Radiation exposure and risk to the general public will continue to be determined by exposure from natural background, medical-related exposures, and exposures from existing residual contamination.

4.14 Waste Management Impacts

As described in GEIS Section 4.4.12, environmental impacts on waste management could occur during all phases of the ISR lifecycle. The proposed project will generate radiological and nonradiological liquid and solid materials that must be handled and disposed of properly. The primary radiological materials that must be disposed are process-related liquids and process-contaminated structures, equipment, and soils, all of which are classified as byproduct material.

Before operations could begin, NRC requires an ISR facility to have an agreement in place with a licensed disposal facility to accept byproduct material. NRC will require by license condition that the disposal agreement be in place before the initiation of operations. Lack of a signed disposal agreement will be grounds for a cessation of operations until a signed agreement is obtained.

<u>GEIS Construction Phase Summary</u>

In GEIS Section 4.4.12.1, NRC staff concluded that waste management impacts from the construction phase of an ISR facility will be SMALL. Because construction activities will be on a relatively small scale, a low volume of construction waste will be generated. (NRC, 2009a)

Table 4.13-2. Significance of Occupational and Public Health and Safety Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

	Class V Injection Wells	Land Application	Combined Class V Injection Wells and Land Application*
Construction			
Radiological	SMALL	SMALL	SMALL
Nonradiological	SMALL	SMALL	SMALL
Operations			
Radiological (Normal Operations)	SMALL	SMALL	SMALL
Radiological (Accidents)	SMALL	SMALL	SMALL
Nonradiological (Normal Operations)	SMALL	SMALL	SMALL
Nonradiological (Accidents)	SMALL	SMALL	SMALL
Aquifer Restoration			
Radiological	SMALL	SMALL	SMALL
Nonradiological	SMALL	SMALL	SMALL
Decommissioning			
Radiological	SMALL	SMALL	SMALL
Nonradiological	SMALL	SMALL	SMALL

*Significance of environmental impact for the combined disposal option is bounded by the significance of environmental impacts for the Class V injection well and land application disposal options.

GEIS Operations Phase Summary

According to GEIS Section 2.7, byproduct material generated during the operations phase at an ISR facility will primarily be liquid consisting of process bleed (1 to 3 percent of the process flow rate). NRC staff also noted in the GEIS that byproduct material will be generated from flushing of eluant to limit impurities, resin transfer wash, filter washing, uranium precipitation process wastes (brine), and plant washdown water. Treatment and disposal methods described in the GEIS for liquid byproduct material at ISR facilities were characterized as effective at reducing the volume of material prior to disposal at an approved facility. Solid byproduct material will be decontaminated and released for other use or disposed of at approved waste disposal facilities.

NRC staff concluded in the GEIS that the waste management impact from disposal of byproduct material will be SMALL given the required preoperational disposal agreements between an applicant and a licensed byproduct material disposal site. The impact from hazardous waste disposal was expected to be SMALL because of the small volume of hazardous waste generated. The impact from disposal of nonhazardous solid waste was expected to be SMALL based on the available disposal capacity of municipal solid waste facilities. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

GEIS Section 4.4.12.3 described waste management activities that will occur during the aquifer restoration phase of an ISR project and noted that the same treatment and disposal options will be implemented as used during operations. Therefore, the waste management impacts will be similar to those during the operations phase of an ISR project. Some increase in wastewater volumes could occur, but the increase in volume will be offset by the decrease in production capacity. NRC staff concluded in the GEIS that the impact on waste management from aquifer restoration will be SMALL. (NRC, 2009a)

GEIS Decommissionig Phase Summary

GEIS Section 2.6 stated that wastes generated from decommissioning an ISR facility will be predominantly byproduct material and nonhazardous solid waste. GEIS Section 4.4.12.4 stated that decommissioning byproduct material (including contaminated facility demolition materials, process and wellfield equipment, excavated soil, and pond bottoms) will be disposed of at a licensed facility. As stated previously, to ensure that sufficient disposal capacity is available for byproduct material (including that generated by decommissioning activities), NRC requires a preoperational agreement with a licensed disposal facility to accept byproduct material for disposal. NRC staff concluded in the GEIS that because the volume of byproduct material, chemical, and solid wastes generated during decommissioning will be small, the impact on waste management will also be SMALL. (NRC, 2009a)

Environmental impacts on waste management resources during the construction, operations, aquifer restoration, and decommissioning phases of the proposed ISR project are discussed next. The environmental impacts of the proposed waste management actions on other resources are evaluated within the applicable subsections of each impact analysis in this chapter.

4.14.1 Proposed Action (Alternative 1)

Under the proposed action, the types of waste streams that could be generated are discussed in SEIS Section 2.1.1.1.6. The primary radiological materials the proposed Dewey-Burdock ISR Project will dispose of are process-related liquid effluent and process-contaminated structures, equipment, and soils, all of which are classified as byproduct material. As described in SEIS Section 2.1.1.1.6.3, the applicant has identified White Mesa for disposal of solid byproduct material. The applicant's preferred method for disposal of liquid byproduct material is by Class V injection well. If a permit cannot be obtained from EPA for Class V injection, the applicant will pursue land application of treated liquid effluent. If the capacity of either method is limited, the applicant will pursue a combination of both Class V injection and land application. The impacts on waste management from the Class V injection well option are described in Section 4.14.1.1. The impacts on waste management from the land application option and combined Class V injection and land application are described in SEIS Sections 4.14.1.2 and

4.14.1.3. Alternative wastewater disposal options, including evaporation ponds and surface water discharge, are described in SEIS Section 4.14.1.4.

4.14.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant's preferred option for disposal of liquid wastes is deep well disposal via Class V injection wells. Potential environmental impacts on waste management from construction, operations, aquifer restoration, and decommissioning associated with the deep Class V injection well disposal option at the proposed Dewey-Burdock ISR Project are discussed in the following sections.

4.14.1.1.1 Construction Impacts

The primary wastes to be disposed of during this phase of the ISR facility lifecycle will be nonhazardous solid waste, such as building materials and piping. As discussed in SEIS Sections 2.1.1.1.6.3 and 3.13.2, the applicant has proposed to dispose of nonhazardous solid wastes at the Custer-Fall River Waste Management District landfill located at Edgemont, South Dakota, approximately 24 km [15 mi] southeast of the proposed Dewey-Burdock ISR Project site or at the Newcastle, Wyoming, landfill, approximately 64 km [40 mi] north of the proposed project site if additional capacity is needed (Powertech, 2010a). As described in SEIS Section 3.13.2, these landfills are not at or near capacity.

The proposed activities to manage construction waste generated by the proposed project are discussed in SEIS Section 2.1.1.1.6. The proposed action will annually generate a volume of 144 m^3 [188 yd^3] of nonhazardous solid waste during the construction phase (SEIS Section 2.1.1.1.6.3), which is 1 percent or less of the annual volume of waste disposed at either the Custer-Fall River Waste Management District landfill or the Newcastle landfill (SEIS Section 3.13.2). Nonhazardous solid waste generated at the proposed annual rate for the duration of the construction phase (6 years) will account for 1 percent or less of the capacity of either landfill. Because there is available capacity and the ISR construction phase will annually generate a small volume, the NRC staff conclude the impact on waste management from the Class V injection well disposal option at the proposed project will be SMALL.

4.14.1.1.2 Operations Impacts

Liquid byproduct material generated during operations is composed of production bleed, waste brine streams from elution and precipitation, resin transfer wash, laundry water, plant washdown water, and laboratory chemicals (SEIS Section 2.1.1.1.6.2). The applicant estimates the maximum production of liquid byproduct material at any time considering concurrent uranium recovery operations and aquifer restoration activities is 746 L/min [197 gal/min] for the deep Class V disposal well option (Powertech, 2011). The applicant proposes to treat this combined liquid byproduct material stream onsite to remove radium and uranium by radium settling and ion exchange, respectively (SEIS Section 2.1.1.1.6.2). This will reduce radionuclide activities below the established NRC limits under 10 CFR Part 20, Appendix B, Table 2, Column 2 prior to injecting the material into a deep Class V disposal well (Powertech, 2011). 10 CFR Part 20, Appendix B, Table 2, Column 2 includes effluent concentration limits for natural uranium, Ra-226, Pb-210 and Th-230. As stated in Section 2.1.1.1.6.2, the applicant will have to meet applicable EPA and NRC requirements before injection in a deep Class V injection well begins. When evaluating permit applications for Class V wells, EPA considers the characteristics of the operation, the material proposed to be injected, and the surrounding environment and determines whether the proposed injection will endanger public health or the environment (EPA, 2012). An EPA permit, if granted, will also prohibit hazardous waste (as defined by RCRA) from being injected. NRC will require (i) liquid byproduct material to be treated prior to injection and (ii) treatment systems to be approved, constructed, operated, and monitored to ensure release standards in 10 CFR Part 20, Subparts D and K and Appendix B are met. The applicant proposes to have 4 to 8 Class V injection wells with a capacity of 1,136 L/min [300 gal/min], sufficient to accommodate the estimated 746 L/min [197 gal/min] of liquid byproduct material generated from the proposed operation. Based on the applicant's proposal to obtain adequate disposal capacity as well as requirements to comply with EPA Class V disposal permit conditions, NRC effluent limits, and other NRC safety regulations, the NRC staff conclude that the waste management impacts from the disposal of liquid byproduct material via deep Class V injection wells during the ISR operation phase will be SMALL.

Solid byproduct material generated during operations could include maintenance and housekeeping rags and trash; packing materials; replaced components; filters; protective clothing; and solids removed from process pumps, vessels, and ponds. As discussed in SEIS Section 2.1.1.1.6.3, the applicant estimates, during the operational period and assuming combined operations and aquifer restoration, the proposed Dewey-Burdock facility will produce 22 m^3 [29 yd^3] of solid byproduct material from radium settling ponds annually from the deep Class V disposal well option (Powertech, 2011). Solid byproduct material will be stored onsite within a restricted area until sufficient volume is generated for disposal. Based on the disposal options currently available and the disposal agreement that NRC requires prior to operations (SEIS Section 2.1.1.1.6.3), the NRC staff conclude that the impacts on waste management from the disposal of solid byproduct material during the ISR operations phase will be SMALL.

Nonhazardous solid wastes generated during operations could include facility trash, septic solids, and other uncontaminated solid wastes (e.g., piping, valves, instrumentation, and equipment). Because the proposed generation rate of nonhazardous solid waste (SEIS Section 2.1.1.1.6.3) will be a small percentage of the landfill capacity (SEIS Section 3.13.2), the NRC staff conclude the impact on waste management will be SMALL.

As discussed in SEIS Section 2.1.1.1.6.3, the applicant has stated it will likely be classified as a conditionally exempt small quantity generator (CESQG). The applicant will transport its hazardous waste to a permitted hazardous waste facility for disposal (Powertech, 2009a).

Based on the type and quantity of byproduct material and waste expected to be generated and the available capacity for disposal, the NRC staff conclude the waste management activities during the ISR operations phase of the proposed Dewey-Burdock Project will have a SMALL impact on waste management resources.

4.14.1.1.3 Aquifer Restoration Impacts

For the proposed Dewey-Burdock Project, the applicant will use the same waste management systems for aquifer restoration as used during ISR operations discussed in SEIS Section 2.1.1.1.6.

Liquid byproduct material generated during aquifer restoration is composed of reverse osmosis brine (SEIS Section 2.1.1.1.6.2). The applicant proposes to manage aquifer restoration wastewater (i.e., liquid byproduct material) by treating the wastewater by reverse osmosis and reinjecting the treated water (i.e., permeate) back into the aquifer production zone undergoing restoration (see SEIS Section 2.1.1.1.4.1). The applicant will combine the contaminants removed from water with operational wastewater and transfer the combined wastewater to the radium settling ponds for further treatment prior to disposal in the deep Class V wells. As stated in SEIS Section 2.1.1.1.6.2, the applicant will have to meet applicable EPA and NRC requirements before injection in a deep Class V disposal well begins. When evaluating permit applications for Class V wells, EPA considers the characteristics of the operation, the material to be injected, and the surrounding environment and determines whether the proposed injection will endanger public health or the environment (EPA, 2012). NRC will require liquid byproduct material to be treated prior to injection and treatment systems be approved, constructed, operated, and monitored to ensure release standards in 10 CFR Part 20, Subparts D and K and Appendix B are met. The applicant proposes to have 4 to 8 Class V injection wells with a capacity of 1,136 L/min [300 gal/min], sufficient to accommodate the estimated 746 L/min [197 gal/min] of liquid byproduct material generated from the proposed operation. Based on the applicant's proposal to obtain adequate disposal capacity as well requirements to comply with EPA Class V disposal permit conditions, NRC effluent limits, and other NRC safety regulations, the NRC staff conclude that the waste management impacts from the disposal of liquid byproduct material via deep Class V injection wells during the ISR aquifer restoration phase will be SMALL.

Solid byproduct material generated during aquifer restoration could include maintenance and housekeeping rags and trash; packing materials; replaced components; filters; protective clothing; and solids removed from process pumps, vessels, and ponds. As discussed in SEIS Section 2.1.1.1.6.3, the applicant estimates, during the operational period and assuming combined operations and aquifer restoration, the proposed Dewey-Burdock facility will produce 22 m^3 [29 yd^3]of solid byproduct material from radium settling ponds annually from the deep Class V disposal well option (Powertech, 2011). Solid byproduct material will be stored onsite within a restricted area until sufficient volume is generated for disposal. Based on the disposal options currently available and the disposal agreement that NRC requires prior to operations (SEIS Section 2.1.1.1.6.3), the NRC staff conclude that the waste management impacts from the generation of byproduct material during the ISR operations phase will be SMALL.

Nonhazardous solid wastes generated during aquifer restoration could include facility trash, septic solids, and other uncontaminated solid wastes (e.g., piping, valves, instrumentation, and equipment). Because the proposed generation rate of nonhazardous solid waste (SEIS Section 2.1.1.1.6.3) will be a small percentage of the landfill capacity (SEIS Section 3.13.2), the NRC staff conclude the impact on waste management will be SMALL.

As discussed in SEIS Section 2.1.1.1.6.3, the applicant has stated it will likely be classified as a CESQG. The applicant will transport its hazardous waste to a permitted hazardous waste facility for disposal (Powertech, 2009a).

Based on the type and quantity of waste expected to be generated and the available capacity for disposal, the NRC staff conclude the waste management actions during the ISR aquifer restoration phase of the proposed project will have a SMALL impact on waste management resources.

4.14.1.1.4 Decommissioning Impacts

The anticipated decommissioning activities occurring at the proposed Dewey-Burdock ISR Project site will be comparable to those described in GEIS Section 2.6. The applicant proposed to conduct radiological surveys of decommissioned facilities and equipment and classify materials in accordance with the applicable disposition of the materials (Powertech, 2009b, 2011), including decontamination, recycling and reuse, disposal as byproduct material at a licensed facility, or disposal as nonhazardous solid waste at a municipal solid waste landfill (Powertech, 2009b, 2011).

As discussed in SEIS Section 2.1.1.1.6.3, the applicant's estimate for byproduct material generated from decommissioning the plant facilities and all wellfields (over a planned 2-year period) is 1,419 m^3 [1,856 yd^3] for the deep Class V injection well disposal option (Powertech, 2011). As discussed in SEIS Section 2.1.1.1.6.3, the applicant does not have a disposal agreement in place with a licensed site to accept solid byproduct material, and as discussed in SEIS Section 4.14.1.1.2, NRC will require that the applicant enter into a written agreement with a disposal site to ensure adequate capacity for byproduct material disposal. The applicant has proposed to pursue an agreement with the White Mesa site in Blanding, Utah, for disposal of solid byproduct material (SEIS Section 3.13.2). Based on the disposal options currently available for byproduct material and the disposal agreement which NRC will require by license condition prior to operations, the NRC staff conclude that the impact on waste management from the generation of byproduct material during decommissioning will be SMALL.

The applicant's estimate of the total volume of nonhazardous solid waste that will be generated from decommissioning is 10,427 m^3 [13,638 yd^3] for the deep Class V injection well disposal option (Powertech, 2011). From this estimate, the NRC staff derived an annual nonhazardous solid waste generation of 5,213 m^3 [6,819 yd^3] from decommissioning by dividing the applicant's total estimate by 2 (the applicant's proposed decommissioning period in years). This estimated solid waste volume is greater than what was analyzed in the GEIS {715 m^3 [935 yd^3]} and thus not bounded by the impact assessment described in the GEIS; therefore, the NRC staff considered additional site-specific information to evaluate impacts.

Although permitted landfill disposal capacities of the Custer-Fall River Waste Management District landfill and the Newcastle landfill are currently available (SEIS Section 3.13.2), considering the proposed project duration and limited future disposal capacity, the NRC staff evaluated the estimated landfill capacities and demand at the time of decommissioning. Based on the current operational life of 12 years (SEIS Section 3.13.2), the Newcastle landfill will not be open to accept waste at the planned time of decommissioning (15 and 16 years after the start of construction; Figure 2.1-1) unless the landfill capacity is expanded. The Custer-Fall River landfill, with an estimated operational life of 17 years after midyear 2012, will still be in operation at the time of decommissioning if project construction started in 2013; therefore, this landfill was evaluated in more detail. NRC staff projections suggest the remaining capacity of the Custer-Fall River landfill at the time of proposed decommissioning will be insufficient to accommodate all decommissioning nonhazardous solid waste and serve the regional annual demand for disposal capacity unless existing landfill capacity and operations are expanded. Furthermore, the NRC staff estimate the additional demand for capacity will consume the remaining landfill capacity at a faster rate with the landfill reaching full capacity approximately 1 year earlier than current projections. The NRC staff's projections supporting these conclusions are detailed in the following paragraphs.

The NRC staff's landfill capacity analysis calculated the total disposal demand from mid-year 2012 through the end of the proposed decommissioning period and compared it with the reported remaining landfill capacity as of mid-year 2012. NRC staff used this comparison of projected demand and capacity to evaluate whether sufficient capacity will be available to dispose of the additional waste from the proposed project. The total disposal demand of 148,079 t [163,229 T] was based on the sum of the regional disposal demand[1] and the project disposal demand[2] from mid-2012 through the end of the proposed decommissioning period in 2028. The projected demand exceeds the available capacity of 139,619 t [154,000 T][3] by 8,372 t [9,229 T].[4]

The staff also evaluated the difference in the projected time the landfill will reach full capacity with and without disposal of waste from the proposed Dewey-Burdock ISR Project. The purpose of this analysis was to evaluate the impact of the additional disposal demand on the projected operational life of the landfill. The NRC staff calculated when the landfill will reach full capacity with the additional disposal of proposed project waste by first calculating the available landfill capacity at the end of 2027 after 1 year of decommissioning waste disposal and 15.5 years of post mid-2012 regional waste disposal.[5] Next, the NRC staff derived a combined monthly disposal demand[6] for year 2028 from the projected disposal rates for decommissioning waste and regional waste. At the combined monthly disposal demand, the projected year 2028 remaining capacity of 6,473 t [7,136 T] will be depleted within the first half of 2028.[7] For comparison, the projected operational life of the landfill without disposal of waste from the proposed action (SEIS Section 3.13.2) is 17 years beyond mid-2012 or mid-year 2029. Therefore, the analysis suggests disposal of waste from the proposed Dewey Burdock ISR Project will cause the landfill to reach full capacity 1 year earlier than expected if the proposed decommissioning was executed on schedule and regional disposal demand continued at the current rate.

The potential for future expansion of capacity is being considered at both landfills (AET, Inc., 2011; SDDENR, 2010); however, specific long-term actions remain uncertain. If one of these landfills does not expand capacity in the future, the applicant will have to dispose of waste elsewhere. Anothermore distant and higher capacity landfill serving Rapid City is projected to be operational until 2050 (HDR Engineering Inc., 2010). Therefore, the staff consider regional

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[1]The regional demand of 134,717 t [148,500T] was calculated based on the product of the annual average disposal volume received by the Custer-Fall River landfill of 8,160 t/yr [9,000 T/yr] (SEIS Section 3.13.2) and 16.5 (the number of years from mid-2012 to the end of proposed decommissioning in 2028).

[2]The project demand (i.e., total nonhazardous solid waste volume from decommissioning) of 13,354 t [14,729 T] is the volume of this waste from SEIS Section 2.1.1.1.6.3 converted to mass using 1.08T/yd^3 multiplier.

[3]The available landfill capacity reported in SEIS Section 3.13.2 as of the end of June 2012 is 139,619 t [154,000 T].

[4] The available capacity of 139,619 t [154,000 T] was subtracted from the total disposal demand of 148,079 t [163,229 T] (the sum of footnotes 1 and 2) to obtain the result of 8,372 t [9,229 T].

[5]The calculated available capacity at the beginning of year 2028 is 6,473 t [7,136 T]. This is the result of subtracting 133,150 [146,865 T] of the combined disposal demand (from regional and decommissioning wastes) for mid-2012 to year 2027 from the available landfill capacity as of mid-2012 of 139,619 t [154,000 T] (SEIS Section 3.13.2). The combined disposal demand was calculated as the product of the annual average disposal volume received by the Custer-Fall River landfill of 8,160 t/yr [9,000 T/yr] (SEIS Section 3.13.2) and 15.5 (the number of years from mid 2012 to the end of the first year of proposed decommissioning in 2027) added to the volume of nonhazardous decommissioning solid waste for year 2027 of 6,680 t [7,364 T] {half of the 2 year decommissioning total waste volume of 13,354 t [14,729 T]}.

[6]The combined monthly disposal demand for year 2028 of 1,237 t/month [1,364 T/month] is the sum of derived monthly disposal demands (i.e., waste generation rates) for proposed decommissioning and regional waste. Specifically, the derived monthly proposed decommissioning disposal demand is the total amount of proposed decommissioning waste of 13,354 t [14,729 T] for 2 years converted to a monthly rate of 557 t/month [614 T/month]. Similarly, the derived monthly regional disposal demand is the Custer-Fall River landfill annual average disposal amount of 8,160 t/yr [9000 T/yr] converted to a monthly rate of 680 t [750 T/month].

[7]The time to reach full capacity of 5.2 months was calculated as the ratio of the available year 2028 capacity of 6,473 t [7,136 T] from footnote 4 and the combined monthly disposal demand of 1,237 t/month [1,364 T/month] from footnote 5.

capacity will be available during the period of decommissioning if local capacity is limited or otherwise unavailable.

Based on the preceding capacity analysis, the NRC staff conclude that the potential impacts on waste management resources will vary depending on the long-term status of the existing local landfill resources. If local landfill capacity is not expanded prior to the proposed decommissioning period, the staff conclude that there will be no impacts to the Newcastle landfill because it will not be open to accept waste at the planned time of decommissioning and the proposed Dewey-Burdock ISR Project will not be able to dispose waste at that location. In turn, impacts to the Custer-Fall River landfill will be MODERATE because the increased demand for capacity will more rapidly consume the waste management resources during the last years of its projected operational life. Any waste disposed at the Rapid City landfill will have SMALL impacts based on the projected operational life and available capacity. Alternatively, if the local landfill capacity is expanded prior to the proposed project decommissioning phase, the impacts on the available capacity of the expanded landfill (Newcastle or Custer-Fall River) will be SMALL.

The applicant estimates the volume of hazardous waste generated from decommissioning activities will be less than 91 kg [200 lb] (Powertech, 2009b). The hazardous waste streams from decommissioning will be similar to the waste streams generated during the ISR construction phase and could include used oil, batteries, and cleaning solvents. The applicant will have in place a hazardous material program that complies with applicable EPA and SDDENR requirements for its handling, storage, and disposal at approved facilities. Because the volume of hazardous wastes generated by the proposed action will be small and the waste will be handled, stored, and disposed of in accordance with applicable regulations, the NRC staff conclude the impacts on waste management will be SMALL.

In summary, NRC staff conclude the impacts to waste management resources during the decommissioning phase of the proposed project for the deep Class V injection well disposal option will be SMALL for all materials except nonhazardous solid waste, which will be SMALL to MODERATE depending on the long-term status of the existing local landfill resources. Based on the type and quantity of waste expected to be generated and the available capacity for disposal, waste management actions during the decommissioning phase will have a SMALL impact on waste management resources for byproduct material and hazardous waste and a SMALL to MODERATE impact for nonhazardous solid waste.

4.14.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not be obtained from EPA or the capacity of the Class V wells is insufficient, the applicant proposes to dispose of liquid byproduct material generated at the proposed Dewey-Burdock ISR Project by land application (see SEIS Section 2.1.1.1.2.4.2). The locations of land application areas for this disposal option are shown in Figure 2.1-12. Potential environmental impacts on waste management resources from construction, operations, aquifer restoration, and decommissioning associated with the land application disposal option are discussed in the following sections.

4.14.1.2.1 Construction Impacts

The primary wastes to be disposed of during this phase of the ISR facility lifecycle will be nonhazardous solid waste, such as building materials and piping. As discussed in SEIS

Sections 2.1.1.1.6.3 and 3.13.2, the applicant has proposed to dispose of nonhazardous solid wastes at the Custer-Fall River Waste Management District landfill located at Edgemont, South Dakota, approximately 24 km [15 mi] southeast of the proposed Dewey-Burdock Project site or at the Newcastle, Wyoming, landfill, approximately 64 km [40 mi] north of the proposed Dewey-Burdock Project site if additional capacity is needed (Powertech, 2010a). As described in SEIS Section 3.13.2, these landfills are not at or near capacity.

The proposed activities to manage construction waste generated by the proposed project are discussed in SEIS Section 2.1.1.1.6. The proposed action will annually generate a volume of 144 m^3 [188 yd^3] of nonhazardous solid waste during the construction phase (SEIS Section 2.1.1.1.6.3), which is 1 percent or less of the volume of waste disposed at either the Custer-Fall River Waste Management District landfill or the Newcastle landfill (SEIS Section 3.13.2). Nonhazardous solid waste generated at the proposed annual rate for the duration of the construction phase (6 years) will account for 1 percent or less of the capacity of either landfill. Because there is available capacity and the ISR construction phase will annually generate a small volume, the NRC staff conclude the impact on waste management from the land application disposal option at the proposed project will be SMALL.

4.14.1.2.2 Operations Impacts

Liquid byproduct material generated during operations is composed of production bleed, waste brine streams from elution and precipitation, resin transfer wash, laundry water, plant washdown water, and laboratory chemicals (SEIS Section 2.1.1.1.6.2). The applicant estimates the maximum production of liquid byproduct material at any time, considering concurrent uranium recovery operations and aquifer restoration activities, is 2,080 L/min [547 gal/min] for the land application option (Powertech, 2011). The applicant proposes to treat this combined liquid byproduct material stream onsite using ion exchange and radium settling prior to land application. The applicant proposes to treat the liquid waste (SEIS Section 2.1.1.1.6.2) to reduce radionuclide activities below the established NRC limits under 10 CFR Part 20, Appendix B, Table 2, Column 2 (Powertech, 2011) for discharge of radionuclides to the environment. 10 CFR Part 20, Appendix B, Table 2, Column 2 includes effluent concentration limits for natural uranium, Ra-226, Pb-210 and Th-230. As stated in SEIS Section 2.1.1.1.6.2, the land application will be carried out under a GDP approved by SDDENR (Powertech, 2012c). In accordance with permit program objectives, the applicant's proposed land application operations will have to meet applicable state groundwater quality standards. NRC will require (i) liquid byproduct material be treated prior to injection and (ii) treatment systems be approved, constructed, operated, and monitored to ensure release standards in 10 CFR Part 20, Subparts D and K and Appendix B are met. While land application capacity varies throughout the year, the applicant estimates that each land application area will be able to dispose of 1,173 Lpm [310 gpm] (Powertech, 2012c). The applicant proposes two land application areas, which will provide 2,347 Lpm [620 gpm] of capacity. The applicant's proposed disposal capacity is sufficient to accommodate the proposed maximum generation rate of liquid byproduct material. Based on the applicant's proposal to obtain adequate disposal capacity and comply with state groundwater quality standards, NRC effluent limits, and other NRC safety regulations, the NRC staff conclude that the waste management impacts from the disposal of liquid byproduct material via land application during the ISR operation phase will be SMALL.

Solid byproduct material generated during operations could include maintenance and housekeeping rags and trash; packing materials; replaced components; filters; protective clothing; and solids removed from process pumps, vessels, and ponds. As discussed in SEIS

Section 2.1.1.1.6.3, the applicant estimates, during the operational period and assuming combined operations and aquifer restoration, the proposed Dewey-Burdock facility will produce 50 m^3 [66 yd^3] of solid byproduct material from the land application option (Powertech, 2011). Solid byproduct material will be stored onsite within a restricted area until sufficient volume is generated for disposal. Based on the disposal options currently available and the disposal agreement that NRC requires prior to operations (SEIS Section 2.1.1.1.6.3), the NRC staff conclude that the impacts on waste management from the disposal of solid byproduct material under the land application option during the ISR operations phase will be SMALL.

Nonhazardous solid wastes generated during operations could include facility trash, septic solids, and other uncontaminated solid wastes (e.g., piping, valves, instrumentation, and equipment). Because the proposed generation rate of nonhazardous solid waste (SEIS Section 2.1.1.1.6.3) will be a small percentage of the landfill capacity (SEIS Section 3.13.2), the NRC staff conclude the impact on waste management will be SMALL.

As discussed in SEIS Section 2.1.1.1.6.3, the applicant has stated it will likely be classified as a CESQG. The applicant will transport its hazardous waste to a permitted hazardous waste facility for disposal (Powertech, 2009a).

Based on the type and quantity of byproduct material and waste expected to be generated and the available capacity for disposal, the NRC staff conclude the waste management activities during the ISR operations phase of the proposed project will have a SMALL impact on waste management resources.

4.14.1.2.3 Aquifer Restoration Impacts

For the proposed Dewey-Burdock ISR Project, the applicant will use the same waste management systems for aquifer restoration as used during ISR operations discussed in SEIS Section 2.1.1.1.6.

Liquid byproduct material generated during aquifer restoration is composed of produced water from the ore zone aquifer (Powertech, 2009b). The applicant estimates the maximum production of liquid byproduct material at any time, considering concurrent uranium recovery operations and aquifer restoration activities, is 2,080 L/min [547 gal/min] for the land application option (Powertech, 2011). The applicant proposes to manage aquifer restoration wastewater (i.e., liquid byproduct material) by treating the wastewater onsite by ion exchange and radium settling prior to land application (SEIS Section 2.1.1.1.6.2). As stated in Section 2.1.1.1.6.2, the land application will be carried out under a GDP approved by SDDENR (Powertech, 2012c). In accordance with permit program objectives, the applicant's proposed land application operations will have to meet applicable state groundwater quality standards. NRC will require liquid byproduct material be treated prior to injection and treatment systems be approved, constructed, operated, and monitored to ensure release standards in 10 CFR Part 20, Subparts D and K and Appendix B are met. While land application capacity varies throughout the year, the applicant estimates that each land application area will be able to dispose of 1,173 Lpm [310 gpm] (Powertech, 2012c). The applicant proposes 2 land application areas, which will provide 2,347 Lpm [620 gpm] of capacity. The applicant's proposed disposal capacity is sufficient to accommodate the proposed maximum generation rate of liquid byproduct material. Based on the applicant's proposal to obtain adequate disposal capacity and comply with state groundwater quality standards, NRC effluent limits, and other NRC safety regulations, the staff conclude that the waste management impacts from the disposal of liquid byproduct material via land application during the ISR aquifer restoration phase will be SMALL.

Solid byproduct material generated during aquifer restoration could include maintenance and housekeeping rags and trash; packing materials; replaced components; filters; protective clothing; and solids removed from process pumps, vessels, and ponds. As discussed in SEIS Section 2.1.1.1.6.3, the applicant estimates, during the operational period and assuming combined operations and aquifer restoration, the proposed Dewey-Burdock facility will produce 50 m^3 [66 yd^3] of solid byproduct material from the land application option (Powertech, 2011). Solid byproduct material will be stored onsite within a restricted area until sufficient volume is generated for disposal. Based on the disposal options currently available and the disposal agreement that NRC requires prior to operations (SEIS Section 2.1.1.1.6.3), the NRC staff conclude that the waste management impacts from the generation of byproduct material during the ISR operations phase will be SMALL.

Nonhazardous solid wastes generated during aquifer restoration could include facility trash, septic solids, and other uncontaminated solid wastes (e.g., piping, valves, instrumentation, and equipment). Because the proposed generation rate of nonhazardous solid waste (SEIS Section 2.1.1.1.6.3) will be a small percentage of the landfill capacity (SEIS Section 3.13.2), the NRC staff conclude the impact on waste management will be SMALL.

As discussed in SEIS Section 2.1.1.1.6.3, the applicant has stated it will likely be classified as a CESQG. The applicant will transport its hazardous waste to a permitted hazardous waste facility for disposal (Powertech, 2009a).

Based on the type and quantity of waste expected to be generated and the available capacity for disposal, the NRC staff conclude the waste management actions during the ISR aquifer restoration phase of the proposed project will have a SMALL impact on waste management resources.

4.14.1.2.4 Decommissioning Impacts

The anticipated decommissioning activities occurring at the proposed Dewey-Burdock ISR Project site will be comparable to those described in GEIS Section 2.6. The applicant proposed to conduct radiological surveys of decommissioned facilities and equipment and classify materials in accordance with the applicable disposition of the materials (Powertech, 2009b, 2011), including decontamination, recycling and reuse, disposal as byproduct material at a licensed facility, or disposal as nonhazardous solid waste at a municipal solid waste landfill (Powertech, 2009b, 2011).

As discussed in SEIS Section 2.1.1.1.6.3, the applicant's estimate for byproduct material generated from decommissioning the plant facilities and all wellfields (over a planned 2-year period) is 1,580 m^3 [2,067 yd^3] for the land application option (Powertech, 2011). As discussed in SEIS Section 2.1.1.1.6.3, the applicant does not have a disposal agreement in place with a licensed site to accept solid byproduct material, and as discussed in SEIS Section 4.14.1.1.2, NRC will require that the applicant enter into a written agreement with a disposal site to ensure adequate capacity for byproduct material disposal. The applicant has proposed to pursue an agreement with the White Mesa site in Blanding, Utah, for disposal of solid byproduct material (SEIS Section 3.13.2). Based on the disposal options currently available for byproduct material and the disposal agreement, which NRC will require by license condition prior to operations, the

NRC staff conclude that the impact on waste management from the generation of byproduct material under the land application option during decommissioning will be SMALL.

The applicant's estimate of the total volume of nonhazardous solid waste that will be generated from decommissioning is 12,496 m^3 [16,344 yd^3] for the land application option (Powertech, 2011). From this estimate, the NRC staff derived an annual nonhazardous solid waste generation of 6,248 m^3 [8,172 yd^3] from decommissioning by dividing the applicant's total estimate by 2 (the applicant's proposed decommissioning period in years). This estimated solid waste volume is greater than what was analyzed in the GEIS {715 m^3 [935 yd^3]} and thus not bounded by the GEIS impact assessment; therefore, the NRC staff considered additional site-specific information to evaluate impacts.

Although permitted landfill disposal capacities at the Custer-Fall River Waste Management District landfill and the Newcastle landfill are currently available (SEIS Section 3.13.2), considering the proposed project duration and limited future disposal capacity, the NRC staff evaluated the estimated landfill capacities and demand at the time of decommissioning. Based on the current operational life of 12 years (SEIS Section 3.13.2), the Newcastle landfill will not be open to accept waste at the planned time of decommissioning (15 and 16 years after the start of construction; SEIS Figure 2.1-1) unless the landfill capacity was expanded. The Custer-Fall River landfill, with an estimated operational life of 17 years after mid-year 2012, will still be in operation at the time of decommissioning if project construction started in 2013; Section 106 consultation between NRC, SD SHPO, BLM, tribal representatives, and the applicant therefore, this landfill was evaluated in more detail. NRC staff projections suggest the remaining capacity of the Custer-Fall River landfill at the time of proposed decommissioning will be insufficient to accommodate all decommissioning nonhazardous solid waste and serve the regional annual demand for disposal capacity unless existing landfill capacity and operations were expanded. Furthermore, the NRC staff estimate the additional demand for capacity will consume the remaining landfill capacity at a faster rate with the landfill reaching full capacity approximately 1 year earlier than current projections. The NRC staff's projections supporting these conclusions are detailed in the following paragraphs.

The NRC staff's landfill capacity analysis calculated the total disposal demand from mid-year 2012 through the end of the proposed decommissioning period and compared it with the reported remaining landfill capacity as of mid-year 2012. NRC staff used this comparison of projected demand and capacity to evaluate whether sufficient capacity will be available to dispose of the additional waste from the proposed Dewey-Burdock ISR Project. The total disposal demand of 150,730 t [166,152 T] was based on the sum of the regional disposal demand[8] and the project disposal demand[9] from mid-2012 through the end of the proposed decommissioning period in 2028. The projected demand exceeds the available capacity of 139,619 t [154,000 T][10] by 11,024 t [12,152 T].[11]

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[8]The regional demand of 134,717 t [148,500 T] was calculated based on the product of the annual average disposal volume received by the Custer-Fall River landfill of 8,160 t/yr [9,000 T/yr] (SEIS Section 3.13.2) and 16.5 (the number of years from mid-2012 to the end of proposed decommissioning in 2028).
[9]The project demand (i.e., total nonhazardous solid waste volume from decommissioning) of 16,003 t [17,652 T] is the volume of this waste from SEIS Section 2.1.1.1.6.3 converted to mass using 1.08T/yd^3 as a multiplier.
[10]The available landfill capacity reported in SEIS Section 3.13.2 as of the end of June 2012 is 139,619 t [154,000 T].
[11]The available capacity of 139,619 t [154,000 T] was subtracted from the total disposal demand of 150,730 t [166,152 T] (the sum of footnotes 8 and 9) to obtain the result of 11,024 t [12,152 T].

The staff also evaluated the difference in the projected time the landfill will reach full capacity with and without disposal of waste from the proposed Dewey-Burdock ISR Project. The purpose of this analysis was to evaluate the impact of the additional disposal demand on the projected operational life of the landfill. The NRC staff calculated when the landfill will reach full capacity with the additional disposal of proposed project waste by first calculating the available landfill capacity at the end of 2027 after 1 year of decommissioning waste disposal and 15.5 years of post mid-2012 regional waste disposal.[12] Next, the NRC staff derived a combined monthly disposal demand[13] for year 2028 from the projected disposal rates for decommissioning waste and regional waste. At the combined monthly disposal demand the projected year 2028 remaining capacity of 5,147 t [5,674 T] will be depleted within the first half of 2028.[14] For comparison, the projected operational life of the landfill without disposal of waste from the proposed action (SEIS Section 3.13.2) is 17 years beyond mid-2012 or mid-year 2029. Therefore, the analysis suggests disposal of waste from the proposed Dewey-Burdock ISR Project will cause the Custer-Fall River landfill to reach full capacity 1 year earlier than expected if the proposed decommissioning was executed on schedule and regional disposal demand continued at the current rate.

The potential for future expansion of capacity is being considered at both landfills (AET, Inc., 2011; SDDENR, 2010); however, specific long term actions remain uncertain. If one of these landfills does not expand capacity in the future, the applicant will have to dispose of waste elsewhere. Another more distant and higher capacity landfill serving Rapid City is projected to be operational until 2050 (HDR Engineering Inc., 2010). Therefore, the staff consider regional capacity will be available during the period of decommissioning if local capacity is limited or otherwise unavailable.

Based on the preceding capacity analysis, the NRC staff conclude that the potential impacts on waste management resources will vary depending on the long-term status of the existing local landfill resources. If local landfill capacity is not expanded prior to the proposed decommissioning period, the NRC staff conclude that there will be no impacts to the Newcastle landfill because it will not be open to accept waste at the planned time of decommissioning and the proposed Dewey-Burdock IRS Project will not be able to dispose waste at that location. In turn, impacts to the Custer-Fall River landfill will be MODERATE because the increased demand for capacity will more rapidly consume the waste management resources during the last years of its projected operational life. Any waste disposed at the Rapid City landfill will have SMALL impacts based on the projected operational life and available capacity. Alternatively, if the local landfill capacity is expanded prior to the proposed project decommissioning phase, the

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[12]The calculated available capacity at the beginning of year 2028 is 5,147 t [5,674 T]. This is the result of subtracting the combined disposal demand (from regional and decommissioning wastes) from mid-2012 to year 2027 from the available landfill capacity as of mid-2012 of 139,619 t [154,000 T] (SEIS Section 3.13.2). The combined disposal demand was calculated as the product of the annual average disposal volume received by the Custer-Fall River landfill of 8,160 t/yr [9,000 T/yr] (SEIS Section 3.13.2) and 15.5 (the number of years from mid-2012 to the end of the first year of proposed decommissioning in 2027) added to the volume of nonhazardous decommissioning solid waste for year 2027 of 8,007 t [8,826 T] {half of the 2 year decommissioning total waste volume of 16,003 t [17,652 T]}.

[13]The combined monthly disposal demand for year 2028 of 1,348 t/month [1,486 T/month] is the sum of derived monthly disposal demands (i.e., waste generation rates) for proposed decommissioning and regional waste. Specifically, the derived monthly proposed decommissioning disposal demand is the total amount of proposed decommissioning waste of 16,003 t [17,652 T] for 2 years converted to a monthly rate of 667 t/month [736 T/month]. Similarly, the derived monthly regional disposal demand is the Custer-Fall River landfill annual average disposal amount of 8,160 t/yr [9,000 T/yr] converted to a monthly rate of 680t/month [750 T/month].

[14]The time to reach full capacity of 3.8 months was calculated as the ratio of the available year 2028 capacity of 5,147 t [5,674 T] from footnote 10 and the combined monthly disposal demand of 1,348 t/month [1,486 T/month] from footnote 11.

impacts on the available capacity of the expanded landfill (Newcastle or Custer-Fall River) will be SMALL.

The applicant estimates the volume of hazardous waste generated from decommissioning activities will be less than 91 kg [200 lb] (Powertech, 2009b). The hazardous waste streams from decommissioning will be similar to the waste streams generated during the ISR construction phase and could include used oil, batteries, and cleaning solvents. The applicant will have in place a hazardous material program that complies with applicable EPA and SDDENR requirements for its handling, storage, and disposal at approved facilities. Because the volume of hazardous wastes generated by the proposed action will be small and the waste will be handled, stored, and disposed of in accordance with applicable regulations; the NRC staff conclude the impacts on waste management will be SMALL.

In summary, NRC staff conclude the impacts to waste management resources during the decommissioning phase of the proposed project for the land application liquid waste disposal option will be SMALL for all materials except nonhazardous solid waste, which will be SMALL to MODERATE depending on the long-term status of the existing local landfill resources. Based on the type and quantity of waste expected to be generated and the available capacity for disposal, waste management actions during the decommissioning phase will have a SMALL impact on waste management resources for byproduct material and hazardous waste and a SMALL to MODERATE impact for nonhazardous solid waste.

4.14.1.3 Disposal Via Combination of Class V Injection and Land Application

If a permit for Class V injection wells is obtained from EPA but the capacity of the wells is insufficient to dispose of all liquid wastes generated at the proposed Dewey-Burdock ISR Project, the applicant has proposed to dispose of liquid waste by a combination of deep well disposal using Class V injection wells and land application (see SEIS Section 2.1.1.1.2.4.3). For the combined deep Class V injection well and land application disposal option, land application facilities and infrastructure will be constructed, operated, restored, and decommissioned on an as-needed basis depending on the deep Class V injection well disposal capacity (Powertech, 2011). The land application option will require the construction and operation of irrigation areas and increased pond capacity for storage of liquid wastes during nonirrigation periods (see SEIS Section 2.1.1.1.2.4.2), whereas the deep Class V injection well disposal option will require the construction and operation of four to eight deep disposal wells (see SEIS Section 2.1.1.1.2.4.1).

The relative volumes of byproduct material generated by the two disposal options differ during operations, aquifer restoration, and decommissioning phases with the land application option generating the larger amount of material for offsite disposal in each phase. The relative volumes of nonhazardous solid waste generated by the two disposal options differ during the decommissioning phase. The significance of these differences with regard to environmental impacts is low and does not change the impact conclusions for each disposal option. Therefore, the environmental impacts on waste management resources associated with the land application option will be the same for the deep Class V injection well disposal option for all phases of the ISR process. Furthermore, only a portion of land application facilities and infrastructure (e.g., irrigation areas and storage ponds) will be constructed, operated, and decommissioned for the combined disposal option. Therefore, the significance of environmental impacts on waste management resources for the combined disposal option will be less than for the land application option alone. Based on this reasoning, NRC staff conclude that the environmental impacts on waste management of the combined deep Class V injection well and land application disposal option for each phase of the proposed Dewey-Burdock ISR Project will be bounded by the significance of environmental land use impacts of the deep Class V injection well disposal option and the land application disposal option as summarized in Table 4.14-1.

4.14.1.4 Alternative Wastewater Disposal Options

If the applicant does not obtain a UIC Class V injection well permit or the necessary permits for land application, it will have to identify another wastewater disposal option. This section evaluates the environmental impacts from implementing the alternate wastewater disposal options identified in SEIS Section 2.1.1.2, namely evaporation ponds and surface water discharge. These alternative wastewater disposal options will involve treatment of the wastewater resulting in the generation of solid waste, which also must be managed.

In the alternative wastewater disposal options considered in the following sections, the footprint of the disposal system would be similar to or increase as compared to disposal via a UIC Class V injection well (the applicant's preferred waste disposal option) (SEIS Section 4.14.1.1) and be similar to or decrease as compared to the applicant's land application option or combination of both. Increasing the size of the proposed facility would lead to more land disturbance and a heavier use of construction equipment, with an anticipated increase in potential impacts to resource areas, such as ecological and wetland systems, cultural and historical resources, and nonradiological air quality. The applicant would have to amend its license application to select one of these alternative wastewater disposal options. NRC staff would perform an additional environmental and safety review before deciding whether to grant or deny the license amendment request for the new wastewater disposal option. The applicant would survey the areas to be affected prior to construction, and the applicant and NRC staff would consult with agencies such as the SD SHPO, SDGFP, and FWS, as appropriate. Mitigation measures, such as avoidance of sensitive areas or documentation of cultural resources, would be discussed and implemented, as appropriate, as part of these consultations. If mitigation measures were implemented, the estimated impacts would be SMALL.

Table 4.14-1. Significance of Environmental Impacts on Liquid Waste Management for the Proposed Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

	Class V Injection Wells	Land Application	Combined Class V Injection Wells and Land Application*
Construction	SMALL	SMALL	SMALL
Operations	SMALL	SMALL	SMALL
Aquifer Restoration	SMALL	SMALL	SMALL
Decommissioning	SMALL, MODERATE depending on future status of local landfills	SMALL, MODERATE depending on future status of local landfills	SMALL, MODERATE depending on future status of local landfills

*Significance of environmental impact for the combined disposal option is bounded by the significance of environmental impacts for the deep Class V injection well disposal and land application disposal options.

4.14.1.4.1 Evaporation Ponds

The types of waste streams and the infrastructure necessary for the use of evaporation ponds as a wastewater disposal option are described in SEIS Section 2.1.1.2.1. The type and volume of wastewater that would be disposed in an evaporation pond would be the same as described in SEIS Section 4.14.1.1 for disposal by injection into a deep Class V UIC well. Before the applicant could begin disposing wastewater into an evaporation pond system, the NRC staff would review the design and construction of the ponds and monitoring system against the criteria in 10 CFR Part 40, Appendix A (NRC, 2003b, 2008), taking into consideration EPA criteria in 40 CFR Part 61, Subpart W. The applicant would be required to demonstrate that the evaporation ponds could be designed, operated, and decommissioned to prevent migration of wastewater to subsurface soil, surface water, or groundwater. The applicant would also be required to demonstrate that monitoring requirements would be established to detect migration of contaminants to groundwater. The NRC staff would establish needed license conditions to ensure that the applicant met the necessary requirements.

Individual evaporation ponds could have a surface area of up to 2.5 ha [6.25 ac], and the total pond system could be as much as 40 ha [100 ac]. During the ISR operations period for the proposed Dewey-Burdock ISR Project, this area would be fenced to exclude wildlife and livestock. A 40-ha [100-ac] footprint would be less than about 1 percent of the total permitted area {4,282 ha [10,580 ac]} for the proposed Dewey-Burdock ISR Project (including both the Dewey and Burdock sites), but it would be much larger than the footprint for a central processing plant without evaporation ponds (Powertech, 2009b). The additional land disturbance required to install an evaporation pond system for wastewater disposal would be similar in scale to the current proposed action for the land application option {55 ha [136 ac]} for the proposed Dewey-Burdock ISR Project. It is also anticipated that the applicant would need to have at least one other wastewater disposal option or additional storage capacity during the winter months in South Dakota because of the low evaporation rates during that season.

Although a wastewater disposal option that uses an evaporation pond system would roughly double the facility footprint relative to UIC Class V injection wells, the total amount of disturbed and fenced land would be small compared to the permitted area and comparable to the generic conditions evaluated in the GEIS with respect to land use. For these reasons, the overall impact on land use associated with an evaporation pond system would be SMALL.

Construction of an evaporation pond system would require earthmoving equipment, such as bulldozers, backhoes, and trucks, to prepare the site and construct the impoundment. The equipment would produce diesel emissions and fugitive dust emissions during construction that could have a temporary effect on nonradiological air quality. Depending on how the applicant elected to phase in the pond system, these effects could extend into the operational phase of the facility as well. BMPs, such as wetting unpaved roads, would minimize fugitive dust, and the anticipated impacts to nonradiological air quality would be SMALL. The applicant may also need to obtain a National Emission Standards for Hazardous Air Pollutants (NESHAP) review to evaluate whether the anticipated radiological releases to air from the evaporation ponds would meet the criteria in 40 CFR Part 61, Subpart W. The applicant would also be required to have an NRC-approved air monitoring system for the wastewater disposal system. Keeping the pond wet to reduce dust and radon emissions would effectively reduce potential air emissions, and the estimated impacts on radiological air quality would be SMALL.

Evaporation ponds designed and constructed following NRC guidance (NRC, 2008) would utilize clay or geotextile liners to reduce the potential for infiltration into the subsurface. An NRC-approved monitoring system would be installed to detect leaks from the ponds, and the applicant also implement an NRC-approved inspection plan for the ponds (NRC, 2008). Based on these measures, the estimated impacts on surface water and groundwater resources would be SMALL.

The evaporation ponds would be constructed at the same time and with the same mitigation measures described in SEIS Section 4.6 (Ecological Resources) for the construction of the rest of the facility. For these reasons, the estimated impact on ecological resources from an evaporation pond disposal system would be the same as identified in SEIS Section 4.6 and could be reduced to SMALL.

At the end of the operational phase of the facility, all of the pond liners and berms, as well as accumulated precipitates and sludges, would be classified as solid byproduct material. For example, the GEIS indicates that about 52 m^3 [68 yd^3] of byproduct material would be generated during evaporation pond decommissioning. These solids would need to be transported to a licensed facility for disposal as part of the decommissioning program. This would increase the total amount of decommissioning byproduct material, increasing the number of truck trips needed to transport the materials to a disposal facility. Given the potential limitations on available byproduct waste disposal capacity, it is anticipated that the impacts from an evaporation pond wastewater disposal system to waste management would be SMALL to MODERATE during the decommissioning phase of the facility. Note that at the conclusion of operations, the licensee would be required to provide a decommissioning plan for NRC review that demonstrates it has a disposal path for any decommissioning wastes, including those related to the wastewater disposal system. The NRC staff would conduct detailed technical and environmental reviews of the proposed decommissioning program for the facility at that time.

4.14.1.4.2 Surface Water Discharge

For surface discharge of wastewater, the applicant would be required to meet the release standards in 10 CFR Part 20, Subparts D and K and Appendix B. The applicant would also be required to obtain a zero-release surface water discharge permit from SDDENR. In accordance with EPA regulations, the applicant would not be allowed to discharge process wastewater to navigable waters of the United States (NRC, 2003b). The applicant would need to develop storage capabilities prior to treatment to 10 CFR Part 20 standards. In addition, the applicant would need to characterize and remediate any residual radioactivity at the discharge point or from storage facilities (tanks, impoundments), radium settling basins, and related liners and sludges above NRC limits as part of the decommissioning of the facility (NRC, 2003b; Sanford Cohen and Associates, 2008).

Establishing the discharge point for the treated effluent would likely require short-term use of earthmoving equipment to install pipelines, small berms, access roads, and fencing to exclude livestock and wildlife. The amount of land to be fenced for the discharge point alone would be limited (see SEIS Section 2.1.1.2.2), and the estimated impact on land use would likely be SMALL. As is the case with both land application and a deep Class V disposal well, the wastewater would likely require treatment to meet state surface water discharge zero-release permit requirements, including treatment facilities to provide an ion-exchange circuit, reverse osmosis, one or more radium settling basins {0.1 to 1.6 ha [0.25 to 4 ac]}, or purge storage reservoirs {4 ha [10 ac] or more}. These treatment facilities would also be fenced to exclude wildlife and livestock and limit public access. The amount of land needed for the wastewater treatment facilities would be similar to that for land application and deep Class V disposal wells. As with evaporation ponds, land application, and Class V disposal wells, the increased footprint for the additional wastewater treatment facilities needed to meet state surface water discharge requirements would be small relative to the entire permitted area {4,282 ha [10,580 ac]}, but large relative to the central processing plant as described for the proposed action (SEIS Section 4.2.1) (Powertech, 2009b). The proposed action would further disturb about 98 ha [243 ac] of previously disturbed land under the deep well disposal option and about 566 ha [1,398 ac] of previously disturbed land under the land application option or a combination of both for the proposed Dewey-Burdock Project. Overall, the increase in the disturbed area to accommodate the addition of a wastewater treatment facility would be about 1 to 4 percent and would have a SMALL impact on land use.

Constructing the wastewater treatment facilities (e.g., radium settling basins) would require earthmoving equipment, such as bulldozers, backhoes, and trucks, to prepare the site and construct the impoundment(s). This would be similar to the proposed action (both deep Class V disposal well and land application options) because wastewater treatment facilities are included in the proposed plans for the Dewey-Burdock Project. The equipment would produce diesel emissions and fugitive dust emissions during construction that could temporarily affect nonradiological air quality. BMPs, such as wetting unpaved roads, would reduce fugitive dust emissions. Taking into consideration the likely short-term duration of the construction period, the anticipated impacts to nonradiological air quality would be SMALL. The applicant may also need to consider emissions of radionuclides such as radon from the surface discharge points. Because the SDDENR permit would require the applicant to monitor and maintain low radionuclide concentrations for the treated wastewater, the estimated impacts on radiological air quality would be SMALL.

The proposed Dewey satellite facility and wellfields would be developed in the Beaver Creek drainage basin, while the Burdock central processing facility and wellfields would be developed within the Pass Creek drainage (SEIS Section 3.5.1). Beaver Creek is a perennial drainage with periods of low flow, but a surface water discharge option would increase water flow and result in the development of aquatic habitat. Pass Creek is intermittent, and surface discharge could result in increased erosion and suspended sediments in the existing stream channel. Sediment loads would likely taper off quickly both in time and distance; therefore, the long-term impact would be SMALL.

As noted previously, the applicant would not be allowed to discharge treated wastewater into navigable waters of the United States. A recent wetlands delineation survey identified four potential jurisdictional wetlands in the Dewey-Burdock ISR Project (SEIS Section 3.5.1 and Figure 4.5-1). These jurisdictional wetlands include Beaver and Pass Creeks and two tributaries. A Nationwide Permit 44 under Section 404 of the Clean Water Act would be required for discharges of dredged or fill material into a wetland or WUS exceeding 0.2 ha [0.5 ac]. The NRC staff assume that, if the applicant pursued surface discharge of treated effluent, the proposed Dewey-Burdock ISR Project would avoid surface discharge points that might disturb any of these wetlands areas, and potential impacts to these wetlands from surface discharge of treated wastewater would be SMALL.

The applicant would be required to demonstrate that any soil affected by the surface discharge of treated wastewater would meet 10 CFR Part 20 requirements. In addition, during operations the applicant would be required to routinely monitor the soils and discharged water to ensure predicted concentrations were not exceeded. For these reasons, it is not anticipated that decommissioning the surface discharge point would produce additional solid byproduct material for disposal. As with the land application wastewater disposal option, however, decommissioning wastewater treatment facilities may produce solid byproduct material, such as spent resins, sludges, and liners from radium settling basin(s), or contaminated building debris. These solids would need to be transported to a licensed facility for disposal as part of the decommissioning program. This would increase the total amount of decommissioning byproduct materials, increasing the number of truck trips needed to transport the materials to a disposal facility. Given the potential limitations on available byproduct material disposal capacity, it is anticipated that the potential impacts on waste management from decommissioning the radium settling basin(s) and other storage facilities associated with treating wastewater for surface water discharge would range from SMALL to MODERATE.

Note that at the conclusion of operations, the licensee would be required to provide a detailed decommissioning plan for NRC review. The decommissioning plan would include final radiological surveys to identify whether there were any areas of soil contamination that would require disposal as byproduct material. The NRC staff would conduct detailed technical and environmental reviews of the proposed decommissioning program for the facility at that time. Topsoil that was removed and stored during construction would be reapplied during land reclamation. Final revegetation of the project area would involve seeding the area with a seed mixture approved by SDDENR, the local conservation district, BLM, and landowners. SDDENR would determine when final revegetation is complete and when the conditions for bond release have been met.

4.14.2 No-Action (Alternative 2)

Under the No-Action alternative, there will be no waste generated from the proposed action. There will be neither deep Class V well injection nor land application of liquid wastes and no disposal of byproduct material, hazardous wastes, or nonhazardous solid wastes. Therefore, there will be no impact on waste management from implementing this alternative.

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5 CUMULATIVE IMPACTS

5.1 Introduction

The Council on Environmental Quality (CEQ) regulations implementing the procedural provisions of the National Environmental Policy Act of 1969, as amended (NEPA) are found in 40 CFR Parts 1500–1508. Cumulative effects are defined in 40 CFR 1508.7 as

> “the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions.”

Cumulative effects or impacts[1] can result from individually minor but collectively significant actions taking place over a period of time. This Supplemental Environmental Impact Statement (SEIS) considers the cumulative impacts of past, present, and future actions in the proposed project area. These actions include oil and gas production; coal mining and coal bed methane operations; gold, sand, gravel, and limestone mining; *in-situ* uranium recovery (ISR) operations; conventional uranium mining; wind farms; transportation projects, and livestock grazing.

The identification of cumulative impacts of the proposed action resulted from an analysis of an extensive body of publicly available information on ongoing and proposed federal projects, information presented in the Generic Environmental Impact Statement (GEIS) (NRC, 2009a), and review of the literature of the environmental and socio-economic conditions in South Dakota and in the nearby communities.

A number of uranium exploration and oil and gas operations are underway within 16 km [10 mi] of the proposed Dewey-Burdock ISR Project. Several ISR uranium projects within the broader region of the proposed Dewey-Burdock ISR Project are in the operation, licensing, or prelicensing stages. Oil and gas operations are underway throughout the area. There is potential for wind energy generation within and in the vicinity of the proposed project area. The U.S. Nuclear Regulatory Commission (NRC) anticipates growth in extraction of coal, coal bed methane, and limestone, as well as government support for and industry interest in developing transmission and transportation infrastructure at distances beyond 16 km [10 mi] from the Dewey-Burdock site.

The GEIS (NRC, 2009a) provides a methodology for conducting a cumulative impacts assessment following CEQ guidance (CEQ, 1997). SEIS Section 5.1.1 describes past, present, and reasonably foreseeable future actions identified and analyzed in the cumulative impacts analysis. The methodology NRC staff used in conducting the cumulative impact analysis in this SEIS is described in Section 5.1.2.

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[1] In this SEIS, “cumulative impacts” is deemed synonymous with “cumulative effects.”

5.1.1 Other Past, Present, and Reasonably Foreseeable Future Actions

The proposed Dewey-Burdock ISR Project is located within the Nebraska-South Dakota-Wyoming Uranium Milling Region defined in the GEIS (NRC, 2009a). This region encompasses parts of Sioux and Dawes Counties in Nebraska; Fall River, Custer, Pennington, and Lawrence Counties in South Dakota; and Niobrara, Weston, and Crook Counties in Wyoming (Figure 5.1-1). The Nebraska-South Dakota-Wyoming Uranium Milling Region holds significant reserves of uranium and has a history of conventional uranium surface mining (NRC, 2009a). Other natural resources that are currently being exploited within the milling region and in surrounding counties include oil and gas, wind, coal, coal bed methane, limestone, and gold. Federal agencies have completed several environmental impact statements (EISs) related to activities within the Nebraska-South Dakota-Wyoming Uranium Milling Region. Most of these EISs are related to resource management actions on federal lands administered by the U.S. Forest Service (USFS) or U.S. Bureau of Land Management (BLM) and are focused on improving natural resources conditions and reducing adverse impacts from various human-related activities.

The various past, present, and reasonably foreseeable future actions in the vicinity of the proposed Dewey-Burdock ISR Project are discussed next.

5.1.1.1 Uranium Recovery Sites

Existing and potential uranium milling operations within the Nebraska-South Dakota-Wyoming Uranium Milling Region exist in the Crow Butte Uranium District located in northwestern Nebraska, in the Southern Black Hills Uranium District in southwestern South Dakota and east-central Wyoming, and in the Northern Black Hills Uranium District in northeastern Wyoming (Figure 5.1-2). Existing and potential uranium recovery sites in the Nebraska-South Dakota-Wyoming Uranium Milling Region are listed in Table 5.1-1.

Seven existing and potential ISR facilities and one uranium recovery and mill tailings facility licensed under Uranium Mill Tailings Radiation Control Act (UMTRCA) Title II are in the region. The only operating ISR facility is at Crow Butte in Dawes County, Nebraska, approximately 105 km [65 mi] south-southeast of the proposed Dewey-Burdock ISR Project. Three satellite facilities or ISR expansions are planned for the Crow Butte site: North Trend, Three Crow, and Marsland. License applications for North Trend and Marsland were submitted to NRC in June 2007 and May 2012, respectively, and are under review. A license application for Three Crow was submitted in August 2010 and withdrawn and has not yet been resubmitted.

In addition to the proposed Dewey-Burdock ISR Project, the applicant has identified other potential uranium orebodies in the region at Dewey Terrace in Niobrara and Weston Counties, Wyoming, and at Aladdin in Crook County, Wyoming (Powertech, 2009b). Dewey Terrace is just west of the proposed Dewey-Burdock ISR Project in Weston and Niobrara Counties, Wyoming (Figure 5.1-3). The uranium orebodies at Dewey Terrace are a continuation of the mapped orebodies at the Dewey-Burdock site (Powertech, 2009b). To date, the applicant has not submitted a letter of intent to NRC for either Dewey Terrace or Aladdin. NRC therefore has no specific information that the applicant plans to go forward with these projects. It is also uncertain whether, if either project went forward, the applicant would seek to operate these projects as satellite facilities and ship uranium-loaded resins from Dewey Terrace or Aladdin to the proposed Dewey-Burdock site for processing into yellowcake. NRC staff and other local

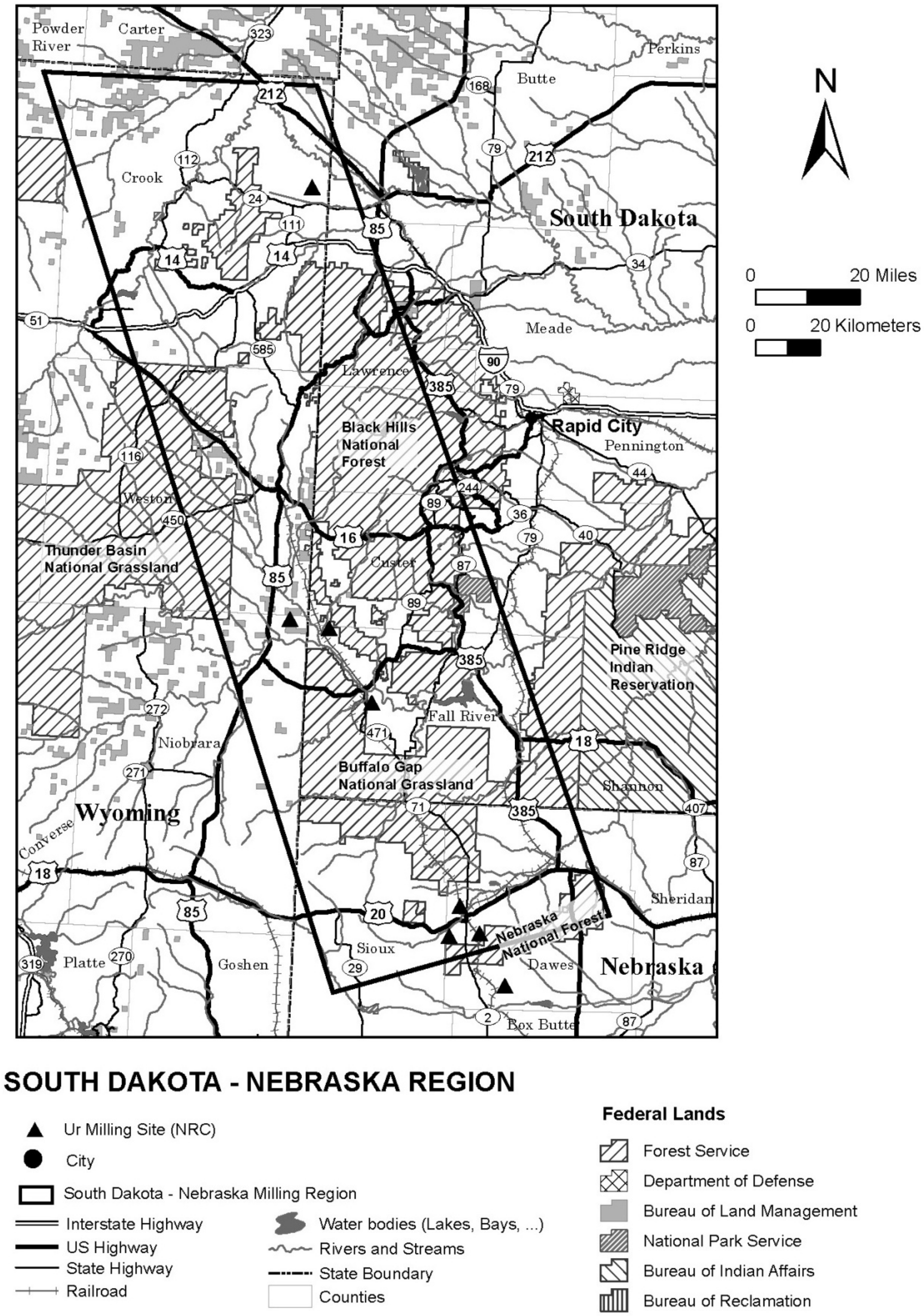

Figure 5.1-1. Nebraska-South Dakota-Wyoming Uranium Milling Region General Map With Current (Crow Butte, Nebraska) and Potential Future Uranium Milling Site Locations
Source: Modified From NRC (2009a)

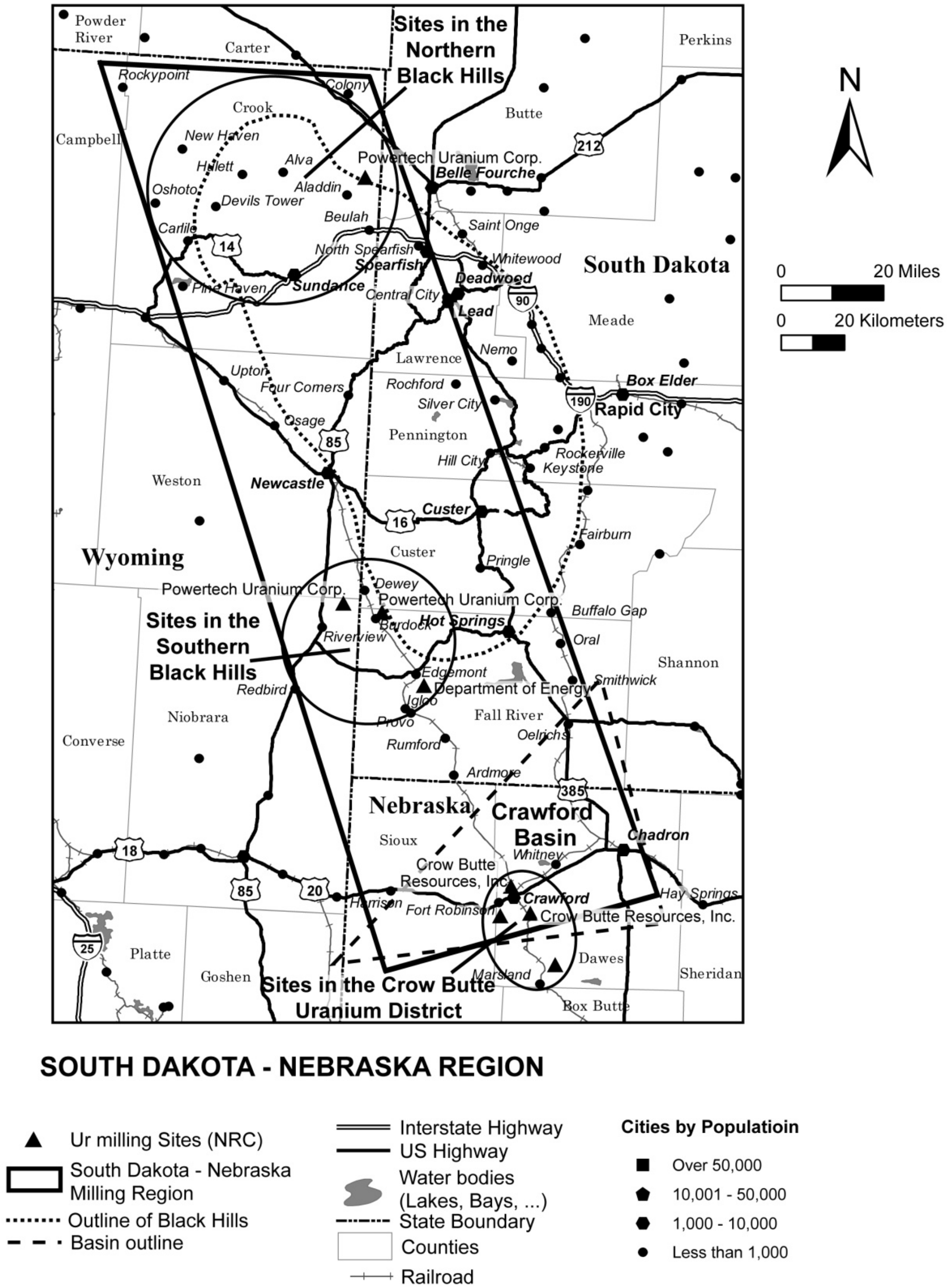

Figure 5.1-2. Map Showing the Nebraska-South Dakota-Wyoming Uranium Milling Region and Existing and Potential Uranium Milling Sites in the Black Hills Uranium Districts in South Dakota and Wyoming and in the Crow Butte Uranium District in Nebraska
Source: Modified From NRC (2009a)

Table 5.1-1. Past, Existing, and Potential Uranium Recovery Sites in the Nebraska-South Dakota-Wyoming Uranium Milling Region*

Site Name	Company/ Owner	Type	County, State	Status†	Approximate Distance km [mi]	Direction
North Trend	Cameco (Crow Butte Resources, Inc.)	*In-situ* uranium recovery (ISR)—Expansion	Dawes County, Nebraska	Potential site—license application received June 2007 (under NRC review)	95 [59]	SSE
Three Crow	Cameco (Crow Butte Resources, Inc.)	ISR—Expansion	Dawes County, Nebraska	Potential site	101 [63]	SSE
Marsland	Cameco (Crow Butte Resources, Inc.)	ISR—Expansion	Dawes County, Nebraska	Potential site	129 [80]	SSE
Crow Butte	Cameco (Crow Butte Resources, Inc.)	ISR—Commercial scale	Dawes County, Nebraska	Operating	105 [65]	SSE
Edgemont	U.S. Department of Energy (DOE)	Conventional uranium mill	Fall River, South Dakota	UMTRCA† Title II disposal site	26 [16]	SSE
Dewey-Burdock	Powertech (USA) Inc.	ISR—Commercial scale	Fall River and Custer, South Dakota	Potential site—license application submitted to NRC in August, 2009	0	—
Dewey Terrace	Powertech (USA) Inc.	ISR—Expansion	Niobrara, Wyoming	Potential site	13 [8]	WNW
Aladdin	Powertech (USA) Inc.	ISR—Expansion	Crook, Wyoming	Potential site	137 [85]	NNW

*Sources: NRC (2009a, 2012); Powertech (2009b)
†Status: Uranium Mill Tailings Radiation Control Act Title II sites are uranium mill processing or tailings sites that have been decommissioned. The DOE is the long-term custodian of these sites.

government agencies will monitor these potential projects, which will be discussed within the context of cumulative impacts in this SEIS based on the available information. The proposed Dewey-Burdock ISR Project is located within the Edgemont Uranium District on the southwestern flank of the Black Hills uplift. Uranium in the Edgemont Uranium District was first discovered in 1951 and mined until 1972. The district derived its name from the town of Edgemont, South Dakota, which was the closest population center to the district. Uranium was extracted from small conventional underground and surface mines in sandstone deposits within

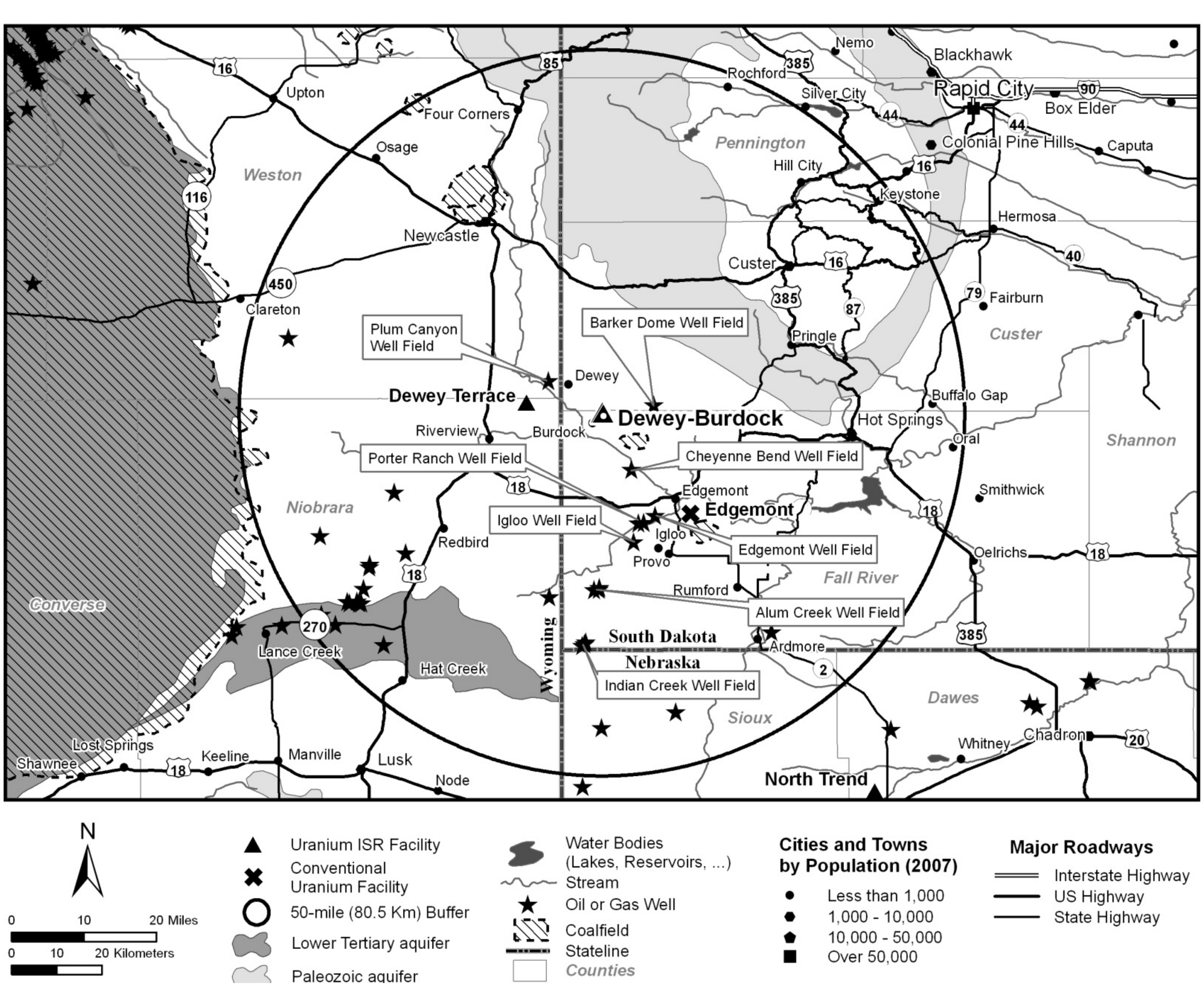

Figure 5.1-3. Oilfields, Coalfields, and Uranium Occurrences Near the Proposed Dewey-Burdock *In-Situ* Recovery Project
Sources: ESRI (2008); National Atlas of the United States (2009); WYOGCC (2012); NOGCC

the Inyan Kara Group. The uranium ore was shipped to conventional mills for processing. The only uranium mill built in South Dakota was at Edgemont. The Edgemont uranium mill processed 1.78 million metric tons [1.98 million short tons] of ore and produced 3.11 million kg [6.86 million lb] of uranium oxide as U_3O_8 before it ceased production in 1974 (SDDENR, 2010). Approximately half the ore {0.9 million metric tons [1.0 million short tons] of ore containing about 1.45 million kg [3.2 million lb] of U_3O_8} processed at Edgemont was produced from deposits in South Dakota, and the other half came from out of state.

Most of the historic uranium mining operations within the Edgemont Uranium District were abandoned prior to the 1970s because they became uneconomical. Abandoned open pits and overburden piles associated with historic surface mining occur in the eastern portion of the proposed Dewey-Burdock ISR Project site (see Figure 3.2-3). Many of the abandoned mine sites in the Edgemont Uranium District are on USFS-managed property. In recent years USFS has reclaimed several abandoned mines in Fall River County, such as the Blue Lagoon, Gladiator, and Dead Horse mines (SDDENR, 2010).

The Tennessee Valley Authority (TVA) reclaimed the uranium mill at Edgemont from 1986 to 1989. The areas excavated during cleanup of the mill site at Edgemont were backfilled with clean soil, graded for proper drainage, and revegetated (SDDENR, 2010). Contaminated uranium mill buildings, tailings sands and slimes, and contaminated soil from the mill site and nearby areas were removed and placed in an engineered disposal site southeast of Edgemont (Figure 5.1-3) (SDDENR, 2010). The Edgemont disposal site is an UMTRCA Title II site owned and administered by U.S. Department of Energy (DOE) under a general NRC license for the custody and long-term care of uranium pursuant to 10 CFR Part 40.28.

Silver King Mines, Inc. (as Darrow Lease operator and manager for TVA) drilled approximately 4,000 exploration holes in the Dewey-Burdock area during the mid-1970s. TVA's uranium exploration activities in the Dewey-Burdock area ended in the early 1980s and did not result in conventional uranium mining or ISR uranium extraction (Powertech, 2009a).

5.1.1.2 Coal Mining

As discussed in GEIS Section 5.3.3, active or former coal mines have not been identified in the Nebraska-South Dakota-Wyoming Uranium Milling Region (NRC, 2009a). Based on information exchanged with BLM staff during a site visit to the project area in December 2009, past resource development in the region included exploitation of small bituminous coal deposits located east and south of the proposed Dewey-Burdock ISR Project site (NRC, 2009b). This information is consistent with isolated mapped coal fields located approximately 3 km [2 mi] southeast of the proposed project and approximately 6 km [4 mi] southeast of Edgemont (Figure 5.1-3).

Unlike the sedimentary formations that host commercially extractable coal deposits in the Powder River Basin in Campbell and Converse Counties, Wyoming (i.e., the Wasatch and Fort Union Formations), the sedimentary formations beneath the counties comprising the Nebraska-South Dakota-Wyoming Uranium Milling Region do not contain thick, continuous coal beds (NRC, 2009a). SEIS Section 3.4.1 describes the lithology of sedimentary formations beneath the proposed Dewey-Burdock ISR Project area as unable to support large-scale commercial coal mining.

5.1.1.3 Oil and Gas Production

Regional oil and gas exploration, production, and pipeline construction could potentially generate cumulative impacts. Coal bed methane gas extraction removes natural gas from coal beds. This form of mining is common in the Powder River Basin located 80 km [50 mi] west of the proposed Dewey-Burdock ISR Project (see Figure 5.1-3). Because the Nebraska-South Dakota-Wyoming Uranium Milling Region does not contain commercially viable coal beds, no ongoing or planned coal bed methane production occurs within an 80-km [50-mi] radius of the proposed site (Figure 5.1-3).

The status of permitted oil and gas wells in Fall River and Custer Counties in South Dakota and Niobrara and Weston Counties in Wyoming is provided in Table 5.1-2. In Fall River County, 11 oil wells are actively producing (SDDENR, 2012a). One producing oil well, one underground injection control (UIC) permitted well for salt water disposal, and six plugged and abandoned wells are located in the Cheyenne Bend oilfield 11 km [7 mi] southeast of the proposed site (Figure 5.1-3). The 10 remaining oil wells in production are located within the Edgemont, Porter Ranch, Igloo, and Alum Creek oilfields (Figure 5.1-3). The Edgemont, Porter Ranch, and Igloo oilfields are located immediately southwest of the city of Edgemont. The Alum Creek oilfield is located approximately 23 km [14 mi] southwest of Edgemont. All Fall River County producing wells are operating within the Minnelusa Formation at depths ranging from 1,081 m [3,547 ft] at the Alum Creek oilfield to 786 m [2,580 ft] at the Cheyenne Bend oilfield (SDDENR, 2012a).

In Custer County, four oil wells are in active production (SDDENR, 2012a). All four producing wells are located at the Barker Dome oilfield located 6 km [4 mi] east of the proposed site (Figure 5.1-4). The Barker Dome oilfield also contains one UIC permitted well for salt water disposal, one well that has been converted to water supply, and 18 plugged and abandoned wells. Three of the producing oil wells at Barker Dome are located in the Minnelusa Formation at total depths of 423 to 433 m [1,387 to 1,420 ft]. The fourth producing well has a reported total depth of 588 m [1,928 ft] but a completion depth of 415 to 418 m [1,363 to 1.370 ft], which also targets the Minnelusa Formation (SDDENR, 2012a).

Weston and Niobrara Counties in Wyoming contain many more completed oil and gas production wells than Fall River and Custer Counties (Table 5.1-2). The closest producing wells to the proposed project are in the Plum Canyon oilfield 5 km [3 mi] to the northwest in Niobrara County (Figure 5.1-4) (WYOGCC, 2012). The Plum Canyon oilfield contains 4 producing wells, which are all located in the Leo Sandstone of the Minnelusa Formation at depths ranging from approximately 785 to 823 m [2,575 to 2,700 ft]. The total depths of completed wells generally increase from east to west across Weston and Niobrara Counties. For example, within the Powder River Basin, which encompasses the southwestern part of Weston County and the northwestern part of Niobrara County, many completed wells reach total depths of more than 1,981 m [6,500 ft] (WYOGCC, 2012).

Demand for drilling permits for oil and gas exploration in the vicinity of the proposed project has been low. Since 2005, South Dakota Department of Environment and Natural Resources (SDDENR) has issued 16 permits for oil and gas exploration drilling in Fall River County and no permits in Custer County (SDDENR, 2012b).

The potential effects of oil well drilling include the need to build temporary access roads to reach and construct 1.2-ha [3-ac] drill pads for each drill site (BLM, 2009a). The length of time

Table 5.1-2. Status of Permitted Oil and Gas Wells in Fall River and Custer Counties, South Dakota, and Niobrara and Weston Counties, Wyoming

County, State	Number of Plugged and Abandoned Wells	Number of Completed Wells	Number of New Permits to Drill	Permits Issued*
Fall River, South Dakota	342	11	2	396
Custer, South Dakota	72	4	0	86
Niobrara, Wyoming	1,661	383	21	2,281
Weston, Wyoming	5,252	1,568	7	7,317

Sources: SDDENR (2012a); WYOGCC (2012)
*The "Permits Issued" category includes wells currently being drilled, wells never drilled, Underground Injection Control permitted wells, wells converted to water supply, dormant wells, and wells with expired permits

required for drilling varies with the depth of each drillhole. Seven tracts of USFS-managed land are available for oil and gas leasing in Custer County in the vicinity of the project area (BLM, 2009a). All the tracts are located within Township 6 South, Range 1 East immediately east of Dewey (see Figure 3.2-5). Two of the tracts (SDM79010BO and SDM79010BN) border the perimeter of the proposed project (Figure 5.1-4). If lease applications were filed and approved by USFS and if the leaseholders apply for SDDENR drilling permits, it is expected that exploratory drilling for oil would be conducted.

5.1.1.4 Wind Power

Because of the proximity of currently operating wind energy projects, the potential exists for the development of wind power facilities in the Nebraska-South Dakota-Wyoming Uranium Milling Region, and these facilities would contribute to meeting forecasted electric power demands. There are wind energy projects currently operating and under construction in South Dakota, Wyoming, and Nebraska (see Table 5.1-3). South Dakota's wind resource is 882,412 megawatts (MW), which ranks 5th in the United States (AWEA, 2012b). Wyoming's wind resource is 552,073 MW, which ranks 8th in the United States (AWEA, 2012c). Nebraska's wind resource is 917,999 MW, which ranks 4th in the United States (AWEA, 2012a). The current online capacity of wind energy projects is 784 MW in South Dakota, 1,412 MW in Wyoming, and 337 MW in Nebraska (AWEA, 2012a–c).

Wind projects in South Dakota, Wyoming, and Nebraska range in capacity from one turbine producing 0.1 MW to 105 turbines producing 210 MW (AWEA, 2012d). The wind power projects closest to the proposed Dewey-Burdock project site are 161 km [100 mi] to the west-southwest near Glenrock in Converse County, Wyoming. Wind power projects in Wyoming are located primarily in the southeastern part of the state (AWEA, 2012c). In South Dakota, wind power projects are located in the central and eastern parts of the state more than 241 km [150 mi] from the proposed Dewey-Burdock site (AWEA, 2012b). Wind power projects in Nebraska are located primarily in the north-central and eastern parts of the state and are also more than 241 km [150 mi] from the proposed Dewey-Burdock site (AWEA, 2012a).

The Dewey-Burdock Wind Association, LLC is a landowner group formed to explore the possibility of a wind farm (referred to herein as the Dewey-Burdock Wind Project) on privately owned land within and surrounding the proposed Dewey-Burdock ISR Project site (Powertech, 2010). Land designated as having potential for wind power electrical generation is shown in Figure 5.1-4. The Dewey-Burdock Wind Project is in the conceptual phase.

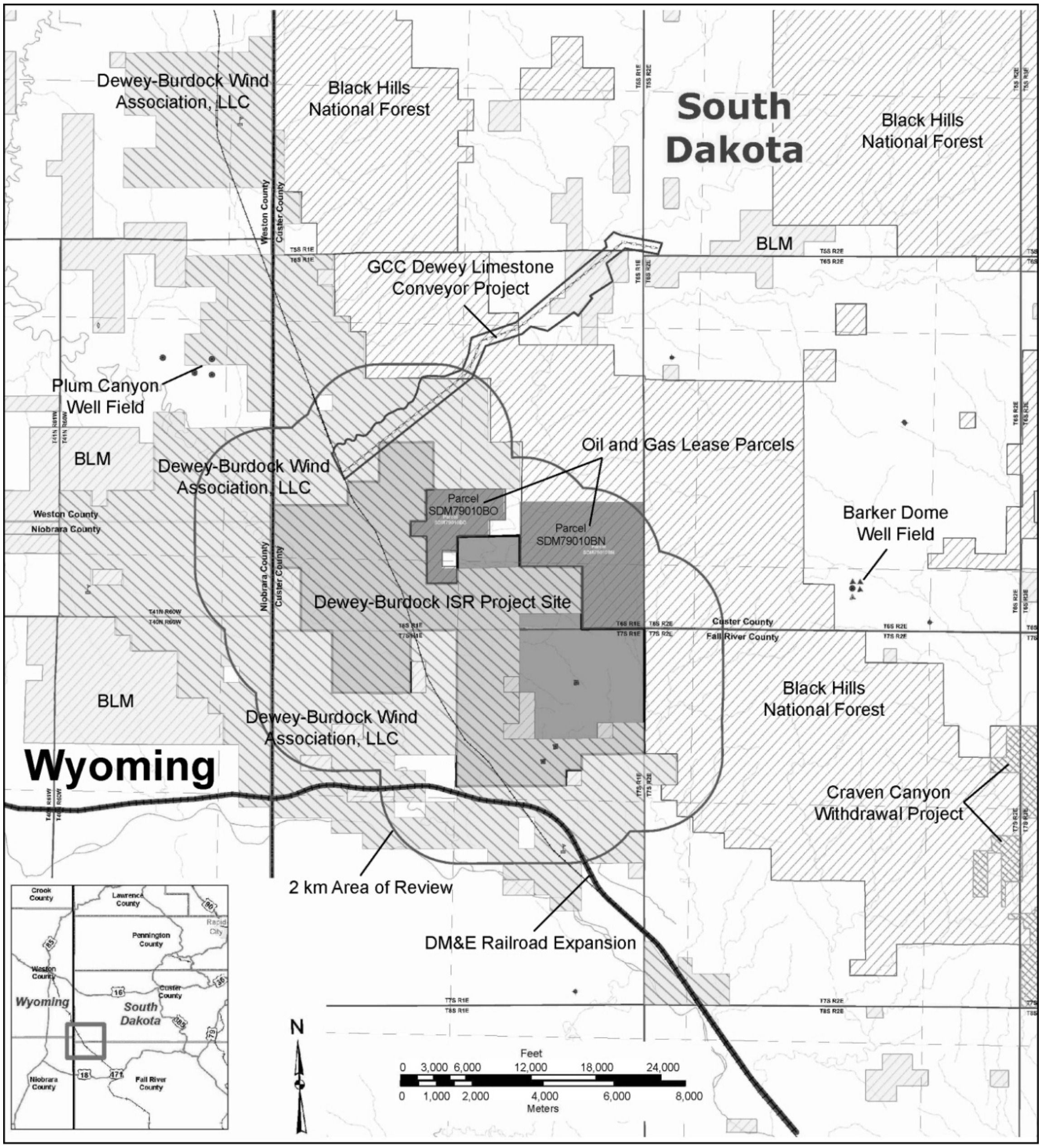

**Figure 5.1-4. Existing, Pending, and Future Projects Within and in the Vicinity of the Proposed Dewey-Burdock *In-Situ* Recovery Project
Source: Modified from Powertech (2010)**

Table 5.1-3. Summary of Wind Energy in South Dakota, Wyoming, and Nebraska

State	Current Online Capacity (MW)	Capacity Added in 2010 (MW)	Wind Resource (MW at 80 m Hub Height)	U.S. Wind Resource Rank
South Dakota	784	396	882,412	5th
Wyoming	1,412	311	552,073	8th
Nebraska	337	60	917,999	4th
Source: AWEA, 2012a–c				

The development of wind energy projects in the Nebraska-South Dakota-Wyoming Uranium Milling Region is limited by availability of transmission lines to end users. Existing transmission capacity for wind-generated power is low, and there are no plans to expand existing or construct new transmission corridors in the Nebraska-South Dakota-Wyoming Uranium Milling Region (AWEA, 2012d).

5.1.1.5 Transportation Projects

Dewey Conveyor Project

In 2007, GCC Dacotah Inc. submitted an Application for Transportation and Utility Systems and Facilities on Federal Lands for the Dewey Conveyor Project. If constructed, the Dewey Conveyor Project will transport limestone mined from the Minnekahta Limestone to a rail load-out facility near Dewey, South Dakota (BLM, 2009a). The conveyor project lies north of the Dewey-Burdock Project area in portions of Township 5 South, Range 1 East, Section 36; Township 6 South, Range 1 East, Sections 1, 2, 9, 10, 11, 12, 15, 16, 17, 18, 19, and 20; and Township 5 South, Range 2 East, Section 31 (Figure 5.1-4). The area proposed for limestone quarrying operations is several kilometers [miles] north, where the Minnekahta Limestone lies at or close to the ground surface (BLM, 2009a). The town of Dewey is located along the existing Burlington Northern Santa Fe (BNSF) Railroad transportation corridor.

The proposed conveyor route crosses BLM-administered public lands, USFS-administered National Forest System land, and GCC Dacotah Inc.'s privately owned land (Figure 5.1-4). The project anticipates construction of an elevated, enclosed conveyor 10.6-km [6.6-mi] in length, a one-lane service road, and access points (BLM, 2009a). The elevated conveyor would be about 5 m [16 ft] high and would provide a minimum vertical clearance of 2 m [6 ft] beneath the structure. Depending on terrain, structural supports would be required at intervals of 7.6 to 12 m [25 to 40 ft]. BLM and USFS will evaluate the application and decide whether to approve it, grant GCC Dacotah Inc. a right-of-way (ROW) to allow the conveyor to cross federal lands, and issue a special use permit. BLM and USFS will decide whether stipulations or mitigation measures must be attached to the ROW grant and special use permit.

Powder River Basin Expansion Project

The Dakota Minnesota and Eastern (DM&E) Railroad filed an application to construct the Powder River Basin (PRB) Expansion Project with the federal Surface Transportation Board (STB) in February 1998. The project seeks approval to construct and operate a new rail line and associated facilities in east-central Wyoming and southwest South Dakota (STB, 2001). If approved and completed, the project will add rail coal-hauling capacity and establish a dedicated, direct route to transport coal from the Powder River Basin to Midwest markets. DM&E's proposed rail expansion will extend DM&E's existing northern line near Wall, South Dakota, southwest to Edgemont, then northwest to Burdock, and finally west into Wyoming. The extension will add 418 km [260 mi] of rail line and connect the northern DM&E line to operating coal mines located south of Gillette, Wyoming (see Figure 5.1-5). The proposed rail expansion route is south of the proposed Dewey-Burdock ISR Project site (see Figure 5.1-4).

At this time, Canadian Pacific—DM&E's parent company—has not yet decided whether to build the extension. The decision to build is contingent on several factors: (i) acquiring the necessary ROW to build the line, (ii) executing agreements with Powder River Basin mining companies for the right of DM&E to operate loading tracks and facilities, (iii) securing

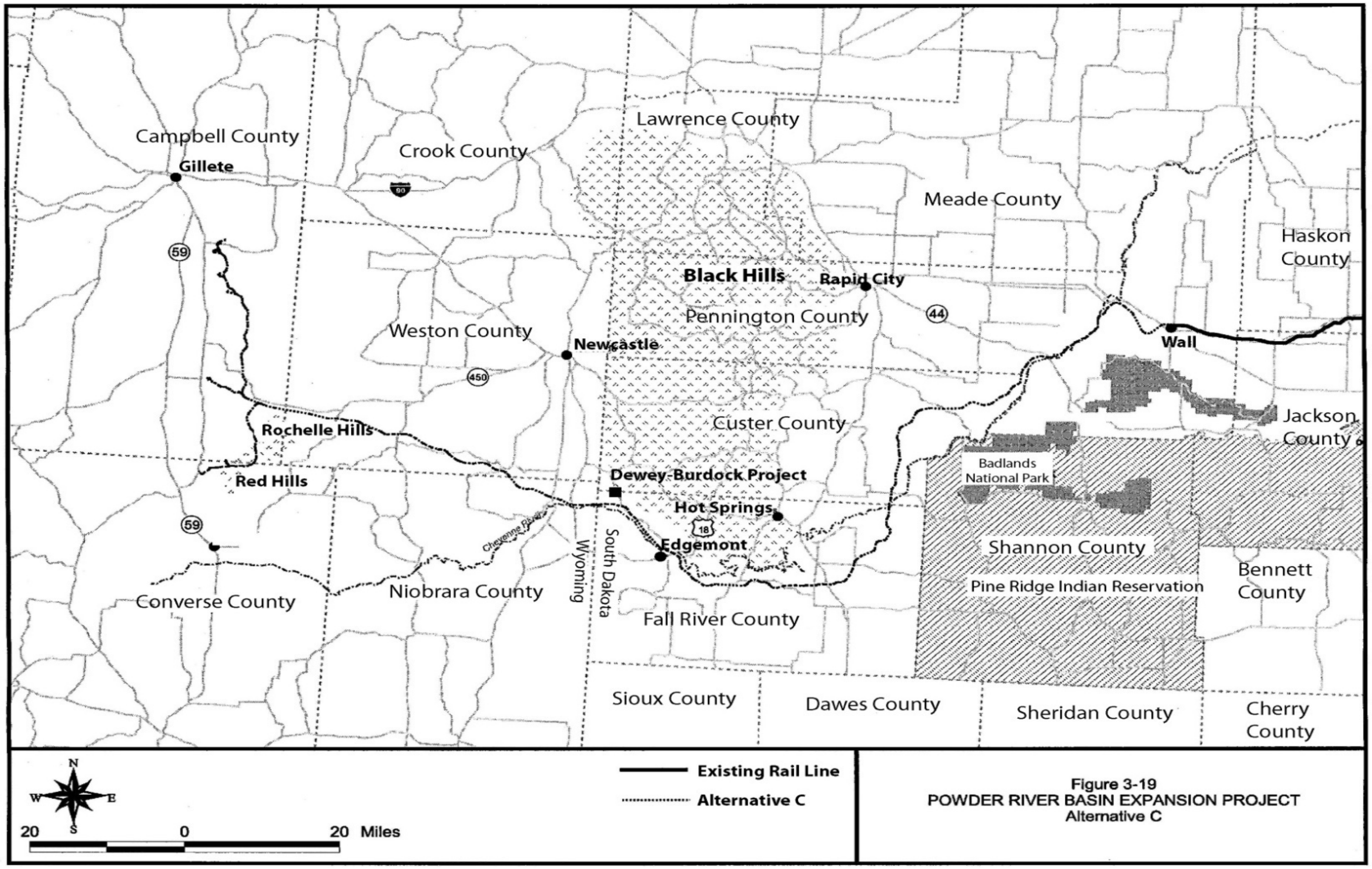

Figure 5.1-5. Map Showing Proposed New Rail Construction (Alternative C) for Dakota Minnesota and Eastern Railroad Powder River Basin Expansion Project From Wall, South Dakota, West Into the Powder River Basin of Wyoming
Source: Modified from STB (2001)

contractual commitments from prospective coal shippers to ensure revenues from the proposed line are economical, and (iv) arranging financing for the project.

5.1.1.6 Other Mining

Gold mining is not extensive in South Dakota; however, gold is the leading mineral commodity by dollar value. Only Wharf Resources Inc. actively mines gold in the state, and it holds four permits for gold operations in the northern Black Hills (Holm, et al., 2008). Wharf Resources is the only company to report silver production, which is a byproduct of its gold recovery process. Sand and gravel are the major nonmetallic mineral commodities produced in South Dakota. Sand and gravel are quarried in every county in South Dakota, mainly for road construction projects. Limestone is quarried in the Black Hills, primarily for the production of cement for use in construction projects.

5.1.1.7 Environmental Impact Statements as Indicators of Past, Present, and Reasonably Foreseeable Future Actions

Indicators of present and reasonably foreseeable future actions are draft and final EISs federal agencies prepare within a recent time period. Using information in GEIS Section 5.2.2 (NRC, 2009a) and other publicly available information, several EISs were identified for the Nebraska-South Dakota Wyoming Uranium Milling Region (see Table 5.1-4). A majority of EISs in Table 5.1-4 are related to resource management actions in the Black Hills National Forest (BHNF) or associated management units. These EISs are for actions that are focused on improving natural resource conditions and reducing adverse impacts from various human-related activities. Three exceptions are the draft EIS that BLM prepared for the Dewey Conveyor Project (BLM, 2009a), the final programmatic EIS that BLM prepared for wind energy development on BLM-administered lands in the western United States (BLM, 2005), and the final EIS that the STB prepared for the DM&E proposal to build the PRB Rail Expansion Project (STB, 2001).

5.1.2 Methodology

In calculating and assessing potential cumulative impacts, the NRC staff developed a methodology that follows CEQ guidance (see NRC, 2009a and CEQ, 1997).

1. Identify the potential environmental impacts of the federal action, and evaluate the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions for each resource area. Potential environmental impacts are discussed and analyzed in Chapter 4 of this SEIS.

2. Identify the geographic scope for the analysis for each resource area. This scope will vary from resource area to resource area, depending on the geographic extent to which the potential impacts of the resource area could be at issue.

3. Identify the timeframe for assessing cumulative impacts. The NRC staff use the period from 2009 to 2030 for identifying and assessing cumulative effects. The timeframe begins with NRC acceptance of the application for an NRC source material license to operate the Dewey-Burdock ISR Project in October 2009. The cumulative impact analysis timeframe ends in 2030, the date estimated for license termination after completion of the decommissioning period (see Figure 2.1-1).

Table 5.1-4. Draft and Final National Environmental Policy Act Documents Related to the Nebraska-South Dakota-Wyoming Uranium Milling Region

November 19, 2001	Surface Transportation Board (STB), Final Environmental Impact Statement (EIS), Dakota, Minnesota and Eastern Railroad Corporation Powder River Basin Expansion Project
June 2005	U.S. Bureau of Land Management (BLM), Final Programmatic EIS on Wind Energy Development on BLM-Administered Lands in the Western United States
June 3, 2005	U.S. Forest Service (USFS), Final EIS, Dean Project Area, Proposal To Implement Multiple Resource Management Actions, Black Hills National Forest (BHNF), Bearlodge Ranger District, Sundance, Crook County, Wyoming (resource management)
August 12, 2005	USFS, Final EIS, Black-Tailed Prairie Dog Conservation and Management on the Nebraska National Forest and Associated Units, Implementation, Dawes, Sioux, Blaine, Cherry, Thomas Counties, NE, and Custer, Fall River, Jackson, Pennington, Jones, Lyman, Stanley Counties, South Dakota (resource management—prairie dog)
October 28, 2005	National Park Service, Draft EIS, Badlands National Park/North Unit General Management Plan, Implementation, Jackson, Pennington, and Shananon Counties, South Dakota (resource management)
November 20, 2005	USFS, Final EIS, Deerfield Project Area, Proposal To Implement Multiple Resource Management Actions, Mystic Ranger District, BHNF, Pennington County, South Dakota (resource management)
November 25, 2005	USFS, Final EIS, Bugtown Gulch Mountain Pine Beetle and Fuels Projects, To Implement Multiple Resource Management Actions, BHNF, Hell Canyon Ranger District, Custer County, South Dakota (resource management)
October 31, 2005	USFS, Final EIS, Black Hills, National Forest Land and Resource Management Plan Phase II Amendment, Proposal To Amend the 1997 Land and Resource Management Plan, Custer, Fall River, Lawrence, Meade, Pennington Counties, South Dakoa; Crook and Weston Counties, Wyoming (resource management)
February 3, 2006	USFS, Final EIS, Black-Tailed Prairie Dog Conservation and Management on the Nebraska National Forest and Associated Units, Implementation, Dawes, Sioux, Blaine, Cherry, Thomas Counties, Nebraska, and Custer, Fall River, Jackson, Pennington, Jones, Lyman, Stanley Counties, South Dakota (resource management—prairie dog)
May 12, 2006	USFS, Final SEIS, Dean Project Area, Proposal To Implement Multiple Resource Management Actions, New Information To Disclose Direct, Indirect, and Cumulative Environmental Impacts, BHNF, Bearlodge Ranger District, Sundance, Crook County, Wyoming (resource management)
June 1, 2007	USFS, Final EIS, Norwood Project, Proposal To Implement Multiple Resources Management Actions, BHNF, Hell Canyon Ranger District, Pennington County, South Dakota, and Weston, Crook Counties, Wyoming (resource management)

Table 5.1-4. Draft and Final National Environmental Policy Act Documents Related to the Nebraska-South Dakota-Wyoming Uranium Milling Region (Cont'd)

June 8, 2007	USFS, Draft EIS, Nebraska and South Dakota Black-Tailed Prairie Dog Management, To Manage Prairie Dog Colonies in an Adaptive Fashion, Nebraska National Forest and Associated Units, Including Land and Resource Management Plan Amendment 3, Dawes, Sioux, Blaine Counties, Nebraska, and Custer, Fall River, Jackson, Pennington, Jones, Lyman, Stanley Counties, South Dakota (resource management—prairie dog)
June 29, 2007	USFS, Final EIS, Mitchell Project Area, Proposal To Implement Multiple Resource Management Actions, Mystic Ranger District, BHNF, Pennington County, South Dakota (resource management)
September 14, 2007	USFS, Final EIS, Citadel Project Area, Proposal To Implement Multiple Resource Management Actions, Northern Hills Ranger District, BHNF, Lawrence County, South Dakota (resource management)
February 22, 2008	USFS, Draft EIS, Upper Spring Creek Project, Proposal To Implement Multiple Resource Management Actions, Mystic Ranger District, BHNF, Pennington County, South Dakota (resource management)
January 2009	USFS/BLM, Draft EIS, Dewey Conveyor Project, Whether or Not to Issue Special Use Permit For 6.6 Mile Conveyor Along Dewey Road and Limestone Claims Northeast of Dewey, Custer County, South Dakota
May 7, 2010	USFS, Final EIS and Record of Decision, Black Hills National Forest Travel Management Plan, To Designate a Motorized Travel System, Lawrence, Meade, Pennington, Custer, and Fall River Counties, South Dakota; and Crook and Weston Counties, Wyoming
January 27, 2012	USFS, Final EA and Decision Notice/Finding of No Significant Impact, Southern Black Hills Water System Argyle Road Service Area Special Use Permit, Approve Occupancy of National Forest System Lands by Proponent to Provide Potable Water to Customers Along Arygle Road, BHNF Custer County, South Dakota
December 10, 2012	USFS, Final EIS and Record of Decision, Mountain Pine Beetle Response Project, Black Hills National Forest, To Implement Multiple Resource Management Actions to Reduce Threat to Ecosystem Components, Including Forest Resources, from the Existing Insect and Disease (Mountain Pine Beetle) Epidemic and Help Protect Local Communities and Resources from Large Scale, Severe Wildfire, Lawrence, Meade, Pennington, Custer, and Fall River Counties, South Dakota; and Crook and Weston Counties, Wyoming (resource management)

NRC source material licenses for ISR facilities are typically granted for a 10-year period. The proposed Dewey-Burdock ISR Project has an estimated 17-year operational lifespan (see Figure 2.1-1). If NRC grants a source material license, the applicant must apply for license renewal before the initial license period expires to continue operations.

4. Identify ongoing and prospective projects and activities that take place or may take place in the area surrounding the project site. These projects and activities are described in Section 5.1.1 of this chapter.

5. Assess the cumulative impacts for each resource area from the proposed action and reasonable alternatives, and other past, present, and reasonably foreseeable future actions. This analysis would take into account the environmental impacts of concern identified in Step 1 and the resource-area-specific geographic scope identified in Step 2.

The following terms describe the level of cumulative impact:

SMALL: The environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource considered.

MODERATE: The environmental effects are sufficient to alter noticeably, but not destabilize, important attributes of the resource considered.

LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource considered.

The NRC staff recognize that many aspects of the activities associated with the proposed Dewey-Burdock ISR Project would have SMALL impacts on the affected resources. It is possible, however, that an impact that may be SMALL by itself, but could result in a MODERATE or LARGE cumulative impact when considered in combination with the impacts of other actions on the affected resource. Likewise, if a resource is regionally declining or imperiled, even a SMALL individual impact could be important if it contributes to or accelerates the overall resource decline. The NRC staff determined the appropriate level of analysis that was merited for each resource area potentially affected by the proposed action and alternatives. The level of analysis was determined by considering the impact level to that resource, as described in Chapter 4, as well as the likelihood that the quality, quantity, and stability of the given resource could be affected.

Table 5.1-5 summarizes the cumulative impacts of the proposed Dewey-Burdock Project on environmental resources NRC staff identified and analyzed. The cumulative impacts are based on analyses the NRC staff conducted and take into account the other past, present, and reasonably foreseeable activities identified in SEIS Section 5.1.1.

Table 5.1-5. Cumulative Impacts on Environmental Resources

Resource Category	Cumulative Impacts	Comment
Land Use	MODERATE	The proposed project will have a SMALL incremental impact when added to the MODERATE cumulative impacts to land use.
Transportation	MODERATE	The proposed project will have a SMALL incremental impact when added to the MODERATE cumulative impacts to transportation.

Table 5.1-5. Cumulative Impacts on Environmental Resources (Cont'd)

Resource Category	Cumulative Impacts	Comment
Geology and Soils	MODERATE	The proposed project will have a SMALL incremental impact when added to the MODERATE cumulative impacts to geology and soils.
Water Resources		
Surface Waters and Wetlands	MODERATE to LARGE	The proposed project will have a SMALL incremental impact when added to the MODERATE to LARGE cumulative impacts to surface waters and wetlands.
Groundwater	MODERATE	The proposed project will have a SMALL incremental impact when added to the MODERATE cumulative impacts on groundwater.
Ecological Resources		
Terrestrial Ecology	MODERATE	The proposed project will have a SMALL incremental impact when added to the MODERATE cumulative impacts to terrestrial ecological resources.
Aquatic Ecology	SMALL	The proposed project will have a SMALL incremental impact when added to the SMALL cumulative impacts to aquatic ecological resources.
Threatened and Endangered Species	MODERATE	The proposed project will have a SMALL incremental impact when added to the MODERATE cumulative impacts to threatened and endangered species.
Air Quality	SMALL to MODERATE	The proposed project will have a SMALL to MODERATE incremental impact on air quality when added to the MODERATE cumulative impacts.
Noise	MODERATE	The proposed project will have a SMALL incremental impact on noise when added to the MODERATE cumulative impacts.

Table 5.1-5. Cumulative Impacts on Environmental Resources (Cont'd)

Resource Category	Cumulative Impacts	Comment
Historic and Cultural Resources	MODERATE to LARGE	The proposed project will have a SMALL to LARGE incremental impact on historic and cultural resources when added to the MODERATE to LARGE cumulative impacts.
Visual and Scenic Resources	MODERATE to LARGE	The proposed project will have a SMALL incremental impact on visual and scenic resources when added to the MODERATE to LARGE cumulative impacts to the viewshed.
Socioeconomics	SMALL to MODERATE	The proposed project will have a SMALL to MODERATE incremental impact on socioeconomic resources when added to the SMALL to MODERATE cumulative impacts.
Environmental Justice	SMALL	The proposed project will have a SMALL incremental impact on environmental justice when added to the SMALL cumulative impacts.
Public and Occupational Health and Safety	SMALL	The proposed project will have a SMALL incremental impact on public and occupational health when added to the SMALL cumulative impacts.
Waste Management	SMALL to MODERATE	The proposed project will have a SMALL to MODERATE incremental impact on waste management when added to the SMALL to MODERATE cumulative impacts.

5.2 Land Use

NRC staff assessed cumulative impacts on land use within a 16-km [10-mi] radius of the proposed Dewey-Burdock ISR Project permit boundary, which includes parts of Custer and Fall River Counties, South Dakota, and Weston and Niobrara Counties, Wyoming. Land use impacts result from interruption to, reduction, or impedance of livestock grazing areas, open wildlife areas, and land access. The assessment of cumulative impacts on land use beyond 16 km [10 mi] was not undertaken, because at this distance the impacts on land use from the proposed project will be minimal. The timeframe for the analysis of cumulative impacts is 2009 to 2030, as described in SEIS Section 5.1.2.

The majority of land within the 16-km [10-mi] radius of the proposed project is in private ownership; however, USFS manages tracts of forest, grassland, and recreational land in the vicinity (see Figures 5.1-1 and 5.1-4). The BHNF borders the project to the north and east, and the Buffalo Gap National Grassland is 4.8 km [3 mi] south of the project. USFS-managed lands provide recreational activities, including camping, hiking, fishing, and hunting.

BLM-administered lands are distributed among other federal and private lands to the north, west, and south of the proposed project site. Cattle grazing is the predominant land use on both public and private rangeland.

Short-term cumulative impacts from the loss of rangeland include a decrease in the area for foraging, temporary loss of animal unit months (AUMs), and temporary loss of water-related range improvements (e.g., improved springs, water pipelines, stock ponds). These impacts would be reduced after an area had been reclaimed. Long-term cumulative impacts result from the permanent loss of forage and forage/cropland productivity in un-reclaimed areas. Other impacts could include dispersal of noxious and invasive weed species both within and beyond areas where the surface had been disturbed, which reduces the area of desirable forage by livestock. The proposed Dewey-Burdock ISR Project will disturb 98 ha [243 ac] if Class V deep injection wells are used to dispose of liquid wastes or 566 ha [1,398 ac] if land application is used to dispose of liquid wastes (see SEIS Section 4.2.1). These amounts of land are small in comparison to the available grazing land within the land use study area {i.e., land within a 16-km [10-mi] radius of the proposed project site}. These amounts of land will also be fenced from grazing at different times over the life of the project.

Past, ongoing, and future conventional uranium mines and ISR facilities in the vicinity of the proposed Dewey-Burdock ISR Project and within the broader regional area are described in SEIS Section 5.1.1. The Crow Butte ISR facility lies 105 km [65 mi] to the south-southeast in Dawes County, Nebraska, and is the closest operational ISR facility to the Dewey-Burdock site. Three ISR expansion or satellite projects are in the planning or licensing stages in the immediate vicinity of the Crow Butte ISR facility (North Trend, Three Crow, and Marsland) (see SEIS Section 5.1.1.1).

In the land use study area, the applicant has identified a potential ISR project at Dewey Terrace. The Dewey Terrace project would be located approximately 13 km [8 mi] west of the proposed project area in Weston and Niobrara Counties, Wyoming (Figure 5.1-3). If developed, the potential Dewey Terrace project will have impacts on land use (i.e., surface disturbances and fencing to restrict livestock grazing) within the land use study area. To assess the projected land area that will be affected by the development of the potential Dewey Terrace project, the NRC staff assumed that approximately the same area affected by the proposed action {98 to 566 ha [243 to 1,398 ac]} will also apply to other potential ISR projects. Like the proposed Dewey-Burdock ISR Project, this amount of land area is small in comparison to the land use study area.

Land disturbed by past conventional surface mining is present in the eastern part of the proposed Dewey-Burdock site, where abandoned open mine pits and mine waste overburden piles are found (see SEIS Section 5.1.1.1). Wellfields are planned within these areas (see Figure 3.2-3). If wellfields in the mine waste areas are constructed and operated, additional land disturbance and access restrictions will occur.

Impacts on land use from oil and gas drilling include building temporary access roads and constructing 1.2-ha [3-ac] drill pads for each drill site (BLM, 2009a). There are no active oil- and gas-producing wells within the proposed Dewey-Burdock permit area. SEIS Section 3.2.3 identifies three plugged and abandoned oil and gas wells in the Burdock portion of the site in Fall River County. There are few producing oil wells in the land use study area {i.e., within a 16-km [10-mi] radius of the proposed Dewey-Burdock project area}. The Barker Dome oilfield in Custer County and the Plum Canyon oilfield in Weston County each have four producing oil wells (see Figures 5.1-3 and 5.1-4). The Cheyenne Bend oilfield in Fall River County has one producing oil well (see Figure 5.1-3). In addition, demand for oil and gas leasing in the vicinity of the proposed project is low (see SEIS Section 5.1.1.3). The majority of active oil and gas development in the region takes place on USFS-managed land (see Figure 5.1-3). This development occurs west and south of Edgemont and in the PRB, which is more than 80 km [50 mi] west of the proposed project (see Figure 5.1-3).

Ongoing and proposed coal bed methane operations and wind energy operations in the region are located in the Powder River Basin west of the cumulative impacts land use study area (see SEIS Sections 5.1.1.2 and 5.1.1.4). Sedimentary formations hosting potential coal bed methane reserves are not present in the land use study area. The nearest existing wind power projects to the land use study area are located approximately 161 km [100 mi] to the west-southwest near Glenrock in Converse County, Wyoming. The potential Dewey-Burdock Wind Project is in the conceptual phase and would be located within and surrounding the proposed Dewey-Burdock site (Figure 5.1-4). If developed, the wind project will be constructed on ridges to exploit the best wind conditions rather than low areas where uranium deposits within and in the vicinity of the proposed project tend to be located (e.g., see Figure 4.5-1). Development of wind energy projects is generally compatible with other land uses, including livestock grazing, recreation, and oil and gas production activities (BLM, 2005).

Two proposed transportation projects are within the cumulative impacts land use study area: the GCC Dacotah Inc.'s Dewey Conveyor Project and the DM&E PRB Expansion Project (see SEIS Section 5.1.1.5).

Lands along the route of the Dewey Conveyor Project are owned by GCC Dacotah and private landowners or are public lands managed by BLM or USFS. About 16.2 ha [40 ac] of land disturbance will be created during the 1-year conveyor construction phase, resulting in temporary loss of forage. After construction, about 6.5 ha [16 ac] of land disturbance will remain, resulting in long-term losses in available forage. These long-term losses will be confined to the conveyor and maintenance road footprints. The conveyor will be designed to allow livestock and wildlife to freely cross beneath. Adequate signage will be posted to prevent potential trespass by GCC Dacotah employees, and GCC Dacotah employees will be trained regarding property boundaries. The conveyor project is designed so as not to interfere with the operation and maintenance of existing electric transmission and oil and gas distribution lines. In addition, changes in road easements and other infrastructure are not expected. (BLM, 2009a)

The proposed DM&E PRB Expansion Project will have a significant impact on use of private agricultural land by farmers and ranchers, grazing allotments leased by ranchers on federal lands, and mineral and mining rights on federal lands in western South Dakota and Wyoming. State-owned land and utility corridors are also expected to have impacts. Construction of the rail extension will involve direct and indirect takings of privately held land and the destruction of wells, windmills, corrals, fencing, outbuildings, irrigation systems, fire prevention and suppression systems, and other capital improvements. Access roads, hauling roads, and borrow pits will be built. DM&E will be required to mitigate adverse environmental impacts to private agricultural and ranch lands, federal lands, state lands, and utility corridors. DM&E will negotiate these mitigation measures with landowners and federal and state agencies. DM&E will be required to restore all federal, state, and privately held agricultural lands disturbed by the project to pre-construction conditions as promptly and fully as possible. (STB, 2001)

The NRC staff have determined that the cumulative impact on land use within the land use study area (i.e., Fall River, Custer, Weston, and Niobrara Counties) resulting from all past, present, and reasonably foreseeable future actions is MODERATE. This finding is based on the assessment of existing and potential impacts on land use within the study area from the following actions:

- Land disturbance from past conventional surface mining in the eastern portion of the proposed Dewey-Burdock site

- Surface disturbance and restrictions on livestock grazing and recreational activities (e.g., hunting and off-road vehicle use) from development of potential ISR projects, such as the potential Dewey Terrace project

- Land disturbance from development of the proposed Dewey Conveyor Project

- Direct and indirect taking of privately held land tied to construction of the DM&E PRB Expansion Project, with resulting destruction of wells, windmills, corrals, fencing, outbuildings, irrigation systems, fire prevention and suppression systems, and other capital improvements

Other ongoing and reasonably foreseeable future actions are not expected to have a significant impact on land use within the cumulative impacts study area. There are few producing oil wells within the study area, and demand for oil and gas leasing is low. Coal bed methane reserves are not present within the study area. Potential wind energy projects, such as the Dewey-Burdock Wind Project, are generally compatible with the primary land uses in the study area, including livestock grazing, recreation, and wildlife habitat conservation (BLM, 2005).

The NRC staff conclude the proposed Dewey-Burdock ISR Project will have a SMALL incremental effect on land use after evaluating its effects and those of all the other past, present, and reasonably foreseeable future actions in the land use study area. As discussed in SEIS Section 4.2.1, land use impacts related to the proposed Dewey-Burdock ISR Project will be SMALL for all stages of the project lifecycle. The estimated land disturbance of 98 to 566 ha [243 to 1,398 ac] for the proposed action is a small amount of land in comparison to the cumulative impacts study area. About this same amount of land will be fenced over the life of the proposed project to restrict livestock grazing and public access to the ISR facilities and to infrastructure, wellfields, and potential land application areas. Fencing around wellfields will be temporary. As wellfield production ends, fencing will be removed and the land reclaimed in accordance with applicable BLM and SDDENR requirements. At the end of operations, the applicant will decommission the site and restore the land to its previous use (with the possible exception of access roads that land owners may request to remain) in accordance with an NRC-approved decommissioning plan (see SEIS Section 2.1.1.1.5).

5.3 Transportation

Cumulative impacts on transportation systems of Custer and Fall River Counties, South Dakota, and Weston and Niobrara Counties, Wyoming, were identified and evaluated. Local highways, existing county roads, and access roads were the focus of this analysis over the 2009–2030 timeframe (see SEIS Section 5.1.2 for the estimated operating life of the facility).

As described in SEIS Section 4.3.1, the impacts to the principal access road to the Dewey-Burdock site (Dewey Road) and heavily traveled regional and local highways will be SMALL during all phases of the proposed Dewey-Burdock ISR Project. As described in SEIS

Section 4.3.1, daily traffic on Dewey Road will increase by 42 percent during the construction phase and by 24 percent during the operations phase of the proposed project. The increase in traffic will incrementally accelerate the degradation of the road surface, increase fugitive dust emissions, and increase the potential for traffic accidents and wildlife or livestock kills. Secondary access roads connecting Dewey Road with the proposed plant facilities and the plant facilities within the wellfields will also experience long-term transportation impacts. However, the transportation impacts to secondary access roads are not considered permanent, because the land will ultimately be returned to its natural condition when production and decommissioning are complete (Powertech, 2009b).

In the cumulative impacts study area, transportation will be impacted by ongoing and reasonably foreseeable future activities. These include impacts to livestock grazing, uranium exploration and mining, and oil and gas exploration and development. The many unimproved, two-track dirt roads and one lane gravel roads in the cumulative impacts transportation study area were constructed to access livestock grazing lands, to facilitate natural resource exploration and extraction, to provide access to recreational areas, and for off-road vehicle recreational activities. County roads in the transportation study area have intermittently provided access for uranium exploration and mining, as well as oil and gas exploration activities, since the mid-1970s. Reasonably foreseeable future uranium, oil, and gas exploration will result in additional trucks and heavy equipment using existing county roads. For example, the potential Dewey Terrace uranium project would be located 13 km [8 mi] west of the Dewey-Burdock ISR Project area in Weston and Niobrara Counties, Wyoming (see SEIS Section 5.1.1.1). If developed, the Dewey Terrace project may contribute to additional traffic on Dewey Road from commuting workers, construction and operations deliveries, and yellowcake and byproduct transport. These future activities may require or benefit from the construction of new road surfaces or the improvement of existing county roads, including Dewey Road.

As noted in SEIS Section 5.1.1, other reasonably foreseeable future projects, such as wind energy and transportation projects, contribute to the analysis of cumulative impacts.

Wind energy projects will impact transportation on local roads; however, these impacts would be temporary. During the 1- to 2-year construction period for a wind energy project, the vehicles of 100 to 150 workers and vehicles used to transport construction equipment, blades, turbine components, and other materials to the site will cause a relatively short-term increase in the use of local roadways. Shipments of materials, such as gravel, concrete, and water, are not expected to significantly affect local primary and secondary road networks. Shipments of overweight and/or oversized loads are expected to cause temporary disruptions on primary and secondary roads used to access construction sites. It is possible that local roads might require fortification of bridges and removal of obstructions to accommodate overweight and oversized shipments. Once completed, wind energy projects will require a relatively low number of workers to operate and maintain. For example, the operation and maintenance of a 180-MWcapacity wind energy project with about 150 turbines will require 10 to 20 workers. Consequently, transportation activities will be limited to a small number of daily trips by pickup trucks, medium-duty vehicles, or personal vehicles. Shipments of large components required for equipment replacement in the event of major mechanical breakdowns are expected to be infrequent. Transportation activities during site decommissioning will be similar to those during construction but will involve a much smaller workforce. Heavy equipment will be required for dismantling turbines and towers, breaking up tower foundations, and regrading and recontouring the site. (BLM, 2005)

The proposed Dewey Conveyor will not impact transportation on heavily traveled regional and local roadways but will temporarily impact transportation on Dewey Road. Dewey Road is the primary transportation corridor along the 10.6 km [6.6 mi] length of the proposed conveyor alignment (Figure 5.3-1). Dewey Road continues both north and south of the proposed conveyor project. The construction workforce for the conveyor project will come primarily from Hot Springs, Custer, and Edgemont and use Dewey Road to access the site from the south. Construction of the conveyor will involve approximately 50 workers and take 1 construction season. During construction, deliveries and commuting workers will increase traffic counts on Dewey Road between Edgemont and Dewey. Following construction, approximately 12 workers will oversee quarrying, transport, and load-out operations related to the project. Due to the short duration of construction and relatively low number of workers needed to operate the conveyor operation, the proposed Dewey Conveyor Project is not expected to have a significant impact on transportation in the cumulative impacts study area. (BLM, 2009a)

The proposed DM&E PRB Expansion Project will have temporary impacts on transportation in western South Dakota and Wyoming. The project will require the construction of temporary roads to access the rail line ROW. In the cumulative impacts study area for transportation, the rail line will parallel the BNSF rail line from Edgemont to Burdock before turning west toward Wyoming (see Figure 5.1-4). Therefore, the project will have an impact on Dewey Road from commuting workers and deliveries of equipment and materials during construction of the rail line. DM&E has proposed mitigation measures as part of the proposed PRB Expansion Project to address potential adverse impacts to transportation. To the extent possible, DM&E will confine all project-related construction traffic to a temporary access road within the ROW or established public roads. Any temporary access roads constructed outside the rail line ROW will be removed and the land reclaimed upon completion of construction. As a result of road closures after construction and during operation of railyards, DM&E will provide or develop alternative access for the safe movement of farm and ranch equipment and livestock to fields and pastures. (STB, 2001)

The NRC staff have determined that the cumulative impact on transportation within the transportation study area resulting from all past, present, and reasonably foreseeable future actions is MODERATE. Regional and local highways in the transportation study area have sufficient capacity to accommodate the traffic of ongoing actions and increases in traffic from other reasonably foreseeable future actions. However, county roads will be impacted. County roads have been used to access uranium exploration and mining and oil and gas exploration activities in the transportation study area since the mid-1970s. Reasonably foreseeable future uranium, oil, and gas exploration and development in the transportation study area will result in additional trucks and heavy equipment using existing county roads. Construction and operation of potential wind energy and transportation projects will also impact county roads in the transportation study area. For example, the potential Dewey-Burdock Wind Project and the proposed Dewey Conveyor Project and DM&E PRB Expansion Project would utilize Dewey Road. Transportation impacts will be most significant during the construction phase of wind energy and transportation projects because construction activities involve more workers and deliveries of materials and equipment.

The NRC staff have concluded that the proposed Dewey-Burdock ISR Project will have a SMALL incremental effect on transportation when considered with all the other past, present, and reasonably foreseeable future actions in the transportation study area. As described in SEIS Section 4.3.1, increased vehicular traffic associated with the proposed

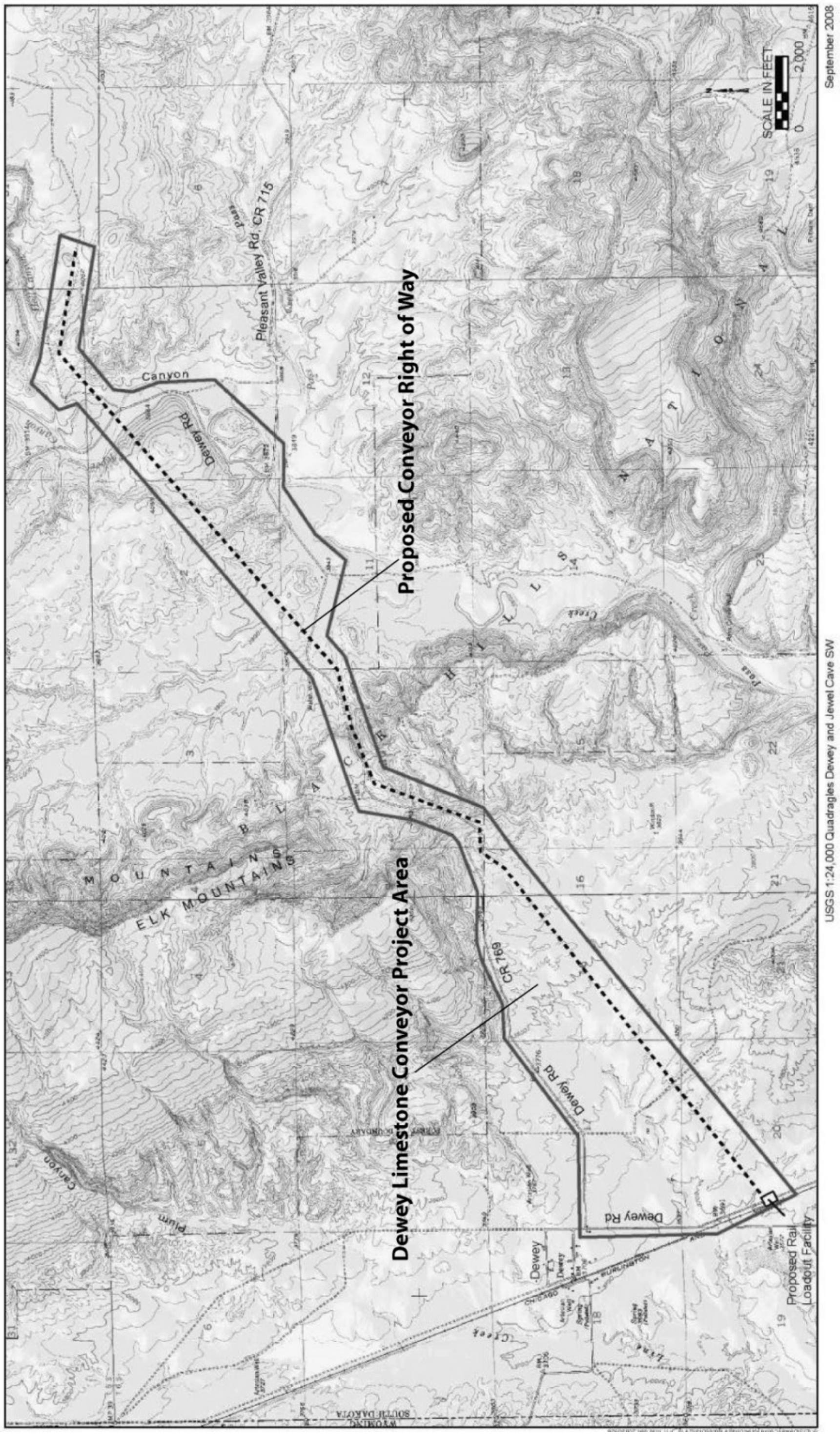

Figure 5.3-1. Map Showing Location of Dewey Road and Pass Creek in Relation to the Proposed Dewey Conveyor Project
Source: Modified From BLM (2009a)

Dewey-Burdock ISR Project will have a SMALL impact. Because regional and local roadways have sufficient capacity to accommodate traffic associated with the proposed project, the proposed Dewey-Burdock ISR Project will have a SMALL incremental impact on regional and local roadways within the transportation study area. As described in SEIS Section 4.3.1, Dewey Road would experience an increase in daily traffic of 42 percent over current levels during the construction phase and a 24 percent increase in daily traffic during the operations phase of the proposed Dewey-Burdock ISR Project. Therefore, the proposed Dewey-Burdock ISR Project will have a SMALL incremental impact on Dewey Road within the transportation study area.

5.4 Geology and Soils

Cumulative impacts on geology and soils within Custer and Fall River Counties, South Dakota, and Weston and Niobrara Counties, Wyoming, were identified and evaluated focusing on an area within a 16-km [10-mi] radius of the proposed Dewey-Burdock ISR Project site. This area was chosen for the assessment of potential cumulative impacts on geology and soils because the uranium mineralization at other potential uranium deposits within 16 km [10 mi] of the proposed site would be located in the same geologic unit (the Inyan Kara Group). The timeframe for the analysis is 2009 to 2030 (see SEIS Section 5.1.2 for the estimated operating life of the facility).

As assessed in SEIS Section 4.4.1, all phases of the proposed Dewey-Burdock ISR Project will have a SMALL impact on geology and soils. The primary impacts on geology and soils will result from earthmoving activities. Earthmoving activities that might impact soils include the clearing of ground and topsoil and preparing surfaces for the Burdock central processing plant, Dewey satellite facility, header houses, access roads, drilling sites, and associated structures. Excavating and backfilling trenches for pipelines and cables, and preparing surfaces for potential land application of process-related liquid wastes, will also impact soils. Operations at the proposed site may produce spills of process fluids or chemical materials that may contaminate soils. Best management practices (BMPs) and required monitoring and mitigation, such as spill prevention and cleanup programs, will reduce these potential soil impacts. Subsurface impacts, such as subsidence and activation of nearby faults, will not occur at the proposed project site, because of the relatively small net withdrawal of fluids from production zone aquifers and because of the low pressures during operations relative to those needed to produce small earthquakes. As described in SEIS Section 3.5.3.2, data from aquifer pumping tests indicated a hydraulic connection between the Lakota and Fall River Formations through the intervening Fuson Shale in the Burdock area resulting from unidentified structural features or old, unplugged exploration holes. A numerical groundwater model developed by the applicant using site-specific geologic and hydrologic information suggested that leakage through the Fuson Shale is caused by improperly installed wells or improperly abandoned exploration holes completed in the Fall River and Lakota Formations (Petrotek, 2012).

Historical, present, and future natural resource development activities that relate to geology and soils in the geological and soil resources study area include stock grazing, uranium exploration/mining, and oil and gas exploration. Geologic formations hosting potential coal bed methane reserves are not present in the immediate vicinity of the proposed project. Surface-disturbing activities related to uranium, oil, and gas exploration activities, such as construction of new access roads and drill pads, will have direct effects on geological resources. During construction of these roads and drill pads, direct impacts on geology will be limited to excavation and relocation of disturbed bedrock and unconsolidated surficial materials associated with surface disturbances. Impacts from these activities include loss of soil productivity due primarily to wind erosion, changes to soil structure from soil handling, sediment delivery to surface water resources (i.e., runoff), and compaction from equipment and livestock pressure. No geological mineral resources will be lost due to grazing. BMPs and reclamation and restoration of soils disturbed by historic livestock grazing and exploration activities will mitigate loss of soil and soil productivity. However, indirect long-term effects, such as cross-contamination of aquifers, may occur if boreholes associated with uranium, oil, and gas exploration are not properly abandoned.

Geology and soil resources have been impacted by past conventional uranium mining in the eastern part of the proposed Dewey-Burdock site, where abandoned open mine pits and mine waste overburden piles are found (see SEIS Section 5.1.1.1). Radiological conditions of soils in the areas of past conventional uranium mining are discussed in SEIS Section 3.12.1. There are underground mine workings associated with four former shallow underground uranium mines and two open pit adits (horizontal tunnels). The underground mines consist of declines (downward sloping ramps) ranging from 0 to 24 m [0 to 80 ft] below ground surface. The adits were driven into the sidewalls of the open pits. All of the underground workings were within sandstones of the Fall River Formation. At this time, there are no plans to reclaim or restore the abandoned open mine pits and mine waste overburden piles.

Development of future ISR projects in the geological and soil resources study area, such as the potential Dewey Terrace project, will have impacts on geology and soils due to increased vehicle traffic, clearing of vegetated areas, soil salvage and redistribution, discharge of ISR-produced groundwater, and construction and maintenance of project facilities and infrastructure (e.g., roads, well pads, pipelines, industrial sites, and associated ancillary facilities). The NRC staff assume that development of future ISR projects within the cumulative impacts study area will be similar to the proposed Dewey-Burdock site, with similar potential for surface impacts to geology and soils. The construction and operation of the infrastructure for these future projects, however, will be subject to the same monitoring, mitigation, and response programs required to limit potential surface impacts (e.g., erosion and contamination from spills) as at the proposed Dewey-Burdock ISR Project. With respect to compaction and surface subsidence, the groundwater will be from the same aquifers and at similar depths as those at Dewey-Burdock, with a small net withdrawal. BMPs and reclamation and restoration of disturbed areas will mitigate loss of soil and soil productivity associated with ISR activities. Salvaged and replaced soil will become viable soon after vegetation is established.

Other reasonably foreseeable future activities in the vicinity of the proposed Dewey-Burdock ISR Project site that may impact geological resources and soils include wind energy projects (see SEIS Section 5.1.1.4), and proposed transportation projects, such as the Dewey Conveyor Project and the DM&E PRB Expansion Project (see SEIS Section 5.1.1.5).

Impacts to geological resources and soils from wind energy projects, such as the potential Dewey-Burdock Wind Project, include use of geologic resources (e.g., sand and gravel), activation of geologic hazards (e.g., landslides and rockfalls), and increased soil erosion. Sand and gravel and/or quarry stone will be needed for access roads. Concrete will be needed for buildings, substations, transformer pads, wind tower foundations, and other ancillary structures. These materials will be mined as close to the potential wind energy site as possible. Tower foundations will typically extend to depths of 12 m [40 ft] or less. The diameter of tower bases is generally 5 to 6 m [15 to 20 ft], depending on the turbine size. Construction activities can destabilize slopes if they are not conducted properly. Soil erosion will result from (i) ground surface disturbance to construct and install access roads, wind tower pads, staging areas, substations, underground cables, and other onsite structures; (ii) heavy equipment traffic; and (iii) surface runoff. Any impacts to geology and soils will be largely limited to the project site. Erosion controls that comply with county, state, and federal standards will be applied. Operators will identify unstable slopes and local factors that can induce slope instability. Implementation of BMPs will limit the impacts from earthmoving activities. Foundations and trenches will be backfilled with originally excavated material, and excess excavation material will be stockpiled for use in reclamation activities. (BLM, 2005)

The construction of the proposed Dewey Conveyor Project will have direct impacts on geological resources, although these will be limited to surface disturbances associated with excavation and relocation of disturbed bedrock and unconsolidated surficial materials along the various ROWs during construction. The surface disturbances resulting from construction of the conveyor will not result in any loss of known mineral resources. Approximately 16.2 ha [40 ac] of soils along the conveyor route will be directly impacted due to excavation and disturbance. These impacts would include loss of soil to wind and water erosion and decreased soil biological activity. Implementation of BMPs and revegetation of disturbed areas and stockpiled topsoil will minimize soil erosion. (BLM, 2009a)

The proposed DM&E PRB Expansion Project will have a significant impact on the geology and soils of western South Dakota and Wyoming. Along the route of the proposed rail line, geology and soils will be disturbed by increased traffic, clearing of vegetated areas, and soil salvage and redistribution. To limit the impacts, DM&E has proposed mitigation measures as part of the proposed PRB Expansion Project to address potential adverse impacts on geology and soils. DM&E will limit ground disturbance to only the areas necessary for project-related construction activities and will commence reclamation of disturbed areas as soon as practicable after project-related construction ends. During project-related earthmoving activities, DM&E will stockpile topsoil for application during reclamation to minimize erosion. DM&E will implement appropriate erosion control measures at stockpiles to prevent erosion. DM&E will be required to restore and revegetate soils disturbed by the project to pre-construction conditions as promptly and fully as possible. (STB, 2001)

The NRC staff determined that the cumulative impact on geology and soils within the study area resulting from all past, present, and reasonably foreseeable future actions is MODERATE. Past conventional underground and open pit surface mining has impacted geology and soils in the eastern part of the proposed Dewey-Burdock site, where abandoned open pits and mine waste overburden piles are not reclaimed or restored. Surface-disturbing activities associated with ongoing and reasonably foreseeable future uranium and oil and gas exploration and development, wind energy, and transportation projects would have direct impacts on geology and soils. Direct impacts will result from increased traffic, clearing of vegetated areas, soil salvage and redistribution, and construction of project facilities and infrastructure. Indirect impacts, such as cross-contamination of aquifers, may also occur if boreholes associated with uranium and oil and gas exploration are not properly abandoned.

The NRC staff conclude that the proposed Dewey-Burdock ISR Project will have a SMALL incremental effect on geology and soils when considered with all the other past, present, and reasonably foreseeable future actions in the study area. As described in SEIS Section 4.4.1, limited areas of the proposed project site will be disturbed by construction, and implementation of BMPs will limit soil erosion and compaction. Systems and procedures will be in place to monitor and clean up soil contamination resulting from spills and leaks. The U.S. Environmental Protection Agency (EPA) will evaluate the suitability of deep geologic formations proposed for deep well disposal of liquid wastes prior to granting a Class V UIC deep injection well permit. The EPA UIC Class V permit will impose an upper limit to the allowable injection pressure and will not allow injection at or above the fracture pressure of the injection zone formations. In potential land application areas, the applicant will be required to routinely collect and monitor soils for contamination and comply with discharge limits for treated liquid wastes applied to irrigation areas. When production and aquifer restoration are complete at the proposed project, reclamation and decommissioning will return the site to preproduction conditions through return of topsoil, removal of contaminated soils, and reestablishment of vegetation.

5.5 Water Resources

The impact to surface and groundwater resources was evaluated within an 80-km [50-mi] radius of the proposed Dewey-Burdock ISR Project (Figure 5.1-3). The 80-km [50-mi] radius for the water resources study area encompasses the watersheds, including the Beaver Creek, Upper Cheyenne, and Angostura Reservoir watersheds, that would be potentially impacted by past, present, and reasonably foreseeable future actions (see Figure 3.5-1). The timeframe for the analysis is 2009 to 2030 (see Section 5.1.2 for the estimated operating life of the facility).

5.5.1 Surface Waters and Wetlands

The proposed Dewey-Burdock ISR Project is located in the Beaver Creek and Pass Creek watersheds (see SEIS Section 3.5.1). Beaver Creek is a perennial stream, while Pass Creek is dry for most of the year. Both creeks have ephemeral tributaries that flow after snowmelt or heavy rains. Pass Creek joins Beaver Creek southwest of the project area. Beaver Creek flows into the Cheyenne River 4.8 km [3 mi] south of this confluence, which eventually flows into the Missouri River. The U.S. Army Corps of Engineers (USACE) identified four jurisdictional wetlands within the proposed site (see SEIS Section 3.5.2). The jurisdictional sites were Beaver Creek, Pass Creek, and an ephemeral tributary to each. As described in SEIS Section 4.5.1.1, under Section 404 of the Clean Water Act the applicant must obtain a permit from USACE for any activities that may potentially impact jurisdictional wetlands. Prior to operations, the applicant must obtain construction and industrial stormwater National Pollutant Discharge Elimination System (NPDES) permits from SDDENR. The NPDES permits will include plans and programs for spill prevention and cleanup, erosion control, and stormwater runoff control, which will mitigate the impacts to surface waters and wetlands.

There are no operating ISR facilities located within 80 km [50 mi] of the proposed site, which is the cumulative impacts surface water study area. Several abandoned open pits and overburden waste piles associated with past surface mining activities are located in the Burdock portion of the site (see SEIS Figure 3.2-3). Radiation surveys reveal that soils near old surface mines have higher than background radiation levels (see SEIS Section 3.12.1). Runoff from snowmelt and heavy rains may leach and transport contaminants from the waste piles associated with these mines to surface waters and wetlands in the Beaver Creek and Pass Creek watersheds (Powertech, 2009c). Water within the Beaver Creek watershed and Pass Creek watershed flows south into the Cheyenne River. The Cheyenne River empties into the Angostura Reservoir east of the proposed Dewey-Burdock ISR Project site. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, has been used to clean up uncontrolled or abandoned legacy uranium mines in western Colorado and eastern Utah. EPA is authorized to implement Superfund. Superfund site identification, monitoring, and response activities in South Dakota would be coordinated through SDDENR.

The potential Dewey Terrace ISR project in Weston and Niobrara Counties, Wyoming, would be located 13 km [8 mi] west of the Dewey-Burdock ISR Project site. This potential future project would necessitate new roads, power lines, facilities construction, underground piping, and well drilling, all of which may have adverse impacts on surface waters and wetlands. As discussed previously for the Dewey-Burdock ISR Project, potential impacts to surface waters and wetlands at the potential Dewey Terrace ISR project site would also be subject to mitigation through BMPs, required NPDES stormwater permits, and permits from USACE for any activities that may potentially disturb jurisdictional wetlands identified at the site.

Surface water quality within the 80-km [50-mi] area of the proposed site may be impacted by conventional oil and gas development, rangeland grazing, wind energy projects, and transportation projects. Cattle grazing is a source of nonpoint pollution to streams and wetlands in the Beaver Creek and Pass Creek drainages. SEIS Section 3.5.1.1 describes Beaver Creek as impaired for all beneficial uses because of high total dissolved and suspended solids, high salinity, presence of fecal coliform, high conductivity levels, and high water temperature. A water quality data report points to livestock as the source of fecal coliform in Beaver Creek (SDDENR, 2008). Poor management of livestock grazing may restrict flow in intermittent streams such as Pass Creek due to erosion and sedimentation resulting from decreased vegetative cover in the drainage area.

Oil wells within 80 km [50 mi] of the proposed Dewey-Burdock ISR Project site are shown in Figure 5.1-3. As discussed in SEIS Section 5.1.1.3, no producing oil and gas wells are located within the proposed Dewey-Burdock permit boundary and, at present, there is low demand for oil and gas leasing within the project boundary and in its immediate vicinity. Within 80 km [50 mi] of the proposed project site, oil wells are clustered west of the site in Weston and Niobrara Counties, southwest of Edgemont in Fall River County, and east of the site at Barker Dome in Custer County. Impacts to surface waters and wetlands from oil and gas exploration activities will be from surface runoff as new access roads and drill pads are constructed. Runoff degrades surface water quality, causes erosion, and leads to siltation of streambeds and wetlands.

Licensees must obtain construction and industrial NPDES permits from the Wyoming Department of Environmental Quality (WDEQ) in Wyoming and SDDENR in South Dakota prior to conducting oil and gas exploration and production activities. NPDES permits include plans and programs for spill prevention and cleanup, erosion control, and stormwater runoff control. These plans and programs significantly mitigate the potential impacts to surface sediment load and turbidity from exploration activities. USACE Section 404 permits are also required for any disturbances in or near jurisdictional wetlands. Section 404 permits include provisions that must be followed to mitigate impacts when conducting activities in and near jurisdictional wetlands.

Impacts to surface waters and wetlands from potential wind energy projects in the western United States, such as the Dewey-Burdock Wind Project, may include changes in water quality and alteration of natural flow systems. The quality of surface water could be degraded by soil erosion and stormwater runoff from construction activities that disturb the ground surface, and by heavy equipment traffic. Surface water flow may be diverted by access road systems or stormwater control systems. Operation of a wind energy project uses very small amounts of water and results in virtually no discharges to surface water. Operators of these facilities implement stormwater management plans to ensure compliance with applicable regulations and prevent offsite migration of contaminated stormwater or increased soil erosion. (BLM, 2005)

The proposed Dewey Conveyor Project is located principally within the Pass Creek drainage. Pass Creek and Hell Canyon merge near the southeast portion of the project area and flow southwest to the confluence of Beaver Creek (see Figure 5.3-1). The proposed conveyor project crosses several ephemeral tributaries within the Pass Creek drainage. Some sediment runoff from road and general construction activities associated with the 10.6-km [6.6-mi]-long conveyor is expected, and this could impact surface water bodies. Expected runoff contaminants will predominantly be in the form of suspended or dissolved solids and increases in turbidity. These impacts will be partially mitigated by the fact that many area streambeds in the vicinity of the project area are dry for most of the year. Runoff potential will also be mitigated by the implementation of BMPs for runoff control. (BLM, 2009a)

The DM&E PRB Expansion Project will have a significant impact on surface water and wetlands, if completed. The new rail line will pass south of the proposed Dewey-Burdock ISR Project site (see Figure 5.1-4), through the Beaver Creek and Pass Creek watersheds. DM&E has proposed mitigation measures to address potential adverse impacts on surface waters and wetlands within the PRB Expansion Project area. Before project-related construction could begin, DM&E must obtain all federal permits, including Clean Water Act Section 404 permits and USACE permits required for project-related alteration or encroachment of wetlands, streams, and rivers. In addition, DM&E must obtain NPDES permits for regulation of stormwater discharges to surface waters. DM&E will employ BMPs, such as silt screens and straw bale dikes, to minimize soil erosion, sedimentation, runoff, and surface instability during project-related construction. These mitigation measures will minimize sedimentation into streams and wetlands. (STB, 2001)

The NRC staff have determined that the cumulative impact on surface water and wetlands within the surface water study area resulting from past, present, and reasonably foreseeable future actions is MODERATE to LARGE. Leaching and transport of contaminants from overburden waste piles associated with past conventional uranium mining in the eastern part of the proposed Dewey-Burdock site may impact surface waters and wetlands in the Beaver Creek and Pass Creek watersheds. Livestock grazing will continue to have the potential to degrade water quality in streams within the study area. Construction activities associated with other ongoing and reasonably foreseeable future actions, including uranium and oil and gas exploration and development, wind energy projects, and transportation projects, will have impacts on surface water and wetland resources. All of these actions will necessitate construction of new roads, power lines, facilities, and infrastructure, which could degrade water quality and alter natural surface water flow systems.

The NRC staff conclude that the proposed Dewey-Burdock Project will have a SMALL incremental effect on surface water and wetlands when added to all other past, present, and reasonably foreseeable future actions in the surface water study area. As described in SEIS Section 4.5.1, potential impacts to surface waters at the proposed Dewey-Burdock site will be mitigated through proper planning and design of facilities and infrastructure, the use of proper construction methods, and implementation of BMPs. Prior to initiating ISR operations at the proposed project, the applicant must also obtain a construction and industrial stormwater NPDES permit from SDDENR. The NPDES permit will include plans and programs for spill prevention and cleanup, erosion mitigation, and stormwater runoff control. In addition, to comply with Section 404 of the Clean Water Act, the applicant must obtain a permit from USACE for any activities that may potentially disturb the four jurisdictional wetlands identified within the proposed project area.

5.5.2 Groundwater

As described in SEIS Section 3.5.3.3, ISR methods will be used to extract uranium from sandstone-hosted uranium orebodies in the Fall River and Lakota aquifers at the proposed Dewey-Burdock site. The combined Fall River and Lakota aquifers are referred to as the Inyan Kara Group aquifer. Consumptive water use during construction at the Dewey-Burdock site will be generally limited to dust control, cement mixing, pump tests, delineation drilling, and well drilling and completion. The applicant estimated that groundwater consumption during the construction phase in the Dewey and Burdock areas will be 0.8×10^5 m^3 and 1.2×10^5 m^3 [21.8×10^6 and 30.6×10^6 gal], respectively (Powertech, 2010). Initially, water for construction activities will be withdrawn from existing wells in the Inyan Kara Group aquifer. The applicant's estimated consumptive groundwater use during the construction phase is of the same magnitude as current withdrawals for domestic and livestock water use from the Inyan Kara Group aquifers within a 2-km [1.2-mi] radius of the proposed project (see Section 4.5.2.1.2.2). The applicant plans to install wells in the deeper Madison aquifer early in the construction phase, and once available, Madison water will become the primary water source for the construction, operation, and aquifer restoration phases (Powertech, 2010).

Assessments of environmental impacts to groundwater resources at the proposed Dewey-Burdock ISR Project are discussed in SEIS Section 4.5.2. Impacts to groundwater are most likely to occur during the operations and aquifer restoration phases of the ISR facility's lifecycle, but may occur during other phases. Potential groundwater impacts during the operations phase of the proposed project will be mitigated and reduced through implementation of leak detection and cleanup programs, mechanical integrity testing of wells, and adherence to EPA UIC permit requirements. During operations, the applicant commits to monitoring all domestic wells within 2 km [1.2 mi] of the wellfields and providing replacement wells to the well owners in the event of significant drawdown or degradation of water quality in these wells. The applicant's excursion monitoring program will ensure the protection of water quality in aquifers underlying production zone aquifers. After uranium production and aquifer restoration are completed and groundwater withdrawals are terminated at the proposed project, groundwater levels will recover with time. Groundwater restoration will also restore impacted aquifers to acceptable water quality levels. The proposed injection zones for the UIC Class V deep disposal wells are the Deadwood Formation and the Minnelusa Formation. EPA will not authorize injection into the Class V deep disposal wells unless the permittee demonstrates the well is properly sited, such that confinement zones and proper well construction minimize the potential for migration of fluids outside of the approved injection zone.

Rural population growth, oil and gas exploration development, and ISR uranium extraction are expected to contribute to the cumulative impact on groundwater resources within an 80-km [50-mi] radius of the Dewey-Burdock site. These activities create an increased demand for groundwater and have been the subject of the Black Hills Hydrology Study (USGS, 2010). The U.S. Geological Survey (USGS) conducted this study during 1992–2002 to assess the quantity, quality, and distribution of groundwater in the Black Hills area of South Dakota and to evaluate alternatives for management of water resources in the area. This study is used by federal, state, and local government agencies to set water development policy and protect area groundwater resources.

Groundwater in the Black Hills area of South Dakota is used for residential, municipal, industrial, and recreational purposes. Forty-five percent of the recent population growth in the Black Hills area of South Dakota has taken place in unincorporated areas without municipal water supply systems (Carter, et al., 2003). Population has grown mainly around Rapid City, but has occurred in rural areas in the southwestern Black Hills. Custer Highlands is a new housing development built approximately 16 km [10 mi] northeast of the proposed Dewey-Burdock site. Recent residential developments 19 to 24 km [12 to 15 mi] east of Dewey-Burdock include the Fundamentalist Church of Jesus Christ of Latter Day Saints facility (NRC, 2009c). The Southern Black Hills Water System has begun constructing a 24-km [15-mi] water transmission pipeline along Argyle Road northwest of Hot Springs, which will serve rural customers in south-central Custer County (USDA, 2012). The western extension of the pipeline will be 24 km

[15 mi] east of the Dewey-Burdock site boundary. The pipeline will transmit water pumped from a Madison aquifer well near Buffalo Gap, South Dakota, 72 km [45 mi] east of the Dewey-Burdock site (Figure 5.1-3). The proposed Dewey-Burdock ISR Project is not expected to impact the Southern Black Hills Water System project because the pipeline and Madison aquifer well are upgradient of the proposed Dewey-Burdock site.

The Madison aquifer is the most important regional aquifer supplying Rapid City, Edgemont, and numerous communities in southwestern South Dakota (see Figures 3.5-4 and 3.5-5). As described in SEIS Section 4.5.2, the applicant submitted an application for a water appropriation permit to SDDENR to pump groundwater from the Madison aquifer during ISR construction, operations, and aquifer restoration (Powertech, 2010). Edgemont is the closest community to the project site that obtains municipal water supply from the Madison aquifer. Edgemont lies 21 km [13 mi] southeast of the Dewey-Burdock site, and it is expected that any impacts on groundwater levels in the Madison aquifer at a regional level from the proposed project will be SMALL (SEIS Section 4.5.2). The applicant's excursion monitoring program described in SEIS Section 4.5.2.1.1.2 will ensure the protection of water quality in aquifers underlying the production zone. The Madison aquifer is separated from the Deadwood Formation, one of the proposed injection zones for the applicant's UIC Class V deep disposal wells, by the Englewood Formation (see Figure 3.5-5). The Englewood Formation is expected to provide confinement above the proposed Deadwood Formation injection zone (Naus, et al., 2001). The Minnelusa Formation is the other proposed injection zone for the UIC Class V deep disposal wells. Confining units at the base of the Minnelusa Formation are expected to provide hydraulic separation between the Minnelusa Formation and the Madison aquifer. In some locations, these confining layers may be absent or provide ineffective confinement; this could enhance the hydraulic connection between the Minnelusa aquifer and the underlying Madison aquifer (Naus, et al., 2001). However, SDDENR concluded based on water levels in Minnelusa and Madison observation wells in the area that there is a significant difference in the potentiometric surfaces of the two aquifers, which suggests that the aquifers are hydraulically separated in the vicinity of the proposed project area (SDDENR, 2012c). Further, the UIC permit will not allow injection into the Class V deep disposal wells unless the permittee demonstrates the well are properly sited, such that confinement zones and proper well construction minimize the potential for migration of fluids outside of the approved injection zone.

The USFS-managed J.H. Keith Cascade Springs aquatic recreational area where Cascade Springs is located is approximately 40 km [25 mi] east-southeast of the proposed project site. These springs discharge groundwater from the Madison and/or Minnelusa aquifers (Driscoll, et al., 2002). As described in SEIS Section 3.5.3.1, regional groundwater flow moves outward radially from the Black Hills, which results in a northeast to southwest regional flow direction in the vicinity of the proposed project site. Because the J.H. Keith Cascade Springs recreational area is located 40 km [25 mi] from the project site and is upgradient of the proposed project site with respect to regional groundwater flow, it is expected that estimated withdrawals of water from the Madison aquifer for operations and aquifer restoration and potential disposal of liquid wastes via deep Class V injection wells into the Minnelusa will have no impact on groundwater quantity and quality at Cascade Springs. The applicant's excursion monitoring program will ensure the protection of water quality in aquifers underlying production zone aquifers.

The former Black Hills Army Depot (BHAD) is approximately 14 miles south of the Dewey-Burdock ISR Project. The BHAD was established in 1942 and remained in continuous operation until 1967. It consisted of approximately 8,537 ha (21,095 ac) and was used to store, maintain, demilitarize, and issue conventional and chemical munitions. Three areas are associated with chemical munitions and chemical agent disposal: BG-1, BG-2, and the

Chemical Plant Area (USACE, 2012). The most likely mechanism by which the Dewey-Burdock ISR Project could affect contaminant migration at the former BHAD is by changing the groundwater gradients of the Inyan Kara aquifers during pumping to redirect groundwater toward the Dewey-Burdock ISR Project. However, the Inyan Kara aquifers must first be contaminated with constituents from the former depot in order for such a change in groundwater gradients to be of any consequence. In 2012, USACE reported that chlorinated solvents and fuel residues were discovered in shallow groundwater samples from the BHAD; however, no groundwater contamination was discovered in the BG-1 and BG-2 areas (USACE, 2012).

According to USACE, the Fall River aquifer is approximately 335 m (1,100 ft) deep at the former BHAD and is overlain by thick sequences of shales (USACE, 1992). Any surface contamination would be unlikely to penetrate such a thick shale sequence and contaminate the Fall River. Furthermore, the Fall River aquifer is artesian in this area (USACE, 1992). Therefore, if the overlying shales were perforated, water would move upward toward the ground surface, essentially preventing contamination from migrating downward into the aquifer. Considering the isolated nature of the Inyan Kara aquifers and the lack of significant groundwater contamination at the site, the NRC staff conclude that proposed operations at the Dewey-Burdock ISR Project will have no impact on site conditions at the former BHAD.

Within an 80-km [50-mi] radius of the proposed project, ongoing and planned ISR facilities, oil and gas exploration, wind energy projects, and transportation projects activities may contribute to impacts on groundwater resources.

The applicant has identified a potential ISR project at Dewey Terrace in Wyoming (Powertech, 2009b). The Dewey Terrace project would be located about 13 km [8 mi] west of the Dewey-Burdock ISR Project area in Weston and Niobrara Counties, Wyoming (Figure 5.1-3). If future ISR operations occurred at Dewey Terrace, there would be uranium extraction from the same aquifer (i.e., the Inyan Kara aquifer) as the proposed Dewey-Burdock ISR Project. The combined ISR projects may impact groundwater levels in the ore zone aquifer and impact the water quality of the ore zone aquifer at the two sites. Licensees of ISR facilities are required to implement excursion detection, control, mitigation, and remediation plans under NRC regulations to reduce the potential impact on groundwater quality and quantity.
Impacts on groundwater resulting from the interaction of ISR activities and oil and gas exploration and production are not likely because these activities are conducted in stratigraphically separated aquifers. ISR activities at the Dewey-Burdock ISR Project will take place in sandstone aquifers of the Fall River and Lakota aquifers at depths of 61 to 244 m [200 to 800 ft] (see SEIS Section 3.4.1.2). Oil and gas producing wells in Fall River and Custer Counties are located in the Minnelusa Formation at depths ranging from 415 to 1,081 m [1,363 to 3,547 ft] (see SEIS Section 5.1.1.3). In Wyoming, the producing wells closest to the project are in Niobrara County and are located in the Leo Sandstone of the Minnelusa Formation at depths ranging from approximately 785 to 823 m [2,575 to 2,700 ft] (see SEIS Section 5.1.1.3). The NRC-required excursion monitoring programs at ISR facilities will ensure that water quality in aquifers underlying production zone aquifers, including the Madison, Minnelusa, and Deadwood aquifers, would be protected.

Deep well injection of process-related water is a disposal method ISR and oil production facilities use. For deep well disposal in South Dakota, the applicant must obtain UIC permits for the targeted deep aquifer from the EPA. The applicant has proposed injecting process-related effluents from the Dewey-Burdock Project into the Deadwood and Minnelusa Formations, below the Morrison Formation (see Figure 3.5-5), using Class V (nonhazardous) wells (Powertech, 2010). EPA will evaluate the suitability of the proposed deep injection wells and would only grant a permit if the deep disposal practice is safe for public health and safety and will not impact potential underground sources of drinking water. To ensure water quality, the liquid waste injected via Class V wells into deep aquifers must not be classified as hazardous under the Resource Conservation and Recovery Act and must be treated to meet NRC release standards in 10 CFR Part 20, Subparts D and K and Appendix B.

Impacts to groundwater from potential wind energy projects in the western United States, such as the Dewey-Burdock Wind Project, will not be significant. During construction, water is required for mixing of concrete and for dust control along access roads and other areas of disturbance around the turbines, but these uses will be temporary. Development and construction of wind energy projects will use BMPs to mitigate impacts to both groundwater and surface water. Once a wind energy project is operating, minimal quantities of water are needed. (BLM, 2005)

Groundwater for the Dewey Conveyor Project will likely be used to suppress dust during road building and use activities, and for the construction of concrete foundation supports for the conveyor along its 10.6-km [6.6-mi] course. In addition, groundwater will be used for dust control/mitigation once the proposed quarry and conveyor are operational. This water demand will be supplied by one or more production wells (one at the quarry site and one at the rail load-out facility). The source for the supply well at the rail load-out facility will likely be developed in the Inyan Kara Group aquifer. This supply well will likely be used solely for dust suppression at the rail load-out area, and therefore the groundwater demand will be quite low, around 94.6 L/min [25 gpm] or less. (BLM, 2009a)

The proposed DM&E PRB Expansion Project (see SEIS Section 5.1.1.5) will have an impact on groundwater. Groundwater will be used to suppress dust during rail and bridge construction activities. Once operational, the PRB Expansion Project will use negligible amounts of groundwater. Water demand during construction activities will be supplied by existing municipal and private wells. DM&E will ensure that any wells that may be affected by project-related construction or reconstruction activities are appropriately protected or capped to prevent well and groundwater contamination. If wells are located on private land, DM&E will secure permission from the landowner before undertaking any actions. (STB, 2001)

The NRC staff have determined that the cumulative impact on groundwater resources within the water resources study area resulting from past, present, and reasonably foreseeable future actions is MODERATE. This finding is based on ongoing and reasonably foreseeable future actions that will (i) increase demand on the regional Madison aquifer, which is used for residential, municipal, and recreational purposes in the study area; (ii) impact groundwater quantity and quality in the Inyan Kara Group aquifer, which hosts uranium deposits surrounding the proposed Dewey-Burdock site; and (iii) potentially impact water quality in deep geologic formations that are used for deep disposal of liquid wastes. In addition, ongoing and reasonably foreseeable future actions will use groundwater for construction of concrete foundations and supports and for dust suppression during construction and operations activities, which will potentially impact water quantity in regional and local aquifers in the study area.

The NRC staff conclude that the proposed Dewey-Burdock ISR Project will have a SMALL incremental effect on groundwater resources when added to all other past, present, and reasonably foreseeable future actions in the groundwater study area. Based on the foregoing analysis, the potential impact of the proposed project on the existing and future use and quality of water for local and surrounding residential, municipal, and recreational purposes will be minimal. Impacts on groundwater resulting from interaction between ISR activities at the proposed Dewey-Burdock site and oil and gas production are unlikely because the ISR production zone aquifers are separated from underlying oil and gas bearing formations by hundreds to thousands of meters [hundreds to thousands of feet]. EPA permitting requirements will protect groundwater in aquifers used for deep well injection of process-related liquid effluents from the proposed action. The liquid waste injected via Class V wells into deep aquifers will have to be treated to meet NRC release standards in 10 CFR Part 20, Subparts D and K, and Appendix B. After uranium production and aquifer restoration are completed and groundwater withdrawals are terminated at the proposed Dewey-Burdock ISR Project, groundwater levels will recover with time. Groundwater restoration will restore impacted aquifers at the proposed project to acceptable water quality levels. Therefore, the NRC staff conclude that the potential impact on groundwater resources from operating the proposed Dewey-Burdock ISR Project will be SMALL (SEIS Section 4.5.2).

5.6 Ecological Resources

The cumulative impact to ecological resources was evaluated for the area within an 80-km [50-mi] radius surrounding the proposed Dewey-Burdock ISR Project. The proposed project is located within the Great Plains physiographic province on the edge of the Black Hills uplift. The area under consideration includes the Sagebrush Steppe, Black Hills Foothills, Black Hills Plateau, and Black Hills core highland ecoregions. The timeframe for the analysis of cumulative impacts is 2009 to 2030 (see SEIS Section 5.1.2 for the estimated operating life of the proposed Dewey-Burdock project). Older data are considered where applicable to demonstrate historical trends.

5.6.1 Terrestrial Ecology

Activities occurring in the area of the proposed Dewey-Burdock ISR Project boundary include grazing and herd management, hunting, and uranium, oil, and gas exploration. There may be cumulative impacts to ecological resources, including both flora and fauna. These impacts include a reduction in wildlife habitat and forage productivity; modification of existing vegetative communities; and the potential spread of invasive species and noxious weed populations. Concerning wildlife, impacts may involve loss, alteration, or incremental fragmentation of habitat; displacement of and stresses on wildlife; modification of prey and predator communities; and direct or indirect mortalities. Land disturbance resulting from reasonably foreseeable future actions (e.g., potential wind farm and transportation projects discussed in Sections 5.1.1.4 and 5.1.1.5) in the ecological resources cumulative impacts study area will have small ecological impacts, individually, if mitigative measures are employed (BLM, 2005, 2009a; STB, 2001). However, assuming that adjacent habitats for each disturbed parcel of land will be at, or near, carrying capacity, and considering there will be an unavoidable reduction or alteration of the habitats, development activities in the Black Hills Foothills and Sagebrush Steppe ecoregions could cumulatively reduce wildlife and plant populations and alter population structure. For some species that may require specific conditions for their habitats, future use will be strongly influenced by the quality and composition of the remaining habitats. Additionally, grasses and noxious weeds tend to replace sagebrush after disturbances.

Loss and degradation of native sagebrush shrubland habitats has imperiled much of this ecosystem type as well as sagebrush-obligate species, including the Greater sage-grouse (*Centrocercus urophasianus*). Sage-grouse are found in the sagebrush shrubland habitats, and sagebrush is essential during all seasons and for every phase of their lifecycle (USGS, 2009). Most of the sagebrush lands in the region have been changed by land use, such as livestock grazing, agriculture, or resource extraction. These uses can influence habitats either directly or indirectly, and they can alter the disturbance regime by changing the frequency of fire (USGS, 2009). The long-term viability of the sage-grouse rangewide continues to be at risk because of population declines related to habitat loss and degradation. Sage-grouse populations have declined overall from 1965 to 2007 with the greatest decline occurring before the mid-1980s. The total rangewide population decline is estimated at 45 to 80 percent from historic levels (Becker, et al., 2009). Populations have been declining at 2.0 percent per year from 1956 to 2003 (Connelly, et al., 2011). Because of its spatial extent, oil and gas resource development is regarded as playing a major role in the decline of the sage-grouse species in the eastern portion of the species' range (Becker, et al., 2009). Future oil and gas development is projected to cause a 7 to 19 percent decline in sage-grouse lek population counts throughout much of the current and historic range of the sage-grouse (Connelly, et al., 2011). As of this writing, the U.S. Fish and Wildlife Service (FWS) has designated the Greater sage-grouse a "candidate species" under the Endangered Species Act (ESA). FWS will consider the bird on an annual basis for listing as a threatened or endangered species. The State of Wyoming is critical for sage-grouse as it currently contains 64 percent of all known sage-grouse habitat and more active leks than any other state (Doherty, et al., 2011).

According to the South Dakota Game, Fish, and Parks (SDGFP), there are no crucial big game habitats or migration corridors in the ecological resources study. However, the area does provide habitat for a variety of big game, including deer, antelope, turkeys, elk, and bighorn sheep. Destruction or alteration of portions of this habitat in conjunction with human disturbance associated with ongoing and reasonably foreseeable future actions could result in SMALL incremental impacts to herd animals.

As discussed in SEIS Section 4.6.1, the proposed Dewey-Burdock Project has the potential to impact vegetation, small- to medium-sized mammals, reptiles, and a number of avian species. These species include raptors, waterfowl, shorebirds, upland game birds, and nongame birds known to occur as seasonal, migratory, or year-round residents. Impacts may occur to species during all phases of the proposed project and are expected to be SMALL to MODERATE. Potential SMALL to MODERATE impacts to avian species (e.g., habitat loss, fragmentation, noise disturbance) will also be likely to occur at other present and reasonably foreseeable future actions (e.g., oil and gas facilities, wind energy projects, and transportation projects; see SEIS Section 5.1.1) throughout the cumulative impacts study area and potentially impact other localized populations. Wind energy projects, such as the potential Dewey-Burdock Wind Project, have the potential to increase avian mortality resulting from bird and bat collisions, particularly in bird migration routes. BLM reported that the number of bird and bat collisions at wind energy projects is generally relatively small, when compared with collisions from other human-made structures (BLM, 2005).

The NRC staff have determined that the cumulative impact on terrestrial ecology within the ecological resources study area resulting from all past, present, and reasonably foreseeable future actions is MODERATE. This finding is based on habitat disturbance resulting from actions including (i) uranium and oil and gas exploration and development, (ii) potential ISR projects such as the Dewey Terrace ISR Project in Niobrara and Weston Counties in Wyoming, (iii) potential wind energy projects such as the Dewey-Burdock Wind Project, and (iv) potential transportation projects such as the Dewey Conveyor Project and the DM&E PRB Expansion Project. Habitat disturbance associated with these actions will impact vegetation by promoting the spread of noxious weeds and fragmenting vegetative communities. Impacts to wildlife could include loss, alteration, or incremental fragmentation of habitat; displacement of and stresses on wildlife; and direct and indirect mortalities.

The NRC staff concludes that the proposed Dewey-Burdock Project will have a SMALL incremental effect on terrestrial ecology when considered with all other past, present, and reasonably foreseeable actions in the ecological resources study area. The proposed action will disturb a maximum of 566 ha [1,398 ac] of habitat with most of the habitat disturbance consisting of scattered, confined drill sites for wells and potential land irrigation areas. These disturbances will not dramatically transform large expanses of habitat from their original character; therefore, no substantial long-term impact will generally be expected. Furthermore, the applicant will control and monitor potential land application areas to ensure observed impacts to soils and vegetation that could adversely affect flora and fauna are addressed. For vegetative species with specialized habitat requirements, future population viability will be strongly influenced by the quality and composition of the remaining habitat. Because the area of disturbed land will be a small percentage of the ecological resources study area, and because of stated mitigative measures the applicant has committed to as described in SEIS Section 4.6.1, impacts on vegetation from the proposed Dewey-Burdock project will have only a SMALL incremental impact when considered with all past, present, and reasonably foreseeable future actions. Although sage-grouse have been present in Fall River County in the past, and although a potential habitat for sage-grouse exists, Greater sage-grouse are not reported within 6.4 km [4 mi] of the proposed project boundary (SEIS Sections 3.6.3 and 4.6.1.1.1.2). Because NRC staff expect that similar habitat is present in the project area that FWS evaluated for the nearby Buffalo Gap National Grassland (see SEIS Sections 3.6.3 and 4.6.1.1.1.2) (Hodorff, 2005), it is unlikely that optimum canopy coverage of sagebrush habitat is present to support breeding and wintering populations within the proposed project area.

5.6.2 Aquatic Ecology

As described in SEIS Sections 4.6.1.1, 4.6.1.2 and 4.6.1.3, because of the limited and ephemeral nature of surface water at the proposed Dewey-Burdock Project, the occurrence of aquatic species is also limited. No loss of aquatic habitat will result from planned construction activities or land application sites at the proposed Dewey-Burdock Project (Powertech, 2009a). In addition, no surface water will be diverted, no process water will be discharged into an aquatic habitat, and stormwater runoff will be managed through the NPDES permit (as discussed in SEIS Section 4.5.1.1.1.2). Therefore, during all phases of the proposed Dewey Burdock Project lifecycle, the potential impacts to aquatic species and habitats will be SMALL.

The NRC staff determined that the cumulative impact on aquatic ecology resulting from all past, present, and reasonably foreseeable future actions is SMALL. Cumulative impacts from oil and gas exploration and development, other ISR activities, wind energy projects, and transportation projects described in SEIS Section 5.1.1 will not affect the aquatic ecosystem across the ecological resources study area. This conclusion is based on the limited and ephemeral nature of surface water in and surrounding the study area. The Beaver Creek and Pass Creek systems are the main surface water drainages in the study area. As discussed previously, Beaver Creek does not support sensitive aquatic species and is impaired due to high dissolved and suspended solids, high salinity, and fecal coliform (SDDENR, 2008). Pass Creek, on the other hand, does not provide a year-round source of water sufficient to maintain a population of aquatic species. In addition, all proposed activities in the study area will employ BMPs and comply with federal and state water quality regulations, which will reduce impacts on aquatic ecology.

The NRC staff have concluded that the proposed Dewey-Burdock Project will have a SMALL incremental effect on aquatic ecology when considered with all other past, present, and reasonably foreseeable actions in the study area. This conclusion is based on the limited and ephemeral nature of Beaver Creek and Pass Creek and other surface water features on the proposed Dewey-Burdock ISR Project site, and on the existing impaired status of Beaver Creek.

5.6.3 Protected Species

As discussed in SEIS Sections 4.6.1.1.1.1.4 and 4.6.1.2.1, no federally listed species are present within the proposed Dewey-Burdock Project license area. Potentially suitable habitat for migrating whooping cranes exists where standing water is present, which will occur primarily along Beaver Creek and Pass Creek and their drainages, and old mine pits. Direct impacts from the proposed project are unlikely because whooping cranes are not known to breed in South Dakota; however, cumulative impacts from oil and gas exploration and development, other ISR activities, wind energy projects, and transportation projects described in SEIS Section 5.1.1 could distress migrating cranes.

Rangewide, the long-term viability of the sage-grouse continues to be at risk because of population declines related to habitat loss and degradation. Because of its spatial extent, oil and gas resource development is regarded as playing a major role in the decline of the sage-grouse species in the eastern portion of species' range (Becker, et al., 2009). Future oil and gas development is projected to cause a 7 to 19 percent decline in sage-grouse lek population counts throughout much of the current and historic range of the sage-grouse (Connelly, et al., 2011).

Not including federally listed species, the NRC staff determined that the cumulative impact on protected species within the ecological resources study area resulting from all past, present, and reasonably foreseeable future actions is MODERATE. Cumulative impacts to federally listed species would be SMALL. This finding is based on habitat disturbance to potential non-federal protected species resulting from actions described in SEIS Section 5.1.1 including (i) uranium and oil and gas exploration and development, (ii) potential ISR projects such as the Dewey Terrace ISR expansion project in Niobrara and Weston Counties in Wyoming, (iii) potential wind energy projects such as the Dewey-Burdock Wind Project, and (iv) potential transportation projects such as the Dewey Conveyor Project and the DM&E PRB Expansion Project. Impacts to protected and threatened species from these actions could include loss, alteration, or incremental fragmentation of habitat; displacement of and stresses on species; and direct and indirect mortalities.

The NRC staff have concluded that the proposed Dewey-Burdock Project will have a SMALL incremental effect on protected species when considered with all other past, present, and reasonably foreseeable actions in the study area. No federally listed protected species are present within the proposed Dewey-Burdock Project license area, and the proposed license area does not contain critical habitat for any protected species. Furthermore, habitat disturbance at the proposed project site will consist primarily of scattered, confined drill sites for wells and potential land irrigation areas that will not result in large expanses of habitat being dramatically transformed, lost, or degraded.

5.7 Air Quality

Cumulative impacts to air quality were assessed primarily for the portions of the Black Hills-Rapid City Intrastate Air Quality Control Region located within an 80-km [50-mi] radius of the proposed Dewey-Burdock ISR Project. This area, hereafter called the air quality region of influence, covers the majority of Custer and Fall River Counties, the eastern portion of Pennington County (excluding Rapid City), and a very small portion of southwestern Lawrence County (see Figure 5.1.3).

5.7.1 Non-Greenhouse Gas Emissions

As described in Section 5.1.1, past, present, and foreseeable activities that may contribute to pollutant emissions include uranium exploration and extraction, oil and gas exploration and production, coal mining and coal bed methane operations, wind energy projects, the proposed Dewey Conveyor Project, and the proposed DM&E PRB Expansion Project. Air pollutants emitted by these sources potentially have a cumulative impact within the region and include, but are not limited to, carbon monoxide (CO) and nitrogen oxides (NO_x) from internal combustion engines used at natural gas pipeline compressor stations; CO, NO_x, particulates, sulfur dioxide (SO_2), and volatile organic compounds (VOCs) from gasoline and diesel vehicle tailpipe emissions; dust generated by vehicle traffic on unpaved roads and agricultural activities; NO_2 and particulate emissions from railroad locomotives; and air pollutants transported from emission sources located outside the region. The contribution of past and present activities will be addressed first. Then the analyses will examine the foreseeable activities.

The past and present contributions of projects in the region that emit air pollutants are represented in the ambient air quality monitoring results described in SEIS Section 3.7.2. These monitoring results indicate the air quality is in attainment for all National Ambient Air Quality Standards (NAAQS). Table 3.7-3 contains data primarily from Wind Cave National Park, the nearest ambient air quality monitoring station, and a Prevention of Significant Deterioration Class I site. This monitoring station was established in 2005 to determine air pollution background levels and whether the site was impacted by the long-range transport of air pollutants, such as pollution from the increase in oil and gas development in Colorado, Wyoming, and Montana (SDDENR, 2009). According to the South Dakota Ambient Air Monitoring Annual Network Plan (SDDENR, 2009), the annual PM_{10} concentrations at the Wind Cave site are the lowest in the state and the annual $PM_{2.5}$ concentrations are some of the lowest in the state. The nitrogen dioxide (NO_2) and SO_2 annual concentrations are very low and are at the monitoring equipment's detection limit (i.e., the ability of the equipment to detect the presence of a compound). The 8-hour average ozone levels at the Wind Cave station are similar to those at the state's other monitoring sites and are below NAAQS. Since 2007, trends at the Wind Cave site, as well as some of the other monitoring sites, show decreasing ozone concentration levels. Ongoing ambient air monitoring, such as that conducted at Wind Cave National Park, provides an avenue to continually assess air quality from the cumulative emissions observed at a particular location. The air permitting process provides a mechanism for regulatory authorities such as SDDENR to protect air quality through permit conditions and restrictions. The permitting process, including the Prevention of Significant Deterioration, is described in SEIS Sections 2.1.1.1.6.1.1 and 3.7.2.

Regional air modeling and other studies in the region of influence often focus on Wind Cave National Park, the Class I area located in Custer County about 46.7 km [29 mi] from the proposed site. As a Class I area, these analyses examine impacts to visibility. Visibility impairment occurs when the pollution in the air either scatters or absorbs the light. Both natural and man-made sources contribute air pollution which impairs visibility. Natural sources include windblown dust and smoke from fires. Man-made sources include electric utilities (i.e., power plants), industrial fuel burning, and motor vehicles.

The South Dakota Department of Environment and Natural Resources Regional Haze State Implementation Plan (SDDENR, 2011) provided pollution emission inventories and modeling results and also indentified the sources of the pollutants that affect the visibility. The plan provided information based on 2002 actual emissions and 2018 projections. This plan identified sulfate, organic carbon, and nitrate as the major contributors to visibility impairment at Wind Cave National Park. The modeling indicates that only about 3 percent of the sulfur dioxide pollution affecting visibility at Wind Cave National Park comes from sources within South Dakota and at most, about 10 percent of the nitrogen dioxide pollution comes from sources within South Dakota. The state that contributes the most sulfur dioxide and nitrogen dioxide pollution that affects visibility at this Class I area is Wyoming. The state that contributes the most organic carbon is South Dakota, with the predominant source coming from natural fires. The state that contributes the coarsest particulate matter is South Dakota, accounting for up to 45 percent of the total. However, between 60 and 71 percent of this coarse particulate matter is attributed to natural sources.

BLM also evaluated potential long-range air impacts to the Wind Cave National Park from activities in Wyoming, specifically the Powder River Basin west of the proposed Dewey-Burdock ISR Project. Emission sources for these activities included coal-related facilities (i.e., mines, power plants, railroads, conversion facilities), permitted sources in Wyoming and Montana, coal bed methane production sources, and miscellaneous (i.e., roads, urban areas, conventional oil and gas, noncoal power plants). Emissions were developed for base year 2004 (NO_2, SO_2, $PM_{2.5}$, and PM_{10}) and were projected for year 2020. For the Wind Cave site, year 2020 projected impacts were well below NAAQS standards. All modeled NO_x and SO_2 levels were near or less than 1 percent of the NAAQS, and the highest PM level was about 12 percent of the NAAQS (BLM, 2009b). Visibility impacts were identified for the Wind Cave site. When comparing the year 2004 baseline case to the projected year 2020 impacts, the number of days with greater than a 10 percent change in visibility increases by 31 days per year. (BLM, 2009b)

The analyses will now consider the various reasonably foreseeable future actions starting with the proposed DM&E PRB Expansion Project. This project would impact air quality in eastern Wyoming and southwestern South Dakota. Mitigation measures have been recommended as part of the proposed DM&E PRB Expansion Project to address potential adverse impacts to air quality. DM&E would be required to meet EPA emission standards for diesel-electric locomotives (40 CFR Part 92). To the extent practicable, DM&E would adopt fuel-saving practices, such as throttle modulation, dynamic braking, increased use of coasting trains, and shutting down locomotives when not in use for more than an hour, to reduce overall emissions during project-related operations. To minimize fugitive dust emissions during project-related construction activities, DM&E would implement fugitive dust suppression controls, such as spraying water, tarp covers for haul vehicles, and installation of wind barriers. (STB, 2001)

The only ISR site listed in Table 5.1-1 that occurs within the entire Black Hills-Rapid City Intrastate Air Quality Control Region is the proposed Dewey-Burdock ISR Project. The Edgemont site associated with conventional uranium milling is within the air quality region of influence and currently serves as a UMTRCA Title II disposal site under DOE ownership. As described in SEIS Sections 5.1.1.2 and 5.1.1.3, coal mining and oil and gas well development activities within the air quality region of influence are minimal.

None of the wind energy projects listed in Table 5.1-3 are within the air quality region of influence. The nearest existing wind power project is located about 161 km [100 mi] west-southwest in Converse County, Wyoming. As described in SEIS Section 5.1.1.4, a landowner group has organized to explore the possibility of a wind farm on privately owned land within and surrounding the proposed Dewey-Burdock ISR Project (see Figure 5.1-4). For wind energy projects, such as the potential Dewey-Burdock Wind Project, the construction phase would generate more air emissions than the operation phase (BLM, 2005). Multiple concurrent construction projects could contribute to regional pollutant emissions loads from construction and worker vehicle exhaust emissions. Localized incidences of fugitive dust along unpaved roads could occur if multiple construction projects occurred simultaneously. However, programmatic BMPs would include mitigation measures to reduce airborne dust at project sites. The dust emission contribution to cumulative impacts to regional air quality would be minimal, because they would be localized and temporary. Air emissions from vehicles involved in operational activities at wind energy projects would be minimal because of the small number of employees needed onsite at any one time (see SEIS Section 5.3). The small number of employees and associated trips during project operations would not have a noticeable effect on cumulative regional air quality (BLM, 2005).

The proposed Dewey Conveyor Project has the potential to cumulatively impact air quality in the vicinity of the proposed project. The aboveground conveyor system would be fully enclosed, preventing material and most dust from escaping into the atmosphere. Fugitive dust would be monitored during construction and during the initial stages of operation using particulate dust collectors (PM_{10} and PM_{25} samplers). The State of South Dakota's Air Quality permit requires this monitoring for various facilities associated with the conveyor project. The rail load-out facility located approximately 1.6 km [1 mi] from the northwestern boundary of the proposed project site would require an air quality permit from SDDENR, which would include requirements for minimizing dust generation by using air pollution control equipment and other applicable operational BMPs (BLM, 2009a).

The NRC staff determined that the cumulative impact on air quality within the study area resulting from other past, present, and reasonably foreseeable future actions is MODERATE. The current ambient air pollution concentrations relate to the air quality impacts from past and present actions. As described in SEIS Section 3.7.2, the area is classified as in attainment for each of the NAAQS pollutants. However, the Regional Haze State Implementation Plan and BLM regional analyses discussed in this SEIS section indicate that Wind Cave National Park does experience visibility impacts.

Cumulative impacts on air quality include the incremental effects from the proposed Dewey-Burdock ISR Project when added to the aggregate effects of other past, present, and reasonably foreseeable future actions. The NRC staff conclude in SEIS Section 4.7.1 that the proposed Dewey-Burdock ISR Project will have a SMALL to MODERATE effect on air quality. As stated in the preceding paragraph, NRC staff find that the impact on air quality within the study area resulting from other past, present, and reasonably foreseeable future actions is MODERATE. When combining the Dewey-Burdock impacts with all other impacts from other past, present, and reasonably foreseeable future actions in the study area, NRC staff conclude that the overall cumulative impact would be MODERATE. Comparing the total pollutant concentration (i.e., the modeling results for the project emissions when added to the background concentration levels) to the NAAQS is useful in making a cumulative impacts assessment. For the final AERMOD modeling run, the peak year total concentration for all of the pollutants are below the NAAQS. Due to short-term PM_{10} fugitive emissions, which are primarily generated from travel on unpaved roads, the proposed project impacts are considered MODERATE at times. However, the modeling shows that this impact is limited to the immediate vicinity where the fugitive emissions are generated. For the visibility analysis, the peak year project-specific results were below the contribution threshold, which indicates whether a source can be reasonably anticipated to cause or contribute to visibility impairment. For the acid deposition analysis, combining the peak year project-specific modeling results with the measured values at Wind Cave National Park, and comparing these to the critical load, provides another type of cumulative impacts assessment. All of the combined acid deposition results are below the critical load.

For information purposes, NRC staff has also presented the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and the staff has included the PM_{10} emissions in the CALPUFF visibility analysis. The NRC staff conclude in SEIS Section 4.7.1 that for analysis under these modeling assumptions and without additional considerations, the proposed Dewey-Burdock ISR Project will have a LARGE effect on air quality. As stated preveiously, NRC staff determined that the impact on air quality within the study area resulting from other past, present, and reasonably foreseeable future actions is MODERATE. When combining the Dewey-Burdock impacts with all other impacts from other past, present, and reasonably foreseeable future actions in the study area, NRC staff conclude that the overall cumulative impact will be LARGE.

5.7.2 Global Climate Change and Greenhouse Gas Emissions

NRC staff determined that a meaningful approach to address the cumulative impacts of greenhouse gas emissions, including carbon dioxide, is to recognize that (i) such emissions contribute to climate change, (ii) climate change is best characterized as the result of numerous and varied sources, each of which might seem to make a relatively small addition to global atmospheric greenhouse gas (GHG) concentrations, (iii) carbon footprint is a relevant factor in evaluating potential impacts of an alternative, and (iv) analysis may include both the proposed action’s contribution to atmospheric GHG levels and the potential effects of climate change to the proposed action. These concepts are more fully developed in Sutley (2010).

GHG emissions are described in SEIS Sections 2.1.1.1.6.1.1, 3.7.2, and 4.7. As described in SEIS Section 4.7.1.1.2, the operation phase emissions bound the other phases in terms of carbon dioxide levels generated. However, the peak year carbon dioxide annual emission estimate (when all four phases occur simultaneously) of 38,621 metric tons [42,572 short tons] represents the highest amount of emissions the proposed action will generate in any one project year (see Table 2.1-6). Electrical consumption is the source that generates the most emissions followed by mobile sources and then the stationary sources. The mobile sources include equipment associated with the drilling activity with the primary contributor being the drill rig (IML, 2013). As described throughout SEIS Section 4.7.1.2, NRC staff do not expect to see any appreciable difference in the overall greenhouse gas emission levels between the land disposal option and the deep well disposal option.

As described in SEIS Section 3.7.2, South Dakota accounted for approximately 36.5 million metric tons [40.2 short tons] of gross carbon dioxide equivalent (CO_2e) emissions in 2005 and forecast levels of 39.1 and 46.6 million metric tons [43.1 and 51.4 short tons] in 2010 and 2020, respectively (Center for Climate Strategies, 2007). The 2005 total is reduced to 34.9 million metric tons [38.5 short tons] as a result of annual sequestration (removal) due to forestry and other land uses (Center for Climate Strategies, 2007). The proposed Dewey-Burdock ISR Project peak year emission estimate of 38,621 metric tons [42,572 short tons] equates to less than 1 percent (0.11 percent) of the overall GHG emissions for South Dakota in 2005. The low level of GHG emissions from the proposed Dewey-Burdock Project relative to the state estimates provides the basis for the NRC staff conclusion that the proposed Dewey-Burdock ISR Project would have a SMALL incremental impact on air quality in terms of GHG emissions when added to the MODERATE cumulative impacts anticipated from other GHG emissions from past, present, and reasonably foreseeable future actions.

NRC also examined the potential effect of climate change on the proposed Dewey-Burdock ISR Project. While there is general agreement in the scientific community that some climate change is occurring, considerable uncertainty remains in the magnitude and direction of some of the changes, especially predicting trends in a specific geographic location. As described in SEIS Section 3.7.2, the recent report from the U.S. Global Change Research Program (GCRP) served as a source for climate change information (GCRP, 2009). From 1993 to 2008, the average temperature in the Great Plains increased by approximately 0.83 °C [1.5 °F] compared to the 1961 to 1979 baseline. South Dakota and the proposed Dewey-Burdock site are considered part of the Great Plains in this study. From 2010 to 2029, the average temperature in the Great Plains is projected to increase approximately 1.7 °C [3 °F] relative to the 1961 to 1979 baseline. Although GCRP did not incrementally forecast a change in precipitation by decade, it did project a change in spring precipitation from the baseline period (1961 to 1979) to the next century (2080 to 2099). For the region of South Dakota where the proposed Dewey-Burdock ISR Project would be located, GCRP forecasted a 10 to 15 percent increase in spring precipitation (GCRP, 2009).

Based on the previous analyses, the overall effect of projected climate change on the proposed Dewey-Burdock ISR Project is SMALL. The predicted increases in temperature and precipitation over the project lifespan are small. Much of the activity associated with ISR milling occurs below ground, whereas the listed climate change parameters are associated with the surficial and atmospheric environments. The predicted increase in precipitation and subsequent infiltration into the groundwater could result in an increase in recharge to the aquifer in the future. This could affect the proposed project by increasing the volume of groundwater in the orebody and improving the effectiveness of the aquifer restoration process. Similarly, potential changes to the site environment and resources, such as ecology during the period when the proposed activities would be conducted, would not be sufficient to alter the environmental conditions at the proposed site in a manner that would change the magnitude of the environmental impacts from what has already been evaluated in this SEIS.

5.8 Noise

Cumulative impacts from noise were assessed within an 8-km [5-mi] radius of the proposed Dewey-Burdock ISR Project. This area served as the cumulative assessment geographic boundary and was chosen because noise dissipates quickly from the source. GEIS Section 4.4.7 stated that sound levels as high as 132 dBA will taper to the lower limit of human hearing (20 dBA) at a distance of 6 km [3.7 mi] in this region, so a larger 8-km [5-mi] study area will be appropriate to evaluate potential cumulative impacts on noise (NRC, 2009a). The timeframe for the analysis is 2009 to 2030 (see SEIS Section 5.1.2 for the estimated operating life of the facility).

Noise associated with the proposed Dewey-Burdock ISR Project includes the operation of equipment such as trucks, bulldozers, and compressors; traffic due to commuting workers or material/waste shipments; and wellfield, central processing plant, and satellite facility activities and equipment. Other noises would include traffic noise from nearby roads and railroads. As detailed in SEIS Section 4.8.1, noise impacts to onsite and offsite residential and wildlife receptors and onsite workers from ISR activities at the proposed project would be SMALL for all stages of the project lifecycle.

Present and reasonably foreseeable future noise-generating activities in the vicinity of the proposed Dewey-Burdock ISR Project would primarily be from operating heavy equipment and traffic noise associated with (i) uranium and oil and gas exploration and development, (ii) wind energy projects, and (iii) transportation projects.

Oil and gas operations generate noise during construction, well drilling, and operation of compressor stations. However, noise levels from these activities are reduced to ambient levels at distances of approximately 488 m [1,600 ft] (BLM, 2003). Noise-related impacts are generally limited to the 610 m [2,000 ft] immediately surrounding each discrete source (e.g., drill rig, compressor station). Within the cumulative impacts from noise study area, there are four producing oil wells at the Barker Dome oilfield 6 km [4 mi] east of the proposed Dewey-Burdock site and another four producing oil wells at the Plum Canyon oilfield 5 km [3 mi] northwest of the proposed Dewey-Burdock site (see Figure 5.1-4). As described in SEIS Section 5.1.1.1, demand for oil and gas leasing in the vicinity surrounding the proposed Dewey-Burdock ISR project area is low and the level of oil and gas exploration and development is not anticipated to increase significantly in the foreseeable future.

At this time, no future ISR projects have been identified within the cumulative noise impacts study area {i.e., within a 8-km [5-mi] radius of the proposed Dewey-Burdock site}. The applicant has identified a potential ISR project at Dewey Terrace located 13 km [8 mi] west of the Dewey-Burdock site (see SEIS Section 5.1.1.1). If developed, Dewey Road may be used to access the potential Dewey Terrace project from Edgemont, which is the nearest community to the south. Therefore, the potential Dewey Terrace project may contribute to noise within the study area from additional traffic on Dewey Road from commuting workers, construction and operations deliveries, and yellowcake and byproduct transport.

Construction of a wind energy project, such as the potential Dewey-Burdock Wind Project, will produce noise from activities including access road construction, grading, drilling and blasting (for tower foundations), construction of ancillary structures, cleanup, and revegetation. In general, construction activities will last for a short period (e.g., 1 to 2 years) and will occur during the day; accordingly, their potential impacts will be temporary and intermittent in nature. Noise generated by turbines, substations, transmission lines, and maintenance activities during the operational phase of a wind energy project will approach typical background levels for rural areas at distances of 610 m [2,000 ft] or less. Like construction activities, decommissioning activities will occur during the day and would last for a short period compared with wind turbine operation, and therefore the potential impacts will be temporary and intermittent in nature. (BLM, 2005)

Noise sources associated with the proposed Dewey Conveyor Project include the conveyor, conveyor drive motors, locomotives, and diesel-powered loaders. Noise levels from the proposed Dewey Conveyor Project are predicted to be below the EPA guideline of 55 dBA within 21 m [70 ft] from the conveyor drive motors and below the estimated existing 40 dBA within 111 m [365 ft] from the conveyor drive motors. Noise levels due to the rail load-out are predicted to meet the EPA guidelines of 55 dBA within 320 m [1,050 ft] from equipment and meet the existing ambient 40 dBA within 1,288 m [4,225 ft] from equipment. Mitigation measures the conveyor operator, GCC Dacotah, proposes to reduce noise impacts include installing high-grade mufflers on diesel-powered equipment, combining noisy operations to occur for short durations, and limiting rail loading to daytime hours. (BLM, 2009a)

The proposed DM&E PRB Expansion Project will have a significant impact on noise in western South Dakota and Wyoming. Noise will be produced by heavy equipment use and vehicular traffic during construction and by locomotive engine and wheel/rail noise during rail line operations. DM&E has proposed mitigation measures as part of the proposed expansion project to address potential adverse impacts on noise. DM&E will maintain project-related construction and maintenance vehicles in good working condition with properly functioning mufflers to control noise. DM&E will comply with Federal Railroad Administration regulations (49 CFR Part 210) for decibel limits for train operations. DM&E will mitigate train wayside noise (locomotive engine and wheel/rail noise) for noise-sensitive receptors along project-related new rail line construction to within 70 dBA. To minimize noise, DM&E will properly maintain rails and regularly service locomotives, keeping mufflers in good working order to control noise. (STB, 2001)

The NRC staff have determined that the cumulative impact on noise within the noise study area resulting from all past, present, and reasonably foreseeable future actions is MODERATE. Operation of reasonably foreseeable future actions, such as the Dewey Conveyor Project and DM&E PRB Expansion Project, would have significant noise impacts within the cumulative impacts study area. Noise associated with operation of the conveyor project will include the conveyor, conveyor drive motors, locomotives, and diesel-powered loaders. Locomotive engine and wheel/rail noise will have long-term noise impacts during operation of the DM&E rail line project. In addition, the potential Dewey Terrace ISR project may contribute to noise along Dewey Road from commuting workers, equipment and materials deliveries, and yellowcake and byproduct transport. Other ongoing and reasonably foreseeable future actions are not expected to have a significant impact on noise within the cumulative impacts study area. There are only eight producing oil wells within the study area, and demand for oil and gas leasing is low. Coal bed methane reserves are not present within the study area. Potential wind energy projects, such as the Dewey-Burdock Wind Project, are generally compatible with the primary land uses in the study area, including livestock grazing, recreation, and wildlife habitat conservation (BLM, 2005). During operation of a wind energy project, noise generated by turbines, substations, transmission lines, and maintenance activities will approach typical background levels for rural areas at distances of 610 m [2,000 ft] or less (BLM, 2005).

The NRC staff have concluded that the proposed Dewey-Burdock Project would have a SMALL incremental effect on noise when considered with all other past, present, and reasonably foreseeable actions in the noise study area. There are few sensitive noise receptors (e.g., residences, communities) in the cumulative impacts noise study area. As described in SEIS Section 4.8.1, noise generated by construction and operational activities at the proposed Dewey-Burdock ISR Project will dissipate or be reduced by mitigation measures before reaching onsite and offsite residential and sensitive wildlife receptors. Additionally, noise levels will be mitigated by administrative and engineering controls to maintain noise levels in work areas below Occupational Safety and Health Administration (OSHA) regulatory limits.

5.9 Historic and Cultural Resources

Cumulative impacts on historic and cultural resources were assessed within a 16-km [10-mi] radius of the proposed Dewey-Burdock ISR Project. This area delineates the geographic boundary utilized for the cumulative analysis of historic and cultural resources and will be collectively referred to as the “historic and cultural resources study area.” The assessment of cumulative impacts on historic and cultural resources beyond 16 km [10 mi] was not undertaken because at this distance the impacts on historic and cultural resources from the proposed Dewey-Burdock ISR Project on other past, present, and reasonably foreseeable future actions will be minimal. The timeframe for the analysis is 2009 to 2030 (see SEIS Section 5.1.2 for the estimated operating life of the facility). In 2009, the applicant submitted a license application to NRC; year 2030 represents the license termination at the end of the decommissioning period. Potential impacts to cultural and historic resources could result from energy development, erosion, and grazing activities. These impacts would result primarily from the loss or damage to historical, cultural, and archaeological resources, but also from temporary restrictions on access to these resources. Applicants for ISR facilities would conduct appropriate historic and cultural resource surveys as part of prelicense application activities. Impacts to cultural resources are often minimized for projects located on federal or tribal lands or that are part of a federal action, because such projects are subject to the National Historic Preservation Act (NHPA), the Section 106 consultation process, and other applicable statutes.

Cultural resources may be affected indirectly by the consequences of nearby projects, such as erosion, destabilization of land surfaces, increased area access, and increased vibration from locomotive and heavy truck traffic. As discussed in SEIS Section 4.9, the impact of the proposed ISR project on historic and cultural resources in the Dewey-Burdock project area has been categorized as SMALL to LARGE, depending on the phase of the facility lifecycle.

The analysis of cumulative impacts on historic and cultural resources at the proposed project focused on identification and the assessment and implementation of mitigative measures to protect resources within the area of potential effect (APE). As described in SEIS Section 3.9, the APE is defined as the area that may be directly or indirectly impacted by construction, operations, aquifer restoration, and decommissioning activities associated with the proposed action. As described in SEIS Section 4.9.1, archaeological field investigations identified 18 historic sites within the proposed project area that are listed in the National Register of Historic Places (NRHP) or are eligible for listing in the NRHP. As further described in SEIS Section 4.9.1, tribal cultural surveys recommended 17 known archaeological sites and 12 newly discovered cultural sites as eligible for listing in the NRHP. Mitigation measures that will be implemented to protect NRHP-eligible sites are described in SEIS Section 4.9.1.

The applicant stated that site avoidance is the goal during development and production of the proposed project (Powertech, 2009a, Section 3.8.1). Sites in areas of activity where ground disturbance is planned will be fenced to avoid accidental disturbance. Furthermore, personnel will be made aware of the presence of sites prior to the start of ground-disturbing activities (Powertech, 2009a). If it is determined that NRHP-eligible sites described in SEIS Section 4.9.1 cannot be avoided, then treatment plans will require that the applicant complete mitigation prior to construction. Treatment plans will be established following the development of an agreement between the applicant, NRC, South Dakota State Historic Preservation Office (SD SHPO), interested federal and state agencies (e.g., BLM and EPA), and interested Native American tribes. As described in SEIS Section 4.9.1, if historical or cultural resources are encountered during ISR activities, the applicant is required by license condition to stop work (NRC, 2013; License Condition 9.8). The discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and BLM to proceed.

The rock art sites in Craven Canyon are the most significant cultural resource that has been identified in the vicinity of the proposed Dewey-Burdock ISR Project. Craven Canyon is located approximately 10 km [6 mi] east of the proposed Dewey-Burdock ISR Project boundary (see Figure 5.1-4). The rock art in Craven Canyon consists of both petroglyphs, the oldest form of rock art, and pictographs. Recently, there have been increased prohibitions on the extraction of uranium and other minerals in the Craven Canyon area, which is designed to protect cultural resources such as rock art.

Past, present, and reasonably foreseeable future actions that have the potential for cumulative effects on historic and cultural resources identified in the cumulative impacts study area include uranium exploration and extraction, oil and gas exploration, wind energy projects (e.g., the Dewey-Burdock Wind Project), and transportation projects (e.g., the proposed Dewey Conveyor Project and the proposed DM&E PRB Expansion Project) (see SEIS Sections 5.1.1.1 through 5.1.1.5).

Uranium extraction, and oil and gas exploration and drilling have occurred in the cumulative impacts study area, and additional drilling is likely to occur in the future. In the case of oil and gas exploration, areas have been proposed for lease sales, but neither applications nor permits to drill have been filed to date (see SEIS Section 5.1.1.3). Activities associated with exploration drilling will include access road and drill pad construction. All access roads and drill sites proposed for any type of exploration drilling will need to be surveyed for historic and cultural resources. Surveys by professional archaeologists and cultural specialists to identify and evaluate NRHP eligibility prior to project construction activities will need to be conducted. In addition, identification of properties of importance to Native American tribes will also need to be undertaken as part of consultation. If NRHP-eligible sites are found, appropriate levels of evaluation and mitigation will be required prior to construction.

One project that may have a cumulative impact on historic and cultural resources in the vicinity of the proposed Dewey-Burdock ISR Project is the potential Dewey Terrace ISR project. As with the current proposed project, the potential Dewey Terrace ISR project will be surveyed for historic and cultural resources prior to licensing and, if NRHP-eligible sites are indentified, appropriate levels of evaluation and mitigation will be required.

Surface-disturbing activities from wind energy developments, such as the potential Dewey-Burdock Wind Project, could uncover and destroy cultural resources. However, the development and implementation of programmatic agreements and BMPs will limit the potential impacts at a wind energy project site. For example, a cultural resources management plan will be developed to determine the mitigation activities needed for cultural resources found at a site. Avoidance of the historic and cultural resources will be the preferred mitigation option. Other mitigation options will include archaeological surveys and excavation (as warranted), monitoring, and inadvertent discovery procedures. The programmatic agreements and BMPs will also require consultation under NHPA Section 106, including consultation with SD SHPO and Native American tribes. The implementation of agreements and BMPs would greatly limit impacts from wind energy projects on cultural resources, which are expected to be mainly archaeological sites. However, impacts to cultural resources with a visual component (i.e., sacred landscapes) may occur. (BLM, 2005)

As described in SEIS Section 5.1.1.5, the proposed GCC Dacotah Inc. Dewey Conveyor Project would use an elevated, enclosed conveyor to transport limestone quarried from the Minnekahta Limestone to a rail load out facility near Dewey, South Dakota (see Figure 5.3-1). GCC Dacotah Inc. controls minerals rights to areas of potential limestone exploitation north of the proposed conveyor, where the Minnekahta Limestone lies at or near the ground surface (BLM, 2009a). These mineral rights are controlled either by ownership or leasing of private lands, or have been acquired by the staking of claims on lands underlain by federally held mineral rights. To date, the location of quarrying operations has not been finalized. However, federal mineral lands acquired by GCC Dacotah Inc. for potential limestone mining have been previously surveyed for cultural resources and over 60 sites were identified (Buechler, 1999; Sundstrom, 1999; Winham, et al., 2001). It is expected that many sites would be impacted during quarrying activities. Therefore, appropriate measures would be required to ensure that identified cultural resource sites are avoided and protected during quarrying operations (BLM, 2009a).

NRHP-eligible historic or cultural resource sites have not been identified along the proposed Dewey Conveyor Project route or within a 30-m [100-ft]-wide buffer zone on either side of the proposed construction zone (see Figure 5.3-1). However, the implementation of alternatives for the proposed Dewey Conveyor Project will result in direct impacts to NRHP-eligible properties. To address these impacts, the following mitigation measures have been proposed: (i) GCC Dacotah Inc. will make a reasonable effort to design the project in a manner to avoid NRHP-eligible properties; (ii) unless authorized by BLM, USFS, and SD SHPO, no surface disturbance will occur within 30 m [100 ft] of the boundary of identified NRHP-eligible properties; and (iii) unless authorized by BLM, USFS, and SD SHPO, no surface disturbance will occur within 30 m [100 ft] of the boundary of 14 unevaluated sites and until their NRHP eligibility has been determined. GCC Dacotah Inc. has also indicated that measures will be taken to ensure that even those sites that are not NRHP-eligible will be avoided and protected, wherever possible. (BLM, 2009a)

The proposed DM&E PRB Expansion Project will have a significant impact on cultural and historical resources. The project area has a long history of human occupation. Known sites of archaeological and historical significance occur throughout the area. The Department of Transportation Section of Environmental Analysis (SEA) identified 408 cultural resources sites within 0.6 km [1.0 mi] of Alternative C for the proposed DM&E project (see Figure 5.1-5). Of these, 96 sites were in South Dakota and 312 were in Wyoming. Within 0.6 km [1.0 mi] of an alternate route (Alternative B) for the proposed project, SEA identified 298 cultural resources sites, 70 in South Dakota and 228 in Wyoming. SEA determined that the project will have significant impacts to these resources because of the likelihood that construction of the proposed project will encounter significant cultural resources. To address potential adverse impacts on cultural resources, DM&E has proposed mitigation measures, including (i) informing workers of applicable federal, state, and local requirements for the protection of archaeological resources, graves, and other cultural resources and training them on how to recognize and treat resources; (ii) complying with a programmatic agreement and identification plan developed through the NHPA Section 106 consultation process; and (iii) implementing mitigation measures documented in a memorandum of agreement (MOA) developed to ensure that the concerns of Native Americans are considered and addressed. (STB, 2001)

Because the cumulative impacts study area has a long history of human occupation, it is expected that historic properties of religious and cultural importance to Native American tribes occur throughout the area and that many will be affected by the ongoing and reasonably foreseeable future actions discussed previously. Certain historic properties may be eligible for inclusion in the NRHP because of their association with cultural practices or beliefs of a living community that are rooted in its history and are important in maintaining its continuing cultural identity (National Register Bulletin 38). Historic properties that might be present within the cumulative impacts study area include camp and burial sites, plant collection areas, and sacred and worship sites.

The NRC staff have determined that the cumulative impact on cultural and historic resources within the cultural and historic resources study area resulting from all past, present, and reasonably foreseeable future actions is MODERATE to LARGE. Archaeological and historic sites and artifacts are present in the area of the proposed site, and any present and future projects could potentially cause adverse impacts to these sites and artifacts.

The NRC staff conclude that the proposed Dewey-Burdock ISR Project will have a SMALL to LARGE incremental impact on historic and cultural resources when added to the MODERATE to LARGE cumulative impact to these resources expected from other past, present, and reasonably foreseeable future actions. As discussed previously, archaeological field investigations identified 18 historic sites listed on or recommended as eligible for listing in the NRHP within the proposed Dewey-Burdock project area. In addition, tribal cultural surveys recommended 17 known archaeological sites and 12 newly discovered cultural sites as eligible for listing in the NRHP. ISR activities, especially ground-disturbing activities during the construction phase at the proposed project, may result in a cumulative loss of historic and cultural resources. The mitigation of adverse impacts at the proposed project will be addressed in an agreement between the applicant, NRC, SD SHPO, interested federal and state agencies (e.g., BLM, SDDENR), and interested Native American tribes.

5.10 Visual and Scenic Resources

Cumulative impacts to visual and scenic resources were assessed within a 3.2-km [2-mi] radius of the proposed Dewey-Burdock ISR Project. Beyond this distance, any changes to the landscape would be in the background distance zone for the purposes of visual resource management (VRM) defined by BLM, and would be either unobtrusive or imperceptible to viewers (BLM, 1984, 1986). The timeframe for the analysis is 2009 to 2030 (see SEIS Section 5.1.2 for the estimated operating life of the facility).

As described in SEIS Section 2.1.1.1, the proposed Dewey-Burdock site encompasses 4,282 ha [10,580 ac] of mostly private land in northern Fall River and southern Custer Counties, South Dakota. BLM has not assigned a VRM class to the region that encompasses the proposed project area. However, similar areas adjacent to the proposed project in Wyoming are identified as VRM Classes III and IV (BLM, 2000). At present, human-made features within and in the immediate vicinity of the proposed site include roads, power lines, ranch residences, fence lines, and abandoned open pits and overburden piles associated with past conventional uranium mining. The primary visual feature superimposed on the proposed project landscape is the transportation and utility corridor consisting of Dewey Road, the BNSF railroad, and overhead power lines. The abandoned open pits and overburden piles from historical mining that are located within the eastern and northeastern parts of the proposed project site contribute adversely to the scenic and visual quality of the area. However, the abandoned open pits and overburden piles are not visible from surrounding county roads and highways.

As described in SEIS Section 4.10.1, potential impacts on visual and scenic resources from the proposed Dewey-Burdock ISR Project will be the contrast of surface facilities and infrastructure (e.g., drilling rigs, powerlines, process buildings, header houses, wellheads, irrigation center pivots) with the existing visual inventory. These types of visual impacts are consistent with the management objectives of the VRM Class III and IV areas that include similar areas adjacent to the proposed project in Wyoming (BLM, 2000). As described in detail in SEIS Section 4.10.1, the impacts to visual and scenic resources from the surface structures and equipment will be SMALL for all phases of the proposed Dewey-Burdock ISR Project. NRC staff base this conclusion on the remote location of the project site and mitigation measures that will be used to reduce potential visual and scenic impacts (e.g., selecting building materials and paint that blend with the natural environment, dust suppression).

Past, present, and reasonably foreseeable future activities that could have cumulative impacts on the visual and scenic resources in the vicinity of the proposed Dewey-Burdock Project

include uranium exploration/extraction, potential oil and gas exploration and development, wind energy projects, and potential transportation projects (i.e., the proposed Dewey Conveyor Project and the proposed DM&E PRB Expansion Project).
Surface disturbances and fugitive dust emissions associated with access roads and drill pad construction developed for uranium and oil and gas exploration should have only a minor cumulative impact on the visual and scenic resources in the area. Access road segments will be considerably shorter than Dewey Road. Truck and equipment traffic for both construction and drilling activities will be relatively minor, consisting of one or two pieces of equipment per day for construction and two to four pick-up truck trips per day to support drilling activities. All surface disturbances and equipment associated with exploration drilling will be temporary, and the affected ground surface will be fully reclaimed after use. Demand for oil and gas leases is low, and there are no producing oil wells within the 3.2-km [2-mi] radius that could potentially contribute to cumulative impacts related to visual and scenic resources (see SEIS Section 5.1.1.3). Furthermore, there are no reasonably foreseeable future ISR operations in the 3.2-km [2-mi] radius that could potentially impact visual and scenic resources (see SEIS Section 5.1.1.1).

Wind energy projects, such as the potential Dewey-Burdock Wind Project (see Figure 5.1-4), will have an impact on visual and scenic resources within the cumulative impacts study area. The heights, type, and color of turbines, together with their placement with respect to local topography (i.e., on a ridge or mesa), are factors that will contribute to visual intrusion on the landscape. Also, the need for additional transmission lines to connect wind energy projects to the regional power grid could contribute to cumulative impacts. On U.S. government-owned lands, flexibility in locating turbines and transmission line towers to avoid visual impacts to important view sheds will be considered through consultation with the wind energy developer and the managing federal agency (e.g., BLM, USFS) on a project-specific basis. (BLM, 2005)

The proposed 10.6-km [6.6-mi]-long Dewey Conveyor Project will have an impact on visual and scenic resources within the cumulative impacts study area (see Figure 5.1-4). The proposed conveyor will consist of elevated 1.5 m by 2.4 m by 12.2 m [5 ft by 8 ft by 40 ft] conveyor segments attached to supporting concrete piers or foundations spaced 7.6 to 12.2 m [25 to 40 ft] apart. The average conveyor height will be 4.9 m [16 ft] with approximately 2.7 m [9 ft] of clearance beneath the conveyor segments. The conveyor alignment is proposed to begin at Dewey Road approximately 1.8 km [1.1 mi] south of the town of Dewey and approximately 1.6 km [1 mi] north-northwest of the proposed Dewey-Burdock Project boundary. The alignment will head east-northeast, progressively away from the proposed Dewey-Burdock Project area. (BLM, 2009a)

The DM&E PRB Expansion Project will impact visual and scenic resources in the cumulative impacts study area by the visual intrusion of the railroad on the landscape (see Figure 5.1-4). Construction and operation will affect the current scenic character of the cumulative impacts study area as well as the remoteness and feeling of vastness this undeveloped area provides. Some visual mitigation will be accomplished by the use of nonreflective rails and color matching of facilities where possible. For example, DM&E will comply with USFS color coordination requirements for facilities associated with the railroad. Any facility more than 41 cm [16 in] tall will be required to be olive drab, flat tan, or desert brown except where they are required by law to be a specific color. (STB, 2001)

The NRC staff have determined that the cumulative impact on visual and scenic resources in the study area resulting from all past, present, and reasonably foreseeable future actions is MODERATE to LARGE. This finding is based on the structures and infrastructure from potential future actions that could significantly alter the viewshed within 3.2 km [2 mi] of the proposed Dewey-Burdock ISR Project including (i) turbines and transmission lines associated with future wind energy projects (e.g., the Dewey-Burdock Wind Project), (ii) the elevated conveyor and supporting concrete piers associated with the Dewey Conveyor Project, and (iii) rails and facilities associated with the DM&E PRB Expansion Project.

The NRC staff have concluded that the proposed Dewey-Burdock ISR Project will have a SMALL incremental impact on visual and scenic resources when considered with all the other past, present, and reasonably foreseeable future actions in the study area. As described in SEIS Section 4.10.1, visual and scenic impacts from the equipment used to construct buildings and drill wells will be temporary and visual impacts from structures and fugitive dust will be mitigated by the rolling topography and BMPs (e.g., color consideration for structures and dust suppression).

5.11 Socioeconomics

As described in SEIS Section 5.1.2, the timeframe for this cumulative impacts analysis for socioeconomics resources begins in 2009 and ends in 2030. The following socioeconomic indicators were evaluated as part of this analysis.

- Population
- Employment
- Housing
- School enrollment
- Public services
- Fiscal revenue

The geographic boundary varies for the socioeconomic resource indicators listed and is described as part of the analyses for each subcategory. The potential socioeconomic impacts for the proposed Dewey-Burdock ISR Project will be SMALL. These impacts are described in SEIS Section 4.11.

5.11.1 Population

The geographic boundary for the cumulative population analysis includes Custer and Fall River Counties in South Dakota and Niobrara and Weston Counties in Wyoming. Population change over time is generally an excellent indicator of cumulative social and economic change in a given area. South Dakota's population has grown from 696,004 in 1990 to 814,180 in 2010 and is estimated to decline modestly to 801,939 in 2020 (Brooks, 2008; USCB, 2012). Population in Custer County grew from 6,179 in 1990 to 8,216 in 2010 and is projected to decline slightly to 8,186 in 2020 (Brooks, 2008; USCB, 2012). In Fall River County, population decreased slightly from 7,353 in 1990 to 7,094 in 2010 and is projected to increase to 7,423 in 2020 (Brooks, 2008; USCB, 2012). Wyoming population has grown from 453,588 in 1990 to 563,626 in 2010 and is projected to increase to 622,360 in 2020 and 668,830 in 2030 (WDAI, 2011, 2012). Niobrara County population has declined slightly from 2,499 in 1990 to 2,484 in 2010 and is projected to increase to 2,660 in 2020 and 2,710 in 2030 (WDAI, 2011, 2012). Weston County population has grown from 6,518 in 1990 to 7,208 in 2010 and is estimated to increase to 7,900 in 2020 and 8,120 in 2030 (WDAI, 2011, 2012).

The relatively flat county population projections do not take into account the current economic conditions, climate change legislation (including cap and trade components), and future technological changes (e.g., wind energy and clean coal innovations). If the reasonably foreseeable future actions described in SEIS Section 5.1.1 go forward and become functional within the boundary of the cumulative population analysis study area, workers will be required to build and operate these facilities. These future actions include potential wind energy projects, such as the Dewey-Burdock Wind Project, and proposed transportation projects, which include the Dewey Conveyor Project and the DM&E PRB Expansion Project. Additional workers will also be required to staff any expansion in uranium extraction projects, such as the development of the potential Dewey-Terrace project in Weston and Niobrara Counties. It is likely that any additional workers will desire to live closer to their place of employment and become active in their community. The towns of Custer (population 2,067), Hot Springs (population 3,711), Edgemont (population 774), and Newcastle (population 3,532) may see population increases associated with future actions in the population analysis study area. Assuming that energy development and transportation projects are developed and constructed, the addition of new workers in these towns will have a MODERATE cumulative impact on population. The relatively small pool of workers associated with the proposed Dewey-Burdock ISR Project (86 short-term positions during construction, 84 positions during operations, 9 positions during aquifer restoration, and 9 positions during decommissioning) will have only a SMALL incremental impact on population. If a disproportionate number of workers associated with the proposed Dewey-Burdock project elect to reside in small towns like Edgemont, the incremental impact on population could be MODERATE.

5.11.2 Employment

The geographic boundary for the cumulative employment analysis includes Custer and Fall River Counties in South Dakota and Niobrara and Weston Counties in Wyoming. While no individual county employment projections are available, the State of South Dakota is expected to experience modest growth through 2020, with an average annual growth rate of 0.9 percent (SDDLR, 2012). Employment in mining is expected to increase annually by 4 jobs or 0.5 percent through 2020, while employment in heavy construction is expected to increase annually by 50 jobs or 1.5 percent through 2020. The State of Wyoming is expected to experience modest growth through 2021, with an average annual growth rate of 1.5 percent (WDWS, 2012). Employment in mining (including oil and gas extraction) is expected to increase annually by 846 jobs or 3.2 percent through 2021.

The cumulative employment analysis study area may experience an increased rate of employment from ongoing and reasonably foreseeable future actions that may occur (see SEIS Section 5.1.1). If the potential Dewey-Burdock Wind Project and the proposed Dewey Conveyor Project and DM&E PRB Expansion Project are financed and developed, workers will be required to build and operate these projects. Wind energy projects are expected to employ 100 to 150 workers during a 1 to 2 year construction period and 10 to 20 workers to operate and maintain the project (BLM, 2005). The proposed Dewey Conveyor project is expected to employ 50 workers during the 1 year construction period and about 12 workers afterwards to operate the project (BLM, 2009a). The proposed DM&E project will employ more than 900 workers over the 2 to 3 year construction phase (STB, 2001). However, only a small portion of the overall construction workforce will be located in a single location at any one time. Once a particular phase of DM&E project is complete, workers will relocate to other job locations (STB, 2001). Workers will also be required to staff potential ISR facilities in the study area, such as the potential Dewey-Terrace project. It is assumed that potential ISR facilities in the study area will employ the same number of workers as the proposed Dewey-Burdock ISR

Project (86 during construction, 84 during operations, 9 during aquifer restoration, and 9 during decommissioning). This projected growth related to future actions will result in SMALL to MODERATE cumulative impacts to employment in the form of additional job opportunities. Based on the number workers expected at the proposed action, the proposed Dewey-Burdock ISR Project will have a SMALL incremental impact on employment.

5.11.3 Housing

The geographic boundary for the cumulative housing analysis includes Custer and Fall River Counties in South Dakota and Niobrara and Weston Counties in Wyoming. With the projected growth from ongoing and reasonably foreseeable future actions, new employees moving into the study area will require housing. Smaller communities, such as Edgemont, are likely to experience MODERATE cumulative impacts due to limited housing availability. Assuming, however, that new employees relocate to one of the larger communities, such as Custer, Hot Springs, or Newcastle, there should be adequate housing opportunities to absorb the influx of facility workers. Therefore, the cumulative impact will be SMALL. Given the number of Dewey-Burdock ISR facility employees (86 during construction, 84 during operations, 9 during aquifer restoration, and 9 during decommissioning), there will be SMALL incremental impacts to housing markets, prices, and real estate development in larger communities such as Custer, Hot Springs, and Newcastle. However, housing impacts may be MODERATE if a disproportionate number of employees at the proposed Dewey-Burdock ISR project elect to reside in smaller communities, such as Edgemont.

5.11.4 Education

The Custer School District, Hot Springs School District, Edgemont School District, Weston County School District No. 1, and Weston County School District No. 7 represent the geographic boundary for the school enrollment resource analysis. These school districts were selected because most permanent Dewey-Burdock ISR Project employees will be likely to live in one of these districts. Most of the construction workforce, however, is not expected to relocate entire families during the relatively brief construction phase (1 to 2 years). Student enrollment in these school districts totaled 2,915 in 2010 and ranged from 150 students in the Edgemont School District to 882 students in the Custer School District (see Table 3.11-5).

Most of the construction workforce for the ongoing and reasonably foreseeable future actions described in SEIS Section 5.1.1 is not expected to relocate entire families into the school enrollment study area. The construction phases of future actions, such as wind projects, ISR facilities, and transportation projects, are relatively brief, ranging from 1 to 3 years. During operations of ongoing and reasonably foreseeable future actions, new employees will be more likely to move their families and send their children to schools in the study area. The potential increase in school-aged children will likely be split between the school districts in the school enrollment study area. Based on the number of permanent employees needed to operate reasonably foreseeable future actions (e.g., 84 for ISR facilities, 10 to 20 for wind projects, and about 12 for transportation projects), cumulative impacts to school enrollment are expected to be SMALL. Based on the number of workers (84) needed for the proposed Dewey-Burdock ISR Project, the proposed action will have a SMALL incremental impact on school resources in the larger school districts within the school enrollment study area, such as the Custer and Hot Springs school districts. However, school enrollment impacts may be MODERATE if a disproportionate number of employees at the proposed Dewey-Burdock ISR Project elect to reside in smaller communities, such as Edgemont.

5.11.5 Public Services

The geographic boundary for the public services socioeconomic resource cumulative impact analysis includes Custer and Fall River Counties in South Dakota and Niobrara and Weston Counties in Wyoming. There may be incremental impacts to local government facilities and public services as population increases in affected counties and communities, which generally result in across-the-board increases in the demand on services. Even small changes in population size may result in additional demand for health and human services, such as doctors, hospitals, police, and fire response. Additionally, the various reasonably foreseeable future actions described in SEIS Section 5.1.1 may result in increased demand for specific services (e.g., road maintenance). Operational impacts to public services and public infrastructure, as a result of the workers relocating with their families, will be area-specific, and may be long term. As described in SEIS Section 3.11.7, there are a number of existing medical and emergency facilities that will be capable of handling issues related to increased population. Additionally, the State of South Dakota Social Services has offices located throughout the state, including in Custer and Hot Springs. The State of Wyoming has numerous social services offices located throughout the state as well. There is an office for Niobrara and Weston Counties, as well as other local offices located in Newcastle. It is not anticipated that additional population from ongoing and reasonably foreseeable future actions will stress the current social services capabilities in the public services resource study area. Therefore, cumulative impacts to public services are expected to be SMALL. Given the number of workers required for the proposed Dewey-Burdock ISR Project (86 during construction, 84 during operations, 9 during aquifer restoration, and 9 during decommissioning), incremental impacts from the proposed action will have a SMALL impact on public services.

5.11.6 Local Finance

The geographic boundary for the local finance socioeconomic resource is Fall River and Custer Counties. Tax revenue will accrue mainly in Fall River and Custer Counties and to the State of South Dakota, and because of the structure of the taxing system, taxes may not accrue or be distributed to the localities proportionate to the population/public service impacts experienced by those entities. The tax system in place helps capture tax revenue during construction, operation, and decommissioning of industrial facilities. Additionally, a county ad valorem tax from current and future mineral extraction operations will contribute to local government revenue. Indirectly, counties and municipalities will benefit from increased sales tax revenue from increases in population and resultant demand for goods and services. If reasonably foreseeable future actions are constructed and operated, there will be a MODERATE cumulative impact on local finance. Contributions from the Dewey-Burdock ISR Project are expected to have a SMALL to MODERATE incremental impact on local finance.

The NRC staff determined that the cumulative impact on socioeconomic resources resulting from past, present, and reasonably foreseeable future actions ranges from SMALL to MODERATE. Impacts to population and local finance will be MODERATE; impacts to employment will be SMALL to MODERATE, and impacts to housing, education, and public services will be SMALL.

The NRC staff conclude that the proposed Dewey-Burdock ISR Project will have a SMALL to MODERATE incremental effect on socioeconomic resources when considered with other past, present, and reasonably foreseeable actions. Impacts to population, housing, local finance, and education will be SMALL to MODERATE, while impacts to employment and public services will be SMALL.

5.12 Environmental Justice

Impacts relating to environmental justice for the proposed Dewey-Burdock ISR Project are described in detail in SEIS Section 4.12. The geographic boundary for this resource includes Custer and Fall River Counties in South Dakota, Weston County in Wyoming, and the Pine Ridge Indian Reservation in Shannon County, South Dakota. The timeframe for the analysis is 2009 to 2030 (see SEIS Section 5.1.2 for the estimated operating life of the proposed project).

As described in SEIS Section 4.12.1, NRC staff determined that the percentage of minority populations living in affected block groups in the vicinity of the proposed Dewey-Burdock ISR Project site in Custer, Fall River, and Weston Counties does not significantly exceed the percentage of minority populations recorded at the state and county levels and is well below the national level. Furthermore, NRC staff determined the percentage of low-income populations living in affected census tracts in the vicinity of the proposed project site in Custer, Fall River, and Weston Counties does not significantly exceed the percentage of low-income populations recorded at the state or county level. Based on an analysis of potential impacts to minority and low-income populations described in SEIS Section 4.12.2, NRC concluded that there will be no disproportionally high or adverse impacts to minority or low-income populations residing near the proposed project area.

In GEIS Section 6.4, NRC staff identified the Native American Oglala Sioux Tribe as a minority population in the Nebraska-South Dakota-Wyoming Milling Region and the Pine Ridge Indian Reservation as a low-income population (NRC, 2009a). The Pine Ridge Indian Reservation is located in Shannon County, South Dakota, approximately 80 km [50 mi] from the proposed Dewey-Burdock ISR Project. Environmental justice impacts related to the protection of cultural and religious resources of significance to the Oglala Sioux Tribe and other potentially affected Native American tribes are being addressed through the NHPA Section 106 consultation process as described in SEIS Sections 1.7.3.5 and 4.9.1. As described in SEIS Section 4.12.1, environmental justice impacts to Native American tribes will primarily be no different than those experienced by other populations within the vicinity of the project area. Although the proposed action may potentially affect certain sites of religious or cultural significance to the tribes, the impacts to such sites would be reduced through mitigation strategies developed during Section 106 consultations.

Because the economic base of the study area is includes ranching, government, tourism, and resource extraction, low income areas are not only widely dispersed but small in size. Furthermore, it is unlikely that race and poverty characteristics in regions surrounding the proposed Dewey-Burdock ISR Project area will change significantly as a result of past, present, and reasonably foreseeable future projects discussed in Section 5.1.1. For reasonably foreseeable future actions, the extent to which there will be potential environmental impacts (e.g., visual impacts of wind turbines and transmission infrastructure associated with wind energy projects) and health and safety risks that create an environmental justice concern will depend on the precise location of low-income and minority populations in relation to specific projects. Full analysis of the potential impacts of specific projects on low-income and minority populations will be undertaken as part of site-specific environmental justice reviews of each proposed development site.

Based on available minority and low income population information and the analysis of human health and environmental impacts presented in Chapters 4 and 5, NRC staff conclude that the potential for adverse incremental impacts within the study area will be SMALL. The NRC staff also conclude that the proposed project will have a SMALL incremental impact on environmental justice populations when added to the SMALL cumulative impacts from other past, present, and reasonably foreseeable future actions.

5.13 Public and Occupational Health and Safety

Cumulative impacts on public and occupational health and safety were evaluated within a 105-km [65-mi] radius of the proposed Dewey-Burdock site. This distance was chosen because the nearest operating ISR facility to the proposed Dewey-Burdock site is located approximately 105 km [65 mi] south at Crow Butte in Dawes County, Nebraska. The timeframe for the analysis is 2009 to 2030 (see SEIS Section 5.1.2 for the estimated operating life of the facility).

The public and occupational health and safety impacts from the proposed Dewey-Burdock ISR Project will be SMALL and are discussed in detail in SEIS Section 4.13.1. During normal activities associated with all phases of the project lifecycle, radiological and nonradiological worker and public health and safety impacts will be SMALL. Annual radiological doses to the population within 105 km [65 mi] of the proposed project will be far below applicable NRC regulations. For accidents, radiological and nonradiological impacts to workers may be MODERATE if the appropriate mitigation measures and other procedures intended to ensure worker safety are not followed. Typical protection measures, such as radiation and occupational monitoring, respiratory protection, standard operating procedures for spill response and cleanup, and worker training in radiological health and emergency response, will be required as a part of the applicant's NRC-approved Radiation Protection Program (Powertech, 2011). These procedures and plans will reduce the overall radiological and nonradiological impacts to workers from accidents to SMALL.

Past, existing, and anticipated future uranium recovery facilities in the vicinity of the proposed Dewey-Burdock ISR Project and within the broader regional area are described in Section 5.1.1.1. Abandoned open pits and overburden waste piles associated with past surface mining activities occur in the Burdock portion of the proposed site (see Figure 3.2-3). Radiation surveys have revealed that soils in and near the old surface mining works have elevated radiation levels (see SEIS Section 3.12.1), which could potentially increase radiological doses to onsite workers. Within a 105-km [65-mi] radius of the proposed project, there is one operating ISR facility at Crow Butte in Dawes County, Nebraska. In addition, three satellite facilities or ISR expansions for the Crow Butte site are in the planning or licensing stages: North Trend, Three Crow, and Marsland. The applicant has also identified a potential ISR project at Dewey Terrace in Niobrara and Weston Counties, Wyoming (Powertech, 2009b). If constructed and operated, each of these facilities will have similar radiological and nonradiological impacts on public and occupational health and safety to those at the proposed Dewey-Burdock site. Potential cumulative impacts from these facilities will result from incremental increases in annual radiological doses to the population when combined with the impacts of the proposed Dewey-Burdock ISR Project.

As stated in Section 4.13.1, for normal operations, Rn-222 will be the only significant radionuclide anticipated to be released at the proposed Dewey-Burdock ISR Project; the primary sources will be from wellfield venting and releases from within the central plant for process operations (predominantly via vent stacks on the ion-exchange columns and various tanks). As further described in SEIS Section 4.13.1, the maximum expected exposure to a member of the public is located southeast of the Dewey satellite facility within the proposed Dewey-Burdock project permit boundary (see Figure 4.13-1). This maximum exposure is estimated to be 0.06 mSv/yr [6.0 mrem/yr] and is consistent with estimates of expected exposure levels at other operating ISR facilities in the United States (NRC, 2009a). This exposure, combined with exposures from other operating and potential ISR facilities in the study area, will remain far below the 10 CFR Part 20 public dose limit of 1.0 mSv/yr [100 mrem/yr] and have a negligible contribution to the 6.2 mSv [620 mrem] average yearly dose received by a member of the public from all sources.

As described in SEIS Section 4.13.1, both worker and public radiological exposures are addressed in NRC regulations at 10 CFR Part 20. Licensees are required to implement an NRC-approved radiation protection program to protect occupational workers and ensure that radiological doses are "as low as reasonably achievable" (ALARA). The applicant's radiation protection program includes commitments for implementing management controls, engineering controls, radiation safety training, radon monitoring and sampling, and audit programs (Powertech, 2011). Measured and calculated doses for workers and the public are commonly only a fraction of regulated limits. Analysis of three separate accident scenarios (thickener failure and spill, pregnant lixiviant and loaded resin spills, and yellowcake dryer accident release) will also result in hypothetical exposures that are less than NRC regulatory limits and produce SMALL potential impacts (SEIS Section 4.13.1.1.2.2).

The types and quantities of chemicals (hazardous and nonhazardous) for proposed use at the Dewey-Burdock ISR Project do not differ from those evaluated in the GEIS. The use of hazardous chemicals at ISR facilities is controlled under several regulations (see SEIS Section 4.13.1.1.2.3 for a list of these regulations) that are designed to provide adequate protection to workers and the public. The handling and storage of chemicals at the facility will follow standard industrial safety standards and practices. Industrial safety aspects associated with the use of hazardous chemicals are regulated by the South Dakota OSHA. Nonradiological worker safety will be addressed through occupational health and safety regulations and practices.

Other past, present, and reasonably foreseeable future actions in the vicinity of the Dewey-Burdock Project that could contribute to nonradiological public and occupational health and safety include oil and gas exploration, wind energy projects, the proposed Dewey Conveyor Project, and the proposed DM&E PRB Expansion Project (see SEIS Sections 5.1.1.3, 5.1.1.4, and 5.1.1.5). Increased risk to human health and safety will occur during development and operation of these projects from the inherent hazards associated with construction and maintenance activities. However, these risks will be minimized by implementation of BMPs, development and implementation of health and safety programs, safety setbacks to nearest residences, mitigation measures, and compliance with applicable federal and state occupational and public safety regulations (BLM, 2005, 2009a; STB, 2001). Hazardous materials that are likely to be used during these ongoing and reasonably foreseeable future projects include diesel fuel, gasoline, hydraulic fluids, motor oil/grease, and compressed gasses used for welding (e.g., acetylene or propane). A large-scale release of diesel fuel or several of the other substances used at the projects may have implications for public health and safety. The location of the release will be the primary factor in determining its importance. However, the probability of a release anywhere along a proposed transportation route is extremely low, the probability of a release within a populated area will be even lower, and the probability of a release involving an injury or fatality will be still lower (BLM, 2009a). Therefore, it is not anticipated that a release involving a severe effect on human health and safety will occur during these ongoing and potential future actions. In addition, ongoing and potential future actions will have federal- and/or state-mandated spill prevention and control plans to prevent spills of oil and other petroleum products and other hazardous materials during construction and operation activities (BLM, 2009a; STB, 2001).

The NRC staff have determined that the cumulative impact on public and occupational health and safety in the study area resulting from all past, present, and reasonably foreseeable future actions is SMALL. This finding is based on estimates of combined radiological exposures from currently operating and proposed future ISR facilities in the study area, which are estimated to remain far below the regulatory public limit of 1.0 mSv/yr [100 mrem/yr] and have a negligible contribution to the 6.2 mSv [620 mrem] average yearly dose for a member of the public from all sources. Nonradiological exposures to workers and the general public from hazardous chemicals and materials resulting from past, present, and reasonably foreseeable future actions will be minimized by implementation of BMPs, mitigation measures, and compliance with applicable federal and state occupational and public safety regulations.

The NRC staff conclude that the proposed Dewey-Burdock ISR Project will have a SMALL incremental impact on public and occupational health when considered with all the other past, present, and reasonably foreseeable future actions in the study area. The maximum expected exposure to a member of the public at the proposed Dewey-Burdock Project is estimated to be 0.06 mSv/yr [6.0 mrem/yr] and is consistent with estimates of expected exposure levels at other operating ISR facilities in the United States (NRC, 2009a). Because the facility is located in a remote, sparsely populated area, the exposure to members of the public will be limited. Occupational health hazards will be limited because licensees are required to implement an NRC-approved radiation protection program to protect workers. As described in SEIS Section 4.13.1.1.2.3, the handling, storage, and disposal of chemicals at the proposed project would follow standard industrial safety standards and practices and the applicant must comply with EPA, SDDENR, and OSHA regulations regarding the industrial and environmental safety aspects associated with the use of chemicals.

5.14 Waste Management

Waste management impacts from the proposed Dewey-Burdock ISR Project would be SMALL to MODERATE and are detailed in SEIS Section 4.14.1. Cumulative impacts on waste management were considered within a 105-km [65-mi] radius of the proposed Dewey-Burdock Project site, and the timeframe for the analysis is 2009 to 2030 (see Section 5.1.2 for the estimated operating life of the facility). This distance was chosen because the nearest operating ISR facility that could generate waste volumes consistent with those projected for the proposed Dewey-Burdock site is located approximately 105 km [65 mi] south at the Cameco Crow Butte operation in Crawford, Nebraska.

The proposed Dewey-Burdock ISR Project will generate radiological and nonradiological liquid and solid wastes that must be handled and disposed of properly. Waste streams and the types and volumes of wastes to be disposed are described in SEIS Section 2.1.1.1.6. The primary radiological wastes are process-related liquid wastes, waste treatment solids, and process-contaminated structures and soils, all of which are classified as byproduct material waste. As discussed in SEIS Section 4.14.1, liquid byproduct material generated during operations is composed of production bleed, waste brine streams from elution, laundry water, plant washdown water, laboratory chemicals, and aquifer restoration water. Liquid byproduct material will be treated onsite using a combination of ion exchange, reverse osmosis, and radium settling followed by deep disposal in Class V injection wells, land application, or combined deep well disposal in Class V injection wells and land application. State- and federal-permitting actions, NRC license conditions, and NRC and state inspections ensure that proper waste disposal practices will be used to comply with safety and environmental requirements to protect workers, the public, and the environment.

As described in SEIS Section 4.14.1, the overall impacts from the disposal of process-related liquid wastes at the proposed Dewey-Burdock ISR Project will be SMALL. In addition, impacts associated with disposal of solid radioactive wastes will be SMALL based on the required preoperational disposal agreements made between the licensee and the licensed byproduct material waste disposal facility. Hazardous waste disposal impacts at the proposed Dewey-Burdock Project will be SMALL based on the low volumes of waste generated. Impacts from disposal of nonradioactive, nonhazardous solid wastes will be SMALL during the construction, operations, and aquifer restoration phases of the proposed project based on estimated volumes and the available capacity of local municipal solid waste landfills. However, impacts from disposal of nonhazardous solid wastes will be SMALL to MODERATE during the decommissioning phase depending on the long-term status of existing local landfill resources. If local landfill capacity is not expanded prior to the proposed decommissioning phase, impacts will be MODERATE because the projected capacity of the local landfill (i.e., the Custer-Fall River landfill) will be insufficient to accommodate all the decommissioning nonhazardous solid waste. If local landfill capacity is expanded prior to the decommissioning phase, impacts from disposal of nonhazardous solid wastes will be SMALL.

Past, existing, and anticipated future uranium recovery facilities in the vicinity of the proposed Dewey-Burdock ISR Project and within the broader regional area are described in Section 5.1.1.1. Abandoned open pits and overburden waste piles associated with past surface mining activities occur in the Burdock portion of the Dewey-Burdock site (see SEIS Figures 3.2-3). Radiation surveys reveal that soils near the old surface mining works have higher than background radiation levels (Powertech, 2009a). At present, there are no plans to clean up and reclaim the old surface mines. However, potential future state- or federal-funded cleanup and reclamation of the abandoned open pits and overburden waste piles will have an impact on waste management if the radioactive soils require disposal in a licensed byproduct disposal facility. As noted previously, within a 105-km [65-mi] radius of the proposed Dewey-Burdock ISR Project, there is one operating ISR facility at Crow Butte in Dawes County, Nebraska, which will generate waste volumes consistent with those projected for the proposed Dewey-Burdock ISR project. In addition, three satellite facilities or ISR expansions are in the planning and licensing stages at the Crow Butte site: North Trend, Three Crow, and Marsland (see SEIS Section 5.1.1.1). Powertech has also identified a potential ISR project at Dewey Terrace in Niobrara and Weston Counties, Wyoming (Powertech, 2009b). All of these potential ISR facilities will generate solid and liquid waste volumes consistent with those projected for the proposed Dewey-Burdock ISR Project, which could contribute to waste management impacts within the cumulative impacts study area. Generation of nonhazardous solid wastes at the planned and potential ISR facilities could impact landfill resources in the cumulative impacts study area. Impacts to landfill resources will be MODERATE if current landfill capacities are not adequate to accept nonhazardous solid wastes generated by the planned and potential ISR facilities and an expansion is necessary to accommodate added volume. Before ISR operations begin, NRC requires ISR facilities to have an agreement in place with a licensed disposal facility to accept byproduct material. Because radioactive wastes are so closely monitored throughout the United States, the impact on waste management from these potential facilities is anticipated to be SMALL.

Regarding the potential cumulative impacts of liquid waste disposal, the applicant is seeking permits from EPA for four to eight Class V deep disposal wells for liquid byproduct materials (Powertech, 2011, Appendix 2.7–L). Additional deep disposal well use in the region is anticipated as additional ISR facilities are licensed. The EPA-permitting process for these wells evaluates the suitability of proposals to ensure groundwater resources are protected and potential environmental impacts are limited to acceptable levels. Based on the assumption that EPA will not permit deep injection wells that will have a significant potential to impact groundwater resources, the NRC staff conclude the cumulative impacts of using deep disposal wells for the proposed action along with the potential impacts from present and reasonably foreseeable future actions will be SMALL.

Other ongoing and reasonably foreseeable future activities in the vicinity of the proposed Dewey-Burdock ISR Project site that may generate nonradiological hazardous wastes include oil and gas exploration, wind energy projects, and proposed transportation projects, such as the Dewey Conveyor Project and the DM&E PRB Expansion Project (see SEIS Sections 5.1.1.3, 5.1.1.4, and 5.1.1.5). Each of these projects will require shipment, storage, use, and disposal of hazardous materials and generation of solid and hazardous wastes; however, BMPs addressing these activities will effectively mitigate potential impacts. Each project will also be responsible for complying with applicable federal and state regulations and site-specific license agreements that manage generated wastes. For example, applicants will be required to comply with Department of Transportation Hazardous Materials regulations (49 CFR Parts 171 and 179) when handling, storing, and disposing hazardous materials. The types of hazardous substances that will likely be present during activities associated with these projects include diesel fuel, gasoline, hydraulic fluids, motor oil/grease, and compressed gases used for welding (e.g., acetylene, propane). Potential impacts will result from accidental releases of these substances during transportation, or during use and storage. The environmental effects of a release will depend on the substance, quantity, timing, and location of the release. The event could range from a minor oil spill on the project site where cleanup equipment will be readily available, to a severe spill during transport involving a large release of fuel or other hazardous substance. Some of the chemicals could have immediate adverse impacts on water quality and aquatic resources if a spill entered a flowing stream. With rapid cleanup actions, contamination will not result in a long-term impact to soils, surface water, or groundwater.

The NRC staff have determined that the cumulative impact on waste management in the study area resulting from all past, present, and reasonably foreseeable future actions is SMALL to MODERATE. All present and reasonably foreseeable future actions will implement BMPs to address shipment, storage, use, and disposal of radiological and nonradiological hazardous materials (both liquid and solid) and will be required to comply with applicable federal and state regulations and site-specific license agreements that manage generated wastes. Impacts to landfill resources will be MODERATE if current landfill capacities are not adequate to accept nonhazardous solid wastes generated by the planned and potential ISR facilities and an expansion is necessary to accommodate added volume.

The NRC staff conclude that the proposed Dewey-Burdock ISR Project will have a SMALL to MODERATE incremental impact on waste management when considered with all the other past, present, and reasonably foreseeable future actions in the study area. The applicant will be required to obtain the necessary permits and contractual agreements for disposing of its solid byproduct material, hazardous waste, and nonradiological, nonhazardous solid and liquid wastes. In addition, the applicant will be required to comply with applicable federal and state regulations and site-specific license agreements for the management and disposal of process-related liquid wastes. Impacts from disposal of nonradioactive, nonhazardous solid wastes will be SMALL during the construction, operations, and aquifer restoration phases of the proposed project based on estimated volumes and the available capacity of local municipal solid waste landfills. However, impacts from disposal of nonhazardous solid wastes will be SMALL to MODERATE during the decommissioning phase depending on the long-term status of existing local landfill resources. If local landfill capacity is not expanded prior to the proposed decommissioning phase, impacts will be MODERATE because the projected capacity of the local landfill (i.e., the Custer-Fall River landfill) will be insufficient to accommodate all the decommissioning nonhazardous solid waste. If local landfill capacity is expanded prior to the decommissioning phase, impacts from disposal of nonhazardous solid wastes will be SMALL.

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NRC FORM 335 (12-2010) NRCMD 3.7 — U.S. NUCLEAR REGULATORY COMMISSION **BIBLIOGRAPHIC DATA SHEET** *(See instructions on the reverse)*	1. REPORT NUMBER (Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.) NUREG-1910, Supplement 4, Volume 1
2. TITLE AND SUBTITLE Environmental Impact Statement for the Dewey Burdock ISR Project in Custer and Fall River Counties, South Dakota Supplement to the Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities - Final Report	3. DATE REPORT PUBLISHED MONTH: January — YEAR: 2014 4. FIN OR GRANT NUMBER
5. AUTHOR(S) See Chapter 10	6. TYPE OF REPORT Technical 7. PERIOD COVERED (Inclusive Dates)

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Division of Waste Management and Environmental Protection
Office of Federal and State Materials and Environmental Management Programs
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

9. SPONSORING ORGANIZATION - NAME AND ADDRESS (If NRC, type "Same as above", if contractor, provide NRC Division, Office or Region, U. S. Nuclear Regulatory Commission, and mailing address.)

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10. SUPPLEMENTARY NOTES

11. ABSTRACT (200 words or less)

By letter dated August 10, 2009, Powertech (USA), Inc. (Powertech, the applicant) submitted a source material license application to the U.S. Nuclear Regulatory Commission (NRC) for the Dewey-Burdock in-situ recovery (ISR) Project. Powertech is proposing to construct, operate, conduct aquifer restoration, and decommission an ISR facility at the Dewey-Burdock ISR Project site, located in Fall River and Custer Counties, South Dakota. The NRC staff evaluated site-specific data and information to assess whether the applicant-proposed activities were consistent with activities considered in NUREG-1910, "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities" (GEIS) and determined which GEIS data and analyses could be incorporated by reference and what resource areas required site-specific review. The final SEIS describes the environment potentially affected by the proposed site activities, describes the potential environmental impacts, and describes Powertech's environmental monitoring program and proposed mitigation measures. The NRC staff has reviewed and considered comments received on the draft SEIS when developing the final SEIS. Comments received on the draft SEIS and associated responses can be found in Appendix E.

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)	13. AVAILABILITY STATEMENT
Uranium Recovery In-Situ Recovery Process Uranium Environmental Impact Statement Supplemental Environmental Impact Statement Powertech Inc. (USA) Dewey-Burdock Project	unlimited 14. SECURITY CLASSIFICATION *(This Page)* unclassified *(This Report)* unclassified 15. NUMBER OF PAGES 16. PRICE

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