40-1162

WESTERN NUCLEAR, INC.

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February 1, 2001

U.S. Nuclear Regulatory Commission
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Dear Mr. Ting:

I am writing to attempt to expedite active consideration and approval of Western Nuclear, Inc.'s (WNI's) Site Closure Plan and Site Ground Water Characterization and Evaluation Report (Site Closure Plan) for its Split Rock facility. In this letter I will describe the interaction on the Site Closure Plan between WNI, Nuclear Regulatory Commission (NRC) staff and the Department of Energy (DOE) Grand Junction staff and for your convenience will attach certain referenced documents. I will not, of course, attach the Site Closure Plan, which is voluminous, and certain other referenced documents (NRC Federal Register publications).

WNI submitted its Site Closure Plan on October 29, 1999. NRC responded to WNI's submittal by letter of December 15, 2000 over the signature of Mr. Thomas H. Essig, then Chief of the Uranium Recovery and Low-level Waste Branch, Division of Waste Management, Office of Nuclear Materials and Safeguards (NMSS). Mr. Essig stated that in order for NRC to proceed with its *acceptance review* of WNI's Site Closure Plan and its groundwater compliance proposals, NRC wished additional information on the so-called "Red Mule" area and on the utilization of institutional controls. WNI was asked, "How would these controls be durable, permanent and enforceable?"

WNI responded to Mr. Essig's inquiries by filing a Supplement to the Site Closure Plan dated January 14, 2000 prepared by our technical consultant, Shepherd Miller, Inc. (SMI). SMI's technical submittals were again supplemented by a letter to Mr. Essig of January 17, 2000. Those submittals were further supplemented by a memorandum of February 1, 2000 to Mr. Essig from Anthony J. Thompson and Warren U. Lehrenbaum of Shaw Pittman addressing the legal and regulatory bases for WNI's proposed institutional controls (ICs) to eliminate access to groundwater for domestic drinking water purposes.

A meeting between WNI's representatives and NRC staff was held on February 3, 2000. And in response to staff inquiries at that meeting, SMI prepared two additional submittals dated February 25, 2000.

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Finally, on June 7, 2000, WNI representatives met with NRC staff, including Stewart Treby, Esq. and Maria Schwartz, Esq. to further discuss legal and policy issues associated with ICs.

This letter is intended to provide additional support for WNI's proposed ICs in combination with informational deed notations and a funded alternate water supply for the "Red Mule" area should it be deemed necessary to protect public health some 100 plus years in the future from slightly elevated site-derived uranium levels in groundwater that could be used for drinking water.

It is readily apparent that in developing and finally promulgating its "Radiological Criteria for License Termination" regulations (D&D regulations) (62 Fed. Reg. 39058, July 21, 1997) NRC specifically addressed the need for ICs to limit long term public exposure by allowing *restricted use* at sites where the presence of large volumes of soil contaminated with long lived radionuclides make off-site disposal exorbitantly expensive. Indeed, "stringent" ICs, "such as legally enforceable deed restrictions" and/or controls backed up by government ownership should be established "with the objective of lasting 1,000 years" (i.e., "durable" ICs). Id at p. 39070. See also p. 39071, subsection C ["Durable institutional controls must be in place. These controls could include significant engineered barriers and/or State, local or Federal Government control of sites or maintenance of site deed restrictions so that site access is controlled."]

In conjunction with the development of the final D&D regulations NRC also developed guidance to address various components of the regulations including restricted use through ICs and mixes of engineered controls and ICs. Draft Regulatory Guide 4006, that initially addressed these issues, has been superseded by the "NMSS Decommissioning Standard Review Plan", NUREG 1727, September 2000, Chapter 16.0. I will not attempt in this letter to set forth in detail how WNI's proposed Site Closure Plan satisfies the criteria in Chapter 16.0, but suffice it to say that WNI has established that all other alternatives considered in its Site Closure Plan would result in significant potential adverse impacts on public health and the environment (including ecological impacts) at exorbitant costs. The legally enforceable ICs for 97% of the site (either through fee ownership or enforceable deed covenants running with the land) are precisely the kind of durable ICs enforceable by a long term custodian envisioned by NRC in Chapter 16.0.

Under the Uranium Mill Tailings Radiation Control Act (UMTRCA) program a perpetual NRC licensee (DOE or the State) will have the obligation and authority to maintain compliance with the proposed ICs. DOE certainly recognizes this obligation as the attached excerpt from its 1999 "Long Term Surveillance and Maintenance Program Report" demonstrates. However, I am aware that DOE too is reviewing and analyzing IC issues in conjunction with its UMTRCA and other long-term stewardship responsibilities. Indeed, as I will report below, WNI has had important correspondence and face-to-face discussions with DOE's Grand Junction Office regarding the Split Rock Site Closure Plan.

With respect to WNI's proposed ICs, I recognize that, strictly speaking, NRC's D&D regulations are not applicable to uranium recovery (UR) facilities. However, under Section 84(c) of the AEA, as amended by UMTRCA, and the Introduction to Appendix A of 10 CFR Part 40, licensees can propose *alternatives* to any NRC or EPA requirement if the *alternative* provides equivalent or greater protection of public health, safety and the environment. As the attached memorandum from Hugh L. Thompson, Jr., Director NMSS to Robert D. Martin, Regional Administrator, Region IV, (June 27, 1988) indicates, the reasons underlying certain regulatory options that, strictly speaking, are not available to Title II UR licensees can, nevertheless, be used to justify a finding that an *alternative* provides the necessary reasonable assurance of adequate protection.

I am also enclosing some other relevant materials regarding ICs and "informational notices or devices" in the following documents:

a. "Institutional Controls: A Site Manager's Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Changes" (September 29, 2000).

- [Non-engineered instruments such as administrative and/or legal controls that minimize the potential for human exposure from contamination by limiting land or resource use;

- Even in the unusual case where a CERCLA Record of Decision (ROD) only requires implementation of ICs, it is considered to be a 'limited action', not a 'no action' ROD;

- Informational devices are most likely to be used as a secondary "layer" to help insure the overall reliability of other ICs.]

b. "Protecting Health and Safety with Institutional Controls, Larry Snapf, Natural Resources and Environment "(Spring)".

- [Thus, it is important that the instrument creating the institutional control identify the party who will have the right to enforce the restrictions and be responsible for maintaining and repairing the controls. Responsibilities of the enforcer may include making periodic site inspections to ensure that prohibited activities are not taking place; checking the integrity of caps, fencing and other barriers; ensuring that site use has not extended into prohibited areas; and inspecting drinking water wells to make sure that they are not being used;

- Though not technically considered institutional controls, informational notices can be an effective mechanism for limiting exposure to contaminants.]

Finally, I am attaching a letter from Harley W. Shaver to Cooper H. Wayman, Senior Counsel, DOE Grand Junction Office dated October 26, 2000.

There had been statements made by members of the NRC staff to WNI representing that DOE personnel had expressed concerns about WNI's Site Closure Plan and a reluctance to accept the site as long term custodian because of the proposed ICs and alternate water supply to the Red Mule area. In order to address any concerns first hand that the DOE staff might have, WNI representatives met with DOE staff in the Grand Junction Office on October 13, 2000. The attached letter from Mr. Shaver to Mr. Wayman was in response to certain questions which arose as a result of that meeting. Subsequent to sending Mr. Shaver's letter and transmitting to DOE copies of WNI's submittal to NRC, I attended a follow-up meeting with DOE staff in Grand Junction on November 27, 2000. At the conclusion of that meeting, I understood DOE staff to state that DOE has <u>no</u> objection to taking the Split Rock Site with WNI's proposed alternate water supply to Red Mule and proposed ICs as set forth in its Site Closure Plan submitted to the NRC fifteen (15) months ago. DOE did express an interest in fine tuning some property boundaries, but this would not affect the central issues and can be accommodated easily.

In conclusion, it seems that every concern expressed by the NRC has been addressed thoroughly from an analytical, technical and legal standpoint. I strongly believe that WNI is entitled to have its Site Closure Plan move expeditiously through NRC review. I would like to schedule a meeting with NRC staff in the near future to discuss any remaining generic or site specific concerns to optimize the license termination process for all concerned.

Sincerely,

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Vice President & General Manager

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SUPPLEMENT TO OCTOBER 29, 1999 SPLIT ROCK SITE CLOSURE REPORT

Prepared For:
Western Nuclear, Inc.

Prepared By:
Shepherd Miller, Inc.

January 14, 2000

SHEPHERD MILLER
INCORPORATED

On October 29, 1999, Western Nuclear, Inc. (WNI) submitted to the NRC a Site Closure Plan for the Split Rock Site that, pursuant to 42 USC §2114c, was structured, in part, as a proposed alternative for long-term protection of the public health and safety and of the environment from potential risks related to ground water impacted by byproduct material.

This alternative, if put into place, will provide the necessary *reasonable assurance* of protection of public health and safety and the environment and will satisfy all appropriate regulatory standards and requirements. This proposed alternative was developed from comprehensive site characterization studies, and from rigorous identification and screening of technical responses to the existence of byproduct material in ground water in the site vicinity. This alternative provides protection while rendering concentrations of site derived constituents to as low as reasonably achievable (ALARA).

Additionally this alternative incorporates several factors of conservatism which, when taken together, enhance the *reasonable assurance* that public health and safety and the environment will remain protected for 1,000 years, to the extent reasonably achievable, and, in any case, for at least 200 years as required by Criterion 6-1 of 10 CFR Part 40, Appendix A.[1]

FACTORS OF CONSERVATISM

The elements of the proposed alternative that employ conservative factors include the highly detailed characterization of geochemical conditions, which lends a high degree of confidence in the model predictions, the conservative over-estimates of mass in the transport system, which tend to over predict potential future concentrations, the highly conservative transport parameters assumed in the modeling, which tend to over predict constituent fate, the broad and durable and enforceable institutional controls included in the proposed alternative and the highly conservative assumptions used to estimate protective levels of constituents in ground water. These items are discussed below.

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[1]Criterion 6(1) of 10 CFR Part 40 Appendix A states "In disposing of waste byproduct material, licensees shall close the waste disposal area in accordance with a design which provides ***reasonable assurance*** (emphasis added) of control over radiological hazards to (i) be effective for 1,000 years, to the extent reasonably achievable, and, in any case, for at least 200 years."

Characterization and Modeling

A very comprehensive and robust numerical ground water transport model was developed to predict the potential future transport of site derived constituents. This model incorporated geochemical aspects of the site sources as well as site ground water flow conditions. The ground water flow component of the model was based on extensive geologic characterization, aquifer testing and model calibration with multiple operational time periods. The net result of these efforts is that the flow component of the transport model justifies placing a high degree of confidence in the model predictions.

The sources of site derived constituents to the ground water transport system were extensively evaluated prior to incorporation into the transport model. The sources include, not only long-term infiltration through, and seepage from, the reclaimed surface tailings, but also gradual re-release of constituents to the ground water from subsurface aquifer solids. These constituents became associated with the aquifer solids during the operational and standby periods (1957 through 1986) that were characterized by tailing seepage rates of over 1,000 gpm.

It should be noted that the state of practice at the time the mill was originally licensed was to design tailings impoundments to rely upon seepage as a form of tailings liquor management. This was a design principal employed in the early days of uranium mining that was approved by the Atomic Energy Commission (AEC) and its successor agency, the Nuclear Regulatory Commission (NRC). WNI's tailings facility was built in the late 1950's. The Uranium Mill Tailings Radiation Control Act was adopted by Congress in 1978, and 10 CFR Part 40, Appendix A, the regulation controlling WNI's site remediation effort, was not adopted until 1985.

The initial mass of uranium assumed in the transport model was conservatively over estimated with respect to the mass estimated from the measured ground water concentrations. This conservative factor over estimates the predicted concentration of site derived constituents in the ground water down gradient from the surface reclamation area. In particular, this factor over estimates the predicted concentration of site derived uranium in the ground water at the Red Mule area in the future such that the predicted concentrations at the Red Mule area are higher than will likely be observed in that area.

In addition, it should be noted that the Red Mule area has already been identified as having naturally elevated background uranium concentrations (0.3 mg/L uranium; see Appendix F to the 10/29/99 Site Closure Plan). It is questionable if any significant increase in potential adverse health effects would result from the low concentrations of site derived constituents contributed to the naturally elevated uranium concentrations by future ground water transport. In any event, there is a reasonable assurance that site derived constituent concentrations will be below protective levels at this particular POE as required in Criterion 6.

Another conservative factor included in the modeling of the proposed alternative, as stated above, was the assumption that the constituent of most concern, uranium, currently having the largest source and greatest mobility would experience no retardation or attenuation beyond the valley mouths. However, site specific testing using site aquifer materials and site ground water has demonstrated that uranium transport is significantly attenuated (10/29/99 Site Closure Plan, Appendix F, Section 6.0; Appendix H, Attachment H.c).

Laboratory batch sorption tests on clean aquifer soils and representative impacted ground water allowed calculation of site specific partitioning coefficient (K_d) values for uranium (Site Closure Plan, Appendix F, Section F.6.3.3.2.2, 10/29/99). These Kd values (concentration of uranium on aquifer solids divided by the concentration of uranium in the associated ground water) for Southwest Valley aquifer materials from locations SWEB-12-235, SWEB-12-395, SWEB-13-65, SWEB-13-455 and WN-43A-15 averaged 0.32, 0.30, 0.14, 0.20, and 0.34 L/Kg, respectively. These values are among the lowest values observed at the site from all testing and reflect the relatively high mobility of uranium in this environment. Retardation (R), or the amount by which constituent transport is slowed due to interaction with the aquifer materials, is calculated according to the following formula:

$$R = 1+(\rho_b/n) \times K_d$$

where ρ_b is the bulk density of the aquifer soil (1.65 g/cm^3) and n is the aquifer material porosity (0.15).

The calculated retardation values for the Southwest Valley aquifer materials range from 2.54 through 4.74 with an average retardation of 3.86. This average retardation value for uranium was applied to the existing transport model (Site Closure Plan, Appendix H, 10/29/99) with no other modifications. Contouring of these modeling runs are presented for the 200 year and 1,000 year time frame as Figures 1 and 2 to this discussion. These modeling predictions, using representative retardation values based on site-specific test results demonstrate that, at 200 years, uranium does not reach the Red Mule area (see Figure 1). Further, at 1,000 years, the uranium concentrations will be below background levels with the exception of a small portion of the Northwest corner of the Red Mule area, which will be at or slightly above the "protective level" of 0.1 mg/L (see Figure 2). It is demonstrated in discussions below that this value of 0.1 mg/L is overly conservative and slightly ~~higher concentrations are protective.~~

Examination of the predicted uranium distribution at 200 years using the highly conservative assumption of no retardation (see Figure H-c-3 included herein, original presented in Attachment C to Appendix H, Site Closure Plan, 10/29/99) demonstrates that all COCs at the Red Mule area will be at background levels with the exception of a small portion of the Northwest corner of the Red Mule area which will be at or slightly above the "protective level" of 0.1 mg/L. The other two constituents of concern, nitrate (NO_3) and manganese (Mn) are assumed to transport conservatively and with no retardation under all modeling scenarios. Under these assumptions and by analogy based on their existing and potential future concentrations in the Southwest Valley, NO_3 and Mn will not exceed background levels for 200 years. Over a 1,000 year period NO_3 and Mn will essentially be at or slightly above "protective levels" (10 mg/L for NO_3 which is the EPA promulgated MCL and 0.7 mg/L for Mn – see Attachment I.a to Appendix I, Site Closure Plan, 10/29/99). These highly conservative potential future conditions would not pose a significant acute risk to residents. In conjunction with the proposed institutional controls, discussed below, and the proposed alternate drinking water supply, there is a reasonable assurance the public health, safety and the environment will continue to be protected in the future.

Institutional Controls

The implementation of institutional controls to eliminate the potential future exposure pathways for human consumption of ground water containing byproduct material is an integral part of the proposed alternative. The application of institutional controls provides an addition level of protection for the public by eliminating potential exposure pathways. The existing institutional controls, which cover more than 97% of the surface and subsurface disposal area, include land ownership in fee, restrictive covenants on ground water use, and acquisition of title to the subsurface estate of a portion of the land. WNI owns approximately 3,650 acres of the 5,195 acres of the proposed control area, slightly more than 70 percent of the total. These lands will be transferred to the long-term custodian. In addition, the US government owns approximately 700 acres within the proposed control area, or nearly 13.5 percent of the total. Future access to ground water from these lands will not exist (unless permitted by the long term custodian). Additionally, WNI has acquired severed title to the entire subsurface estate more than seven feet below ground surface for an additional 565 acres within the proposed long-term control area (nearly 11 percent of the total). Title to the subsurface estate over this area includes control over access to and use of ground water for any purpose. This title will be transferred to the long-term custodian. Therefore, actual ownership of any land which contains, or will contain, byproduct material in groundwater will be transferred to the long-term custodian (presumably the Department of Energy [DOE]) and encompass 94.5 percent of the proposed long-term control area.

Further, WNI has acquired restrictive covenants, or deed restrictions, from the owners of 127 acres (or nearly 2.5 percent of the total) forbidding the use of ground water obtained from under their land for human consumption. Restrictive covenants for approximately 82 acres of these 127 acres require the land owner and their successors to refrain from allowing any human use or consumption, or any domestic use of water, from any *new or existing* water wells in or upon the land. The restrictive covenants for the other 45 acres of these 127 acres enjoin the land owner from permitting, drilling, building, opening or utilizing any *new* water wells of any kind in or upon the land. These restrictive covenants run with the land and may be enforced by WNI and its successor owners of the reclaimed surface tailings area and its successor licensees (i.e., the long term custodian, presumably DOE).

Accordingly, these restrictive covenants eliminate any potential future exposure pathway to site derived constituents from this acreage.

Land ownership, the ultimate intitutional control, combined with enforceable restrictive covenants, eliminate any potential future human pathway to site derived constituents in the ground water for over 97 percent of the proposed long-term control area and, consequently, provide *reasonable assurance* that any associated potential hazards to the public health and safety or the environment associated with these constituents are eliminated.

The remaining 3% of the proposed long term control area is called the "Red Mule" area (approximately 150 acres). WNI has not acquired ownership or restrictive covenants over this small portion of the proposed long-term control area. According to information recently obtained from the Freemont County Assessors Office, there are 14 parcels of separate ownership in the Red Mule ~~area. Three of these parcels are vacant, one has a free standing home, one has a log cabin, several~~ have old mobile or manufactured homes, one has a Quonset hut and two of the parcels have sheds. In addition, 11 existing domestic wells in this area have been identified though only 6 wells are in active use.

As part of the proposed alternative, WNI has developed a program to supply a perpetual alternate source of domestic water, including drinking water, to this small area should it ever be required. This alternate water supply will remove any need for residents of the Red Mule area to use ground water for domestic or drinking water purposes. Other uses of ground water in this area will not pose any substantial potential future hazard to public health and safety and the environment. Additionally, only through the application of all the overlapping conservative factors in the predictive transport modeling estimation of potential risk factors could there be any possibility of future risks to the Red Mule area. As a result, it is highly unlikely that any potential future incremental risk from uranium in drinking water will be realized.

In addition to providing the alternate drinking water supply, notification in the local (Fremont County) public land records will be provided regarding the fact that a small portion of the subsurface of the proposed long-term control area beneath the Red Mule area is being used for the disposal of byproduct material and is subject to either an NRC general or specific license[2]. This notification, of a type contemplated by the regulations in Criterion 11(C) of 10 CFR Part 40 Appendix A, provides an additional component of the required *reasonable assurance* that there will be no significant potential exposure from site derived uranium to the public in the Red Mule area, the only area of the WNI site not subject to direct control. This is particularly true in light of the final mandatory component of the required *reasonable assurance*—the existence of a licensed, long term, governmental custodian that will be responsible for warning any residents of Red Mule about the import of the deed notations, if the site derived constituents ever get there, and who will be responsible for notifying and for providing the residents with an alternate water supply. Additionally, until the alternate supply is needed, no individual land owner in the control area would be exposed to any site derived constituents.

Conservatism In Development Of "Protective" Concentrations

The maximum predicted future concentrations of site derived constituents have been conservatively over estimated in the transport model. Of the six site derived constituents identified as constituents of concern (U, Ra-226+228, Mn, Mo, NH_3, NO3; COC; see Appendix I to the 10/29/99 Site Closure Plan), only U, Mn, and NO_3 have the potential to be transported as far as the Red Mule area (see Appendix H to the 10/29/99 Site Closure Plan). Moreover, these conservatively predicted maximum future concentrations are near the identified "protective" concentrations. Several factors of conservatism were incorporated into the development of these "protective" concentrations.

[2] 42 USC §2113 provides: "***IN EXERCISING THE AUTHORITY OF THIS PARAGRAPH***, the Commission ***SHALL*** take into consideration the status of the ownership of such land and interests therein and the ability of the licensee to transfer title and custody thereof to the United States or a State." (Emphasis added.)

Criterion 11(C) of 10 CFR Part 40 Appendix A states that, in certain circumstances, rather than acquiring the land, the licensee may "provide notification in the public land records of the fact that the land is being used for the disposal of radioactive material and is subject to either an NRC general or specific license prohibiting the disruption and disturbance of the tailings. . . . ***FOR LICENSES ISSUED BEFORE NOVEMBER 8, 1981***, the Commission ***MAY*** take into account the status of the ownership of such lands, and interests therein, and the ability of the licensee to transfer title and custody thereof to the United States or a State." (Emphasis added.)

The following discusses various conservative assumptions used in development of the "protective" concentrations.

One principal conservative assumption for all constituents is that the local ground water will supply all drinking water 350 days each year for 30 years. This is not likely to be the case for residents in this area.

Nitrate (NO_3)

The maximum predicted future concentrations of NO_3 at the Red Mule area are on the order of 30 mg/L to 50 mg/L. The Maximum Contaminant Level (MCL) developed by the US Environmental Protection Agency (EPA) which is considered to be the "protective" concentration, is 10 mg/L. However, this "protective" concentration is based on a sensitive population of infants less than 3 months old fed formula made from water containing elevated levels of NO_3. At the conservatively predicted future concentrations at the Red Mule area, adult human exposure would be below identified adverse risk levels. The literature indicates that NO_3 concentrations up to 500 mg/L have no observed adverse health effects when consumed by adults or older children on a long-term basis. Again, the long term custodian could warn any residents regarding use of ground water in infant formula.

Maganese (Mn)

The current average Mn concentration at the mouth of the Southwest Valley is approximately 5 mg/L, though point concentrations at a few locations have been observed to be higher. Maximum Mn concentrations at the Red Mule area, if Mn ever is transported that far, would be expected to be on the order of 0.5 to 1 mg/L. The EPA has not promulgated an MCL value for Mn, although the published EPA reference dose (RfD) for all exposure to Mn is 0.14mg/kg-day. Given a typical human of 70 Kg this RfD translates to 9.8 mg of Mn per day as a safe chronic level of Mn consumption. The EPA assumes that Mn is ingested both through food sources and non-food sources such as water and soil. The EPA also assumes that 3 times more Mn is adsorbed into the body from these non-food sources than from food source although it acknowledges that there are no data to support this assumption. Therefore, the EPA applies a safety factor of 3 to the consumption of Mn from the non-food source of drinking water consumption.

EPA Region III has developed a risk based concentration (RBC) for Mn in tap water, which is a screening level guidance value only. This RBC value for Mn is 0.73 mg/L and includes the 3 fold factor of safety for Mn from non-food sources. Without this unsupported factor of conservatism but still following the conservative EPA risk calculation methods, the RBC value becomes 2.2 mg/L as a safe concentration of Mn in drinking water for the long-term even considering additional manganese consumption through food. This value is below the range of probable maximum Mn concentrations at the Red Mule area in the future.

Uranium (U)

The maximum predicted future concentrations of U at the Red Mule area are on the order of 0.3 mg/L to 0.8 mg/L. Currently, the EPA has not promulgated an MCL value for U. Additionally, the Wyoming State drinking water standard for U, which the State presumably considers protective, is 5 mg/L and naturally occurring U concentrations in the Red Mule area ground water are 0.3 mg/L.

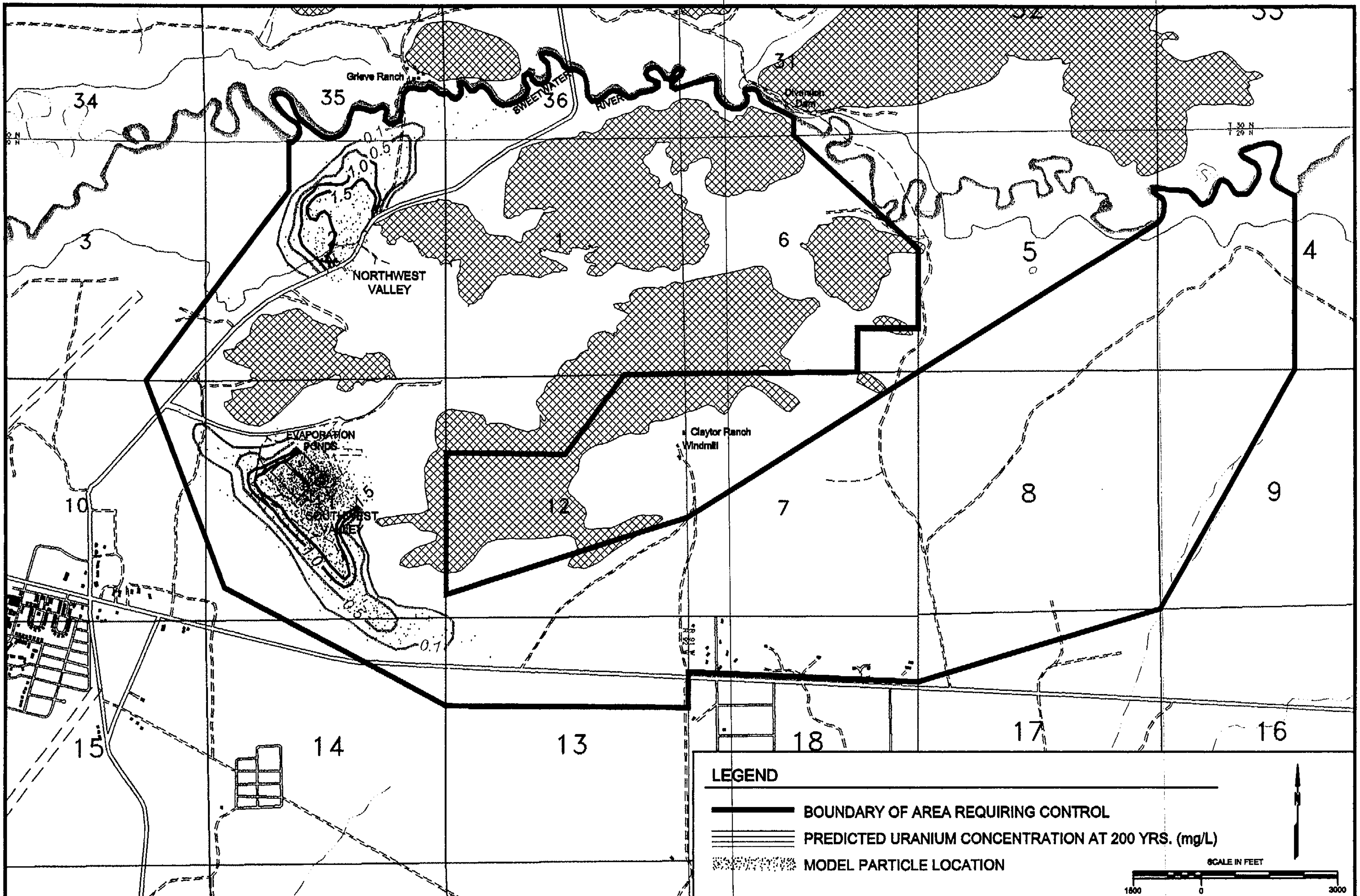
The EPA calculation of a "safe level" for uranium exposure starts with the lowest observed adverse effect level (LOAEL) reference dose (RfD) value of 2.8 mg/kg-day (or 196 mg/day for a 70 Kg adult) and then employs a factor of safety of 1000. (As a point of comparison, the Swiss Office of Public Health has proposed a No Effect value for humans of 1mg/kg-day, an exposure level 333 times higher than the EPA RfD.) Without the application of this huge factor of conservatism, the "safe" drinking water concentration would be approximately 100 mg/L. The highly conservatively predicted future concentrations of U at the Red Mule area are still several times lower than the "safe level using a factor of conservatism of 50, an reasonable and ample margin of safety. Therefore, an individual's exposure to uranium, should the individual choose not to use the alternate drinking water supply, would be below identified adverse risk levels.

CONCLUSION

Taken together, the extensive characterization, conservatism in the predictive modeling, the implementation of broad enforceable institutional controls, the supply of a perpetual alternate drinking water source, notification in the land records that the lands are being used for byproduct material disposal, and the conservatism inherent in the "protective" concentrations, individually and collectively, demonstrate that the proposed alternative posses the requisite "reasonable assurance" of protection for public health and safety and the environment as required by 10 CFR Part 40, Criterion 5(D)[3].

The ground water component of the Site Closure Plan, submitted to the NRC on 10/29/99, through the detailed and carefully considered review of site conditions and alternatives has identified the best alternative. It is protective and reduces impacts to public health and safety and the environment to as low as reasonably achievable. The detail and conservatism designed into this alternative provides the requisite "reasonable assurance" of protection to public health and safety and the environment for 1,000 years, to the extent reasonable achievable, and, in any case, for at least 200 years (10 CFR Part 40, Criterion 6-1[4]).

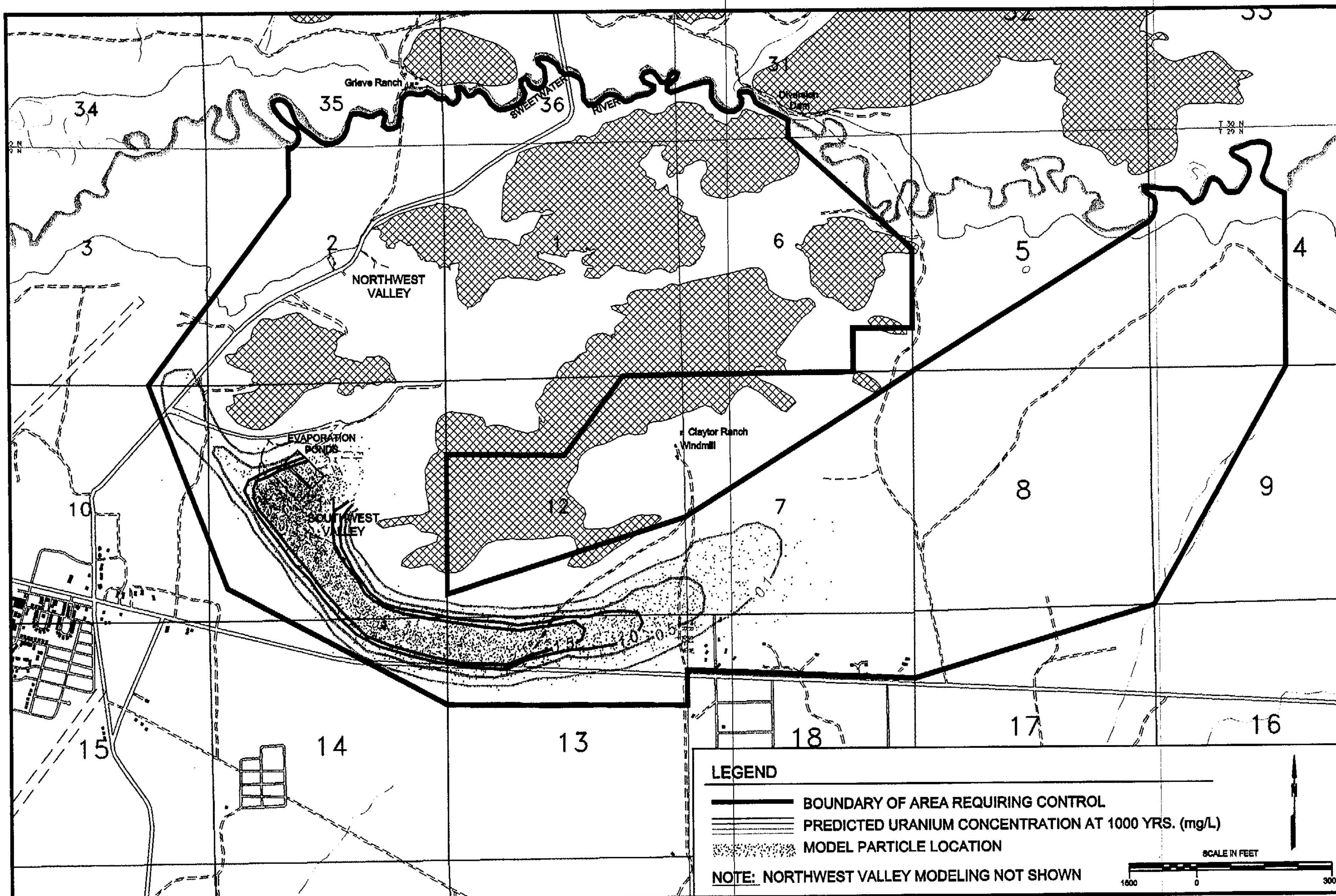
[3] Criterion 5(D) of 10 CFR Part 40 Appendix A states "The Commission will determine when the licensee may terminate corrective action measures based on data from the ground-water monitoring program and other information that provide reasonable assurance that the ground water protection standard will not be exceeded."
[4] Criterion 6(1) of 10 CFR Part 40 Appendix A states "In disposing of waste byproduct material, licensees shall close the waste disposal area in accordance with a design which provides reasonable assurance of control over radiological hazards to (i) be effective for 1,000 years, to the extent reasonably achievable, and, in any case, for at least 200 years."



SHEPHERD MILLER
INCORPORATED

FIGURE 1
PREDICTED URANIUM CONCENTRATION AT 200 YEARS (mg/L)
WITH RETARDATION

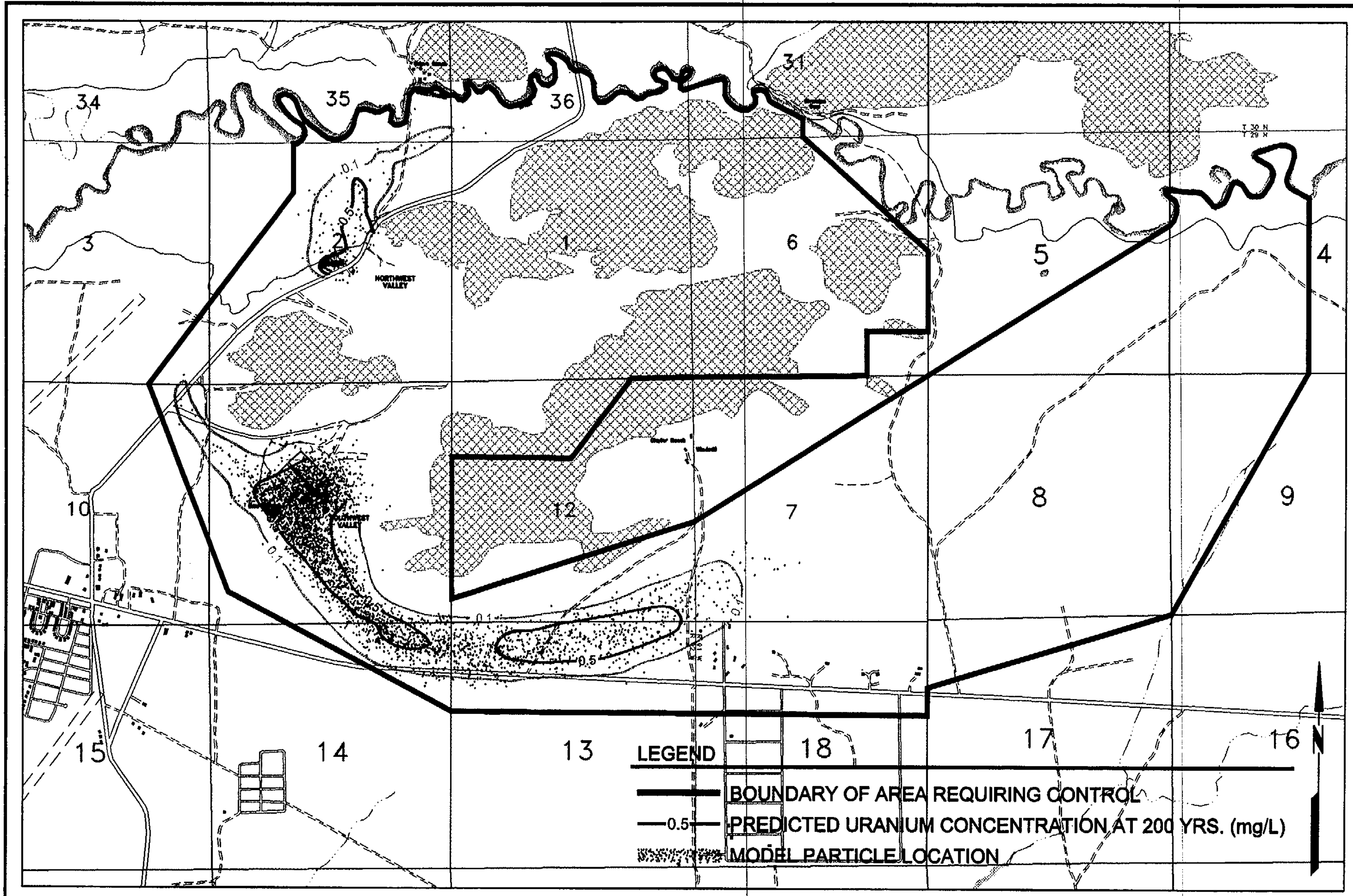
Project:	03-347\TASK7
File:	RET-UR02



SHEPHERD MILLER
INCORPORATED

FIGURE 2
PREDICTED URANIUM CONCENTRATION AT 1000 YEARS (mg/L)
WITH RETARDATION

Project:	03-347\TASK7
File:	RET-UR10



SHEPHERD MILLER
INCORPORATED

FIGURE H-c-3
INSTITUTIONAL CONTROL ALTERNATIVE
200-YEAR URANIUM PREDICTION

Project:	03-347\TASK9\ACAD
File:	UPR_200.DWG

WESTERN NUCLEAR, INC.

UNION PLAZA SUITE 300, 200 UNION BOULEVARD, LAKEWOOD, COLORADO 80228
TELECOPIER (303) 989-8993 TELEPHONE (303) 989-8675

January 17, 2000

Thomas H. Essig, Chief
Uranium Recovery and
Low-Level Waste Branch
Division of Waste Management
Office Of Nuclear Material Safety
and Safeguards
United States Nuclear Regulatory Commission
Washington, D.C. 20555-0001

~~RE: Site Closure Plan for Western Nuclear, Inc., Split~~
Rock Wyoming Site, Source Material License SUA-56

Dear Mr. Essig:

As a supplement to Western Nuclear Inc.'s (WNI) October 29, 1999, Site Closure Report incorporating the Site Groundwater Characterization and Evaluation Report, and in response to the U.S. Nuclear Regulatory Commission (NRC) staff comments of December 15, 1999, it seems sensible to characterize and then address the staff's concerns within an analytical, technical and legal framework.

As an overview, WNI will have the ability to transfer 97% of the area within the boundary proposed to be transferred to the long term custodian that will provide durable and enforceable institutional controls which will absolutely prohibit a pathway to underground water for human consumptive use. Of the total area, 700 acres (approximately 13.5 percent of the total) is presently owned by the United States and administered by the Bureau of Land Management. For property owned in fee, the long term custodian will have the right to restrict access to groundwater that is concomitant with land ownership. With respect to property burdened by restrictive covenants, which run with and in favor of the fee land, similar rights exist. At present, there are no existing stock or domestic wells on the land comprising this 97% of the area to be transferred to the long term custodian.

The ability to restrict access to groundwater by the long term custodian may be enforced in a court of law upon numerous theories, including an action for trespass, declaratory relief or injunctive relief. Rights which run with the land cannot be divested or removed without the consent of the long term custodian. These rights are as permanent and endurable as the legal system and institution of existing government under which such rights exist.

With respect to the less than 3% of the area referred to as "Red Mule", WNI has proposed both engineered and institutional controls. Moreover, there is reasonable assurance on a risk basis that site derived constituents which may impact groundwater in the "Red Mule" area, utilizing site-specific modeling parameters, will not adversely affect human health and safety.

A discussion of the issues, and answers to the staff's specific questions, is more fully developed in conjunction with reference to documents accompanying this letter. Transmitted with this response are the following documents:

1. A supplement to the 10-29-99 Site Closure Report authored by WNI's consultant, Shepherd Miller, Inc. which provides a discussion of potential risks from site derived constituents for the "Red Mule" area and addresses other concerns of the staff.

2. Draft deeds by which Lonnie J. Claytor and Yvonne I. Claytor, husband and wife, and Claytor Livestock & Ranch Company, a co-partnership, will deed a sub-surface fee interest in 565 acres to WNI. ~~By the terms of the grant language in these deeds, WNI's estate is the~~ dominant estate and access to groundwater (and minerals) can be prohibited. WNI and it's successors (long term custodian) will have a perpetual license to go upon and utilize the surface for water monitoring and for performing corrective action, if necessary.

3. A restrictive covenant and agreement running with the land enforceable by WNI and/or its successors from Beulah Peterson Walker and Arliss Peterson by which they "agree that permitting, drilling, building, opening or utilizing any new water wells in or upon the lands [described] will not be allowed except upon prior consent of Western Nuclear, Inc. or its successors." Additionally, Beulah Peterson Walker and Arliss Peterson granted WNI and its successors access to the land for monitoring, sampling, and for performing corrective action, if required.

4. A covenant or agreement running with the land enforceable by WNI and/or its successors from Joe E. and Jennifer Ann McIntosh by which they agree to refrain "from allowing any human use or consumption or any domestic use of water from any new or existing water wells" on approximately 160 acres. (By-product constituent concentrations in this area are predicted to return to background values by virtue of passive remediation. See Appendix #H from 10-29-99, Site Closure Report).

5. A land ownership map detailing fee land, BLM land, land burdened by restrictive covenants and land to which an alternate water supply can be provided.

As a threshold analytical concept within the regulatory framework for the protection of human health and safety, it should be stated that there are two types of controls which can provide protection: Engineered controls and legal controls. Examples of engineered controls are fences, water treatment facilities, alternative water supplies, etc. Examples of legal controls are land ownership, restrictive covenants, zoning restrictions, notations on the public record, etc. (See, e.g. 10 CFR Part 40, App. A, Criterion 11.) Legal controls are also referred to as institutional controls.

The ultimate institutional control is land ownership. WNI, under its proposed alternative, will cause the transfer, by deed, to 94.5% of the land utilized for the disposal of by-product material to the long term custodian. (This includes BLM land.) An additional 2.5% of the land in the control area, owned by third parties, is burdened by restrictive covenants which run with the land and are enforceable by the long term custodian as a matter of real property law.

These institutional controls absolutely restrict, prohibit and forbid access to groundwater to be utilized for ingestion by humans, or any domestic use, for over 97% of the long term control area. Moreover, the long term custodian can enter upon all of this land for any necessary testing, drilling or corrective action.

Less than 3% of the land in the proposed control area constitutes the "Red Mule" area. In this area, WNI's proposed preferred alternative incorporates both engineered controls and institutional controls. The engineered control provides for an alternate water supply, should the same ever become necessary. The institutional control provides for notification in the public land records that the groundwater underlying this small area may be impacted by site derived constituents (by-product material) in approximately 150 years. If it is so impacted, an alternate water supply will be made available by the long term custodian. This type of protective institutional control is contemplated by the regulations, i.e. 10 CFR Part 40, Appendix A, Criterion 11. WNI believes these controls meet the regulatory requirement of protecting human health and safety with reasonable assurance.

WNI's proposed preferred alternative was developed using many conservative factors which, in an abundance of caution, over-estimated the potential future distribution and concentration of constituents of concern (COCs) in groundwater. As demonstrated in the attached discussion of potential risks by our consultant, predictive modeling using average and representative transport parameters for uranium that are based on site-specific testing, concentrations of all COCs at the "Red Mule" area after 200 years will be at background levels, even if no institutional controls or alternative drinking water supply are implemented in this area. The highly conservative model predicted concentrations of all COCs at the "Red Mule" area after 200 years will be at background levels with the possible exception of a small portion of the Northwest corner of the "Red Mule" area which will be at or slightly above the "protective level of 0.1 mg/L". Further, predictive modeling using average and representative transport parameters for uranium demonstrates that concentrations of all COCs at the "Red Mule" area after 1,000 years will be at background levels with the exception of a small portion of the Northwest corner of the "Red Mule" area which will be at or slightly above the "protective level of 0.1 mg/L".

Taken together, the modeling using representative transport parameters demonstrates that there is a reasonable assurance that protection of public health and safety and the environment is maintained for 1,000 years to the extent reasonably achievable, and, in any case, for at least 200 years even if no measures are taken at the "Red Mule" area. Under all modeling scenarios, concentrations of constituents of concern will never exceed background levels at or beyond the long-term control area.

However, in an effort to assuage any possible concern, WNI has proposed both engineered and institutional controls for the "Red Mule" area should future monitoring indicate the need to provide an alternate water supply.

The statutorily mandated government long term custodian (DOE) provides an additional layer of "reasonable assurance"; the custodian can ensure that alternatives will be implemented and restrictions enforced. The institutional controls and the proposed alternate water supply do not exist in a vacuum - they need not be self-executing. They need only be utilized if necessary. Implementation can be achieved by the long term custodian which will be a permanent NRC licensee of the site and will be required to monitor the site and file periodic reports with NRC.

The staff has asked some specific questions which are addressed below.

Question: WNI should include information that addresses the issue of current and future water rights over this area. (Red Mule)

Response: Owners of existing domestic water wells in the Red Mule area have only the legal right to use groundwater for domestic purposes by virtue of having drilled and permitted domestic wells; they have no current rights beyond that. They certainly have no current or future right to drill a groundwater well for large scale irrigation or commercial use. Any future wells in this area which would enlarge upon the current household, domestic use purpose would have to be permitted and approved by the Wyoming State Engineer.

The staff has also made inquiry as to the consequences and effect of possible future subdivision in the "Red Mule" area. Wyoming requirements for the approval of subdivisions should prevent the use of any groundwater that may contain site derived constituents above protective levels in the "Red Mule" area as a source of domestic water. Wyoming statutes require that, as part of the county approval process for any subdivision proposed after July 1, 1997, the WDEQ review the subdivision application to determine the adequacy of the water supply, including the quality of the groundwater, if it is to be the source of water for the subdivision. WDEQ provides its comments to the relevant county authority. In the event that part of the "Red Mule" area is further subdivided in the future, the WDEQ will have an opportunity to assess the condition of the water and to recommend against its use, if necessary.

Question: How would these controls be durable, permanent and enforceable?

Response: Western Nuclear and its successors, including the long term custodian, have the right to prevent access to groundwater on owned land, including the subsurface estate owned through deed in the "Claytor" land. The restrictive covenants limiting groundwater access on the Peterson and MacIntosh land are enforceable in perpetuity as covenants running with the land.

Question: How would Western Nuclear address existing and future water right issues over these areas?

Response: It is not believed that there are any, per se, adjudicated groundwater rights which exist anywhere within the proposed control area. The only water rights which exist in the area are surface rights for irrigation of hay land near the Sweetwater River. WNI owns those rights. In any event, surface water is not an issue with respect to protection of public health and safety. The fact that drilling for groundwater will be prohibited, absolutely, on approximately 97% of the control area does not affect existing water rights. WNI does not contemplate acquiring any water rights within the proposed control area.

Question: If only land restrictions are proposed, would the State of Wyoming agree to these restrictions on existing and future access to groundwater beneath these lands?

Response: All groundwater and surface water located in Wyoming are waters belonging to the State. A water right is the right to use, not own, water. None of the restrictions on access to groundwater affect any current rights to use groundwater. There are no currently existing groundwater wells on 97% of the proposed area. At "Red Mule", there would be no future loss of a right or a domestic use because the proposed alternative would provide an alternate source of water for domestic use.

The State of Wyoming owns none of the land which is proposed to be conveyed to the long term custodian. Therefore, the State's assent to restrictions on drilling and future access to groundwater from the surface of these lands is not an issue. On any land owned by the State of Wyoming, and on any other land outside of the control area for that matter, the groundwater can be intercepted and utilized for whatever purposes are lawfully appropriate. Surface waters, which under Wyoming water law grant water rights dating to the date of appropriation for a beneficial use, are not affected.

Should the staff believe that the engineered and institutional controls proposed for the "Red Mule" area could use another "layering" of control, the Wyoming Statutes provide for groundwater geographic control districts which can be established by the Wyoming Board of Control, upon the recommendation of the State Engineer. The Wyoming Statutes state that such a control district may be implemented if it is in the "public interest". Should the NRC staff be of the opinion that such a control district would be in the public interest, WNI will undertake to approach the State Engineer and pursue establishment of a control district, or some variation thereof, designed to ensure an adequate water supply which would include the "Red Mule" area and an additional area from which the alternate water supply would be provided to "Red Mule".

Very truly yours,

Lawrence J. Corte
Manager, WNI

LJC
Enclosures
c: Mark Thiesse, Wyoming DEQ
Mr. Stockdale, Office of Wyoming State Engineer

ShawPittman

A Law Partnership Including Professional Corporations

MEMORANDUM

By Hand Delivery

TO: Thomas H. Essig, Chief
Uranium Recovery and Low Level Waste Branch

CC: Maria E. Schwartz, Esq.
Office of General Counsel

FROM: Anthony J. Thompson
Warren U. Lehrenbaum

DATE: February 1, 2000

RE: **Adequacy Of Institutional Controls Proposed For Western Nuclear Inc.'s Split Rock Facility, Source Material License No. SUA-56.**

I. BACKGROUND

On October 29, 1999 Western Nuclear, Inc. ("WNI") provided NRC with a Site Closure Plan and a Site Ground Water Characterization and Evaluation Report for the Split Rock facility (for ease of reference we refer to these two documents together as the "Site Closure Plan"). The Site Closure Plan summarizes the steps that have been taken by WNI to satisfy the license and regulatory requirements pertinent to closure of the Split Rock site and termination of WNI's license. In addition, the Site Closure Plan presents a comprehensive strategy to assure protection of public health, safety, and the environment from site-derived constituents in groundwater. As reflected in the Site Closure Plan, the impact of byproduct material in groundwater presents the only significant issue remaining to be resolved as a predicate to site closure and license termination.

The Site Closure Plan submitted by WNI presents two alternative approaches for addressing groundwater concerns. The first approach relies on the establishment of alternate concentration limits (ACLs), as provided for in the Commission's regulations at 10 C.F.R. Part 40, Appendix A, Criterion 5B(5).[1] The second approach presented in the Site Closure Plan is based on a

[1] The ACLs that have been proposed by WNI are somewhat atypical in that they address more than one source term. As explained in greater detail in the Site Closure Plan, constituents from mill tailings at the Split Rock site have, over the

Footnote continued on next page

determination that site-derived constituents are not capable of posing a substantial present or potential threat to human health or the environment, pursuant to the Commission's regulations at 10 C.F.R. Part 40, Appendix A, Criterion 5B(3). Both of these approaches rely primarily on ownership of the impacted land by the long term government custodian, and to a lesser extent on the use of other institutional controls, supplemented with an available alternate water supply. This combination of controls minimizes or eliminates future access to groundwater for domestic consumption within the boundaries of the long term control area. Thus, the Site Closure Plan provides the requisite *reasonable assurance* that there will be no human exposure pathway for site-derived groundwater constituents of concern.

In a letter to WNI dated December 15, 1999, you identified several questions that NRC Staff raised with respect to WNI's Site Closure Plan, and, in particular, with respect to the groundwater compliance component of that Plan. WNI addressed those questions in a submission to you dated January 17, 2000. This memorandum is intended to supplement WNI's January 17, 2000 submission. Specifically, a number of the questions raised in your December 15, 1999 correspondence pertain to the institutional controls that WNI proposes to put into place in order to minimize or eliminate the human exposure pathway. This memorandum is intended to demonstrate the adequacy of those institutional controls from a legal standpoint. In particular, this memorandum addresses the question of whether fee ownership of all of the property comprising the long term control area is required under the applicable law and the relevant regulations and guidance. In addition, this memorandum examines the broader question of whether or not the types of institutional controls proposed by WNI are legally adequate and appropriate for the portions of the site for which fee ownership will not be transferred to the long term custodian.

II. FEE OWNERSHIP OF LAND IN THE LONG TERM CONTROL AREA

As a preliminary matter, it is important to recognize that under the Site Closure Plan put forward by WNI, approximately 94.5% of the land comprising the long term control area will be transferred *in fee* to the long term custodian. In addition, WNI has obtained restrictive covenants on another 2.5% of the land comprising the long term control area. These covenants run with the land owned by WNI (therefore, upon license termination, they will be enforceable by the long term custodian) and they provide rights that are essentially equivalent to fee ownership with respect to the ability to control access to groundwater. Thus, upon license termination, WNI will be in a position to transfer to the long term custodian fee ownership, or control over access to groundwater, with

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Footnote continued from previous page

years, become associated with aquifer solids. These constituents are expected to slowly re-mobilize from aquifer solids into the groundwater over time. Thus, seepage from tailings is not the only source of groundwater constituents, as is assumed to be the case for the typical ACL application. However, to the extent that WNI's proposal does not fit precisely the paradigm of a typical ACL application it could be considered a licensee-proposed alternative to NRC's requirements, as provided for under Section 84(c) of the Atomic Energy Act (AEA), 42 U.S.C. § 2114(c).

respect to 97% of the long term control area. The remaining 3% of land, with respect to which fee ownership (or its equivalent) cannot be transferred by WNI, comprises the area designated as "Red Mule."

It is clear from the plain language of the AEA that the ability to transfer fee ownership to the long term custodian with respect to land used for the disposal of byproduct material is *not* a prerequisite to license termination. Section 83 of the statute provides that, upon termination of the license for a uranium mill tailings facility, title to the tailings and to the land used for disposal of the tailings must be transferred to the long term custodian, *unless* NRC determines that such transfer is not required to protect public health, safety and the environment.[2] Specifically, the statute states as follows:

> The Commission shall require by rule, regulation, or order that prior to the termination of any license which is issued after the effective date of this section [November 8, 1981], title to the land, including any interests therein (other than land owned by the United States or by a State) which is used for the disposal of any byproduct material, as defined in section 11e.(2), pursuant to such license shall be transferred to --
>
> (i) the United States, or --
>
> (ii) the State in which such land is located, at the option of such State,
>
> *unless the Commission determines prior to such termination that transfer of title to such land and such byproduct material is not necessary or desirable to protect the public health, safety, or welfare or to minimize or eliminate danger to life or property.*[3]

While this provision may not be directly applicable to WNI (because WNI's license was not issued after November 8, 1981), the general principle it establishes is important: transfer of title to land used for the disposal of byproduct material will not be required if NRC determines that such transfer is not necessary to protect public health, safety and the environment.

Moreover, with respect to sites licensed prior to 1981, like WNI's site, the statute provides NRC with even greater flexibility in determining whether to require transfer of title to land used for the disposal of byproduct material. Specifically, the statute provides that:

> In the case of any such license under section 62, which was in effect on the effective date of this section [November 8, 1981], the Commission may require, before the termination of such license, such

[2]42 U.S.C. § 2113(a), (b).

[3]42 U.S.C. § 2113(b).

> transfer of land and interests therein (as described in paragraph (1) of this subsection) to the United States or a State in which such land is located, at the option of such State, as may be necessary to protect the public health, welfare, and the environment from any effects associated with such byproduct material. *In exercising the authority of this paragraph, the Commission shall take into consideration the status of the ownership of such land and interests therein and the ability of the licensee to transfer title and custody thereof to the United States or a State.*[4]

This provision is directly applicable to WNI.

Thus, the statute presumes that, in general, title to uranium mill tailings at licensed facilities, and title to the land used for disposal of such tailings, will be transferred to the government upon license termination, *unless* NRC determines that such transfer is unnecessary to protect human health, safety and the environment. In addition, in the case of source material licenses that were in effect as of November 1981, like WNI's license for the Split Rock facility, NRC is directed to take into account the status of land ownership and the ability of the licensee to transfer title when deciding whether to require transfer of title to the government. Consequently, if fee ownership of land used for the disposal of mill tailings is not necessary to protect public health and the environment, or, in the case of sites such as Split Rock that were licensed prior to 1981, if fee ownership of such land cannot as a practical matter be transferred to the long term custodian, then transfer of ownership of land used for the disposal of byproduct material is not required.

Similarly, NRC's guidance pertaining to ACLs (the Staff Technical Position on Alternate Concentration Limits; hereinafter, the "ACL Guidance")[5] also indicates that fee ownership of land used for the attenuation of groundwater constituents is not a prerequisite to obtaining an ACL.

In general, compliance with the groundwater concentration limits established by NRC is determined based upon monitoring results at a designated "point of compliance" ("POC"), which is defined as "the site specific location in the uppermost aquifer where the groundwater protection standard must be met."[6] When an ACL is sought for a groundwater constituent, a second point of reference, called the "point of exposure" or "POE" must also be considered. The POE is defined as the location(s) at which humans, wildlife or other environmental species could reasonably be exposed to hazardous constituents from groundwater.[7] In its ACL Guidance NRC explains that an ACL must be "adequately protective of human health and the environment" at the POE. This means

[4] 42 U.S.C. § 2113(b)(4) (emphasis added).

[5] U.S. Nuclear Regulatory Commission, *Staff Technical Position Alternate Concentration Limits for Title II Uranium Mills*, January 1996 (hereinafter, "ACL Guidance") at 6.

[6] 10 C.F.R. Part 40, Appendix A, Introduction.

[7] ACL Guidance at 6.

that an applicant for an ACL must be able to demonstrate that the hazardous constituent covered by the ACL will not pose a "*substantial* present or potential hazard to human health or the environment" at the POE, as long as the ACL is not exceeded.[8] Significantly, when an ACL is established for a site, NRC will take into account any attenuation of the groundwater constituent that occurs between the POC(s) and the POE. Thus, the ACL that NRC establishes for a constituent may be less than adequately protective of human health and the environment at the POC(s) so long as the licensee can demonstrate that, because of attenuation that occurs between the POC(s) and POE, the constituent will fall within allowable health and environmental exposure levels in groundwater at the POE.[9]

NRC's ACL Guidance provides additional evidence that fee ownership of the property needed for the disposal of byproduct material (and transfer of fee ownership to the long term custodian) it is not a prerequisite to obtaining an ACL. The Guidance naturally begins with the presumption that the POE will be located in lands that will be transferred to the government. According to NRC, "in most situations, the POE will be located at the down-gradient edge of the land that will be transferred to the government for long term custody following license termination."[10] However, NRC also recognizes that in some instances it may be desirable for the POE to be located at a point that is some distance *outside* of the lands that are presumptively required to be transferred to the government under UMTRCA (i.e., *outside* of the lands used for the disposal of byproduct material). This is referred to in the ACL Guidance as a "distant" POE.[11] According to NRC, a distant POE might be justified on the basis that land ownership by the licensee or by the government "would ensure that no water resource use would exist on the property," thus ensuring that no unreasonable risk to human health or the environment would exist beyond the POE.[12] However, after stating that a distant POE might be justified on the basis that land ownership by the government custodian would prevent the use of groundwater between the POC and POE, the ACL Guidance goes on to provide as follows:

> It should be noted that in some instances, a distant POE may be established without invoking land ownership or long-term custody; for

[8]*Id.* at 8 (emphasis added).

[9]*Id.* at 6-7.

[10]ACL Guidance at 7.

[11]Id. This portion of the ACL Guidance is not, strictly speaking, applicable to the WNI proposal, since WNI is not proposing a "distant" POE; nevertheless, the Guidance is relevant by analogy. A "distant POE" is different from a POE that is simply located some distance from the POC(s). If the land that lies between the POC(s) and the POE is necessary for disposal of 11e.(2) byproduct material then under Section 83 of the AEA title to the land must be transferred to the long term custodian, provided that the licensee is able to transfer title and provided that NRC determines that transfer of title to such land is necessary to protect human health and the environment. In such a case, the POE would not be considered a "distant" POE under the ACL Guidance, even though the POE might be located a considerable distance from the POC(s). Under the ACL Guidance a "distant POE" is one where the land between the POC(s) and POE is *not* necessary for the disposal of 11e.(2) byproduct material.

[12]*Id.*

example, when the possibility of human exposure is effectively impossible because the ground water is either inaccessible or unsuitable for use.[13]

There are two important implications to this guidance: First, a distant POE and a POE located a distance from the POC(s) can be justified if there is adequate assurance that groundwater between the POC and POE will not be utilized. Second, given such assurances, *land ownership and transfer of custody to the long term custodian may not be necessary in order to establish such a POE.* Later on, the ACL Guidance discusses the factors that should be evaluated in determining whether there is adequate assurance that groundwater between the POC and POE will not be utilized. Specifically, the Guidance provides that, when assessing whether there is a significant risk of human exposure to hazardous groundwater constituents (and, therefore, in determining whether a proposed ACL presents a "*substantial* present or potential threat to human health") one must consider, among other things, the "availability and characteristics of alternate water supplies," as well as any "statutory or legal constraints and institutional controls on water use in the site area."[14] Thus, under the ACL Guidance, fee ownership of land used for the attenuation of groundwater constituents should not be required, provided that institutional controls, perhaps in combination with an alternate water supply, provide *reasonable assurance* that groundwater in the affected area will not be utilized. WNI's Site Closure Plan provides for the availability of an alternate water supply for the Red Mule area, should such an alternate supply be needed. In addition, the Site Closure Plan proposes institutional controls for the Red Mule area. In the following section we address the adequacy of those controls.

III. ADEQUACY OF INSTITUTIONAL CONTROLS PROPOSED BY WNI FOR THE "RED MULE" PORTION OF THE LONG TERM CONTROL AREA

In its Site Closure Plan, WNI has proposed four different types of institutional controls that are designed to prevent human exposure to site-derived groundwater constituents in the long term control area. For the bulk of the long term control area, two types of controls are proposed:

- Fee ownership of land. Upon license termination, fee ownership of lands in the long term control area owned by WNI in fee would be transferred to the long term custodian. In prior discussions of institutional controls, NRC has characterized fee ownership by the government as "the ultimate form of control."[15] WNI has obtained fee ownership of approximately 94.5% of the land required for the long term control area at the Split Rock

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[13] *Id.*

[14] *Id.* at 18.

[15] Draft Generic Environmental Impact Statement in Support of Rulemaking on Radiological Criteria for Decommissioning of NRC-Licensed Nuclear Facilities, NUREG 1496 (April 1994) (hereinafter "Draft NUREG 1496"), vol. 2 at F-18.

site, which would be transferred to the long term custodian upon license termination.

- Restrictive covenants. These covenants apply to another 2.5% of the land comprising the long term control area. Since they run with the land owned by WNI, these restrictive covenants allow WNI -- and WNI's successors (i.e., the long term custodian) -- to prohibit the domestic use of groundwater and/or the drilling of new wells on the encumbered properties. In that sense, the restrictive covenants provide WNI and the long term custodian with rights that are akin to fee ownership with respect to the ability to restrict access to groundwater on the affected property.

Thus, for approximately 97% of the land in the long term control area, WNI has proposed institutional controls that provide fee ownership or equivalent control over access to groundwater. To date, WNI has been unable to obtain fee ownership or restrictive covenants for the 3% of the long term control area that comprises "Red Mule." Instead, WNI has proposed as an institutional control for the Red Mule area, the inclusion of a notation in the public land records indicating that groundwater in the area may be impacted by site-derived byproduct material.[16] In addition, WNI has proposed to make available an alternate water supply for domestic consumption in the Red Mule area, should site-derived hazardous constituents in groundwater reach unacceptable levels. As discussed below, this combination of institutional and engineered controls, in conjunction with the mandated long term government custodian, provides adequate assurance of protection of human health and the environment in the Red Mule area.

As a threshold matter, it is important to recognize that in evaluating the effectiveness of long term controls to protect against exposure to 11e.(2) byproduct material from the disposal of uranium mill tailings, the standard to be applied is one of *reasonable assurance*. Thus, NRC's regulations provide that designs for the disposal of byproduct material at uranium mill tailings facilities must provide "*reasonable assurance* of control of radiological hazards" for 1000 years to the extent practicable and, in any case, for at least 200 years.[17] Similarly, with respect to groundwater protection at mill tailings facilities, the Commission's regulations provide that the effectiveness of a groundwater corrective action program should be evaluated on the basis of whether available data "provide *reasonable assurance* that the [relevant] ground-water protection standard will not be exceeded."[18] Absolute certainty is not required. Moreover, in the context of decontamination and decommissioning (D&D), NRC has clearly indicated that institutional controls will be deemed

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[16] Notating land records, such as WNI has proposed, is one of several types of institutional control mechanisms that were specifically discussed by NRC in the development of its Decontamination and Decommissioning Rule (62 Fed. Reg. 39058 (1997)), where the Commission formally embraced the concept of releasing sites for restricted use, based upon the use of institutional controls. See Draft NUREG-1496 at vol. I, p.7-17 and vol. II, p. F-20.

[17] 10 C.F.R. Part 40, Appendix A, Criterion 6 (emphasis added).

[18] 10 C.F.R. Part 40, Appendix A, Criterion 5D (emphasis added).

adequate if they provide *reasonable assurance* that exposures will not occur above protective limits. Thus, NRC's D&D regulations provide that a site will be found acceptable for license termination under restricted conditions if, *inter alia*,

> The licensee has made provisions for legally enforceable institutional controls that provide *reasonable assurance* that [the relevant dose criteria will not be exceeded].[19]

This focus on reasonable assurance is consistent with the broader position articulated by NRC that the effectiveness of long term controls with respect to long-lived radionuclides cannot be assured with absolute certainty, but instead can be demonstrated only with *reasonable certainty*. For example, the Commission has taken the position that its procedure for evaluating the adequacy of low level radioactive waste disposal plans:

> cannot be used to demonstrate *unequivocally* that a site will be safe; rather it is a technique for examining factors that may affect site safety and providing a basis to assess whether *reasonable assurance* exists that a site will meet performance objectives.[20]

Similarly, with respect to the design of uranium mill tailings disposal facilities, NRC has explained that:

> The very long-term performance of tailings isolation (that is several thousand years into the future and beyond) will be governed by climatic and geologic factors which cannot be predicted precisely .... The pertinent question is "What siting and design factors should be considered

[19] 10 C.F.R. § 20.1403. It should be noted that in the preamble to the Federal Register notice setting forth the final D&D rule, NRC explains that where large quantities of long lived radionuclides (e.g., uranium or thorium) are concerned, "[m]ore stringent institutional controls will be required . . . such as legally enforceable deed restrictions and/or controls backed up by State and local government control or ownership, engineered barriers, and federal ownership, as appropriate." 62 Fed. Reg. 39058, 39070. Three aspects of this statement should be highlighted. First, since the D&D rule does not apply to uranium mill tailings facilities, there is no presumption built into the rule that a long term government custodian will monitor and oversee the decommissioned site. By comparison, for uranium mill tailings facilities such as WNI's, the statute *requires*, at least presumptively, that upon license termination, land used for the disposal of byproduct material will be monitored and overseen by a long term government custodian. Second, as we discuss in more detail later, in the case of the Red Mule area, WNI has proposed institutional *and* engineering controls *backed-up* by the oversight of a long term government custodian. In other words, WNI has proposed a "more stringent" kind of institutional control, as contemplated under the D&D rule. Finally, consistent with the notion of "reasonable assurance" NRC specifically states that "[r]equiring absolute proof that such controls would endure over long periods of time would be difficult, *and the Commission does not intend to require this of licensees*." Id.

[20] Evaluation of a Performance Assessment Methodology for Low Level Radioactive Waste Disposal Facilities, NUREG/CR-5927 (1993) vol.1, p. 5.

or taken into account in order to provide *reasonable assurance* of long term isolation of tailings.[21]

In addition, with respect to ACLs in particular, NRC has taken the position that an applicant for an ACL must be able to demonstrate with *reasonable assurance* that the proposed ACL will not pose a significant threat to human health and the environment. Specifically, the ACL Guidance provides that for purposes of evaluating the potential for human exposure to site-derived hazardous constituents, "a technical basis would still be needed to provide a *reasonable assurance* that the proposed ACLs do not pose a health hazard to human health or the environment."[22]

Thus, in evaluating the adequacy of the institutional and engineering controls that have been proposed for the Red Mule area, the relevant inquiry is whether those controls provide *reasonable assurance* that exposure to site-derived hazardous constituents above protective limits will not occur. As set forth more fully in the Site Closure Plan and in WNI's submission of January 17, 2000, the controls that have been proposed by WNI for Red Mule do provide such reasonable assurance. Specifically, notations in the public land records will put all landowners on notice that groundwater in Red Mule may be affected by site-derived constituents. Moreover, in accordance with NRC's regulations at 10 C.F.R. Part 40, Appendix A, Criterion 10, upon site closure, the long term custodian will be charged with monitoring the site, including site-derived hazardous groundwater constituents in the area of Red Mule. If the long term custodian detects concentrations of hazardous constituents that exceed protective levels, the custodian will be able to provide any residents in the potentially effected area with relevant information regarding any potential hazard (in addition to the warning provided by the notations in the public land records) and the custodian will be in a position to activate the alternative water supply provided for under WNI's Site Closure Plan.

Thus, the combination of controls that has been proposed by WNI for Red Mule, namely (i) land record notations, (ii) an alternate water supply, and (iii) active oversight by the long term custodian, provides *reasonable assurance* that exposure to hazardous site-derived groundwater constituents will not occur in Red Mule. This reasonable assurance is augmented by the multiple conservative factors that have been built into WNI's assessment of the potential risks to residents in Red Mule from site-derived groundwater constituents.[23] As that risk assessment demonstrates, the likelihood of site-derived constituents reaching Red Mule in concentrations that pose a risk to health is insignificant, even without taking into consideration the institutional and engineering controls discussed above. Those controls, which effectively eliminate the human exposure pathway, coupled with the low probability and relative insignificance of any potential incremental risk to public health that might result from exposure to site-derived constituents at Red Mule, provide an adequate basis upon which to approve WNI's Site Closure Plan.

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[21] Final Generic Environmental Impact Statement on Uranium Milling, NUREG-0706 (1980), vol. II, p. 12-30 (emphasis added).

[22] ACL Guidance at 25.

[23] Shepherd Miller, Inc., *Supplement to October 29, 1999 Split Rock Site Closure Report* (January 14, 2000) at 2-4; 7-10.

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SHEPHERD MILLER
INCORPORATED

February 25, 2000 SMI #03-347/6

Mr. Thomas H. Essig, CHP
Uranium Recovery Projects Branch - MS-T-7-J-8
Division of Waste Management
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, Maryland 20852

Re: Docket No. 40-1162, License No. SUA-56, License Condition No. 74, Transmittal of Additional Analyses

Dear Mr. Essig:

On October 29, 1999, Western Nuclear, Inc. (WNI) submitted its Site Closure Plan regarding final reclamation and license termination for the Split Rock site in Jeffrey City, Wyoming. A component of this submittal, the Site Groundwater Characterization and Evaluation Report, fulfilled the requirement of Source Material License SUA-56, License Condition No. 74C, which required a revised groundwater corrective action plan with a complete site investigation by October 31, 1999. In that submittal, WNI evaluated a wide range of potential alternatives and proposed a preferred alternative for addressing protection of public health and safety and the environment from potential future risks associated with site-derived constituents in groundwater.

In your letter to WNI dated December 15, 1999, the U.S. Nuclear Regulatory Commission (NRC) identified several questions that NRC staff raised with respect to WNI's Site Closure Plan, and, in particular, with respect to the groundwater compliance component of the Plan. WNI addressed those questions in a submittal to NRC dated January 17, 2000, and a hand-delivered submittal dated February 1, 2000. Further, WNI and its consultants met with NRC staff on February 3, 2000 to discuss these questions. Additional predictive transport modeling was provided as part of the January 17, 2000 submittal to illustrate some of the inherent conservatism employed in the Site Closure Plan proposed alternative. The additional predictive modeling and the discussion of conservatism included in the proposed alternative support the conclusion that this alternative provides the requisite *reasonable assurance* of protection of public health and safety and the environment.

At the meeting on February 3, 2000, NRC indicated that the additional predictive modeling included in the WNI January 17, 2000 submittal, which incorporated site-specific retardation

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values for constituent transport, did not include re-calibration of the predictive transport model. Consequently, NRC indicated that it was unsure of accuracy of these additional predictions.

Therefore, WNI herein submits a Technical Memorandum from WNI's consultant (Shepherd Miller, Inc.) to address NRC concerns regarding this issue.

Complete re-calibration of the predictive transport model would require a level of effort and expenditure of time and money that is inappropriate for this issue. Therefore, the Technical Memorandum develops a more simple analytical model for predicting uranium concentrations in groundwater, calibrates this tool in a similar manner as the original and more robust predictive model, and provides predictions of future uranium distribution for the 200- and 1,000-year time periods.

The results of this analytical predictive modeling are consistent with the results presented in the January 17, 2000 submittal. This modeling confirms the conclusion that there is a *reasonable assurance* that uranium will not reach the Red Mule area within 200 years and may not significantly influence water quality or adversely impact public health and safety at the Red Mule area in 1,000 years.

In conclusion, WNI reiterates its request that NRC complete its review of the Split Rock Site Closure Plan and, in particular, the groundwater compliance component of the proposed Plan, as expeditiously as practicable. Please feel free to contact me if you have further questions or concerns.

Sincerely,

SHEPHERD MILLER, INC.

Toby Wright

Toby Wright
Project Manager

LMW:hmr
Enclosures

cc: M. Layton
B. Von Till
L. Corte
H. Shaver, Esq.
T. Thompson, Esq. (w/o enc.)
J. Gearhart
A. Root
File

SHEPHERD MILLER, INC.
Environmental and Engineering Consultants

TECHNICAL MEMORANDUM

DATE: February 25, 2000 **SMI #** 03-347

TO: Toby Wright

FROM: Walt Niccoli

SUBJECT: Analytical Solution to Split Rock Mill Site Uranium Transport from the Southwest Valley – Including Retardation

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Problem Statement:

As part of the Western Nuclear, Inc. (WNI) Split Rock Site Closure Plan (October 29, 1999), a comprehensive and robust groundwater transport model was developed to estimate the potential future distribution of the more mobile site-derived constituents (i.e., dissolved uranium). In an abundance of prudence and caution, this original model did not incorporate the known retardation characteristics of dissolved uranium in its simulations, but rather assumed uranium is transported conservatively. However, extensive testing of site-specific soils and groundwater has demonstrated that uranium does partition to the solids in the aquifer, causing some retardation of uranium transport. The average retardation from these site-specific tests (see Appendix F to the October 29, 1999 Site Closure Plan) is 3.86, or approximately 4.

Due to the complexity of the original predictive transport model, a significant amount of effort would be required to re-calibrate the model with retardation. However, more simple analytical techniques can be applied to simulate retarded uranium transport, incorporating site-specific calibration efforts, and checked against the original predictive model. To better understand the potential future distribution of uranium in groundwater considering retardation values, an analytical tool (model) was developed. The specific objectives of this modeling are discussed below. This effort is focused on uranium transport to the south and east of the site, toward the Red Mule area, and does not address the effects of retardation on flow out the Northwest Valley.

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Objectives:

1. Develop a tool that allows quick predictions and ease of use.

2. Calibrate this tool in a similar manner to the RAND3D model presented in Appendix G of the Site Closure Plan, assuming a retardation factor of greater than one.

3. Predict the potential future distribution of uranium in groundwater at 200 years and 1,000 years considering retardation.

General Approach:

The general approach in this evaluation was to develop a 2-dimensional, analytical solution to simulate uranium transport beyond the mouth of the Southwest Valley to the south plain. The 2-dimensional form of the analytical solution for the advection-dispersion equation (McWhorter, 1998; see Table 1) was used for this effort. Hydrologic properties (e.g., hydraulic conductivity, effective porosity, etc.) from the original calibrated flow and transport models were employed and a retardation of 3.86 (R= 3.86) was used based on site-specific materials testing (Appendix F to the October 29, 1999 Site Closure Plan). The same mass loading function used for the original predictive model was also employed for the analytical model prediction.

The calibration approach involved 2 steps: (1) calibrating the analytical model assuming no retardation and average flow velocities based on the hydraulic properties used in the RAND3D modeling effort, and (2) using the same average velocity, re-calibrating with an assumed retardation. Calibration targets were: (1) matching the center of mass (COM), and (2) the extent of uranium in groundwater measured in 1996. The first calibration step (with no retardation) was performed and then a model prediction (with no retardation) was run to check the arrival time and approximate extent of the uranium at the Red Mule area. This result was compared to the original RAND3D model prediction (with no retardation) to confirm the analytical solution reasonably approximated the anticipated system behavior and to confirm that the average flow velocity was reasonable for this scenario. The second calibration step involved using the same average flow velocity and re-calibrating assuming a greater retardation value.

A single average flow velocity along the predicted flow path was required by the analytical solution for the entire period of the prediction. This does not account for relatively high flow rates near the valley mouth early in the transport history, which were responsible for establishing the existing mass of uranium outside the Southwest Valley mouth. To compensate for the lack of rigor in the analytical approach, it was necessary to extend the starting date at which mass was initially released from the site (from the Southwest Valley mouth) to match the 1996 conditions (COM and extent).

After manipulation of these parameters, within the range of known or reasonable values, achieved a reasonable match with the measured 1996 site conditions, the "calibrated" analytical solution was used to estimate the concentration of uranium at a known point (the Red Mule area) through time. The following sections develop specific aspects of this model in greater detail.

Groundwater Flow Field

The average flow velocity from the original calibrated MODFLOW flow model for the 1986 to 1996 time period between the extent of the 1996 plume and the Red Mule area was determined. This average velocity (0.0726 ft/day) incorporates the highest historic flow gradients, and consequently the highest velocities, in the area of interest. Use of this flow velocity is conservative in that the average flow velocity for the entire prediction period (up to 1,000 years) will be less due to the decrease in gradients near the valley mouth with time. However, as mentioned above, this velocity is much lower than the velocities that were responsible for moving the uranium outside the valley mouth. This is important as it is the primary limitation of the analytical model and requires adjustment of the initiation of the mass addition to the model. This topic is discussed further in the Calibration Section of this memorandum.

Calibration

The calibration consisted of two general steps. The first step involved confirming that the analytical model can reasonably reproduce the predictions of the original RAND3D model. Calibrating the analytical model assuming no retardation provided this confirmation. This also served to confirm that the parameters in the analytical model (i.e., average flow velocity) are reasonable and appropriate. The second step involved re-calibrating the model with the parameters confirmed in the earlier step and assuming a retardation value for uranium greater than one. Calibration targets included the estimated COM of uranium in groundwater and the extent of uranium in groundwater measured in 1996, as discussed below.

Because analytical solutions require a uniform groundwater flow field, the analytical model focused only on the portion of the plume that moved to the South Plain and the Red Mule area. Therefore, previously calculated COMs (1986 and 1996 COMs; Appendix G to the Site Closure Plan) for the Southwest Valley uranium plume are not appropriate (only a portion of the plume [approximately half] flows to the South Plain and the Red Mule area). New calculations of the COM for only that portion of the plume moving to the South Plain are provided as discussed below.

To estimate the COM for the portion of the 1996 dissolved uranium plume that flows toward the Red Mule area, the average 1996 uranium concentration in the cells of the MODFLOW model layer one was used (Appendix G to the Site Closure Plan). Because layer one is considered to progress farther than the aquifer on average, this usage is conservative. A grid was superimposed over the "plume" area and a value corresponding to the concentration in that grid was assigned to each grid center. A first-order momentum equation was then applied to calculate the location of the COM. The location of the 1996 COM is shown on Figure 1, along with the centerline of the general flow path. This COM is calculated to be 1,381 feet from the Southwest Valley source term, and the approximate uranium concentration at this point is approximately 2.5 mg/L to 3 mg/L. As expected, the 1996 COM for the eastward flowing portion of the dissolved uranium plume differs from previous calculations presented in Appendix G. The reason for the difference is that including the northward flowing portion of the plume in the COM calculations shifts the calculated COM location significantly. The approximate extent of measured uranium in groundwater for 1996, as defined by the 0.1 mg/L concentration contour, is approximately 4,000 feet from the analytical model source. The average flow velocity used in the analytical model, and consequently the hydraulic conductivity (3.25 ft/day) and porosity (0.15), was the same as used in the original RAND3D transport model.

The first calibration step assumed no retardation. The analytical model was "calibrated" through the timing of the source initiation and adjustment of the longitudinal and horizontal transverse dispersivities. The 2-dimensional solution to the advective-dispersive equation was programmed into a MathCad worksheet (Table 1), which allowed application of a transient source term. The source term was assumed to equal that presented in Appendix G for the mouth of the Southwest Valley, as approximated by an exponential decay function (Figure 2A, Table 2, equation for C_o). The starting time of the source was adjusted until the COM for 1996 reasonably matched the newly calculated COM for the eastward flowing portion of the plume.

The longitudinal (α_L) and transverse (α_T) dispersivities were the same as used in the original RAND3D modeling with $\alpha_L = 200$ feet and $\alpha_T = 20$ feet. The extent of the *measured* uranium plume is defined by the 0.1 mg/L uranium concentration contour, because this is the background uranium concentration and the point at which site-derived uranium can no longer be distinguished from naturally occurring uranium in the regional waters. The extent of the analytical model extent was defined as the 0.001 mg/L uranium concentration contour. This represents the leading edge of the transported uranium that would constitute arrival of uranium at a given location. The source timing was adjusted until the predicted 1996 COM reasonably matched the newly calculated 1996 COM. The pre-1996 source concentration (input as a constant concentration) was then adjusted such that the total mass per unit depth in the aquifer resembled approximately two-thirds of the interpreted conditions. Two-thirds was used because the measured uranium concentrations in layer one over-represent the mass of the entire plume. The input parameters for this first calibration are presented in Table 3.

Once the analytical model source term was adjusted such that the 1996 uranium COM and extent were reasonably matched, the model was run to predict the arrival time and potential future concentrations at the Red Mule area. The Red Mule area is approximately10,465 feet from the source at the mouth of the Southwest Valley. The results of this calibration are discussed in the Results Section below.

The second calibration step included retarded transport of uranium and assumed the same average flow velocity used in the first calibration step. As with the first calibration step, the date at which uranium mass was introduced (see Table 4) into the system was adjusted to allow formation of the uranium distribution beyond the valley mouth (see Figure 2B). The input parameters for this calibration step are presented in Table 5.

Results and Discussion

The analytical model has been developed to incorporate the essential elements of the original RAND3D transport model. This includes use of the average flow velocity from the calibrated MODFLOW model and, consequently the site-specific hydrologic properties, and the same transient source term (beyond 1996) used in the original modeling. The analytical model is considered to be calibrated in that it reasonably matched measured 1996 COM and extent by adjusting the source timing and source concentration values within reasonable ranges.

Initial Calibration (No Retardation)

The results of this calibration are presented in Table 3. The function C_A (1381, y, t) describes the calculated concentration at a distance of 1,381 feet from the source (which is the calculated COM for 1996 from field measurements) along the center of the flow path at time t. The calibration predicts a concentration of 2.568 mg/L in 1996 at this point, which corresponds well to the average uranium concentration of 2.5 mg/L to 3 mg/L measured in this area. This indicates that the model calibration reasonably matches the actual 1996 COM.

The function C_A (4016, y, t) describes the calculated leading edge or total extent of the uranium in 1996 as defined by the 0.001 mg/L uranium concentration (concentration above background). This indicates that the model has uranium just reaching the estimated extent of uranium in groundwater as determined by the field investigation. Therefore, these results suggest that the first calibration reasonably matches the calibration targets. This calibration required the mass loading to the system begin in 1943. This start date is an artificial yet necessary manipulation of the analytical model to develop a plume of sufficient size and mass outside the Southwest Valley by 1996.

This first calibration reasonably approximates the 1996 COM and uranium extent. The figure in Table 3 presents the results of prediction of uranium concentrations through time at the Red Mule area, approximately 10,465 feet from the source term along the central flow path. This figure illustrates that the unretarded transport of uranium first arrives at the Red Mule area in approximately 200 years, which is comparable to the predicted arrival time of 150 to 200 years from the original RAND3D modeling.

Second Calibration (With Retardation)

The results of the calibration considering a retardation value of 3.86 are presented in Table 5. As with the first calibration, the function C_A (1381, y, t) describes the calculated concentration at the distance of the calculated COM for 1996 (1,381 feet from the source) along the center of the flow path at time t. The calibration predicts a concentration of 2.557 mg/L in 1996 at this point, which corresponds well to the 2.5 mg/L to 3 mg/L average measured in this area. This indicates that the model calibration reasonably matches the actual 1996 COM.

Similarly, the results of the function C_A (4016, y, t) indicates that the model has uranium just reaching the 1996 extent of uranium in groundwater as determined by the field investigation.

Therefore, these results indicate that the second calibration reasonably matches the calibration targets. This calibration required the mass loading to the system begin in 1793. As with the first calibration, this start date is an artificial yet necessary manipulation of the analytical model to match the plume size and mass outside the Southwest Valley in 1996 as an initial condition to the predictive modeling.

The prediction of the analytical model with a retardation value of 3.86 is presented in Table 5. The figure illustrates that the uranium would be expected to first arrive at the Red Mule area in approximately 700 to 800 years from the present. Using a uranium retardation value of 3.86 produces a result consistent with an earlier prediction developed using the original RAND3D model, which was not developed or calibrated using any retardation values.

As a check on sensitivity, the analytical model was re-calibrated and re-run with a retardation value of only 1.5 and with the same average flow velocity and dispersivity values used in the other model calibrations and model runs. The results of the calibration considering a retardation value of 1.5 are presented in Table 6. As with the other calibrations, the 1996 COM and extent were reasonably matched (see Table 6). The figure in Table 6 illustrates that the uranium would be expected to first arrive at the Red Mule area in approximately 250 to 300 years from the present. This result is consistent with earlier predictions and supports the conclusion that uranium transport, even with low retardation values, will not reach the Red Mule area for at least 200 years.

Conclusions:

Although the predictions from the 2-dimensional analytical model were more conservative than those estimated by the RAND3D modeling effort, the objectives of this exercise were met, as discussed in the following:

1. **Develop a tool that allows quick predictions and ease of use.**

   The tool should have the same predictive quality as the RAND3D model. The model is easy to use and is quickly modified for different scenarios. Although it is not as robust as the RAND3D model and does not produce the exact same results, it possesses similar predictive quality in that the input used in the analytical model are identical or similar to the values used in the RAND3D modeling.

2. **Calibrate this tool in a similar manner to the RAND3D model presented in Appendix G of the Site Closure Plan, assuming a retardation factor of greater than one.**

   The same calibration principals used in the RAND3D modeling effort were applied. Selected parameters within the analytical model were adjusted to reasonably match the COM and extent of the measured uranium distribution. A retardation factor of 3.86 was used.

3. **Predict the potential future distribution of uranium in groundwater at 200 years and 1,000 years considering retardation.**

   The model predicts that the uranium in groundwater under these conditions would not arrive at the Red Mule area for well over 200 years into the future.

Table 1. Non-Reactive Transport

Calculations: **Two-Dimensional Transport Equation (McWhorter, 1998 CB638)**

Input

Transport Parameters:

$\alpha_L := 250 \cdot ft$ $\quad \alpha_T := \frac{1}{10} \cdot \alpha_L$ $\quad T_{half} := 10^{10} \cdot yr$ $\quad v_x := 0.259 \cdot \frac{ft}{day}$ $\quad R := 1$ $\quad L := 1100 \cdot ft$

Source Term Parameters:

$a := 4.078 \cdot \frac{mg}{liter}$ $\quad b := \frac{0.002507}{yr}$ $\quad c := 0.2336 \cdot \frac{mg}{liter}$ $\quad \phi := 0.075$

$M_{u86} := 27.087 \cdot \frac{lb}{ft}$

$M_{u96} := 71.380 \cdot \frac{lb}{ft}$

Solution "Location" Parameters:

$x := 594 \cdot ft$ $\quad y := 0 \cdot ft$ $\quad t_1 := 1986 \cdot yr$ $\quad t := t_1 - 1980 \cdot yr$ $\quad t = 6 \cdot yr$

Equations:

$\mu := \frac{0.693}{T_{half}}$ $\quad D_L := \alpha_L \cdot v_x$ $\quad D_T := \alpha_T \cdot v_x$

$\mu = 0 \frac{1}{s^2} \cdot yr$ $\quad D_L = 2.365 \cdot 10^4 \cdot \frac{ft^2}{yr}$ $\quad D_T = 2.365 \cdot 10^3 \cdot \frac{ft^2}{yr}$

$$f_1(x,\tau) := \frac{1}{2\left[\frac{\pi D_L \cdot (\tau)}{R}\right]^{0.5}} \cdot e^{\frac{-\left[x - \frac{v_x(\tau)}{R}\right]^2}{4 \cdot D_L \cdot \frac{(\tau)}{R}} - \mu \cdot (\tau)}$$

$$F_y(y,\tau) := \frac{1}{2} \cdot \left[\operatorname{erf}\left[\frac{y+L}{2 \cdot \left[\frac{D_T \cdot (\tau)}{R}\right]^{0.5}}\right] - \operatorname{erf}\left[\frac{y-L}{2 \cdot \left[\frac{D_T \cdot (\tau)}{R}\right]^{0.5}}\right]\right]$$

$$C_o(\tau) := c + a \cdot e^{-b \cdot \tau}$$

$$C_A(x,y,t) := \frac{v_x}{R} \cdot \int_{0 \cdot yr}^{t} C_o(\tau) \cdot f_1(x,\tau) \cdot F_y(y,\tau)\, d\tau$$

$$M_{release}(\tau) := v_x \cdot \phi 2 \cdot L \cdot \int_{0 \cdot yr}^{t} C_o(\tau)\, d\tau$$

Table 1. Non-Reactive Transport (continued)

Calibration $t := 6 \cdot yr$

$C_o(t) = 4.251 \cdot \frac{mg}{liter}$	$C_A(x,y,t) = 1.38 \cdot \frac{mg}{liter}$	**1986 COM**
	$C_A(2365 \cdot ft, y, t) = 5.674 \cdot 10^{-4} \cdot \frac{mg}{liter}$	**1986 Disp to 1mg/L**
$M_{release}(\tau) := v_x \cdot \phi 2 \cdot L \cdot \int_{0 \cdot yr}^{t} C_o(\tau)\, d\tau$	$M_{release}(t) = 25.029 \cdot \frac{lb}{ft}$	**1986 Mass Release**
$M_1 := M_{release}(t)$	$\frac{M_{u86}}{M_{release}(t)} = 1.082$	
$t := 16 \cdot yr$		
$C_o(t) = 4.151 \cdot \frac{mg}{liter}$	$C_A(1540 \cdot ft, y, t) = 1.603 \cdot \frac{mg}{liter}$	**1996 COM**
	$C_A(4200 \cdot ft, y, 16 \cdot yr) = 2.091 \cdot 10^{-3} \cdot \frac{mg}{liter}$	**1996 Disp to 1mg/L**
$M_{release}(\tau) := v_x \cdot \phi 2 \cdot L \cdot \int_{0 \cdot yr}^{t} C_o(\tau)\, d\tau$	$M_{release}(t) = 65.962 \cdot \frac{lb}{ft}$	**1986 Mass Release**
	$\frac{M_{u96} - M_{u86}}{M_{release}(t) - M_1} = 1.082$	

Table 2. Calibration of the COM Travel Time (Non-Reactive)

Statistics of Measured Hydraulic Conductivity

Min	0.6	ft/d
Max	46.7	ft/d
Average	11.8	ft/d
Geomean	7.5	ft/d

Retardation= [redacted]

x	y	z	K	Porosity	Distance	Gradient	Velocity	Cum. Elapsed Time	Cumulative Distance	Interpolated Time	Desired Distance	
[feet]	[feet]	[feet]	[ft/d]	[ ]	[feet]	[ ]	[ft/day]	[years]	[feet]	Years	[feet]	Notes
7778.913	4919.966	6300.084	[redacted]	[redacted]				0.0				
7624.711	4806.059	6299.509	3.25	0.15	191.71	[redacted]	0.07	7.2	191.71			
7470.509	4692.152	6298.769	3.25	0.15	191.71	-0.00335	0.07	14.5	383.42			
7349.829	4584.945	6298.168	3.25	0.15	161.42	-0.00335	0.07	20.6	544.84			
7242.558	4397.333	6297.601	3.25	0.15	216.11	-0.00335	0.07	28.8	760.96			
7188.923	4296.827	6297.38	3.25	0.15	113.92	-0.00335	0.07	33.2	874.88			
7135.287	4196.321	6297.197	3.25	0.15	113.92	-0.00335	0.07	37.6	988.80			
7135.287	4022.11	6296.966	3.25	0.15	174.21	-0.00335	0.07	44.3	1163.01			
7135.287	3834.498	6296.741	3.25	0.15	187.61	-0.00335	0.07	51.5	1350.62			
7188.923	3660.287	6296.563	3.25	0.15	182.28	-0.00335	0.07	58.5	1532.91	53	1381	1996 COM

Table 3. Non-Reactive Transport

Calculations:

Two-Dimensional Transport Equation
Source Adjustment Only

Input:

Transport Parameters:

$$\alpha_L := 200\,\mathrm{ft} \qquad \alpha_T := \frac{1}{10}\cdot\alpha_L \qquad T_{half} := 10^{10}\cdot\mathrm{yr} \qquad R := 1 \qquad L := 200\,\mathrm{ft}$$

$$\phi := 0.15 \qquad K := 3.25\frac{\mathrm{ft}}{\mathrm{day}} \qquad \iota := 0.00335 \qquad v_x := \frac{K\cdot\iota}{\phi} \qquad v_x = 0.0726\frac{\mathrm{ft}}{\mathrm{day}}$$

Times to Set Initial Conditions:

$$t_1 := 1996\,\mathrm{yr} \qquad t := t_1 - 1943\,\mathrm{yr} \qquad t = 53\,\mathrm{yr}$$

U "Measured" in 1996

$$M_{u96} := 71.380\frac{\mathrm{lb}}{\mathrm{ft}}$$

Equations:

$$\mu := \frac{0.693}{T_{half}} \qquad D_L := \alpha_L\cdot v_x \qquad D_T := \alpha_T\cdot v_x$$

$$\mu = 0\frac{1}{s^2}\,\mathrm{yr} \qquad D_L = 5.302\times 10^3\frac{\mathrm{ft}^2}{\mathrm{yr}} \qquad D_T = 530.21\frac{\mathrm{ft}^2}{\mathrm{yr}}$$

$$f_1(x,\tau) := \frac{1}{2\left[\frac{\pi D_L\cdot(\tau)}{R}\right]^{0.5}}\cdot e^{\frac{-\left[x-\frac{v_x\cdot(\tau)}{R}\right]^2}{4\cdot D_L\frac{(\tau)}{R}}-\mu\cdot(\tau)}$$

$$F_y(y,\tau) := \frac{1}{2}\cdot\left[\mathrm{erf}\left[\frac{y+L}{2\cdot\left[\frac{D_T\cdot(\tau)}{R}\right]^{0.5}}\right]-\mathrm{erf}\left[\frac{y-L}{2\cdot\left[\frac{D_T\cdot(\tau)}{R}\right]^{0.5}}\right]\right]$$

Source Term:

$$a := 4.5068\frac{\mathrm{mg}}{\mathrm{liter}} \qquad b := \frac{0.002705}{\mathrm{yr}} \qquad c := 0.2337\frac{\mathrm{mg}}{\mathrm{liter}} \qquad C_o(\tau) := \begin{cases} 9.04\frac{\mathrm{mg}}{\mathrm{liter}} & \text{if } t \le 53\cdot\mathrm{yr} \\ c + a\cdot e^{-b\cdot\tau} & \text{otherwise}\end{cases}$$

Transport Equation:

$$C_A(x,y,t) := \frac{v_x}{R}\cdot\int_{0\cdot\mathrm{yr}}^{t} C_o(\tau)\cdot f_1(x,\tau)\cdot F_y(y,\tau)\,d\tau$$

$$M_{release}(\tau) := v_x\cdot\phi\cdot 2\cdot L\cdot\int_{0\cdot\mathrm{yr}}^{t} C_o(\tau)\,d\tau$$

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Table 3. Non-Reactive Transport (Continued)

Calibration

$x := 1381 \cdot ft \quad y := 0 \cdot ft \qquad C_A(x,y,t) = 2.568 \frac{mg}{liter}$ **1996 COM**

$x := 4016 ft \quad y := 0 \cdot ft \qquad C_A(x,y,t) = 0.001 \frac{mg}{liter}$ **1996 Extent**

$M_{u96} \cdot \frac{2}{3} = 47.587 \frac{lb}{ft}$ **1996 Uranium Mass Target**

$M_{release}(t) = 47.577 \frac{lb}{ft}$ **1996 Total Simulated Mass**

Predictions at Red Mule

Distance along flow path to Red Mule

$x := 10465 ft \qquad y := 0 \cdot ft$

Set up time function

$t := 25 \cdot yr, 50 \cdot yr .. 1000 yr$

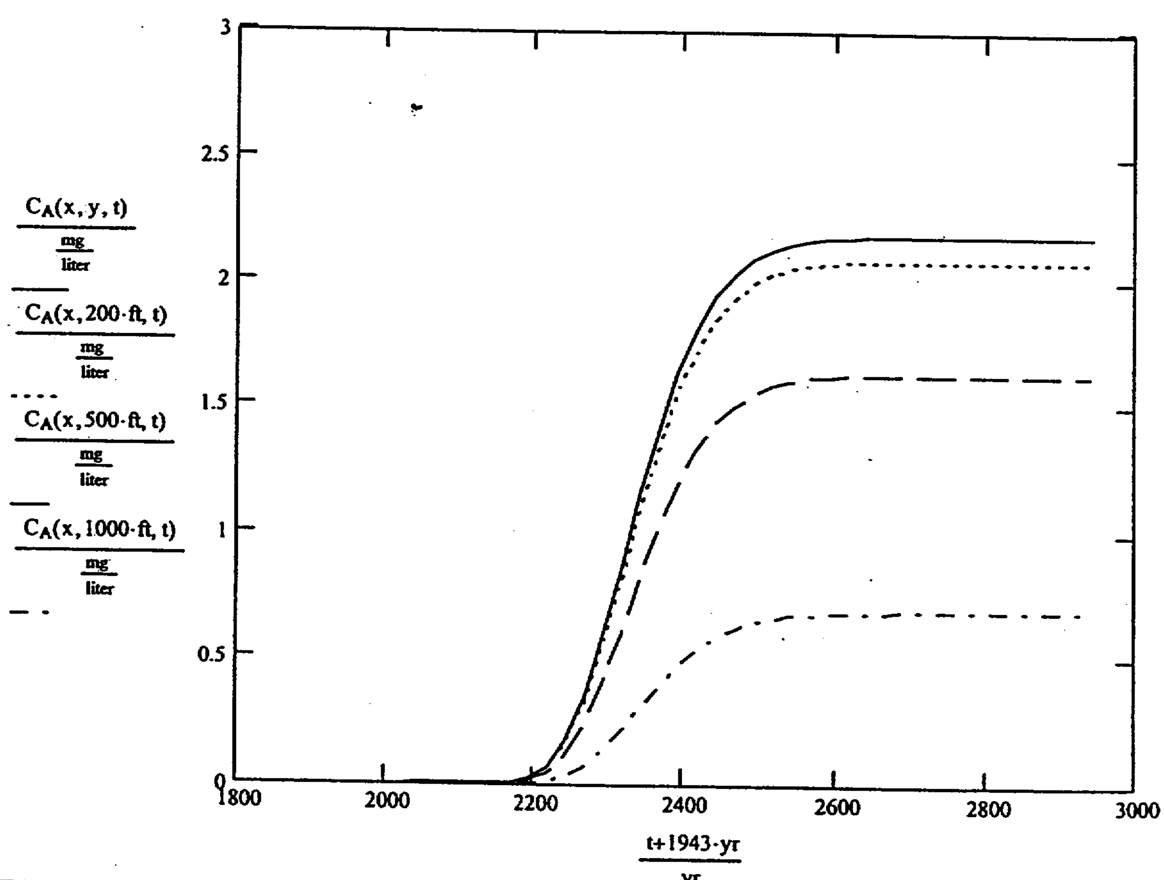


Table 4. Calibration of the COM Travel Time (Reactive)

Statistics of Measured Hydraulic Conductivity

Min	0.6 ft/d
Max	46.7 ft/d
Average	11.8 ft/d
Geomean	7.5 ft/d

Retardation = [redacted]

x [feet]	y [feet]	z [feet]	K [ft/d]	Porosity [ ]	Distance [feet]	Gradient [ ]	Velocity [ft/day]	Cum. Time Elapsed [years]	Cumulative Distance [feet]	Interpolated Time Years	Desired Distance [feet]	Notes
7778.913	4919.966	6300.084	[redacted]	[redacted]				0.0				
7624.711	4806.059	6299.509	3.25	0.15	191.71	[redacted]	0.02	27.9	191.71			
7470.509	4692.152	6298.769	3.25	0.15	191.71	-0.00335	0.02	55.9	383.42			
7349.829	4584.945	6298.168	3.25	0.15	161.42	-0.00335	0.02	79.6	544.84			
7242.558	4397.333	6297.601	3.25	0.15	216.11	-0.00335	0.02	111.3	760.96			
7188.923	4296.827	6297.38	3.25	0.15	113.92	-0.00335	0.02	128.2	874.88			
7135.287	4196.321	6297.197	3.25	0.15	113.92	-0.00335	0.02	145.2	988.80			
7135.287	4022.11	6296.966	3.25	0.15	174.21	-0.00335	0.02	171.0	1163.01			
7135.287	3834.498	6296.741	3.25	0.15	187.61	-0.00335	0.02	198.8	1350.62			
7188.923	3660.287	6296.563	3.25	0.15	182.28	-0.00335	0.02	225.9	1532.91	203	1381	1996 COM

Table 5. Reactive Transport

Calculations: **Two-Dimensional Transport Equation with Retardation (Source Adjustment Only)**

Input:

Transport Parameters:

$\alpha_L := 200\,ft$ $\quad \alpha_T := \frac{1}{10}\cdot\alpha_L$ $\quad T_{half} := 10^{10}\cdot yr$ $\quad R := 3.86$ $\quad L := 200\,ft$

$\phi := 0.15$ $\quad K := 3.25\frac{ft}{day}$ $\quad \iota := 0.00335$ $\quad v_x := \frac{K\cdot\iota}{\phi}$ $\quad v_x = 0.0726\frac{ft}{day}$

Times to Set Initial Conditions:

$t_1 := 1996\,yr$ $\quad t := t_1 - 1793\,yr$ $\quad t = 203\,yr$

U "Measured" in 1996

$M_{u96} := 71.380\frac{lb}{ft}$

Equations:

$\mu := \frac{0.693}{T_{half}}$ $\quad D_L := \alpha_L\cdot v_x$ $\quad D_T := \alpha_T\cdot v_x$

$\mu = 0\frac{1}{s^2}\,yr$ $\quad D_L = 5.302\times 10^3\frac{ft^2}{yr}$ $\quad D_T = 530.21\frac{ft^2}{yr}$

$$f_1(x,\tau) := \frac{1}{2\left[\frac{\pi D_L\cdot(\tau)}{R}\right]^{0.5}}\cdot e^{\frac{-\left[x-\frac{v_x\cdot(\tau)}{R}\right]^2}{4\cdot D_L\cdot\frac{(\tau)}{R}}-\mu\cdot(\tau)}$$

$$F_y(y,\tau) := \frac{1}{2}\cdot\left[erf\left[\frac{y+L}{2\cdot\left[\frac{D_T\cdot(\tau)}{R}\right]^{0.5}}\right]-erf\left[\frac{y-L}{2\cdot\left[\frac{D_T\cdot(\tau)}{R}\right]^{0.5}}\right]\right]$$

Source Term:

$a := 6.7618\frac{mg}{liter}$ $\quad b := \frac{0.002704}{yr}$ $\quad c := 0.23346\frac{mg}{liter}$

$$C_o(\tau) := \begin{cases} 9.111\cdot\frac{mg}{liter} & \text{if } t \le 203\cdot yr \\ c + a\cdot e^{-b\cdot\tau} & \text{otherwise} \end{cases}$$

Transport Equation:

$$C_A(x,y,t) := \frac{v_x}{R}\cdot\int_{0\cdot yr}^{t} C_o(\tau)\cdot f_1(x,\tau)\cdot F_y(y,\tau)\,d\tau$$

$$M_{release}(\tau) := v_x\cdot\phi\cdot 2\cdot L\cdot\int_{0\cdot yr}^{t} C_o(\tau)\,d\tau$$

Table 5. Reactive Transport (continued)

Calibration

$x := 1381 \cdot ft \quad y := 0 \cdot ft \qquad C_A(x, y, t) = 2.557 \frac{mg}{liter}$ **1996 COM**

$x := 4016 ft \quad y := 0 \cdot ft \qquad C_A(x, y, t) = 0.001 \frac{mg}{liter}$ **1996 Extent**

$M_{u96} \cdot \frac{2}{3} = 47.587 \frac{lb}{ft}$ **1996 Uranium Mass Target** $\qquad \frac{M_{release}(t)}{R} = 47.58 \frac{lb}{ft}$ **1996 Total Simulated Mass in Solution**

Predictions at Red Mule

Distance along flow path to Red Mule

$x := 10465 ft \qquad y := 0 \cdot ft$

Set up time function

$t := 25 \cdot yr, 50 \cdot yr .. 1500 yr$

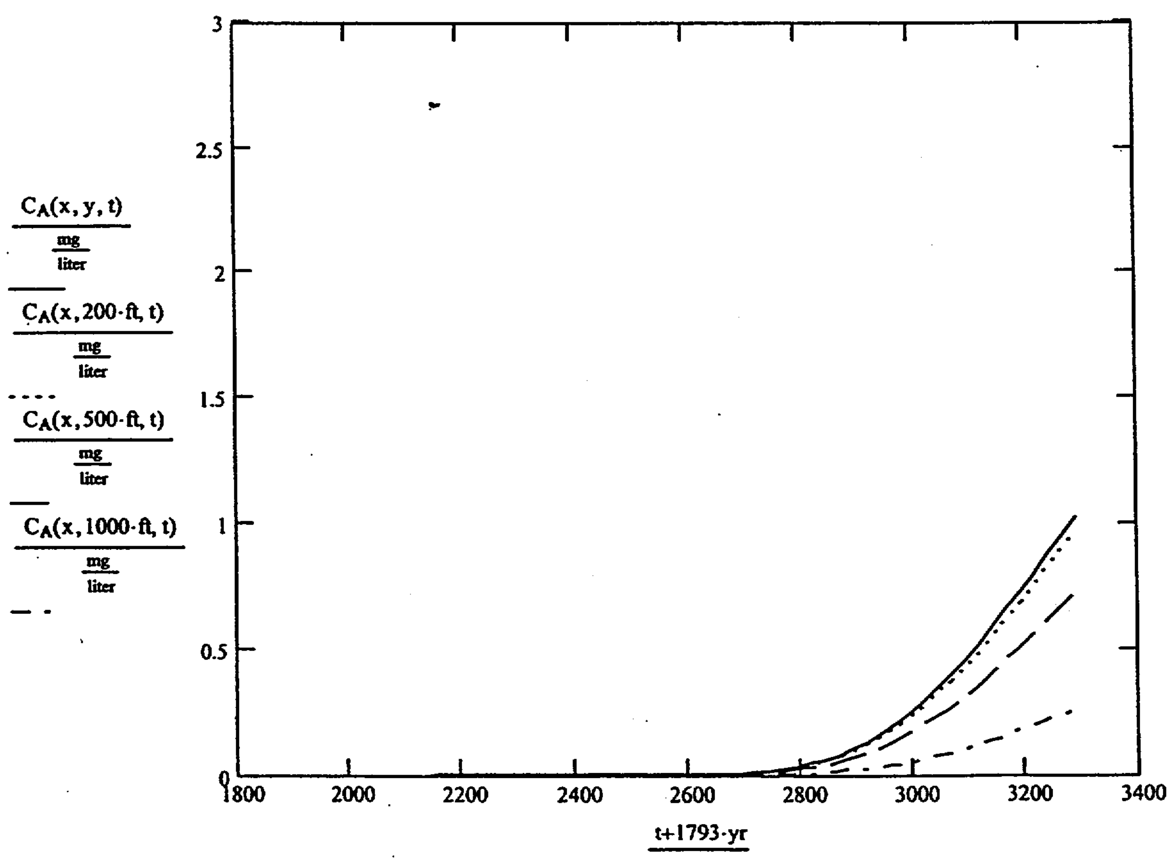


Table 6. Reactive Transport (R=1.5)

Calculations: **Two-Dimensional Transport Equation with Retardation (Source Adjustment Only)**

Input:

Transport Parameters:

$\alpha_L := 200\,ft$ $\quad \alpha_T := \frac{1}{10}\cdot\alpha_L$ $\quad T_{half} := 10^{10}\cdot yr$ $\quad R := 1.5$ $\quad L := 200\,ft$

$\phi := 0.15$ $\quad K := 3.25\frac{ft}{day}$ $\quad \iota := 0.00335$ $\quad v_x := \frac{K\cdot\iota}{\phi}$ $\quad v_x = 0.0726\frac{ft}{day}$

Times to Set Initial Conditions:

$t_1 := 1996\,yr$ $\quad t := t_1 - 1917\cdot yr$ $\quad t = 79\,yr$

U "Measured" in 1996

$M_{u96} := 71.380\frac{lb}{ft}$

Equations:

$\mu := \frac{0.693}{T_{half}}$ $\quad D_L := \alpha_L\cdot v_x$ $\quad D_T := \alpha_T\cdot v_x$

$\mu = 0\frac{1}{s^2}\,yr$ $\quad D_L = 5.302\times 10^3\frac{ft^2}{yr}$ $\quad D_T = 530.21\frac{ft^2}{yr}$

$$f_l(x,\tau) := \frac{1}{2\left[\frac{\pi D_L\cdot(\tau)}{R}\right]^{0.5}}\cdot e^{\frac{-\left[x-\frac{v_x\cdot(\tau)}{R}\right]^2}{4\cdot D_L\cdot\frac{(\tau)}{R}}-\mu\cdot(\tau)}$$

$$F_y(y,\tau) := \frac{1}{2}\cdot\left[\operatorname{erf}\left[\frac{y+L}{2\cdot\left[\frac{D_T\cdot(\tau)}{R}\right]^{0.5}}\right]-\operatorname{erf}\left[\frac{y-L}{2\cdot\left[\frac{D_T\cdot(\tau)}{R}\right]^{0.5}}\right]\right]$$

Source Term:

$a := 4.8352\frac{mg}{liter}$ $\quad b := \frac{0.002705}{yr}$ $\quad c := 0.23382\frac{mg}{liter}$

$$C_o(\tau) := \begin{cases} 9.099\frac{mg}{liter} & \text{if } t \le 79\cdot yr \\ c + a\cdot e^{-b\cdot\tau} & \text{otherwise}\end{cases}$$

Transport Equation:

$$C_A(x,y,t) := \frac{v_x}{R}\cdot\int_{0\cdot yr}^{t} C_o(\tau)\cdot f_l(x,\tau)\cdot F_y(y,\tau)\,d\tau$$

$$M_{release}(\tau) := v_x\cdot\phi\cdot 2\cdot L\cdot\int_{0\cdot yr}^{t} C_o(\tau)\,d\tau$$

Table 6. Reactive Transport (R=1.5, Continued)

Calibration

$x := 1381 \cdot ft \quad y := 0 \cdot ft \qquad C_A(x,y,t) = 2.559 \frac{mg}{liter}$ **1996 COM**

$x := 4016 ft \quad y := 0 \cdot ft \qquad C_A(x,y,t) = 0.001 \frac{mg}{liter}$ **1996 Extent**

$M_{u96} \cdot \frac{2}{3} = 47.587 \frac{lb}{ft}$ **1996 Uranium Mass Target** $\qquad \frac{M_{release}(t)}{R} = 47.586 \frac{lb}{ft}$ **1996 Total Simulated Mass in Solution**

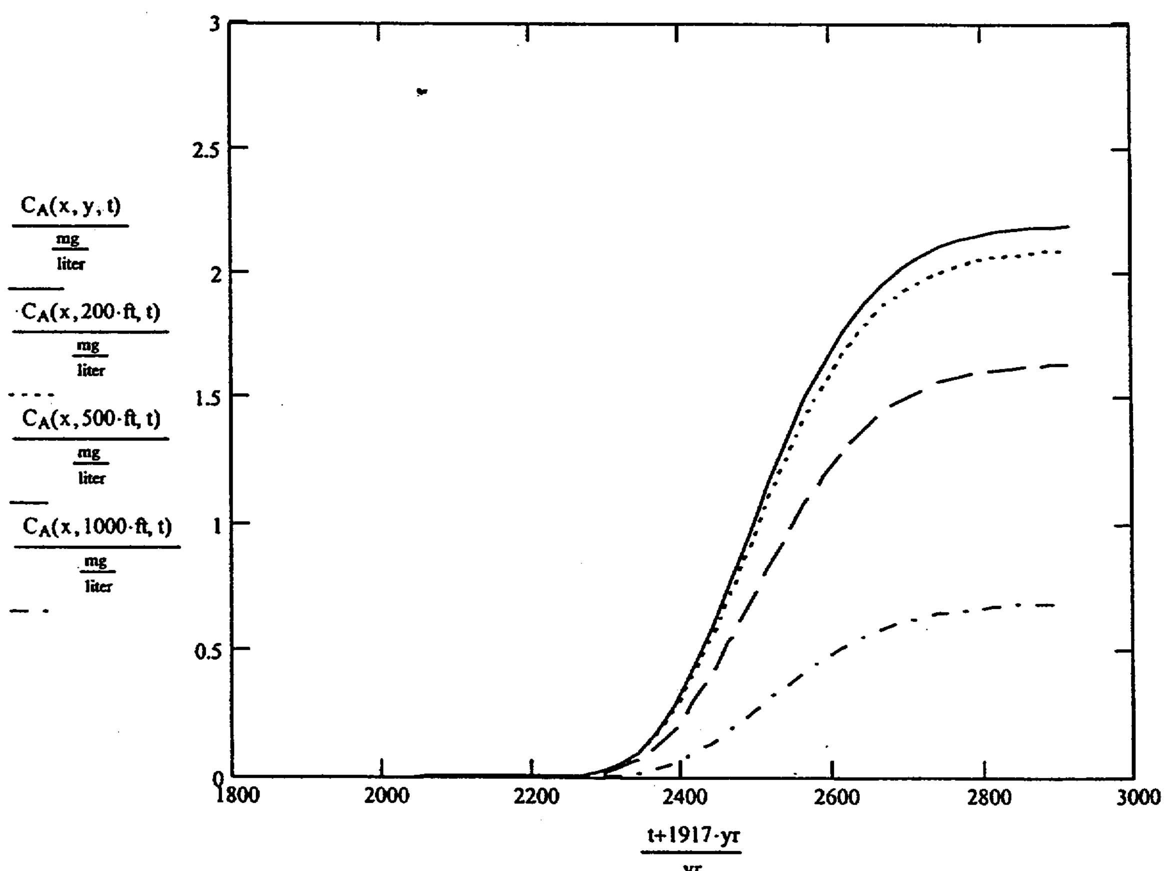
Predictions at Red Mule

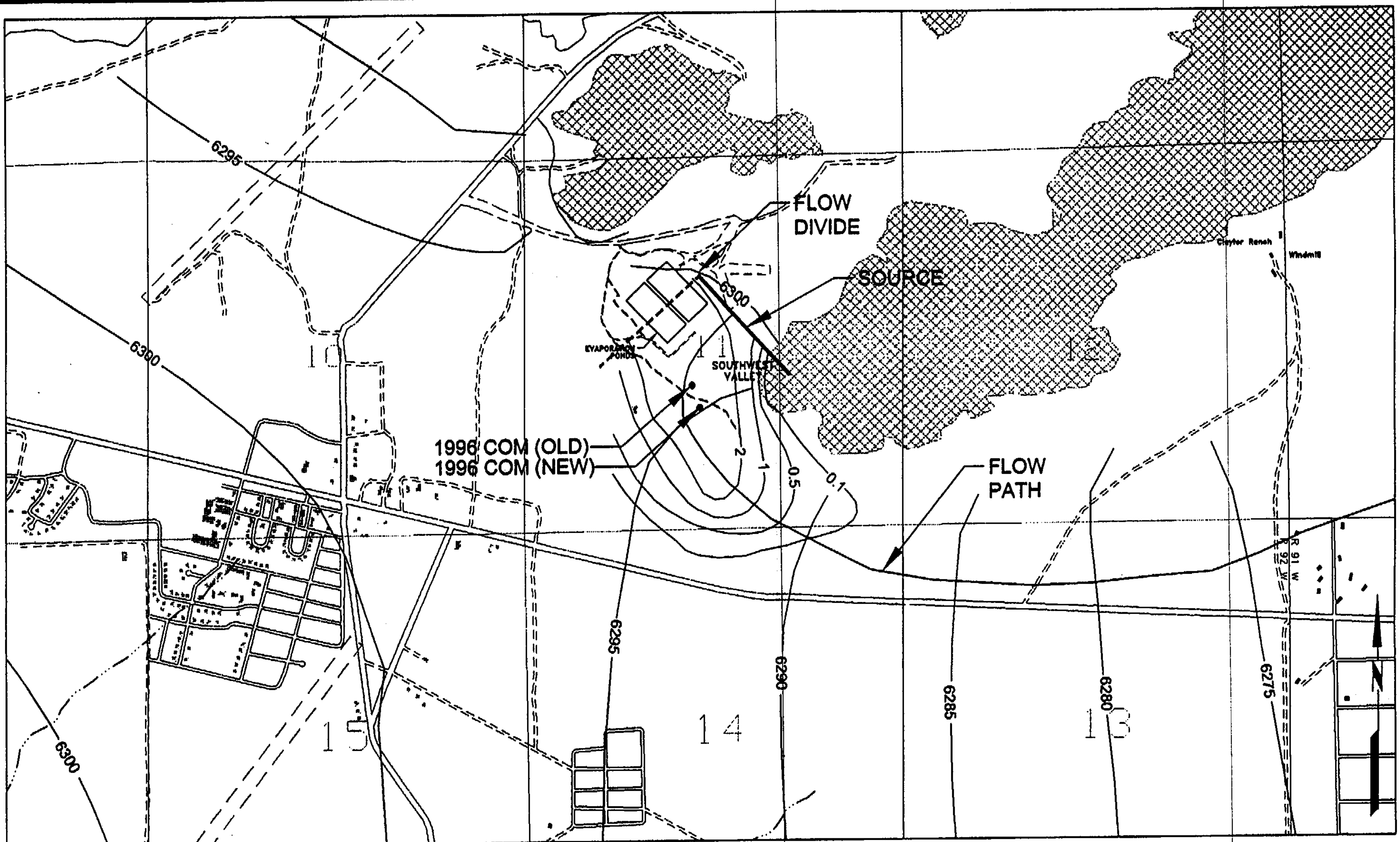
Distance along flow path to Red Mule

$x := 10465 ft \qquad y := 0 \cdot ft$

Set up time function

$t := 25 \cdot yr, 50 \cdot yr .. 1000 yr$





COM CENTER OF MASS FOR URANIUM mg/L LAYER 1 (~1,381 FEET FROM SOURCE TO NEW COM)

—1— URANIUM mg/L FROM RAND3D MODEL CALIBRATION (~4,016 FEET FROM SOURCE TO 0.1 mg/L CONTOUR)

SCALE IN FEET

0 2000

SHEPHERD MILLER INCORPORATED

FIGURE 1
ANALYTICAL TRANSPORT MODEL FRAMEWORK

Date:	FEBRUARY 2000
Project:	03-347\TASK3
File:	TRANSPORT.DWG

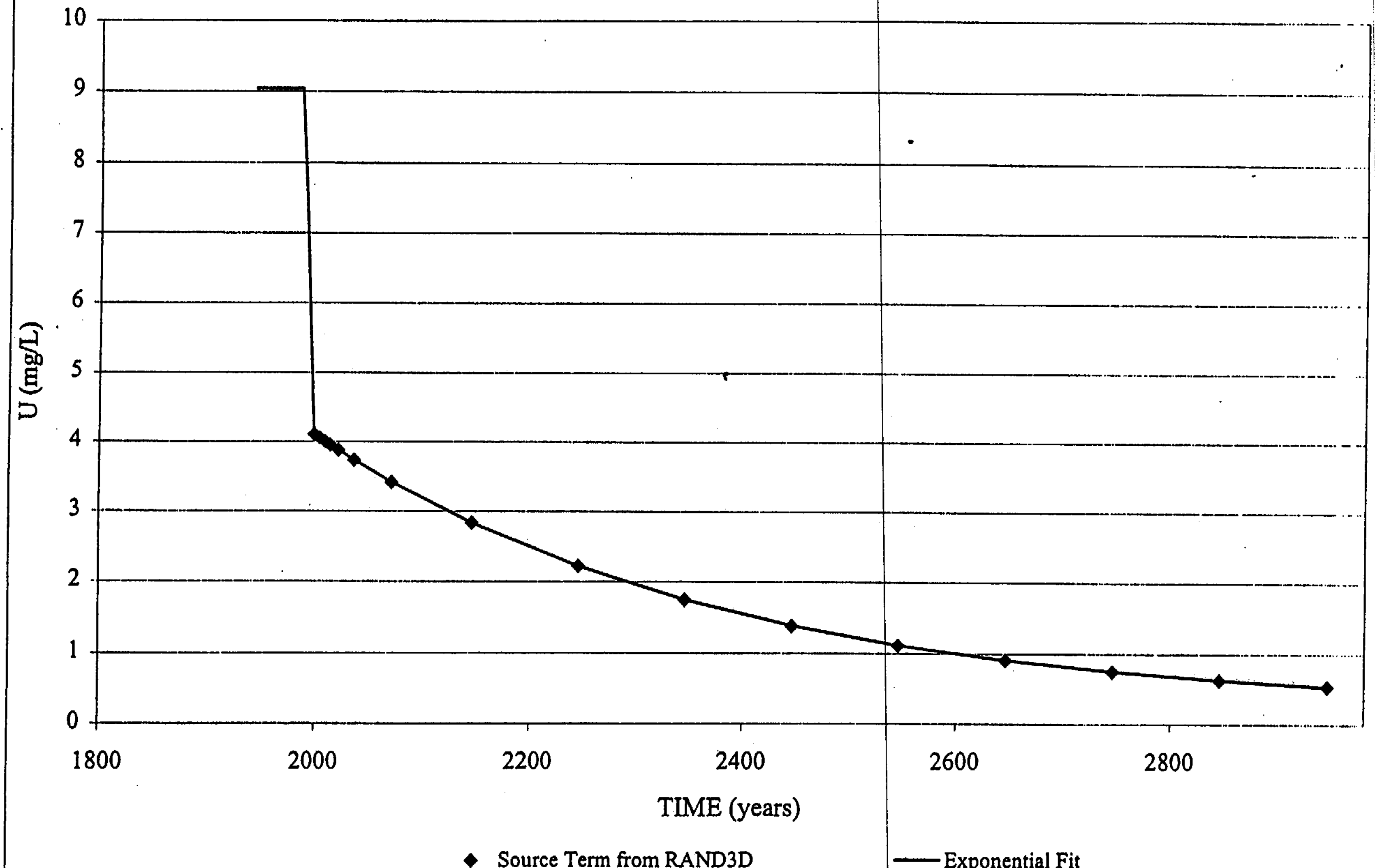


FIGURE 2A. SOURCE CONCENTRATIONS VS TIME (with no reatrdation)

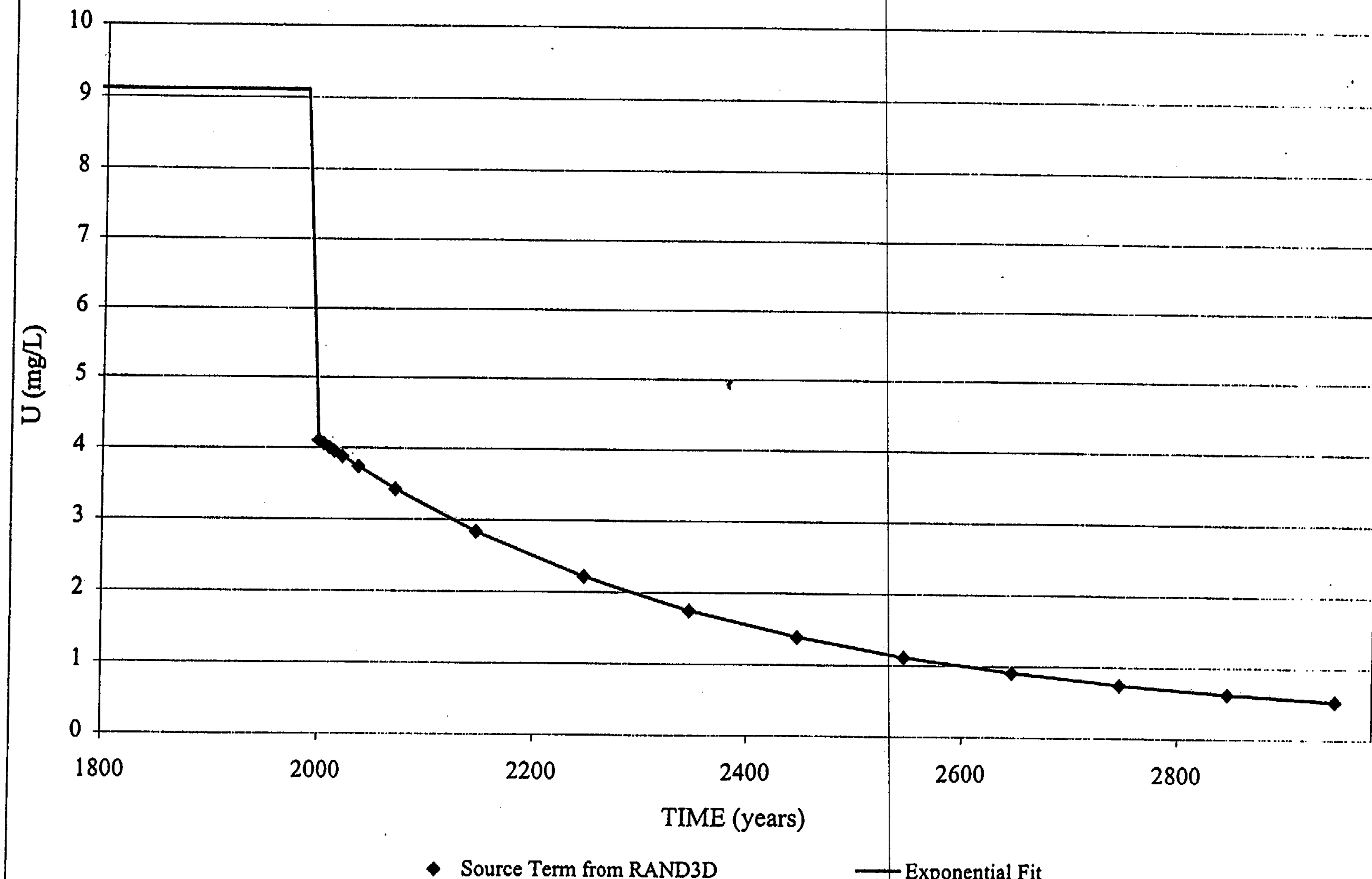


FIGURE 2B. SOURCE CONCENTRATIONS VS TIME
(with Retardation =3.86)

SHEPHERD MILLER, INC.
Environmental and Engineering Consultants

TECHNICAL MEMORANDUM

DATE: February 25, 2000 **SMI #** 03-347

TO: Toby Wright

FROM: Terry Fairbanks

SUBJECT: Evaluation of Hypothetical Pumping Stresses on Transport of Site-derived Constituents at the WNI Split Rock Site, Jeffrey City, Wyoming

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Problem Statement:

Anomalous groundwater quality conditions in the vicinity of Well SWAB-36, located approximately 1 mile Southwest of the Split Rock site reclaimed tailings facility (see Figure 1), were identified during the comprehensive site investigation performed by Western Nuclear, Inc. (WNI). The results of this investigation were submitted to the U.S. Nuclear Regulatory Commission (NRC) in the groundwater compliance component of the October 29, 1999 WNI Site Closure Plan. Recent inquiries by the NRC during their review of the Site Closure Plan has prompted additional analyses to be performed in an effort to: (1) better characterize the potential transport of site-derived constituents, and (2) evaluate the ability or inability of these constituents to influence the groundwater quality in the vicinity of well SWAB-36.

Objective:

To evaluate the potential for site-derived constituents to migrate to the SWAB-36 area under hypothetical worst-case conditions.

Approach:

Inspection of the existing groundwater table contours at the Split Rock site demonstrate that the area in the vicinity of well SWAB-36 is hydraulically upgradient of groundwater flow exiting the

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Southwest Valley (see attached Figure 1). Review of historical data indicates that the hydraulic conditions in the vicinity of the Townsite and well SWAB-36 have not significantly changed due to the operations of the tailings facility or increased flow of groundwater from the site. The only significant hydraulic stress that could have changed gradients in the area between the Southwest Valley and SWAB-36 was pumping from the Townsite wells, which continue to be used to supply water for the Jeffrey City Townsite. Data regarding the historic pumping from the Townsite wells and an evaluation of the worst-case potential for impacting Townsite groundwater has been presented in the October 29, 1999 submittal (Attachment D.h to Appendix D). These data indicate that the peak pumping (1977 to 1981) from the Townsite supply wells ranged from 152.6 gallons per minute (gpm) in the winter to 587.5 gpm in the summer with an annual average of 370 gpm. At this point in time, these pumping rates supported a population of over 3,000 people. Current average annual pumping rates to support a population of approximately 75 are on the order of approximately 110 gpm.

The previously submitted evaluation demonstrated that even if the Townsite wells were to pump at a steady-state rate of 600 gpm 24-hrs/day, 365-days/year, it would require more than 1,500 years for the first particle of site-derived constituents to reach this area. Additional analyses, presented in this Technical Memorandum, evaluate the potential effect of ***hypothetical*** pumping stresses applied in the SWAB-36 area, specifically, at an older, pre-existing well in this area, Well-14 (see Figure 2). It should be noted that there is no record of significant historical pumping stresses to the aquifer in this area, and this evaluation is purely to provide additional demonstration that the anomalous uranium values in the SWAB-36 area are not site derived.

For the analyses addressed in this Technical Memorandum, the calibrated groundwater flow model (see Appendix D and Appendix E to the October 29, 1999 submittal) was used to simulate a steady-state pumping stress of 370 gpm at Well-14. The travel time for conservative constituent transport to reach the pumping well from the edge of the Alternate Tailings Impoundment was calculated for this hypothetical condition. This modeling incorporated several additional factors of conservatism.

First, the peak flow gradients for the site (1986 conditions) were used for this steady-state simulation. Second, the pumping rate assumed for this steady-state simulation was the peak historical average annual pumping rate from the existing Townsite wells (1977 to 1981) based on actual pumping records (see Attachment D.h to Appendix D). The time period from which this pumping rate was developed reflects the maximum population of Jeffrey City and, therefore, peak water usage, a highly conservative assumption. Third, the use of a steady-state pumping scenario is conservative in that the hydraulic stress created by this simulation is significantly greater than the effect of a well being pumped periodically (on and off), as a supply pump would be operated (see Attachment D.h to Appendix D). Fourth, the modeling assumed that constituents entered the groundwater flow system at the edge of the reclaimed tailings. In actuality, the early tailings impoundment was much farther up the valley and tailings were not deposited in the Alternate Tailings Impoundment area (in the lower Southwest Valley) until the late 1960s. Fifth, site-derived constituents were assumed to be entirely conservative with no retardation to their transport, which has been demonstrated not to be the case (see Appendix F, Section 5 of the October 29, 1999 submittal).

The USGS model MODPATH was used to track the flow path of particles introduced into the steady-state flow field developed under this scenario. As stated above, the particles are introduced at the edge of the Alternate Tailings Impoundment, and their migration paths were evaluated through time.

Results:

The results of the analysis are presented in the attached Figure 2 for particle positions at 25, 50, 75, 100, 150, 175, and 200 years. As shown by Figure 2, it would take approximately 200 years for a conservative constituent to initially reach Well-14 subject to the highly conservative assumptions presented above. Further, it would require a prolonged pumping period much greater than 200 years, even under these highly conservative conditions for this evaluation, to draw enough groundwater to this area such that 0.8 mg/L of uranium would persist in this area for 25 years after the pumping stopped.

Conclusion:

This hydrologic and conservative constituent transport evaluation demonstrates that it is highly unlikely for the uranium anomaly observed in groundwater in the SWAB-36 area to be site-derived.

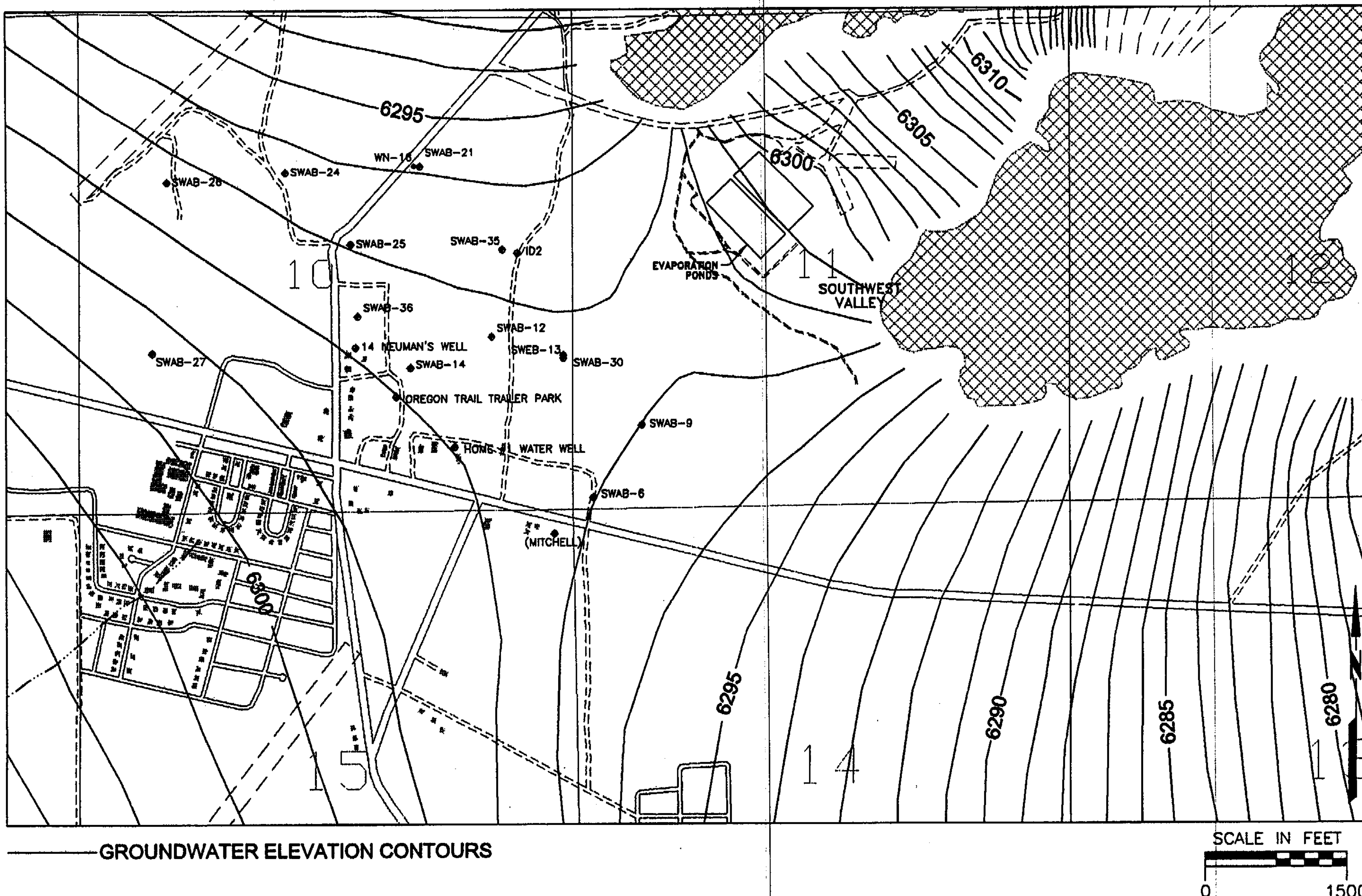

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FIGURE 1
POTENTIOMETRIC SURFACE
NOVEMBER 1996

Date:	FEBRUARY 2000
Project:	03-347\TASK3
File:	POTENT-01.DWG

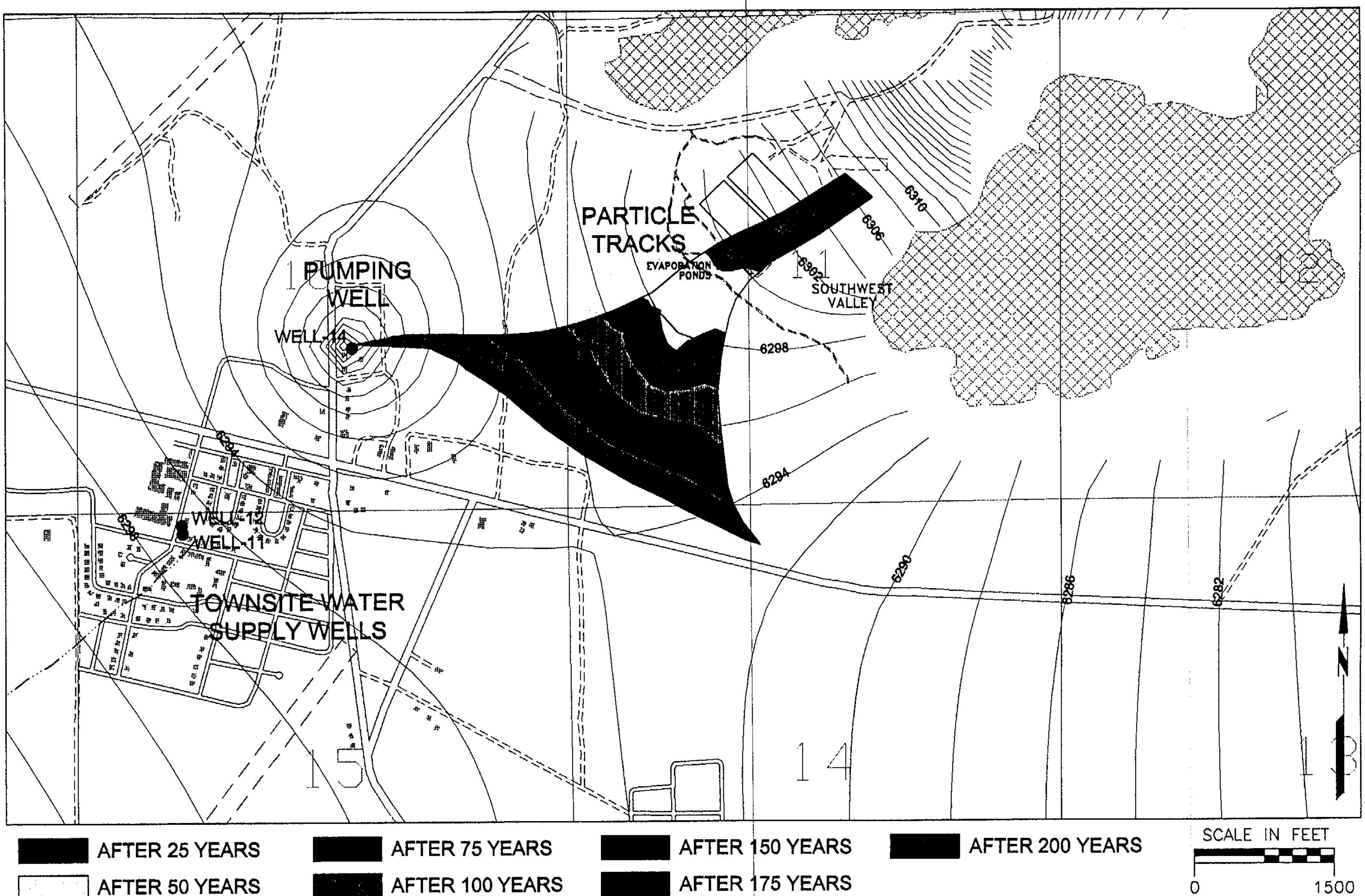

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FIGURE 2
HYPOTHETIC PUMPING AT WELL-14 AND FLOW PATH AND DISTANCE OF PARTICLES FROM SITE

Date:	FEBRUARY 2000
Project:	03-347\TASK3
File:	WELL14_025.DWG

SHEPHERD MILLER, INC.
Environmental and Engineering Consultants

TECHNICAL MEMORANDUM

DATE: February 25, 2000 **SMI #** 03-347

TO: Toby Wright

FROM: David Levy

SUBJECT: Anomalous Groundwater Chemistry North Near SWAB-36

Anomalous groundwater quality conditions have been identified in the vicinity of well SWAB-36, which is located approximately 1 mile southwest of the reclaimed Split Rock site tailings impoundment (see Figure 1). These anomalies include concentration of uranium above regional background concentrations in groundwater from well SWAB-36 and elevated concentrations of uranium, sulfate, and chloride above regional background concentrations in wells SWAB-21 and SWAB-25 located in the vicinity of SWAB-36.

These anomalies were identified during the comprehensive site investigation and characterization study performed between 1996 and 1999 by Western Nuclear, Inc. (WNI). The results of that study were presented to the U.S. Nuclear Regulatory Commission (NRC) on October 29, 1999, in Appendix F of WNI's Site Closure Plan. The WNI study concluded that the anomalous groundwater quality conditions in the vicinity of SWAB-36 were not the result of impacts from site-derived constituents, but reflected local baseline water quality conditions.

This Technical Memorandum presents the results of additional evaluations of the site investigation and characterization study data supporting the conclusion that the anomalous groundwater quality conditions in the vicinity of well SWAB-36 were not the result of site-derived constituents. The evaluations include comparisons of groundwater quality data from well groupings representing: (1) groundwater associated with site-derived constituents; (2) regional groundwater; (3) groundwater in the vicinity of well SWAB-36; and (4) groundwater between the site-derived plume and groundwater in the vicinity of well SWAB-36.

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Technical Approach

Groundwater quality data from four identified well groupings were evaluated. These well groupings were:

1. Wells SWAB-1, -2, -18, and -19, representing groundwater associated with the site-derived constituents (groundwater in the site-derived plume)
2. Wells SWAB-26 and SWAB-27, representing regional groundwater
3. Wells SWAB-21, -24, -25, and -36, representing groundwater in the vicinity of well SWAB-36
4. Wells SWAB-12, -30, and -35, representing groundwater between the site-derived plume and groundwater in the vicinity of well SWAB-36.

The average concentrations of the major cations (calcium, sodium, potassium, and magnesium) and anions (chloride, sulfate, and bicarbonate) in groundwater samples obtained from the above wells were used to construct interpretive geochemical diagrams to aid in grouping the waters according to their major chemical composition. The data used to develop the average concentrations of major cations and anions were obtained from groundwater quality data presented in Table F-5-4 of Appendix F to the Site Closure Plan. The data are summarized in the attached Table 1.

The data were plotted on two types of diagrams that illustrate water quality characteristics and assist in identifying differences in water types: (1) Stiff Diagrams, which show equivalent concentrations of anions and cations in the groundwater, and (2) Piper Diagrams, which show the relative proportions of anions and cations in the groundwater. As discussed below, grouping the waters according to their major chemical composition by use of the Stiff and Piper Diagrams shows that, despite water quality anomalies, water quality in the vicinity of SWAB-36 is representative of local baseline groundwater conditions and not water associated with the site-derived constituents.

Discussion of Results

Figure 2 presents Stiff Diagrams showing the equivalent concentrations of anions and cations in groundwater in the vicinity of well SWAB-36 (groundwater samples from wells SWAB-21, -24, -25, and -36) and groundwater associated with site-derived constituents (groundwater samples from wells SWAB-1, -2, -18, and -19). The diagrams show that the concentrations of anions plus cations in groundwater in the vicinity of well SWAB-36 are generally 20 meq/L or less. In contrast, the concentrations of anions plus cations in groundwater associated with site-derived constituents are significantly higher, 70 meq/L or greater.

Wells SWAB-1, -2, -18, and -19 are located at the mouth of the Southwest Valley and monitor groundwater associated with site-derived constituents. These waters are dominated by sulfate and calcium, with the calcium being contributed largely from the dissolution of calcite (calcium carbonate) by the low pH fluids from the tailings. The strikingly different major ion equivalent concentration patterns between the site groundwater samples and groundwater in the vicinity of well SWAB-36 indicate a different water quality history and different source of constituents in groundwater in these two areas.

The Piper Diagrams presented in Figure 3 also support the different water quality history and different source of constituents in groundwater in the two areas. The Piper Diagrams show that the site groundwater (from wells SWAB-1, -2, -18, and -19) is calcium and sulfide-rich. This water composition typically results when acidic tailing water reacts with calcium carbonate, releasing calcium into the groundwater. In contrast, groundwater in the vicinity of well SWAB-36 (groundwater samples from wells SWAB-21, -24, -25, and -36) is generally calcium and bicarbonate-rich.

In summary, the water quality characteristics of groundwater in the vicinity of well SWAB-36 and groundwater associated with the site-derived constituents (in the Southwest Valley) are significantly different, indicating a different water quality history and different source of constituents in groundwater in these two areas.

In order to evaluate the anomalous water quality characteristics in groundwater in the vicinity of well SWAB-36 and further confirm that the anomalies are not associated with site-derived constituents, groundwater quality in the vicinity of SWAB-36 was also compared with regional groundwater quality and groundwater quality in an area downgradient of the site-derived plume and upgradient of the groundwater in the vicinity of SWAB-36. As discussed below, the comparisons show that groundwater quality characteristics in the area between the site-derived plume and in the vicinity of SWAB-36 are comparable to regional groundwater quality and show no evidence that water associated with site-derived constituents passed through this intermediate area or reached the SWAB-36 area. Hence, there is no evidence that the water quality anomalies in the vicinity of SWAB-36 are associated with site-derived constituents, but rather are representative of local baseline conditions.

Figure 4 presents the Stiff Diagrams for groundwater between the site-derived plume and groundwater in the vicinity of SWAB-36 (wells SWAB-12, -30, and -35), groundwater in the vicinity of SWAB-36 (wells SWAB-21, -24, -25, and -36), and regional groundwater (wells SWAB-26 and SWAB-27). The diagrams show that, although groundwater samples from wells SWAB-21, -24, and -25 have slightly higher overall equivalent concentrations, the concentrations of anions plus cations for all these waters are similar. The similarity of these results is contrasted with those for groundwater associated with site-derived constituents shown in Figure 2 (groundwater samples from wells SWAB-1, -2, -18, and -19), indicating that these groundwaters have a different water quality history and different source of constituents than groundwater associated with site-derived constituents.

Figure 5 presents the Piper Diagrams for these same waters and includes groundwater associated with site-derived constituents. These diagrams show that the groundwater between the site-derived plume and SWAB-36, in the vicinity of SWAB-36, and representative of regional water quality all plot as calcium and bicarbomate-rich waters, compared with the calcium and sulfide-rich water associated with site-derived constituents. Further, the groundwater associated with these areas share the same characteristics, indicating that water quality anomalies in the vicinity of well SWAB-36 are not associated with site-derived constituents.

It should be noted that the Piper Diagram in Figure 3 shows that the major ion concentration patterns in groundwater samples from wells SWAB-21 and SWAB-25 are similar to each other, but are dissimilar when compared to groundwater samples from the other wells shown in Figure 3. The equivalent concentrations of sodium plus potassium with respect to calcium, and the anion's ratio of carbonate plus bicarbonate to sulfate in samples from wells SWAB-21 and SWAB-25 are distinctly different from those shown for the other wells. As noted in the October 29, 1999 submittal (Appendix F, Section F.5), wells SWAB-21 and SWAB-25 are downgradient from the Townsite sewage lagoon, which is still in use. This lagoon is a potential source for the elevated levels of sulfate and chlorine (possibly from detergents and household products in the gray water effluent from the Townsite) observed in groundwater samples from these wells. In addition, SWAB-21 and SWAB-25 are directly downgradient from a drainage pipe outlet that conveys surface runoff and drainage from the Townsite (See Figure 1). This drainage pipe outlet is another potential source for the addition of constituents to the groundwater in the area of wells SWAB-21and SWAB-25, which could alter the basic chemistry of the local groundwater.

Additionally, the major ion composition of groundwater from wells SWAB-21 and SWAB-25 is also distinctly different from groundwater associated with site-derived constituents. If anomalous groundwater quality in the area of wells SWAB-21 and SWAB-25 was associated with site-derived constituents, it would be expected that these waters would plot somewhere along the continuum between regional groundwater quality characteristics and characteristics of groundwater associated with site-derived constituents. This is not the case.

The water quality characteristics are also consistent with the anomalous dissolved uranium concentrations in groundwater samples from wells SWAB-21, SWAB-25, and particularly well

SWAB-36. As shown in Figure 3, the dominant anions in groundwater samples from these wells are carbonate and bicarbonate, with the highest proportion of carbonate and bicarbonate found in samples from well SWAB-36. High concentrations of these anions enhance the ability of uranium to remain dissolved, which explains the dissolved uranium concentrations found in the groundwater samples from these wells.

Conclusions

1. The evaluation of groundwater data by means of Stiff Diagrams and Piper Diagrams shows that groundwater in the vicinity of well SWAB-36, groundwater between the site-derived plume and well SWAB-36, and regional groundwater all possess similar major ion signatures which are distinct from groundwater associated with site-derived constituents. The results of the evaluation show that groundwater in the vicinity of well SWAB-36 has not been influenced by site-derived constituents.

2. The differences in major ion signatures between groundwater from wells SWAB-21 and SWAB–25, located in the vicinity of well SWAB-36, and other wells representative of regional groundwater indicate that the groundwater in the areas of wells SWAB-21 and SWAB-25 has been influenced by a non-site-derived source(s) of constituents. Possible non-site-derived sources of constituents include the Townsite sewage lagoon and the Townsite drainage pipe outlet located upgradient of wells SWAB-21 and SWAB-25.

3. The elevated dissolved uranium concentrations in groundwater from wells SWAB-21, -25, and -36 are consistent with the dominant anions, carbonate and bicarbonate, in groundwater samples from these wells. High concentrations of these anions enhance the ability of uranium to remain dissolved, which explains the elevation of dissolved uranium in groundwater from these wells.

Table 1 Average Constituent Concentrations for Groundwater Samples Collected from Selected SWAB-series Monitoring Wells*

Well Name	Mn	U	NO_2+NO_3-N	Alk$CaCO_3$	Ca	Cl	HCO_3	K	Mg	Na	SO_4
SWAB-1	0.05	3.517	na	na	680	62.5	na	10.4	144	148	1644
SWAB-1	0.02	3.15	126	294	803	79.8	358.68	11.3	164	147	1910
SWAB-1	0.005	2.56	171	311	870	110	379.42	10.9	210	129	2190
SWAB-1	0.005	2.84	176	320	750	81.2	390.40	12.2	193	161	1860
SWAB-1	0.02	2.853	na	256	496	44.2	312.32	8.6	97	124	1270
SWAB-1	0.04	2.989	153	293	714	91.5	357.46	11.3	164	132	1940
Average	**0.02**	**2.98**	**157**	**295**	**719**	**78**	**359.66**	**10.8**	**162**	**140**	**1802**
SWAB-2	10.9	2.699	142	390	600	90	475.80	63.1	212	141	2230
SWAB-2		3.033	na	437		90	533.14				2580
SWAB-2	11.1	2.79	148	415	606	83.7	506.30	59.3	200	147	2140
Average	**11.0**	**2.84**	**145**	**414**	**603**	**88**	**505.08**	**61.2**	**206**	**144**	**2317**
SWAB-7			4.6		66.3	4.1	200.08	4.3	6.3	14.1	28.3
SWAB-7			4.02		68	6.3	196.42	3.6	6.1	12.2	28.7
SWAB-7			na		61.3	4	203.74	3.5	5.8	13.6	15.2
SWAB-7			na		61	4.3	196.42	3.5	5.6	12.9	25
Average			**4.3**		**64**	**5**	**199.17**	**3.7**	**6.0**	**13.2**	**24**
SWAB-12	0.005	0.057	na	151	66.7	19.5	184.22	5.9	8.5	29.6	78
SWAB-12	0.005	0.047	0.42	149	66.8	18.3	181.78	6.96	9.01	30.2	77.7
SWAB-12	0.005	0.0532	0.43	149	65.1	18.4	181.78	6.2	8.5	29.3	76.2
Average	**0.005**	**0.052**	**0.43**	**150**	**66.2**	**18.7**	**182.59**	**6.4**	**8.7**	**29.7**	**77**
SWAB-14			na								
SWAB-14			0.3								
SWAB-14			0.3								
SWAB-14			0.32								
SWAB-14			0.3								
Average			**0.3**								
SWAB-17			4.56		58.1	4.5	170.80	3.47	11.6	5.68	32.1
SWAB-17			na				170.80				
SWAB-17			4.75		58.9	4.1	167.14	3.3	11.3	5.5	32.4
Average			**4.66**		**58.5**	**4.3**	**169.58**	**3.4**	**11.5**	**5.6**	**32.3**
SWAB-18			na		526	71	405.04	42	146	148	1960
SWAB-18			111		544	81	363.56	51	160	150	2112
SWAB-18			107		606	83	355.02	42.3	179	142	2140
Average			**109**		**559**	**78**	**374.54**	**45**	**162**	**147**	**2071**
SWAB-19	23.4	3.043	93.4	389	512	54.1	474.58	54.1	164	109	1923
SWAB-19	22.7	3.4	na	400	464	46	488.00	50	152	119	1810
SWAB-19	25.3	3.24	100	389	458	55.3	474.58	51	150	109	1890
Average	**23.8**	**3.2**	**97**	**393**	**478**	**52**	**479.05**	**52**	**155**	**112**	**1874**

* Values previously submitted in Table F-5-4 of the October 29, 1999 submittal.

Table 1 Average Constituent Concentrations for Groundwater Samples Collected from Selected SWAB-series Monitoring Wells*

Well Name	Mn	U	NO_2+NO_3-N	AlkCaCO$_3$	Ca	Cl	HCO$_3$	K	Mg	Na	SO$_4$
SWAB-20			10.1		134	22	237.90	11.6	27.5	34.9	232
SWAB-20			9.5		136	22.5	236.68	10.6	27.4	33.7	241
SWAB-20			na		117	19.8	231.80	10.4	24.7	33.2	220
Average			**9.8**		**129**	**21**	**235.46**	**10.9**	**26.5**	**33.9**	**231**
SWAB-21	0.005	0.159	0.11	228	110	60.2	278.16	11.1	20	174	396
SWAB-21	0.03	0.128	na	204	78.7	39.2	248.88	8.7	14.3	126	255
SWAB-21	0.02	0.166	0.1	234	119	70.5	285.48	10.9	21.3	171	419
Average	**0.02**	**0.151**	**0.1**	**222**	**103**	**56.6**	**270.84**	**10.2**	**19**	**157**	**357**
SWAB-23			na								
SWAB-23			2.25								
SWAB-23			2.13								
Average			**2.19**								
SWAB-24	0.005	0.068	7.46	269	104	20.2	328.18	10.3	14.8	60.3	117
SWAB-24	0.03	0.073	na	266	100	19.8	324.52	9.1	14.2	50.9	114
Average	**0.02**	**0.071**	**7.46**	**268**	**102**	**20.0**	**326.35**	**9.7**	**14.5**	**55.6**	**116**
SWAB-25	0.005	0.149	na	324	88.6	62.5	395.28	8.2	11.6	214	305
SWAB-25	0.005	0.139	0.36	309	92.2	76.6	376.98	9.47	12.3	231	358
Average	**0.005**	**0.144**	**0.36**	**317**	**90.4**	**69.6**	**386.13**	**8.8**	**12.0**	**223**	**332**
SWAB-26	0.005	0.015	1.56	135	42	15.5	164.70	6.91	5.51	27.8	27
SWAB-26	0.005	0.014	1.39	133	42.4	15.3	162.26	6.2	5.3	27	26.3
SWAB-26	0.005	0.015	na	133	39.3	13.6	162.26	6.3	5.1	27.6	26.1
Average	**0.005**	**0.015**	**1.48**	**134**	**41**	**14.8**	**163.07**	**6.5**	**5.3**	**27**	**26**
SWAB-27	0.005	0.021	1.74	138	54.2	19.4	168.36	7.51	6.51	29.9	50.6
SWAB-27	0.005	0.017	1.51	135	54.6	21.3	164.70	6.6	6.3	28.3	41
SWAB-27	0.005	0.023	na	134	49.2	16.6	163.48	6.6	5.7	27.4	43.5
Average	**0.005**	**0.020**	**1.63**	**136**	**52.7**	**19.1**	**165.51**	**6.9**	**6.2**	**28.5**	**45**
SWAB-30	0.02	0.023	0.77	139	55.8	11.2	169.58	6.08	8.16	23.2	58.1
SWAB-30	0.005	0.021	0.71	149	56.9	9.7	181.78	6.42	8.21	23.8	54
Average	**0.01**	**0.022**	**0.74**	**144**	**56.4**	**10.5**	**175.68**	**6.25**	**8.19**	**23.5**	**56**
SWAB-35	0.005	0.032	0.65	155	65.4	10.5	189.10	6.7	8.5	23.1	67.4
SWAB-35	0.05	0.03	0.57	162	61.9	9	197.64	6.7	7.8	22	55.1
Average	**0.03**	**0.03**	**0.61**	**159**	**63.7**	**10**	**193.37**	**6.7**	**8.2**	**23**	**61.3**
SWAB-36	0.12	0.751	0.89	218	69.8	5.9	265.96	6.5	10.7	29	38.5
SWAB-36		0.752	0.98	228	77.7	6.5	278.16	6.4	10.8	32.6	40
SWAB-36	0.03	0.903	1.79	272	81.3	6.2	331.84	6.8	12	28.9	42.2
Average	**0.08**	**0.802**	**1.22**	**239**	**76.3**	**6.2**	**291.99**	**6.6**	**11**	**30**	**40**

* Values previously submitted in Table F-5-4 of the October 29, 1999 submittal.

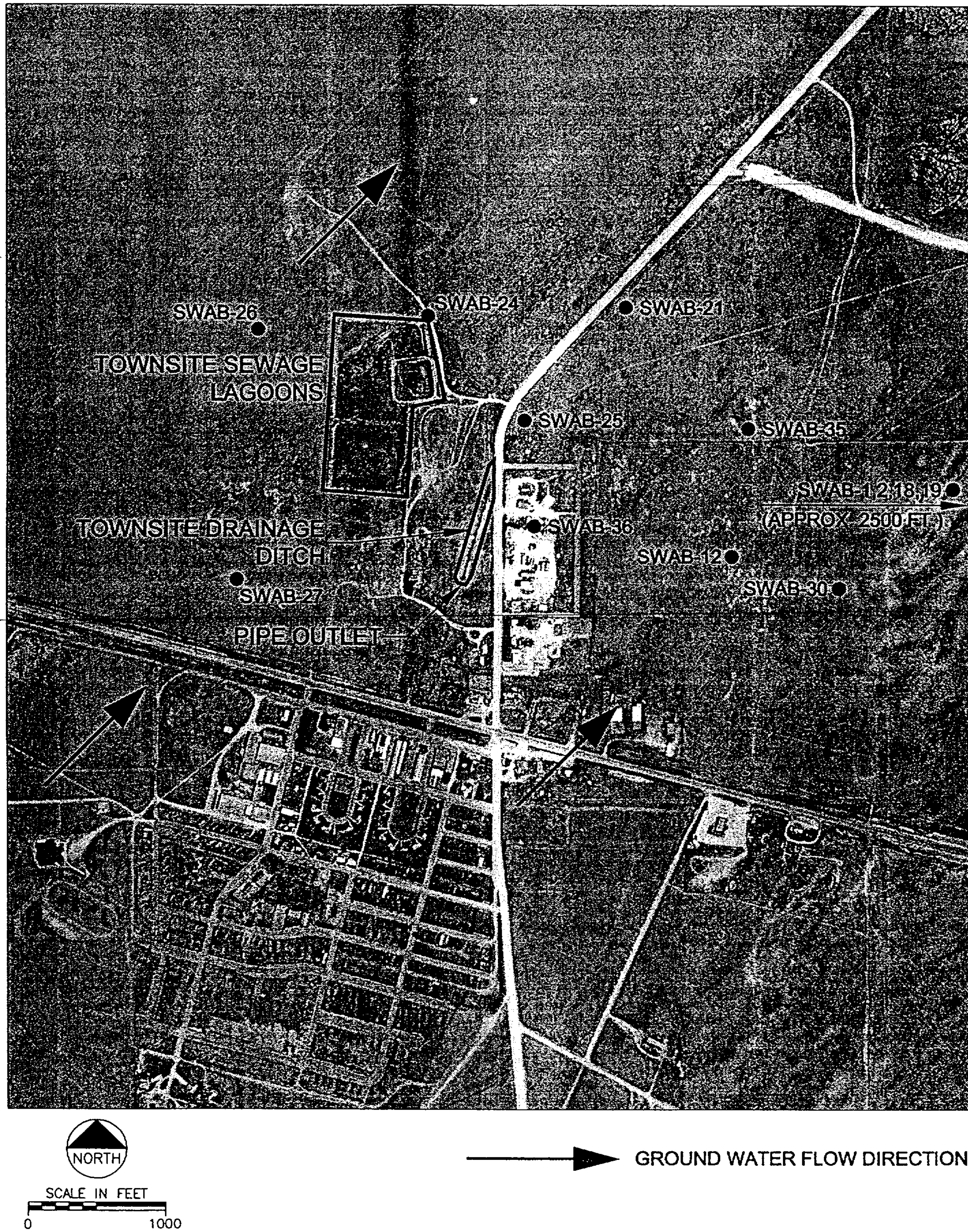

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FIGURE 1
POTENTIAL SOURCES TO LOCAL GROUND WATER QUALITY ANOMALIES

Date:	FEBRUARY 2000
Project:	03-347/2000
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Figure 2
Stiff Diagram for SWABs in the Vicinity of SWAB-36 and
and at the mouth of the Southwest Valley

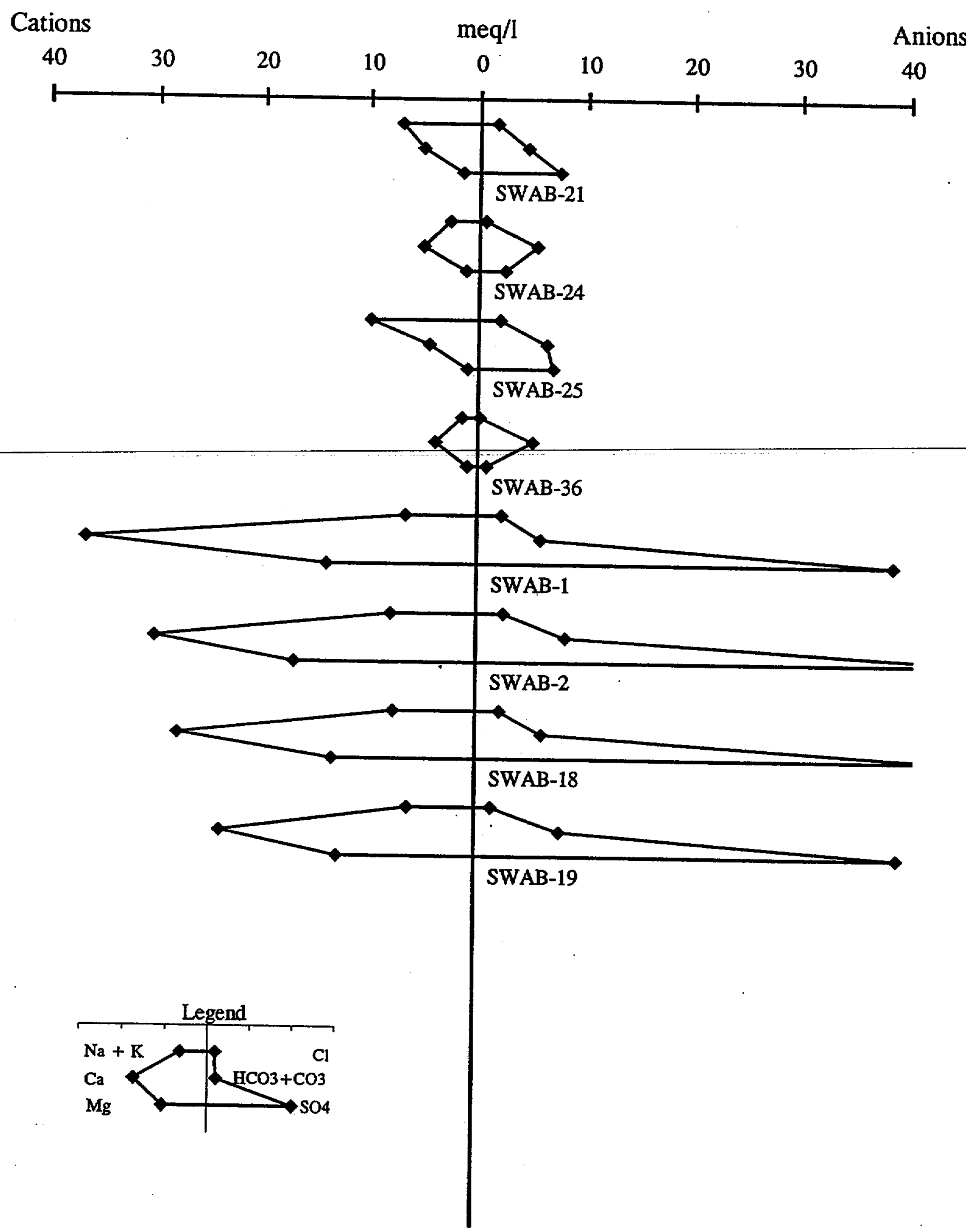

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Figure 3
Piper Diagram for Ground Water in the Vicinity of SWAB-36 and in the Southwest Valley

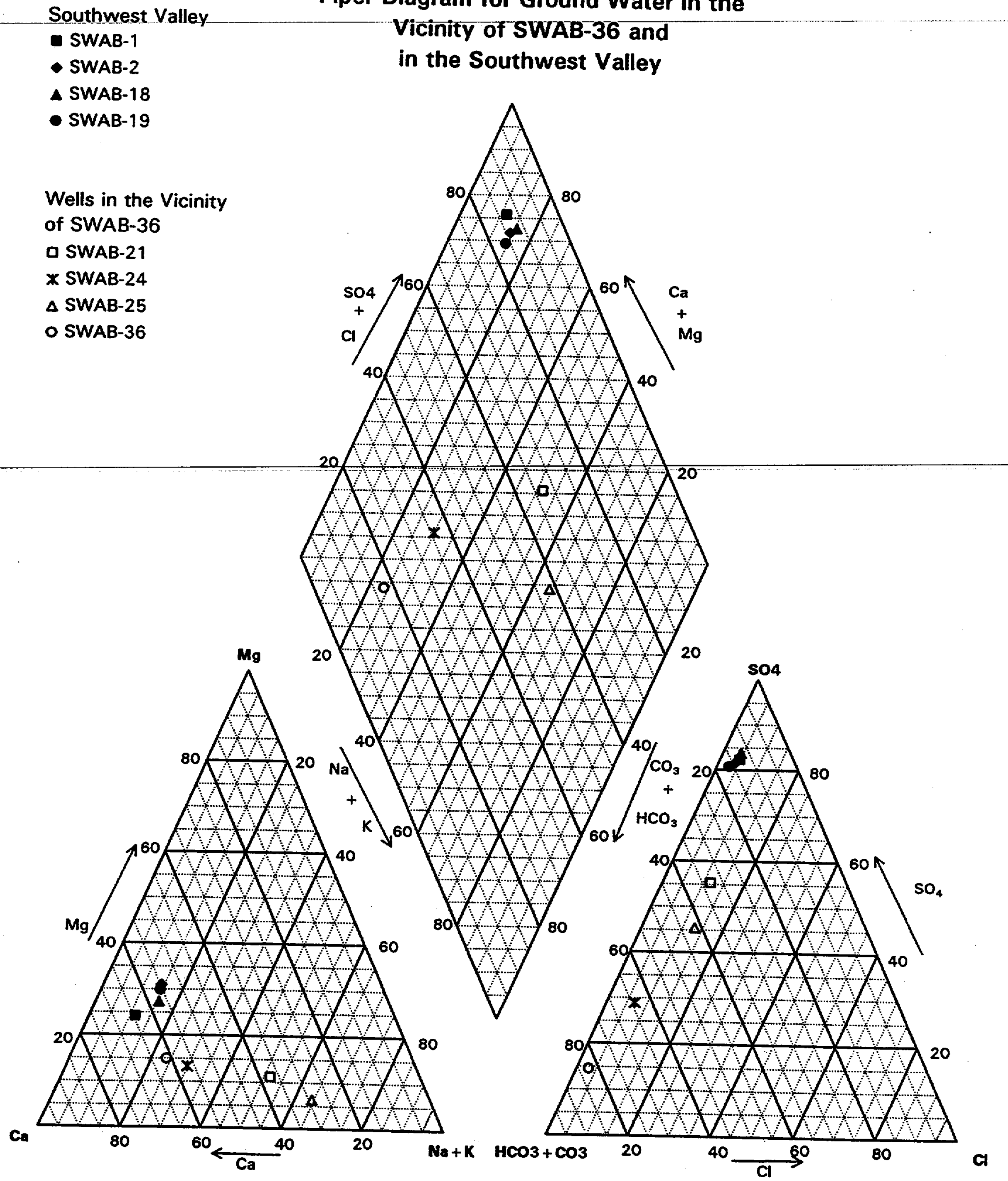

Figure 4
Stiff Diagram for SWABs in the Vicinity of SWAB-36 and Between the Site-Derived Plume and SWAB-36

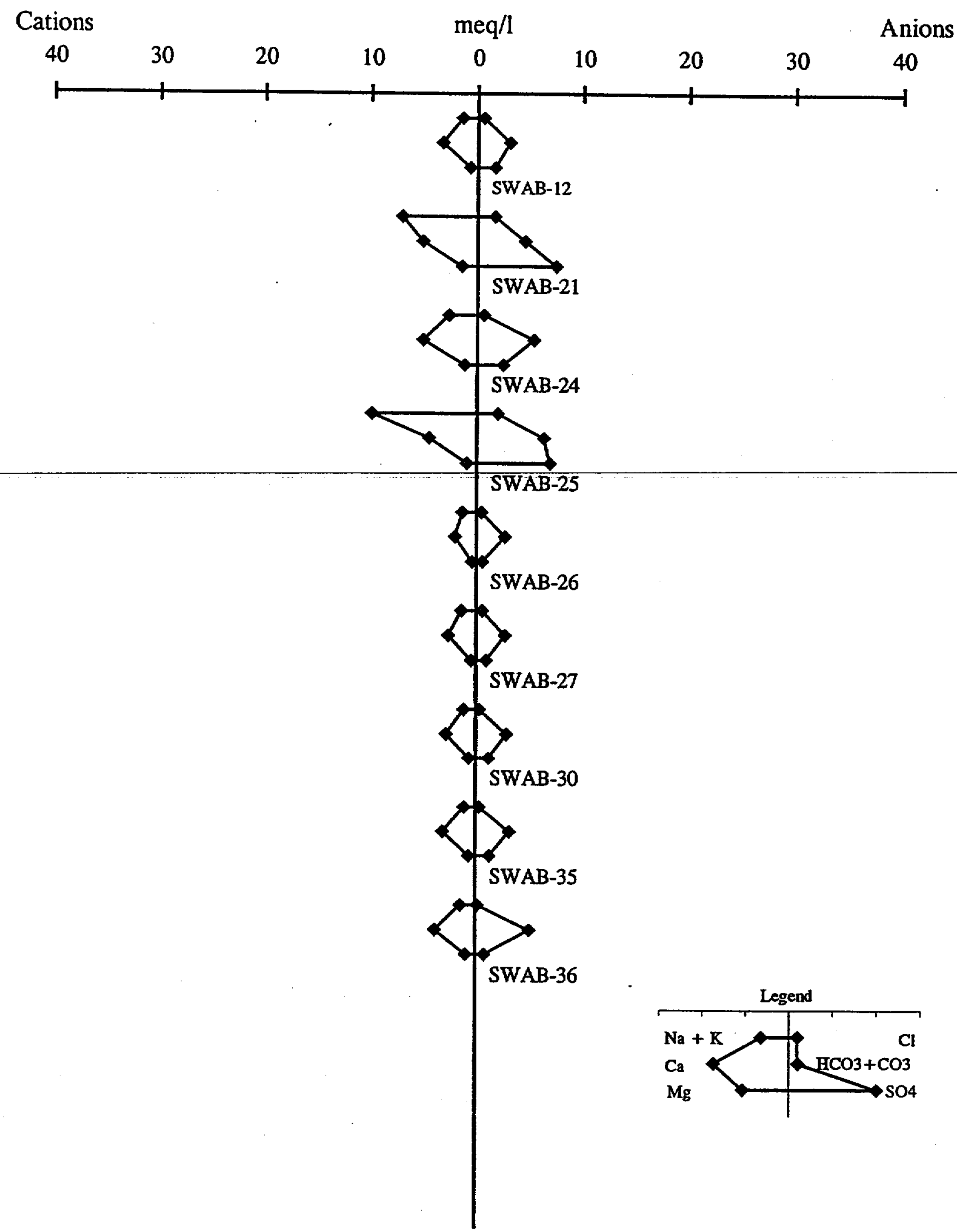

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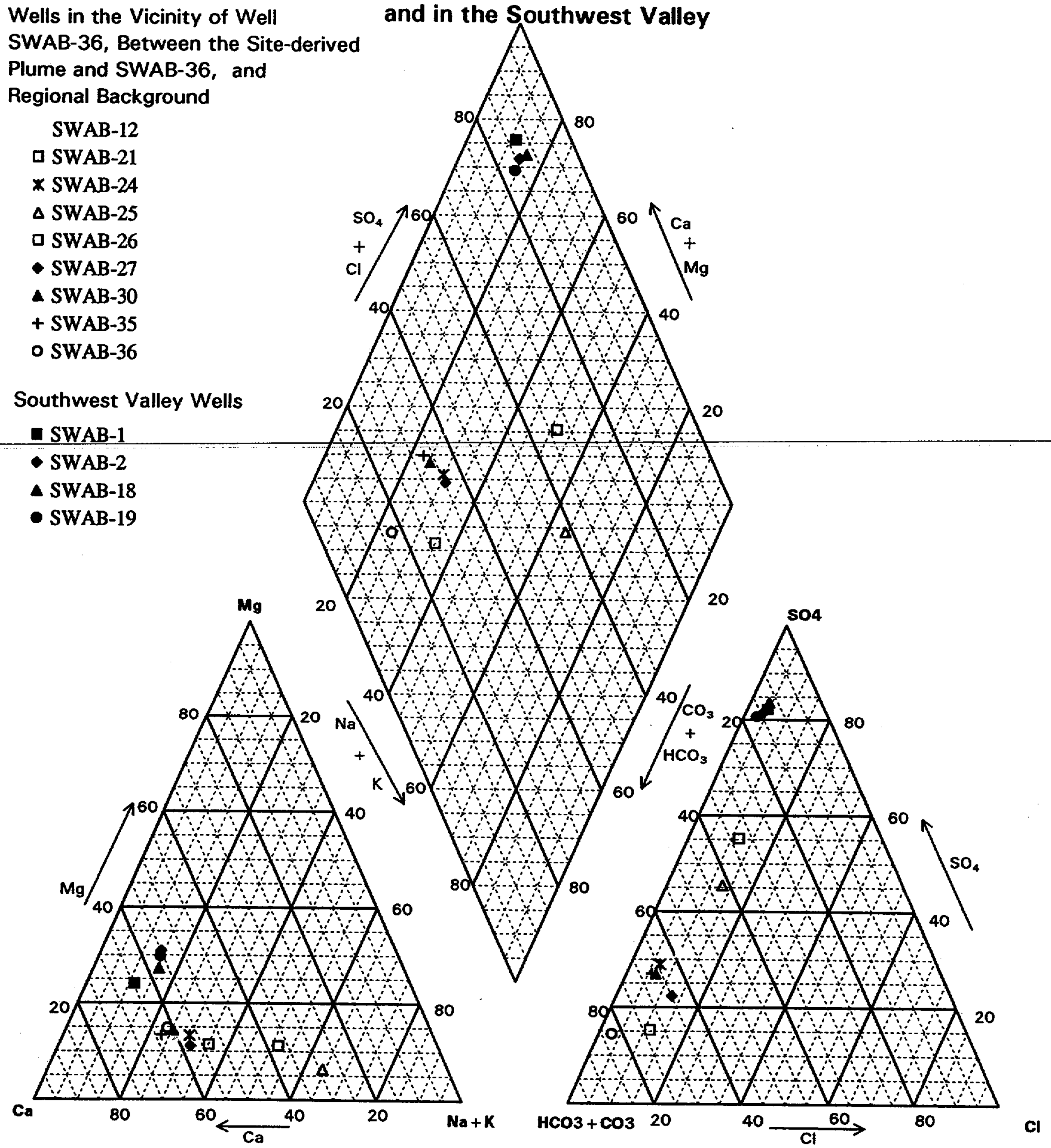
Figure 5
Piper Diagram for Ground Water in the Vicinity of SWAB-36, Between the Site-derived Plume and SWAB-36, Regional Background, and in the Southwest Valley



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NMSS DECOMMISSIONING PROGRAM

STANDARD REVIEW PLAN 16.0
RESTRICTED USE/ALTERNATE CRITERIA

The requirements of 10 CFR 20.1403 and 10 CFR 20.1404 are briefly summarized in Appendix I of this SRP. In addition, Appendix J contains guidance on seeking public advice on institutional controls which should be used to evaluate a licensee's or responsible parties' program for compliance with 10 CFR 20.1403(d)(1-2) and 10 CFR 20.1404 (a)(4).

RESPONSIBILITY FOR REVIEW

Primary:	NMSS	Division of Waste Management - Decommissioning Branch
		Division of Fuel Cycle Safety and Safeguards - Licensing Branch
	Region I:	Division of Nuclear Materials Safety - Decommissioning and Laboratory Branch
	Region II:	Division of Nuclear Materials Safety - Materials Licensing/Inspection Branch 1
	Region III:	Division of Nuclear Materials Safety - Decommissioning Branch
	Region IV:	Division of Nuclear Materials Safety - Nuclear Materials Licensing Branch, Fuel Cycle and Decommissioning Branch

Secondary: Environmental and Performance Assessment Branch, DWM/NMSS

Support: Office of the General Counsel

AREAS OF REVIEW

The staff will review the information supplied by the licensee or responsible party to determine if the description of the activities undertaken by the licensee or responsible party is adequate to allow the staff to conclude that the licensee or responsible party has complied with the applicable requirements of 10 CFR 20.1403, or 10 CFR 20.1404 for those licensees that intend to request termination of their radioactive materials licenses using either the restricted use or alternate criteria provisions of Subpart E.

If the licensee or responsible party is requesting license termination under restricted use this information should include: a demonstration that the licensee or responsible party qualifies for license termination under 10 CFR 20.1403(a); a description of the institutional controls the licensee or responsible party has instituted or plans to institute at the site; a description of the activities undertaken by the licensee or responsible party to obtain advice from the public on the proposed institutional controls and the results of these activities; a demonstration that the potential doses from residual radioactive material at the site will not exceed the limits in 10 CFR 20.1403 and are ALARA; and, a description of the financial assurance mechanism required under 10 CFR 20.1403 (c).

If the licensee or responsible party is requesting license termination using the alternate criteria provisions of 10 CFR 20.1404, the information should include: a description of the institutional controls the licensee or responsible party has instituted or plans to institute at the site; a demonstration that doses from residual radioactive material at the site will not exceed the limits in 10 CFR 20.1404(a)(1); a description of the restrictions on site use the licensee or responsible party has provided to comply with 10 CFR 20.1404(a)(2); a demonstration that the potential doses are ALARA; a description of the activities undertaken by licensee or responsible party to obtain advice from the public and the results of these activities[1]; and a description of the financial assurance mechanism required under 10 CFR 20.1403(c).

REVIEW PROCEDURES

Acceptance Review

The staff will ensure that the decommissioning plan contains the information summarized under "Areas of Review," above. Staff will review the licensee's or responsible party's descriptions of the 10 CFR 20.1403 or 10 CFR 20.1404 compliance activities without assessing the technical accuracy or completeness of the information contained therein. The adequacy of this information will be assessed during the detailed review. Staff will review the decommissioning plan table of contents and the individual descriptions under "Areas of Review," above, to ensure that the licensee or responsible party has included this information in the decommissioning plan and to determine if the level of detail of the information appears to be adequate for the staff to perform a detailed technical review.

Safety Evaluation

The material to be reviewed is both informational and technical in nature. The staff will make a qualitative assessment as to whether the licensee's or responsible party's eligibility demonstration, description of institutional controls, description of financial assurance, and description of activities undertaken to obtain advice from the public on the proposed institutional controls and the results of these activities are adequate to allow the staff to conclude that the

[1]10 CFR 20.1403 requires that licensees or responsible parties obtain advice from institutions and individuals that may be affected by the decommissioning on specific issues related to institutional controls and financial assurance. However, 10 CFR 20.1404 provides for a much broader discussion of the issues associated with the use of alternate criteria and, as such, licensees must obtain advice on essentially any issue associated with the use of alternate criteria.

licensee or responsible party has complied with the requirements of 10 CFR 20.1403 or 10 CFR 20.1404. The staff will make a quantitative evaluation of the licensee's or responsible party's dose calculations and ALARA demonstrations.

16.1 RESTRICTED USE

16.1.1 ELIGIBILITY DEMONSTRATION

The purpose of the review of the licensee's or responsible party's demonstration that it is eligible to request release of the site under the provisions of 10 CFR 20.1403 is to verify that the licensee or responsible party has demonstrated that further reductions in residual radioactivity at the site to meet the unrestricted release criteria in 10 CFR 20.1402 would: (1) result in net public or environmental harm; or (2) are not being undertaken because the residual radioactivity levels are ALARA.

ACCEPTANCE CRITERIA

Regulatory Requirements

- 10 CFR 20.1403(a), 30.36(g)(4)(ii), 40.42(g)(4)(ii), 70.38(g)(4)(ii) and 72.54(g)(2)

Regulatory Guidance

None

Information to be Submitted

The information supplied by the licensee or responsible party should be sufficient to allow the staff to fully understand how the licensee has concluded that reducing radioactivity to the unrestricted use levels in 10 CFR 20.1402 would result in net public or environmental harm or are not being undertaken because the residual radioactivity levels are ALARA. The staff's review should verify that the following information is included in the licensee's or responsible party's demonstration that it is eligible for requesting license termination under the provisions of 10 CFR 20.1403:

- A demonstration that the benefits of dose reduction are less than the cost of doses, injuries and fatalities (see Section 7 of this SRP); or
- A demonstration that the proposed residual radioactivity levels at the site are ALARA.

EVALUATION FINDINGS

Evaluation Criteria

If the licensee or responsible party has concluded that further reductions in residual radioactivity levels would result in net public or environmental harm, the staff should verify that the licensee has accurately calculated the benefits vs. costs of further remediation using the guidance in Section 7 of this SRP. In considering the net public and environmental harm a licensee's evaluation should consider the radiological and non-radiological impacts of decommissioning on person that may be impacted, as well as the potential impact on ecological systems from decommissioning activities (see Section B.3.2. of the "Statements of Consideration" for the License Termination Rule 62 FR 39069).

If the licensee or responsible party has concluded that further reductions in residual radioactivity levels are not required because they are ALARA, the staff should verify that the licensee or responsible party has considered all of the applicable benefits and costs of further reduction of residual radioactivity and accurately calculated the benefits and costs using the methodology described in Section 7 of this SRP.

Sample Evaluation Findings

The NRC staff has reviewed the licensee's justification for requesting license termination under restricted conditions in the Decommissioning Plan for the [insert name and license number of facility] located at [insert location of facility] according to the NMSS Decommissioning Standard Review Plan, Section 16 ("Restricted Use/Alternate Criteria").

Based on this review, the NRC staff has determined that the licensee [insert name and license number] has adequately demonstrated that [insert one] [the benefits of dose reduction are less than the cost of doses, injuries and fatalities] or [further reductions in radioactivity levels at the site are unnecessary because they are ALARA].

SUGGESTED FORMAT

1. Physical Specifications: See Appendix B

16.1.2 INSTITUTIONAL CONTROLS

The purpose of the review of the description of the institutional controls the licensee or responsible party has provided for the site is to determine if the licensee or responsible party has made provisions for legally enforceable institutional controls that will limit the dose to the average member of the critical group to less than 0.25 mSv/yr (25 mrem/yr).

ACCEPTANCE CRITERIA

Regulatory Requirements

- 10 CFR 20.1403(b)
- 10 CFR 30.36(g)(4)(ii), 40.42(g)(4)(ii), 70.38(g)(4)(ii) and 72.54(g)(2)

Regulatory Guidance

None

Information to be Submitted

The information supplied by the licensee should be sufficient to allow the staff to fully understand what institutional controls the licensee plans to use or has provided for the site and the manner in which these institutional controls will limit doses to the average member of the critical group to 0.25 mSv/yr (25 mrem/yr). The staff's review should verify that the following information is included in the description of institutional controls that the licensee plans to use or has provided for the site:

- A description of the legally enforceable institutional control(s) and an explanation of how the institutional control is a legally enforceable mechanism;
- A description of any detriments associated with the maintenance of the institutional control(s);
- A description of the restrictions on present and future landowners;
- A description of the entities enforcing, and their authority to enforce, the institutional control(s);
- A discussion of the durability[2] of the institutional control(s);
- A description of the activities that the entity with the authority to enforce the institutional controls may undertake to enforce the institutional control(s)
- The manner in which the entity with the authority to enforce the institutional control(s) will be replaced if that entity is no longer willing or able to enforce the institutional control(s) (this may not be needed for Federal or State entities);

[2] The Commission has stated (see Section B3.3 of the "Statements of Consideration" for 10 CFR Part 20,Subpart E "Radiological Criteria for License Termination") that stringent institutional controls would be needed for sites involving large quantities of uranium and thorium contamination. Typically these would involve legally enforceable deed restrictions backed up by State and local government control or ownership, engineered barriers, and as appropriate, Federal ownership.

- A description of the duration of the institutional control(s), the basis for the duration, the conditions that will end the institutional control(s) and the activities that will be undertaken to end the institutional control(s);

- A description of the plans for corrective actions that may be undertaken in the event the institutional control(s) fail; and

- A description of the records pertaining to the institutional controls, how and where will they will be maintained, and how the public will have access to the records.

EVALUATION FINDINGS

Evaluation Criteria

The staff should determine whether the information summarized under "Information to be Submitted," above satisfies the criteria summarized below. The application of the criteria below is dependent on the circumstances of the case. In each case the staff should consult with the Office of the General Counsel on the application of the criteria and the sufficiency of the licensee or responsible party's proposal.

A. For legally enforceable institutional controls on privately owned land

- Proprietary institutional controls on privately owned land should:

  1. Be enforceable against any owner of the affected property and any person that subsequently acquires the property or acquires any rights to use the property;

  2. Be enforceable by entities, other than the landowner, that have the legal authority to enforce the restriction;

  3. Be developed based on considerations of how durable the controls need to be;

  4. Include provisions to replace the entity with authority to enforce the restriction;

  5. Indicate actions the entity with authority to enforce the restrictions may take;

  6. Remain in place for the duration of the time they are needed;

  7. Have appropriate funds set aside if funds are necessary;

  8. Be appropriately recorded, including in the deed and in land records, as appropriate;

9. Include a legal opinion by an attorney specializing in real estate law who is knowledgeable in the particular State and local land use laws that:

    a. The property law of the particular State and locality in which the land is located ensures that the particular instrument selected will accomplish its intended purpose;
    b The restrictions have been reviewed and their validity affirmed for the locality;
    c. The owner of the affected property (i.e., the possessor of the land) can be compelled to abide by the terms of the use restriction; and
    d. The restrictions are binding on future owners (possessors) of the land (i.e., they should "run with the land").

10. Include a legal opinion that the entity with the right to restrict the land's use and the responsibility to enforce the restriction has the legal authority to do so and is someone other than the owner or possessor of the land in question;

11. Include a demonstration that the entity (or entities) with authority to enforce the restrictions have the knowledge, capability, and willingness to do so, and are appropriate for the specific situation;

12. Include a demonstration that the institutional control is durable enough to provide an adequate level of protection of public health and safety and the environment for the amount of residual radioactivity remaining on the site;

13. Include a provision to replace the entity with authority to enforce the restriction if that entity is no longer willing or able to enforce the restriction;

14. Clearly state the actions that the parties with authority to enforce the restrictions may take to keep the restrictions functioning (e.g., monitoring of deed compliance, control and maintenance of physical barriers);

15. Include a demonstration that the restrictions will remain in place for the duration that they are needed, including periodic re-recording of the restrictions;

16. If restrictions will end, the conditions that would end the restriction must be clearly stated, and the procedures for canceling or amending the restriction should be readily available. There should be no provisions in the restriction or in the land use law of the local jurisdiction that would cause the restrictions to end while they are still needed to protect the public;

17. Identify corrective actions to be taken in case the restrictions need to be broken. For example, a no-excavation restriction may need to be broken if a water main under the site bursts and must be repaired;

18. Include a demonstration that the information about restrictions is recorded on the deed and on land records and will contain:

   a. A legal description of the property affected;
   b. The name or names of the current owner or owners of the property as reflected in public land records;
   c. Identification of the parties that can enforce the restriction (i.e., own the rights to restrict use of the land);
   d. The reason for the restriction, the nature of the radiation hazard, including the estimated dose if institutional controls fail, and that this restriction is established as a condition of license termination by the NRC pursuant to 10 CFR 20.1403;
   e. A statement describing the nature of the restriction, limitation, or control created by the restriction;
   f. The duration of the restriction;
   g. Permission to install and maintain physical controls, if any are used; and
   h. The location of a copy of the final radiation status survey report for the facility at license termination.

B. For legally enforceable institutional controls on government owned land:

The NRC may accept government ownership of land as a method to enforce controls on land use and to meet the legally enforceable institutional control requirements in 10 CFR 20.1403(b) and (e). Government ownership will generally be acceptable when the dose to an average member of the critical group could exceed 100 mrem (1 mSv) per year (but be less than 500 mrem (5 mSv) per year) if the institutional controls were no longer in effect. In reviewing restrictions involving government ownership of land the NRC staff should ensure that the restriction will remain in place for the entire time they are needed and that the nature of the controls and restrictions on the land are clearly stated in a publicly available legal record. Depending on the government entity involved, consider as appropriate the items under #A, above.

C. For institutional controls based on sovereign or police powers:

Institutional controls that are based on sovereign or police powers generally consist of zoning or other restrictive requirements. The permissibility and effectiveness of governmental controls at a particular site will depend on the applicable State and local law.

- Institutional controls based on sovereign or police powers should:

   1. Include a legal opinion by an attorney specializing in real estate law who is knowledgeable in the particular State and local land use laws that:

a. Zoning and other restrictive requirements have been reviewed and their validity affirmed; and
b. They are binding on present and future owners of the land.

2. Include a demonstration that the government agency imposing the zoning or restriction will assume responsibility for enforcing the restriction;

3. Include a demonstration that the restrictions will remain in place for the entire time that they are needed or the conditions that can cause them to be changed;

4. Include a demonstration that the restrictions or zoning requirements are clear to current and future owners of the land, local and State governments, and others, as appropriate, through public documents, notification, placement in land records, etc. Such documentation should include an indication of the activities allowable and the residual radioactivity remaining on site.

Sample Evaluation Findings

The NRC staff has reviewed the description of the institutional controls in the Decommissioning Plan for the [insert name and license number of facility] located at [insert location of facility] according to the NMSS Decommissioning Standard Review Plan, Section 16 (Restricted Use/Alternate Criteria) and considered public comments made pursuant to 10 CFR 20.1405. The NRC staff has determined that the licensee [insert name] has adequately demonstrated that institutional controls are enforceable, durable and should ensure that doses to the public comply with the criteria in 10 CFR 20.1403. In addition, the licensee or responsible party has made adequate provisions to replace the entity charged with enforcing the institutional control in the event that the entity is no longer willing or able to enforce the institutional control and has made provisions to address corrective actions at the site.

SUGGESTED FORMAT

1. Physical Specifications: See Appendix B
2. 1-2 pages summarizing each of the items outlined in "Acceptance Criteria," above. Licensees should be also encouraged to submit the information in electronic format.

16.1.3 SITE MAINTENANCE

The purpose of the review of the information about the license's site maintenance program is to ensure that adequate arrangements have been made to ensure that the site will be maintained in accordance with the institutional controls described above and that the licensee has an adequate arrangement to ensure that an independent third party can assume and carry out responsibilities for any necessary control and maintenance of the site after the NRC has terminated the license. Criteria for evaluating the licensee's or responsible parties' mechanism to ensure that sufficient funds are available to allow an independent third party to assume and carry out responsibilities for any necessary control and maintenance of the site after the NRC has terminated the license are addressed in Section 15 of this SRP.

ACCEPTANCE CRITERIA

Regulatory Requirements

- 10 CFR 20.1403(c), 30.36(g)(4)(ii), 40.42(g)(4)(ii), 70.38(g)(4)(ii) and 72.54(g)(2)

Regulatory Guidance

None

Information to be Submitted

The information supplied by the licensee should be sufficient to allow the staff to fully understand what arrangements for site maintenance have been provided by the licensee or responsible party. This should include descriptions of how the site maintenance arrangements will ensure that the site will be managed per the institutional controls described above and how an independent third party will assume and carry out responsibilities for any necessary control and maintenance of the site after the NRC has terminated the license. The staff's review should verify that the following information is included in the discussion of the site maintenance program in the facility decommissioning plan:

- A demonstration that an appropriately qualified entity has been provided to control and maintain the site;
- A description of the site maintenance and control program and the basis for concluding that the program is adequate to control and maintain the site;
- A description of the arrangement or contract with the entity charged with carrying out the actions necessary to maintain control at the site;
- A demonstration that the contract or arrangement will remain in effect for as long as feasible, and include provisions for renewing or replacing the contract;
- A description of the manner in which independent oversight of the entity charged with maintaining the site will be conducted and what entity will conduct the oversight;
- A demonstration that the entity providing the oversight has the authority to replace the entity charged with maintaining the site;
- A description of the authority granted to the third party to perform, or have performed, any necessary maintenance activities;

- Unless the entity is a government entity, a demonstration that the third party is not the entity holding the financial assurance mechanism;

- A demonstration that sufficient records evidencing to official actions and financial payments made by the third party are open to public inspection;

- A description of the periodic site inspections that will be performed by the third party, including the frequency of the inspections.

EVALUATION FINDINGS

Evaluation Criteria

The staff should determine whether that the information summarized under "Information to be Submitted," above satisfies the criteria summarized below. The application of the criteria below is dependent on the circumstances of the case. In each case the staff should consult with the Office of the General Counsel on the application of the criteria and the sufficiency of the licensee or responsible party's proposal.

- The entity to control and maintain the site may be the former licensee, the landowner, a governmental agency, an organization, a corporation or company, or occasionally a private individual. Control and maintenance of a site does not necessarily have to be carried out by an independent third party. The entity should be capable of carrying out its responsibilities and should be appropriate given the nature of the restrictions in place. The entity could be a contractor to the entity that holds the rights to restrict use of the property. Note that Government control and/or ownership is generally appropriate for sites involving large quantities of uranium and thorium contamination and for those site where the potential dose to the public could exceed 1 mSv/yr (100 mrem/yr) if institutional controls fail;

- The maintenance and control program includes detailed descriptions of: the repair/replacement and maintenance program for the site; if appropriate, an environmental monitoring program, including the duration of the monitoring, who will be informed of the results, action levels and what action will be taken if the action levels are exceeded; and the mechanism to detect and mitigate the loss of site controls; the mechanism to, if necessary, inform local emergency responders of the loss of controls;

- An arrangement or contract is in place to carry out any actions necessary to maintain the controls so that the annual dose to the average member of the critical group does not exceed 0.25 mSv (25 mrem). The arrangement or contract should be for as long a time as is feasible, and there should be provisions for renewing or replacing the contract to be consistent with the duration of the restrictions. The arrangement may include oversight of the entity by a government entity or the courts;

- A mechanism is in place to replace the entity controlling/maintaining the site if that becomes necessary. Replacement may be specified in the agreement with the conditions under which a government, the courts, or other entity can replace the entity;

- The entity is authorized to either perform the necessary work to maintain the controls or to contract for the performance of the work. The entity would need the authority to contract for the necessary work, review and approve the adequacy of the work performed, replace contractors if necessary, and authorize payment for the work;

- The entity performing the site control and maintenance should not hold the funds itself [i.e., the entity should not serve as the provider of financial assurance (e.g., escrow agent, trustee, issuer of letter of credit)]. However, if the entity is a government, the licensee may elect to allow the government to hold the funds;

- A demonstration that sufficient records evidencing the official actions of and financial payments made by the entity are open to public inspection;

- The entity has the responsibility to perform periodic checks of the site no less frequently than every 5 years (if required by 10 CFR 20.1403(e)(2)(iii)) to ensure that the institutional controls continue to function. The periodic checks should include an onsite inspection to verify that prohibited activities are not being conducted and that markers notices, and other physical controls remain in place. A review of the deed to ensure that the deed restrictions are still in place is not usually necessary; but the review should be performed if there is any cause to believe that the restrictions are not still properly part of the deed.

Sample Evaluation Findings

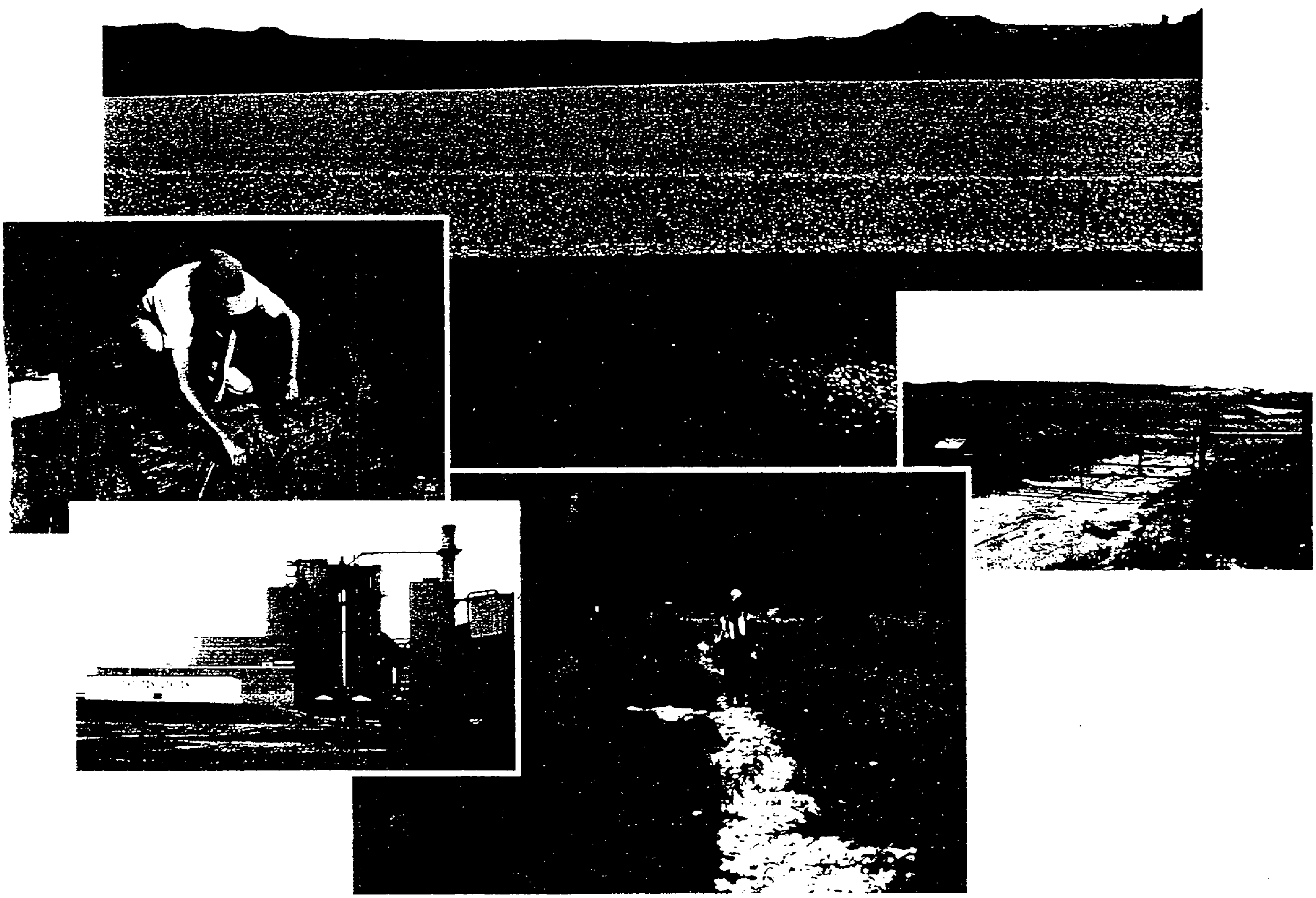
The NRC staff has reviewed the information regarding site maintenance and financial assurance in the Decommissioning Plan for the [insert name and license number of facility] located at [insert location of facility] according to the NMSS Decommissioning Standard Review Plan, Section 16 (Restricted Use/Alternate Criteria). Based on this review, the NRC staff has determined that the licensee [insert name] has adequately demonstrated that the site maintenance arrangements and financial assurance mechanism are adequate to ensure that the site will be maintained in accordance with the institutional controls described in the decommissioning plan and that sufficient funds are available to allow an independent third party to assume and carry out responsibilities for any necessary control and maintenance of the site after the NRC has terminated the license.

SUGGESTED FORMAT

1. Physical Specifications: See Appendix B
2. One to two paragraphs summarizing the information in each of the bullets in "acceptance Criteria,"above. Licensees should be encouraged to submit the information in electronic format.

LTSM

Long-Term Surveillance and Maintenance Program REPORT



U.S. Department of Energy Grand Junction Office
Grand Junction, Colorado

GJO-2000-139-TAR

Long-Term Surveillance and Maintenance Program

1999 Report

Long-Term Surveillance and Maintenance Program
U.S. Department of Energy
Grand Junction Office
Grand Junction, Colorado

March 2000

Front cover photographs (clockwise from top)

An LTSM Program inspector traverses the top slope of the Mexican Hat, Utah, Disposal Cell.

Limited grazing is allowed on the grass-covered disposal cell at Edgemont, South Dakota.

LTSM Program personnel inspect a rock-filled drain installed at the Burrell, Pennsylvania, Disposal Site to channel run-on water away from the cell.

The sealed heat-exchanger building (with the "Sheldon Station" sign) is all that remains above the ground surface at the Hallam, Nebraska, Decommissioned Reactor Site.

A plant ecologist removes the aboveground plant material to measure the leaf area index at the Lakeview, Oregon, Disposal Site.

Foreword

In 1999, the Long-Term Surveillance and Maintenance (LTSM) Program at the U.S. Department of Energy (DOE) Grand Junction Office marked its 11th year of operations.

Currently, the LTSM Program has custody of 26 disposal sites with low-level radioactive material. By 2006, approximately 60 sites are expected to be assigned to the LTSM Program for custody and care. The program ensures protection of the environment from the potentially hazardous materials contained at the assigned sites and maintains the sites in full compliance with applicable regulations.

Stewardship services provided by the program during 1999 included inspecting sites, conducting minor maintenance, monitoring groundwater, supervising permits, monitoring institutional controls, providing information and assistance to other agencies and stakeholders, and managing records. This work was accomplished while improving methods and procedures to reduce costs and increase efficiencies.

The LTSM Program is in a unique position of having acquired actual stewardship experience while many sites in the DOE complex and elsewhere still are undergoing remediation. LTSM Program sites and methods provide test cases and lessons learned for other stewards. To fulfill the obligation to share this information, the LTSM Program serves as a resource to stewardship and stakeholder working groups at many sites, to DOE Headquarters, and to workers in other countries.

LTSM Program outreach activities continued in 1999. A public information site on the World Wide Web was inaugurated in March. A second Stewardship Workshop was held in Grand Junction in September. LTSM Program experts expanded cooperative research projects with other Federal agencies to investigate isolation and monitoring technologies.

I am pleased to present this report of the operations and recent accomplishments of the DOE Grand Junction Office LTSM Program. In this report, we provide descriptions of the spectrum of activities that constitute a working stewardship program as well as the condition of and concerns about the sites in our custody. For more information about the LTSM Program, please contact me at (970) 248–6037 or visit our World Wide Web site at **http://www.doegjpo.com/programs/ltsm/**.

Russel Edge
LTSM Program Manager
U.S. Department of Energy
Grand Junction Office

LTSM Program Stewardship Activities

As steward, the LTSM Program must ensure that the sites in its care do not cause harm to workers, the public, or the environment. The program also must ensure that the sites remain fully compliant with applicable regulations. Program systems and activities are designed to meet these goals.

The LTSM Program conducts site surveillance and monitoring activities in accordance with approved site-specific LTSPs. LTSM Program personnel inspect each assigned site at least annually. They prepare, distribute, and archive an annual site condition report. The purposes of the annual inspection are to confirm the integrity of visible features at the site; to identify changes or new conditions that may affect site integrity; and to determine the need, if any, for maintenance or follow-up inspections and monitoring. At the time of the inspection, program specialists evaluate the effectiveness of site-specific institutional controls and ensure that the site remains in full compliance with applicable regulations.

The disposal impoundments were designed to require only minimal maintenance for the duration of their design lives. Because these cells are relatively new, only minor maintenance is required at present. However, as the sites age, they will require routine replacement of wear items such as fencing and signs.

LTSM Program activities also include groundwater monitoring and other environmental monitoring, as stipulated in the site-specific LTSPs. Monitoring results are reviewed to ensure regulatory compliance. All sites remain in full compliance.

If a disposal site receives severe damage or sustains catastrophic failure, DOE will undertake the necessary corrective action. The LTSM Program maintains contacts with local law enforcement officials near each site, who will notify DOE in case of an incident or emergency. Signs with the DOE–GJO 24-hour phone number [(970) 248–6070] are posted at each site.

An LTSM Program soil scientist meets with representatives of the U.S. Bureau of Land Management to inspect the revegetated haul road near the Gunnison, Colorado, Disposal Site.

As site steward, the LTSM Program documents all activities at the site. That information is archived at the GJO facility so that it is available to future stewards. Records that describe baseline conditions are acquired from remedial action contractors before site transfer. Ongoing surveillance and monitoring results are preserved so trends may be established. Records are maintained in National Archives and Records Administration-compliant storage areas and are tracked in an electronic database.

The LTSM Program encourages stakeholder involvement with program operations. Stakeholders consist of all interested parties for a given site, including local residents, regulators, elected officials, and the general

LTSM Program Risks and Responses

Risk	Extent of Risk	Probability	Impact	Risk-Reduction Response
Release of contaminated solids	Site	Low	Increased risk to public and environment, violation of laws or regulations, potential contamination of soil and groundwater	Sites are inspected to identify and address potential problems before a release can occur. DOE–GJO maintains an emergency response team that can be called upon to respond if necessary. The LTSM Program also maintains communication with local response agencies.
Release of contaminated leachate	Site	Moderate	Increased risk to public and environment, violation of laws or regulations, potential contamination of soil and groundwater	Leachate accumulation levels are monitored at sites with leachate collection systems. Conservative action points have been established. If leachate levels rise to the action points, leachate will be pumped and treated. Early warning point-of-compliance monitor wells are sampled at other sites where this risk is identified. Cover integrity is evaluated annually.
Public injury at site	Site	Low	Potential lawsuit, negative publicity	Exercise due diligence. Sites are clearly marked and access is impeded where necessary.
Failure of institutional controls	Site	Low, near-term; increases with time	Increased risk to local population and environment	A review of institutional controls is conducted at the time of the annual inspection and before conducting a nonroutine activity.
Records damage or loss	Program	Low	Loss of mission-critical active and historical records. Inability to respond to frequent requests for information	National Archives and Records Administration-compliant records management system in place and operational.
Loss of funding	Program	Low	Site operations would scale down or cease, may incur fines or other penalties	Sites are designed to require only minimal surveillance and maintenance; they should remain protective for short periods of time without intervention. If funding is curtailed for longer periods, Federal regulators can order DOE to resume work.
Degradation of containment systems	Site	Varies from low to high	Expense to re-evaluate containment system design and implement repair	Sites are inspected regularly for early warning of integrity reduction. The LTSM Program is notified of severe natural events or events that might threaten site integrity.
Vandalism to sites	Site	Moderate, high at some sites	Theft or damage to cover materials, possible release of or exposure to contaminated materials	Passive security measures are evaluated annually and maintained as necessary. Ongoing vandalism may require upgrades to access controls or increased site presence.
Regulatory noncompliance	Program	Low, but funding dependent	Noncompliance notification, potential negative publicity	A regulatory compliance review is conducted at the time of the annual inspection and before conducting a nonroutine activity.
Loss of key personnel	Program	Moderate	Short-term disruption of operations	Program operations are guided by approved plans. Records are maintained of site conditions and program activities.

NMSS 8800328 DS 6/22   JUN 27 1988

MEMORANDUM: Robert D. Martin, Regional Administrator
Region IV

FROM: Hugh L. Thompson, Jr., Director
Office of Nuclear Material Safety
and Safeguards

SUBJECT: USE OF TITLE I SUPPLEMENTAL STANDARDS FOR TITLE II SITES

We have reviewed your memorandum dated June 9, 1988 on the use of the Title I Supplemental Standards for off-site clean up at Title II sites. We concur in the concept of approving alternatives to the current staff practice of requiring licensees to clean up off-site radium-226 contamination to the 5 pCi/g or 15 pCi/g levels as recommended by EPA (FRN 48 No. 196, p. 45940). However, since EPA's recommendation was not incorporated into either the EPA's or the NRC's regulations for Title II sites, there is no basis to make the finding that the proposed alternative is equivalent to, to the extent practicable, or more stringent than the requirements in Appendix A and the EPA standards in 40 CFR Part 192, Subparts D and E. Therefore, application of Section 84c of the Atomic Energy Act as codified in Appendix A to 10 CFR Part 40 does not specifically apply.

In those cases where licensees request an alternative to current license conditions or request authorization to leave material in situ, we recommend that you authorize such requests on a case-by-case basis upon a finding that the public health and safety and the environment will be protected. We concur that use of criteria like the Title I Supplemental Standards established by EPA (40 CFR Part 192.21) provides an acceptable basis to make the finding. The licensing staff may also apply other criteria to account for any differences between the Title I and Title II programs.

RECunningham for

Hugh L. Thompson, Jr., Director
Office of Nuclear Material Safety
and Safeguards

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United States Environmental Protection Agency

Office of Solid Waste and Emergency Response

OSWER 9355.0-74FS-P
EPA 540-F-00-005
September, 2000

Institutional Controls:

A Site Manager's[1] Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups

Office of Solid Waste and Emergency Response

Purpose

This fact sheet provides Superfund and RCRA Corrective Action site managers and decision-makers with an overview of the types of Institutional Controls (ICs) that are commonly used or implemented, and outlines the factors that should generally be considered when evaluating and selecting ICs as part of the remedy. For more detailed information on the different types of instruments available, site managers and attorneys should consult the document, "Institutional Controls: A Reference Manual (Workgroup Draft - March 1998)." EPA site managers should also work closely with Regional attorneys and Headquarters staff in the Office of Emergency and Remedial Response (OERR), the Office of Site Remediation Enforcement (OSRE), the Federal Facilities Restoration and Reuse Office (FFRRO), the Federal Facilities Enforcement Office (FFEO) and/or the Office of Solid Waste (OSW) on any site-specific issues that may arise while evaluating, implementing, enforcing, or monitoring ICs.[2]

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Definition and Importance of ICs

Generally, EPA begins the remedy evaluation process with the expectation that treatment or engineering controls will be used to address principal threat wastes and that groundwater will be returned to its beneficial use. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) emphasizes that ICs, such as water use restrictions, are meant to supplement engineering controls during all phases of cleanup and may be a necessary component of the completed remedy. The NCP also cautions against the use of ICs as the sole remedy unless active response measures are determined to be impracticable. At the same time, ICs play an important role in site remedies. Often, ICs are a critical component of the cleanup process and are used by the site manager to ensure both the short- and long-term protection of human health and the environment. For this reason it is important to understand what constitutes an IC. Specifically for EPA, ICs:

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[1]Site Manager, as used in this fact sheet, refers to both CERCLA sites and RCRA facilities. In RCRA, project managers are the equivalent to site managers in CERCLA.

[2]This document provides guidance to EPA Regions and states involved in Superfund and RCRA corrective action cleanups. It also provides guidance to the public and the regulated community on how EPA intends to evaluate and implement institutional controls as part of a cleanup decision. The guidance is designed to implement national policy on these issues. The document does not, however, substitute for CERCLA, RCRA or EPA's regulations, nor is it a regulation itself. Thus, it does not impose legally-binding requirements on EPA, States, or the regulated community, and may not apply to a particular situation based upon the circumstances. EPA and State decision makers retain the discretion to adopt approaches on a case-by-case basis that differ from this guidance where appropriate. Any decisions regarding a particular facility will be made based on the applicable statutes and regulations. Therefore, interested parties are free to raise questions and objections about the appropriateness of the application of this guidance to a particular situation, and EPA will consider whether or not the recommendations or interpretations in the guidance are appropriate in that situation. EPA may change this guidance in the future.

- are non-engineered instruments such as administrative and/or legal controls that minimize the potential for human exposure to contamination by limiting land or resource use;
- are generally to be used in conjunction with, rather than in lieu of, engineering measures such as waste treatment or containment;
- can be used during all stages of the cleanup process to accomplish various cleanup-related objectives; and,
- should be "layered" (i.e., use multiple ICs) or implemented in a series to provide overlapping assurances of protection from contamination. These concepts are discussed in the text box below.

Some examples of ICs include easements, covenants, well drilling prohibitions, zoning restrictions, and special building permit requirements. Deed restriction is a phrase often used in remedy decision documents to describe easements or other forms of ICs; however, this is not a traditional property law term and should be avoided. Fences that restrict access to sites are often termed ICs; however, because fences are physical barriers instead of administrative or legal measures, EPA does not consider them to be ICs. ICs are among the tools allowable under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) [as amended by the Superfund Amendments and Reauthorization Act (SARA)], the NCP, and the Resource Conservation and Recovery Act (RCRA). To read more about the regulatory framework for ICs, refer to the box on page 3 entitled, "A Look at ICs in CERCLA, the NCP and RCRA." Finally, where protectiveness depends on reducing exposure, ICs are a response action under CERCLA or a corrective action under RCRA. Accordingly, even in the unusual case where a CERCLA Record of Decision (ROD) only requires the implementation of ICs, it is considered to be a "limited action," not a "no action" ROD. Likewise, when a corrective action under RCRA includes an IC, whether it is part of an interim measure or occurs at the end of the cleanup as part of the final corrective measure, the IC is considered a part of the remedy.

Common Misnomers

"Deed restriction" is not a traditional property law term, but rather is a generic term used in the NCP and elsewhere as a shorthand way to refer to types of ICs. To avoid confusion, site managers should avoid the term and instead be specific about the types of ICs under consideration and their objectives. In addition, EPA does not consider physical barriers as ICs. Fences that restrict access to sites are often termed as ICs. However, fences are not considered by EPA to be ICs .

ICs are vital elements of response alternatives because they simultaneously influence and supplement the physical component of the remedy to be implemented. On the one hand, the right mix of ICs can help ensure the protectiveness of the remedy; on the other, limitations in ICs may lead to reevaluation and adjustment of the remedy components, including the proposed ICs. At some sites, remedy contingencies may protect against uncertainties in the ability of the ICs to provide the required long-term protectiveness. These points illustrate how important it is for site managers to evaluate ICs as thoroughly as the other remedy components in the Feasibility Study (FS) or Corrective Measures Study (CMS), when looking for the best ICs for addressing site-specific circumstances. Adding ICs on as an afterthought without carefully thinking about their objectives, how the ICs fit into the overall remedy, and whether the ICs can be realistically implemented in a reliable and enforceable manner, could jeopardize the effectiveness of the entire remedy.

Often ICs are more effective if they are layered or implemented in series. Layering means using different types of ICs at the same time to enhance the protectiveness of the remedy. For example, to restrict land use, the site manager may issue an enforcement tool [e.g., Unilateral Administrative Order (UAO)]; obtain an easement; initiate discussions with local governments about a potential zoning change; and enhance future awareness of the restrictions by recording them in a deed notice and in a state registry of contaminated sites. Also, the effectiveness of a remedy may be enhanced when ICs are used in conjunction with physical barriers, such as fences, to limit access to contaminated areas.

ICs may also be applied in series to ensure both the short- and long-term effectiveness of the remedy. For example, the site manager may use an enforcement tool to require the land owner to obtain an easement from an adjacent property owner in order to conduct ground water sampling or implement a portion of the active remedy. This easement may not be needed for the long-term effectiveness of the remedy and is terminated when the construction is complete. At another site, the site manager may use an Administrative Order on Consent (AOC) or permit condition to prohibit the land owner from developing the site during the investigation. Later, the site manager may add a provision to the Consent Decree (CD) or the permit requiring the land owner to notify EPA if the property is to be sold and to work with the local government to implement zoning restrictions on the property.

Layering and Implementing ICs in Series

ICs are more effective if they are layered or implemented in series.

Layering ICs means using different types of ICs at the same time to enhance the protectiveness of the remedy.

Using ICs in series is the use of ICs at different points in the investigation and remediation process to ensure the short- and long-term protection of human health and the environment.

Types of ICs

the cleanup process and a matrix summarizing examples of ICs are included at the end of the fact sheet.

A Look at ICs in CERCLA, the NCP, and RCRA

CERCLA as amended by SARA, the NCP and RCRA support the use of ICs in remediation of a site:

CERCLA—Section 121(d)(2)(B)(ii)(III) refers to the use of enforceable measures (e.g., ICs) as part of the remedial alternative at sites. EPA can enforce the implementation of ICs, but not necessarily their long term maintenance. For example, the local government with zoning jurisdiction may agree to change the zoning of the site to prohibit residential land uses as part of the remedy, but the local government retains the authority to change the zoning designation in the future. EPA is authorized, under CERCLA section 104(j), to acquire (by purchase, lease or otherwise) real property interests, such as easements, needed to conduct a remedial action provided that the state in which the interest is to be acquired is willing to accept transfer of the interest following the remedial action. Transfers of contaminated Federal property are subject to special deed requirements under CERCLA sections 120(h)(3)(A)(iii) and 120(h)(3)(C)(ii)(I) and (II).

NCP—the NCP provides EPA's expectations for developing appropriate remedial alternatives, including ICs under CERCLA. In particular, it states that EPA expects to use treatment to address the principal threats posed by sites; engineering controls for wastes that pose relatively low risk or where treatment is impracticable; and a combination of the two to protect human health and the environment [40 CFR 300.430(a)(1)(iii)(A), (B), and (C)]. In appropriate situations, a combination of treatment, containment, and ICs may be necessary. The NCP also emphasizes the use of ICs to supplement engineering controls during all phases of cleanup and as a component of the completed remedy, but cautions against their use as the sole remedy unless active response measures are determined to be impracticable [40 CFR 300.430(a)(1)(iii)(D)]. In the case where ICs are the entire remedy, the response to comments section of the preamble to the NCP states that special precautions must be made to ensure the controls are reliable (55 Federal Register, March 8, 1990, page 8706). Recognizing that EPA may not have the authority to implement such controls, the NCP requires that (for fund financed sites) the state assure that the ICs implemented as part of the remedial action are in place, reliable, and will remain in place after the initiation of operation and maintenance [40 CFR 300.510(c)(1)]. Lastly, for Superfund financed and private sites, the NCP also requires the state to hold any interest in property that is acquired (once the site goes into O&M) to ensure the reliability of ICs [40 CFR 300.510(f)].

RCRA—RCRA requirements are imposed through legal mechanisms different from those used under CERCLA. In RCRA, authorized states are the primary decision makers, this results in a wide variety of state-specific mechanisms being available. This fact sheet does not attempt to list all of the state and local IC mechanisms, but to identify key principles for the use of ICs. If the IC is being imposed through a RCRA permit, steps should be taken to ensure that long-term enforcement is not lost through property transfer or permit expiration. Cleanups under RCRA are conducted in connection with the closure of regulated units and facility-wide corrective action either under a permit [RCRA sections 3004(u) and (v)], interim status order [RCRA section 3008(h)] or imminent hazard order [RCRA section 7003] or other authorities. It should also be noted that landfill closure requirements under 40 CFR 264.119 require deed notices that the land has been used to manage hazardous waste, although the notice itself does not restrict future use. EPA expects to use a combination of methods (e.g., treatment, engineering, and institutional controls) under RCRA, as appropriate, to achieve protection of human health and the environment. EPA also expects to use ICs, such as water and land use restrictions, primarily to supplement engineering controls, as appropriate, for short- and long-term management to prevent or limit exposure to hazardous wastes and constituents. ICs are not generally expected to be the sole remedial action.

General Categories

There are four categories of institutional controls: governmental controls; proprietary controls; enforcement and permit tools with IC components; and informational devices. Each of these categories is described below. In addition, a checklist that highlights steps in implementing ICs during

Governmental Controls—Governmental controls are usually implemented and enforced by a state or local government and can include zoning restrictions, ordinances, statutes, building permits, or other provisions that restrict land or resource use at a site. Local governments have a variety of land use control measures available from simple use restrictions to more sophisticated measures such as planned unit development zoning districts and overlay zones. Development zoning districts allow for more flexible site planning and overlay zones impose additional requirements to those of the underlying zoning district. Regardless of which measures are relied on, the land use control should be carefully evaluated to make certain that there are no exceptions which could allow for improper use of the site (e.g., allowing a day care center use within an industrial district). Once implemented, local and state entities often use traditional police powers to regulate and enforce the controls. Since this category of ICs is put in place under local jurisdiction, they may be changed or terminated with little notice to EPA, and EPA generally has no authority to enforce such controls.

For active military bases, the local authority for regulating and enforcing ICs is the Commanding Officer. Therefore, EPA and the state should work with the installation personnel to incorporate restrictions into the base master plans, instructions, and orders used by the Commanding Officer to govern conduct, actions and activities on the base (in some cases these restrictions may be imposed as permit conditions if the base is subject to RCRA permit requirements).

Proprietary Controls—These controls, such as easements and covenants, have their basis in real property law and are unique in that they generally create legal property interests. In other words, proprietary controls involve legal instruments placed in the chain of title of the site or property. The instrument may include the conveyance of a property interest from the owner (grantor) to a second party (grantee) for the purpose of restricting land or resource use. An example of this type of control is an easement that provides access rights to a property so the Potentially Responsible Party (PRP), facility owner/operator, or regulatory agency may inspect and monitor a groundwater pump-and-treat system or cover system. The benefit of these types of controls is that they can be binding on subsequent purchasers of the property (successors in title) and transferable, which may make them more reliable in the long-term than other types of ICs.

However, proprietary controls also have their drawbacks. Property law can be complicated because a property owner has many individual rights with respect to his or her property. To illustrate this point, property rights can be thought of as a bundle of sticks, with each stick representing a single right (e.g., the right to collect rents). The terminology, enforceability, and effect of each of these rights is largely dependent upon real property common law and the state where the site is located. A property owner can convey certain rights to other entities (either voluntarily or involuntarily through condemnation) and keep other rights. For example, if it is determined that a long-term easement is required to ensure remedy protectiveness, this "right" would need to be transferred by the property owner to another entity. For the easement to bind subsequent purchasers, some states require that the entity be an adjacent property owner. This may complicate long-term monitoring and enforcement since the party receiving the right (the grantee) is often not an adjacent property owner. To eliminate this problem, a proprietary control may be established "in gross." This means that the holder of the control (the grantee) does not need to be the owner of the adjacent property. However, it should be noted that easements in gross may not be enforceable under the laws of some states. State property laws governing easements should therefore be researched before this type of IC is selected in order to determine its enforceability in that jurisdiction.

A distinction at Federal sites being transferred to the private sector is that CERCLA sections 120(h)(3)(A)(iii) and 120(h)(3)(c)(ii) and (iii) require that property interests be retained by the Federal government. At active Federal sites, proprietary controls may not be an option because a deed does not exist or the landholding Federal agency lacks the authority to encumber the property. However, the landholding Agency may be willing to enter a Memorandum of Understanding (MOU) with EPA and/or state regulators providing for specific IC implementation plans, periodic inspections and other activities which it will undertake (in lieu of deed restrictions) to assure that ICs for the active site will remain effective.

Enforcement and Permit Tools with IC Components—Under sections 104 and 106(a) of CERCLA, UAOs and AOCs can be issued or negotiated to compel the land owner (usually a PRP) to limit certain site activities at both Federal and private sites; CDS can also be negotiated at private sites under 122(d). Similarly, EPA can enforce permits, conditions and/or issue orders under RCRA sections 3004(a), 3004(u) and (v), 3008(h), or 7003. These tools are frequently used by site managers, but may also have significant shortcomings that should be thoroughly evaluated. For example, most enforcement agreements are only binding on the signatories, and the property restrictions are not transferred through a property transaction. For example, if a PRP under CERCLA signs a CD or receives a UAO and then sells his or her property, many types of ICs would not be enforceable against the next owner. This could jeopardize the protectiveness of the remedy. One possible solution to this problem is to ensure that the enforcement tool contains provisions requiring EPA or state notification and/or approval prior to a property transfer. In this instance, EPA could negotiate an agreement with the new owner. Another solution is to require signatories of an enforcement document to implement additional long-term institutional controls such as information devices or proprietary controls (*i.e.*, layering).

Informational Devices—Informational tools provide information or notification that residual or capped contamination may remain on site. Common examples include state registries of contaminated properties, deed notices, and advisories. Due to the nature of some informational devices (*e.g.*, deed or hazard notices) and their potential non-enforceability, it is important to carefully consider the objective of this category of ICs. Informational devices are most likely to be used as a secondary "layer" to help ensure the overall reliability of other ICs.

ICs at Federal Facilities

Because of Federal ownership, there are significant differences in the way ICs are applied at Federal facilities. Some proprietary or governmental controls cannot be applied on active Federal facilities. However, for properties being transferred as part of a base closure, the Department of Defense does have the authority to restrict property by retaining a property interest (i.e., an easement intended to assure the protectiveness of the remedy). For active bases, ICs are commonly addressed through remedy selection documents, base master plans, and separate MOUs. More detailed information on ICs and Federal facilities is contained in "Institutional Controls: A Reference Manual (Workgroup Draft - March 1998)" and in the FFRRO IC guidance ("Institutional Controls and Transfer of Real Property under CERCLA Section 120(h)(3)(A), (B), or (C)," January, 2000).

Legal Mechanisms for Imposing ICs Under CERCLA and RCRA

CERCLA and RCRA employ the same types of ICs to reduce exposure to residual contamination. However, as explained below, EPA's legal authority to establish, monitor and enforce ICs varies significantly between the two programs. As a result, officials involved in cleanups need to appreciate the range of options available under each program before determining whether, and to what extent, ICs should be incorporated into a remedial decision.

At CERCLA sites, EPA often imposes ICs via enforcement tools (e.g., UAOs, AOCs, and CDs). Since these enforcement tools only bind the parties named in the enforcement document, it may be necessary to require the parties to implement ICs that "run with the land" (i.e., applied to the property itself) in order to bind subsequent land owners. For Fund-lead CERCLA sites, the lead agency has the responsibility for ensuring ICs are implemented. Legal mechanisms such as UAOs, AOCs and CDS should also require reporting to EPA and/or the state of any sale of the property.

Under RCRA, ICs are typically imposed through permit conditions or by orders issued under section 3008(h). In certain circumstances cleanup may also be required under the imminent hazard order authority of section 7003. In the case where an IC is meant to continue beyond the expiration of a permit, an order may be required to ensure the IC remains in effect for the long term RCRA permit writers should incorporate ICs as specific permit conditions, where appropriate. By doing so, such conditions would be enforceable through the permit. At the same time, permit writers should consider whether additional ICs are available (e.g., governmental and/or proprietary controls) to ensure that subsequent property owners will be aware of, and bound by, the same types of restrictions. Similar factors should be considered when preparing RCRA corrective action orders to ensure that both the current facility owner/operator and any subsequent property owners are subject to effective and enforceable ICs that will minimize exposure to any residual contamination.

One significant difference between RCRA and CERCLA is that RCRA generally does not authorize EPA to acquire any interests in property. Therefore, many proprietary controls (such as easements) will require the involvement of third parties (e.g., states or local governments) under RCRA.

ICs and Future Land Use

Land use and ICs are usually linked. As a site moves through the Superfund Remedial Investigation/Feasibility Study (RI/FS) or RCRA Facility Investigation/Corrective Measures Study (RFI/CMS), site managers should develop assumptions about reasonably anticipated future land uses and consider whether ICs will be needed to maintain these uses over time. EPA's land use guidance (Land Use in CERCLA Remedy Selection Process, OSWER Directive No. 9355.7-04, May 25, 1995) states that the site manager should discuss reasonably anticipated future uses of the site with local land use planning authorities, local officials, and the public, as appropriate, as early as possible during the scoping phase of the RI/FS or RFI/CMS. Where there is a possibility that the land will not be cleaned up to a level that supports unlimited use and unrestricted exposure, the site manager should also discuss potential ICs that may be appropriate, including legal implementation issues, jurisdictional questions, the impact of layering ICs and reliability and enforceability concerns. It is also important for the site manager to recognize that, in addition to land uses, ICs can be used to affect specific activities at sites (e.g., fishing prohibitions).

Screening ICs

The need for ICs can be driven by both the need to guard against potential exposure and to protect a remedy. If any remedial options being evaluated in the FS or CMS leave waste in place that would not result in unrestricted use and unlimited exposure, ICs should be considered to ensure that unacceptable exposure from residual contamination does not occur. However, ICs may not be necessary if the waste that is left at the site allows for unrestricted use and unlimited exposure. Remedy options that typically leave residual wastes on site and necessitate ICs include capping waste in place, construction of containment facilities, natural attenuation and long-term pumping-and-treatment of groundwater.

ICs should be evaluated in the same level of detail as other remedy components. ICs are considered response actions under CERCLA and RCRA. ICs must meet all statutory requirements, and are subject to the nine evaluation criteria outlined in the NCP (40 CFR 300.430 (e)(9)(i)) for CERCLA cleanups. The balancing criteria recommended for corrective actions should generally be used in evaluating ICs under RCRA. However, before applying these criteria, the site manager should first make several determinations:

- Objective—Clearly state what will be accomplished through the use of ICs.

  Example: Restrict the use of groundwater as a drinking water source until the Maximum Contaminant Levels are met.

- Mechanism—Determine the specific types of ICs that can be used to meet the various remedial objectives.

  Example: Work with the local jurisdiction to develop ordinances to restrict well drilling or prohibit groundwater access until cleanup goals are met; record the groundwater contamination in the land record to provide notice of the issue to the public; and record contaminated aquifers on state registry to maintain institutional tracking.

- Timing—Investigate when the IC needs to be implemented and/or secured and how long it must be in place. Since ICs are often implemented by parties other than EPA, the time required to secure an IC should be taken into consideration.

  Example: A deed notice may be required in the short-term, and a formal petition for a zoning change may be necessary in the long-term, both of which need to be in place prior to site deletion from the NPL.

- Responsibility—Research, discuss, and document any agreement with the proper entities on exactly who will be responsible for securing, maintaining and enforcing the control. It might be useful to secure a written statement of the appropriate entities' willingness to implement, monitor, and enforce the IC prior to the signature of the remedy decision document.

  Example: Work with the State to determine whether it is willing and able to hold an enforceable easement to ensure appropriate land use; in addition, determine whether the local government is willing and able to change and enforce the applicable zoning requirements. If assurances cannot be obtained, then ICs may not be a viable component of the remedy.

Typically, the site manager is faced with balancing the relative strengths of ICs in terms of enforceability, permanence, etc., with achieving remedial objectives. As discussed previously, one option is to "layer" different controls to ensure long-term reliability. For example, layered ICs may involve concurrent use of enforceable agreements, deed notices, and adoption of land use controls by a local government. ICs may also be used in series. For example, an enforcement order may prohibit the land owner from disturbing the cap on his/her property (i.e., a short-term control), until the local government goes through the process of restricting the future use of the land (i.e., the long-term control).

Determining the State Role

Where EPA is implementing a remedy, states often play a major role in implementing and enforcing ICs. As stated previously, some governmental controls may be established under state jurisdiction: the state may use its enforcement tools to compel the PRP or facility land owner to limit site activities; the state may provide the notification or information on the contamination that remains on-site; or the state may assume ownership of a property in order to implement, maintain, and enforce proprietary controls. Under RCRA, the state will typically be imposing and overseeing the remedial action.

When to Begin Coordinating with the State

No matter what role the state assumes with ICs, the EPA site manager should begin coordinating with the state early in the RI/FS (for CERCLA) or RFI/CMS (for RCRA) process or after sampling has been completed and the extent of the risk is known. Even if ICs are not required for the long-term maintenance of the selected remedy, they may be necessary during the response activities.

Factors to Consider in State Coordination

In evaluating the need for and the type of ICs that may be implemented at a site, the site manager should consult with their Regional attorney to determine who has the proper legal authority to implement and enforce the proposed controls. Certain states have enacted statutes that provide the state with the legal authority to restrict land use at contaminated properties. In addition, several states have adopted statutes providing for conservation easements. These easements override common law barriers to the enforcement of easements by parties who do not own adjacent property. For example, at many sites, the state, in cooperation with the PRPs or facility owner/operator, may use its own enforcement tools to restrict the use of the land and ensure that the selected remedy, including ICs, is implemented and maintained. At other sites, a property interest may be conveyed (either directly or, if necessary, through EPA at Superfund sites) from the owner of the land to the state which becomes the holder and enforcer of a proprietary control. Finally, the state is often responsible for issuing advisories or warnings of potential risks (e.g., fishing or swimming prohibitions), and providing registries of hazardous waste sites (i.e., informational controls).

If it appears that the state will be relied upon to establish the ICs, the site manager should immediately talk to state agency personnel to gauge their willingness to establish, maintain and enforce the control, if necessary. This discussion is encouraged regardless of the type of IC(s) that will be implemented. The site manager should work with his or her state counterpart to identify and contact the appropriate state agency and personnel for each proposed IC. In addition, if a property interest is conveyed by the land owner to EPA to perform a remedial action (e.g., to ensure the reliability of the ICs restricting the use of the land), CERCLA requires the state to accept transfer of the title from EPA following completion of the CERCLA remedial action. If the state does not agree to accept title to the property, the site manager must find another party to assume ownership (e.g., a local government, community group or trust) or another type of IC (e.g., local government control)[3] must be selected. State assurances for O&M or for transfer of property interest are formalized in a Superfund State Contract (SSC), cooperative agreement, or MOU that is negotiated between the state and EPA.

State Role at Fund-Financed CERCLA Cleanups

The state assumes other responsibilities for ICs if the remedial action, including the ICs, will be Fund-financed under CERCLA. CERCLA specifically requires that the state provide assurance that it will assume responsibility for operation and maintenance (O&M) of the selected remedy before a Fund-financed remedial action is implemented. The NCP requires the state to ensure that any ICs implemented as part of the remedial action at the site are in place, reliable, and will remain in place after the initiation of O&M. These assurances are also documented in a cooperative agreement, SSC or MOU.

State Role at RCRA Sites

Under RCRA, states will typically be the implementing and overseeing agency. Therefore the state, when authorized and overseeing corrective action, will be responsible for identifying appropriate institutional controls. Where EPA is overseeing the remedy there are no state assurance requirements in RCRA Corrective Action. However, because there is no Federal mechanism in RCRA allowing EPA to acquire interest in property, EPA may be forced to rely on third parties (typically state or local government) to establish, maintain and enforce most types of ICs.

State Role at Federal Facilities

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[3]Likewise, either the state or a third party must be willing to accept property interests at PRP-led sites.

At Federal facilities, the landholding agency is ultimately responsible for all response activities. The state is not required to provide assurance that it will assume responsibility for O&M. However, states may enter into an agreement with the landholding Federal agency to monitor and enforce ICs at Federal sites.

Determining the Role of Local Governments

CERCLA, RCRA, and the NCP do not specify a role for local governments in implementing the selected remedy. However, a local government is often the only entity that has the legal authority to implement, monitor and enforce certain types of ICs (e.g., zoning changes). While EPA and the states take the lead on CERCLA and RCRA response activities, local governments have an important role to play in at least three areas: (1) determining future land use; (2) helping engage the public and assisting in public involvement activities; and (3) implementation and long-term monitoring and enforcement of ICs. Therefore, it is critical that the site manager and his or her state counterpart involve the appropriate local government agency in discussions on the types of controls that are being considered. The capability and willingness of the local government to implement and ensure the short- or long-term effectiveness of the proposed ICs should be considered during the RI/FS or RFI/CMS. In certain cases, cooperative agreements may be considered to assist local governments in the implementation, monitoring and enforcement of required ICs.

Evaluating ICs

Once the site manager has considered the objectives, mechanism, timing, and entity responsible for implementing, monitoring and enforcing the ICs, the next phase is selecting the ICs. The following sections contain a discussion of the CERCLA and RCRA factors that site managers should generally consider when evaluating ICs during the FS or CMS. If the site manager proposes to layer or use the ICs in series, he or she should also characterize the likelihood that this approach can actually be achieved. It is important to note that at CERCLA sites, the statute requires the site manager to evaluate ICs, just like other remedy components, against the nine NCP criteria. The site manager must ensure that remedies are protective of human health and the environment. ICs may be an important element in this determination. RCRA sites managers have the latitude to use balancing criteria, but unlike CERCLA, RCRA regulations do not require this balancing step. The CERCLA and RCRA criteria are categorized below in three groups: threshold, balancing, and modifying.

ICs in CERCLA Removal Actions

ICs will rarely be a component of true emergencies where a time critical action serves as the only response at a site. It is more likely that a site manager will choose ICs as a component of a non-time critical removal action or during a follow-up remedial action. A post-removal site control agreement must be completed before commencing a fund-financed removal action where ICs are included in post-removal site control (OSWER Directive No. 9360.22-02). As in the remedial process, begin considering ICs when conducting an analysis of land use assumptions during the removal decision-making process. Where a final, site-wide, non-time critical removal remedy decision will be made, ICs should be thoroughly and rigorously evaluated with all other response actions in the Engineering Evaluation/Cost Analysis (EE/CA). In short, because ICs are considered to be actions, apply the full criteria required by the NCP for EE/CA evaluations. It is anticipated that ICs would not be chosen as the sole action for a removal.

Threshold Criteria

It is fundamental that a remedy under RCRA or CERCLA that includes ICs meet the following threshold criteria:

- protect human health and the environment; and
- for CERCLA sites, comply with Applicable or Relevant and Appropriate Requirements (ARARs).

The site manager for RCRA facilities should also consider whether remedies that include ICs:

- attain media cleanup standards or comply with applicable standards for waste management; and
- control the source(s) of releases so as to reduce or eliminate, to the extent practicable, further releases of hazardous waste that might cause threats to human health and the environment.

Balancing Criteria

The site manager evaluates the individual, layered or series of ICs to determine their respective strengths and weaknesses. ICs are also evaluated in combination with engineered controls to identify the key tradeoffs that should be balanced for the site. Following are balancing criteria required by CERCLA and the NCP and recommended by the RCRA program in guidance.

Long-term effectiveness and permanence (CERCLA) or reliability (RCRA)—Under both CERCLA and RCRA, this factor assesses the permanence/reliability and effectiveness of ICs that may be used to manage treatment residuals or untreated wastes that remain at the site over time. When evaluating whether an IC will be effective over the long-term, the site manager should consider factors such as: whether the property is a government-owned site or a privately-owned site that is likely to change hands; the applicability of ICs to multiple property owners; the size of the area to be managed; the number of parcels; the contaminated media to be addressed; the persistence of the contamination; whether site contamination is well-defined; and whether local governments or other governing bodies are willing and able to monitor and enforce long-term ICs. The site manager should also consider the contaminated media to be addressed by the ICs. Different ICs may be required for different media.

Where ICs must be effective for a long period, either proprietary or governmental controls should be considered because they generally run with the land and are enforceable. However, both proprietary and governmental controls have weaknesses in terms of long-term reliability. For example, with proprietary controls, common law doctrines may restrict enforcement by parties who do not own adjoining land. This can render proprietary controls ineffective if EPA or another party capable of enforcing the control is not the owner of the adjacent property. To eliminate this problem, proprietary controls may be established "in gross," signifying that the holder of the control does not need to be the owner of the adjacent property. However, some courts do not recognize in gross proprietary controls.

At some sites, governmental controls may be preferable to proprietary controls. For example, the site manager might work with a local government to pass an ordinance to restrict construction or invasive digging that might disturb or cause exposure to covered residual lead contamination in a large residential area. The implementation of government controls might be considered a beneficial addition to information tools that may be forgotten over the long term or an enforcement action that would be binding only on certain parties. Proprietary controls would likely be deemed impractical at such a site due to the complex and uncertain task of obtaining easements from multiple property owners.

Like proprietary controls, the use of governmental controls may not be effective over the long term. Of primary concern are the political and fiscal constraints that may affect the ability of a state or local government to enforce the controls. Similarly, governmental controls may be problematic when the local or state government is or may become the site owner or operator because of the appearance of a conflict of interest. Regardless of the control selected, its viability over the long term needs to be closely evaluated.

Reduction of toxicity, mobility, or volume through treatment— This CERCLA and RCRA criterion does not apply since ICs are not treatment measures.

Short-term Effectiveness—Short-term effectiveness of ICs at CERCLA and RCRA sites should be evaluated with respect to potential effects on human health and the environment during construction and implementation of the remedy. In order to satisfy this criterion, the remedy might entail the use of an IC through an enforcement order to compel the PRP to restrict certain uses of the groundwater at or down gradient from the site during remediation. After remediation is complete, other ICs might be implemented if residual contamination remains on site (i.e., implementing ICs in series).

Implementability—This CERCLA and RCRA criterion evaluates the administrative feasibility of an action and/or the activities that need to be coordinated with other offices and agencies. Implementation factors that generally should be considered for ICs include whether the entity responsible for implementation possesses the jurisdiction, authority, willingness and capability to establish, monitor and enforce ICs. A proper analysis of implementability can be complex, considering such diverse factors as the extent to which land being restricted is owned by liable parties and the willingness and capability of the local government or other authority responsible for establishing controls for land or resource use.

Cost—This CERCLA and RCRA criterion includes estimated capital and O&M costs. In CERCLA, estimated costs for implementing, monitoring, and enforcing ICs should be developed. For example, cost estimates for ICs might include legal fees associated with obtaining easements restricting land use, the costs of purchasing property rights (e.g.., groundwater rights, easements), or the wages of the state or local government personnel that will regularly monitor the IC to ensure that it has not been violated. It is interesting to note that once the total life-cycle costs of implementing, monitoring and enforcing an IC – which may exceed 30 years – are fully calculated, it may actually be less costly in the long term to implement a remedy that requires treatment of the waste. For more information on estimating response costs, see "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study," EPA 540-R-00-002, OSWER 9355.0-075. In RCRA, costs historically have played a less prominent role in remediation selection. Typically cost estimates are expected to be developed at the discretion of the owner/operator, although implementors should take into account sites where ICs are inappropriately costly.

Modifying Criteria

Typically the site manager presents the proposed remedy, including ICs to the state, local government, and community for comment prior to implementation. The issues and concerns of these stakeholders may result in modifications to the remedy and are addressed by the site manager in the remedy decision document. Following is a discussion of these modifying criteria *(note: these criteria are only recommended in RCRA guidance).*

State Acceptance—The site manager should make the appropriate state authorities aware of the basis and scope of the ICs to be implemented under CERCLA or RCRA, and what role, if any, the state is expected to play to make ICs an effective part of the remedy. The state can formally express its concerns about the use of ICs, in general, and its role, in particular, or indicate its willingness to take on the responsibility for implementing and enforcing the proposed ICs.

If the state's position is uncertain at the time the remedy is selected (e.g., for CERCLA sites, when the ROD is signed or, for RCRA facilities, when the permit/order is issued or modified), it may be necessary to outline contingent remedial approaches in the decision documents. Specifically, remedies that require long-term ICs to remain protective may require alternative actions (e.g., additional soil removal) if the ICs are later determined to be unenforceable or cannot meet the remedial objectives. Alternatively, at a RCRA site, it may be necessary to leave a facility under a permit or other mechanism enforceable by the regulating agency. If the state's willingness or ability to implement or enforce an IC changes after remedy selection, the protectiveness of the remedy should generally be re-evaluated and, when necessary, remedial decisions revised. Under CERCLA, this may require an Explanation of Significant Differences (ESD), or even a ROD amendment. Under RCRA, a permit modification or change to a corrective action order may be necessary. It is important to note that under no circumstances can a Fund-financed CERCLA remedial action be initiated without receiving state assurances on ICs and property transfer.

Local Government and Community Acceptance—Involving the community and local government early during the remedy decision process will enable the site manager to more fully evaluate IC options. Discussions with the local government and community give the site manager the opportunity to:

- gather local government and community input on the proposed ICs;
- identify whether a particular stakeholder group may be harmed as a result of a proposed IC (for example, will a ban on fishing cause an economic hardship in the community);
- receive comment on the impacts of the potential ICs on religious or cultural customs and beliefs (e.g., preventing access to property which grows the plants that are used in a tribal ceremony); and
- determine if the community has special needs in regards to the IC (for example, will it be necessary to publish informational devices in multiple languages).

In addition, the local government and community's response to certain types of ICs and the willingness and capability of the local government to monitor ICs will help the site manager determine whether the ICs will be effective overall. This is especially important if nearby property owners will need to agree to implement proprietary controls or if other governmental ICs (e.g., zoning changes) will have an impact on the community. Early involvement will also enable the community to work with the local government to develop innovative approaches to using ICs, especially in light of any future land use plans.

As with other aspects of the proposed remedy, the community should have the opportunity to comment on the proposed IC component of the remedy during the public comment period. It may be necessary to educate the community about ICs so that its members understand how the different ICs may impact their property and activities. Under CERCLA, it may also be possible, as long as all appropriate requirements are met, to provide a Technical Assistance Grant to the community so they can hire a technical expert to assist them in evaluating ICs and the overall remedy.

In some cases, it may be appropriate not to identify the exact IC required at the time of the remedy decision. In these instances the critical evaluation of the available ICs should still be conducted and the specific objective(s) of the ICs should be clearly stated in the ROD or other decision document. Examples of when this flexibility may be appropriate are contingent remedies based on pilot studies or if a remedy would not be implemented for several years and the state is developing enabling language for Conservation Easements authority.

Site Manager Responsibilities After ICs are Selected

The site manager's responsibilities for ICs does not end once the ICs are selected. Site managers also should ensure that the ICs are actually implemented, are reliable, are enforced, and remain effective. It should be noted that NPL sites cannot be deleted until the entire remedy, including ICs, have been implemented. This may involve the following:

- working with state and local governmental entities to obtain commitments and resources for implementing and enforcing ICs, including negotiating a CERCLA SSC with the state to obtain assurances that the ICs will be put in place, are reliable and will remain in place after initiation of O&M activities;
- ensuring that the PRP or facility owner complies with the provisions in the enforcement tools to implement the ICs and provides notice of the ICs to potential future users/owners of the property;
- working with other Federal agencies to implement and enforce ICs;
- acquiring property for implementation of the CERCLA remedy; and
- checking the status of ICs during the CERCLA five-year review.

Conclusion

The ICs outlined in this fact sheet can be important elements of environmental cleanups. ICs play an important role in limiting risk and are often needed to ensure that engineered remedies are not affected by future site activities. When selecting ICs, the site manager needs to evaluate the situation at the site, define the needs that ICs are intended to address, identify the kinds of legal and other tools available to meet these needs, and ensure the ICs are implemented effectively. All of this requires up-front planning and working closely with the Regional office attorneys, the state, community, and PRPs or facility owner/operators. Key concepts to keep in mind when implementing ICs are provided in the text box below.

If you have questions regarding the material covered in this fact sheet, consult the draft document, "Institutional Controls: A Reference Manual" or contact your Regional Coordinator in the OERR Technical Regional Response Center. For information on model language for enforcement or legal documents used to implement ICs, consult your Regional Counsel, OSRE or the Office of General Counsel.

Key Concepts

- Under the NCP, the use of ICs should not substitute for active response measures (unless active measures are not practicable).
- If the site cannot accommodate unrestricted use and unlimited exposure, an IC will generally be required.
- Make sure the objective(s) of the IC are clear in the decision document.
- Coordinate early with state and local governments.
- Layer ICs and/or place them in series depending upon site circumstances.
- Evaluate ICs as rigorously as other remedial alternatives.
- Understand the life-cycle strengths, weaknesses and costs for the implementation, monitoring and enforcement of ICs.
- Get assurances, in writing, from entities that will implement, monitor, and enforce ICs.
- Remember that since all ICs have weaknesses, the role of the RCRA/CERCLA decision makers is to select the best ICs to protect human health and the environment.

Protecting Health and Safety with Institutional Controls

Larry Schnapf

Federal and state environmental agencies are under increasing pressure to expedite the cleanup of contaminated sites so that the properties can be returned to productive use. One of the more popular tools to accelerate site cleanups is implementation of institutional controls (e.g., deed restrictions and drinking water prohibitions).

Under a more traditional cleanup approach, health risks are addressed by either treating contaminants onsite or removing them to a treatment or disposal facility. An alternative to complete treatment or removal of contaminants, institutional controls are legal controls that create barriers that prevent the public from being exposed to unhealthy concentrations of contaminants. They are often used in conjunction with engineering controls that are physical barriers such as impermeable caps that physically separate people and environmental receptors from contact with contaminants. Because cleanups relying partially or wholly on institutional controls may not require groundwater treatment or may allow higher levels of residual contamination to remain in soils, cleanups using institutional controls may be more cost-effective initially and be completed much faster than the more comprehensive site cleanups.

The use of institutional controls in hazardous waste site cleanups is not a new development. The United States Environmental Protection Agency (EPA) has promulgated hazardous waste regulations, 40 C.F.R. §§ 264.118 and 265.118, and the National Contingency Plan (NCP), 40 C.F.R. § 300.430(a)(i)(D), authorizes the use of institutional controls. EPA has acknowledged that institutional controls will play a key role in future cleanup remedies. U.S. EPA, Office of Solid Waste and Emergency Response, *Land Use in the CERCLA Remedy Selection Process*, OSWER Directive No. 9355.7-04, 9 (May 1995) (Land Use Directive). Moreover, the Department of Defense (DOD) also has relied on institutional controls at closed military bases to speed up the transfer of these facilities to local redevelopment agencies.

What is significant is the extent to which institutional controls are being used to achieve cleanup goals. In the twelve years following passage of the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§ 9601 *et seq.* (CERCLA), only 14 percent of the CERCLA cleanups used institutional controls. Since the mid-1990s, however, 60 percent of all remedies approved by EPA require long-term management or monitoring that utilize some form of institutional or engineering controls. ROBERT HERSH ET AL., RESOURCES FOR THE FUTURE, *Linking Land Use Controls and Superfund Cleanups: Uncharted Territory* 72. (1997). Institutional controls also are playing a crucial role at sites that are being remediated under state brownfield and voluntary cleanup programs.

This shift toward relying on institutional controls has been criticized by some government regulators and environmental organizations. There is concern that there has been insufficient debate over what types of properties and land use controls are appropriate to protect the public from the risks of residual contamination. For example, a 1998 United States General Accounting Office report indicated that 96 percent of the sites potentially eligible for inclusion on the federal National Priorities List (NPL) are located within a half-mile of residences or places of regular employment. U.S. GENERAL ACCOUNTING OFFICE, HAZARDOUS WASTE: UNADDRESSED RISKS AT MANY POTENTIAL SUPERFUND SITES, REPORT TO THE RANKING MINORITY MEMBER, COMMITTEE ON COMMERCE, UNITED STATES HOUSE OF REPRESENTATIVES, GAO/RCED-99-8, 2 (Nov. 1998). An EPA study indicated that 80 percent of the existing sites subject to CERCLA cleanups are adjacent to or near residential neighborhoods. U.S. EPA, SUPERFUND ADMINISTRATIVE REFORM FACT SHEET (May 1995). The large numbers of people living or working within proximity of these sites illustrate the importance of ensuring that institutional controls effectively protect these individuals from the risks posed by the presence of hazardous substances.

However, there is also concern over the long-term effectiveness of institutional controls. Unlike permanent remedies, land use controls need to be monitored to ensure their effectiveness. If an impermeable cap placed over a commercial site contaminated with heavy metals is allowed to deteriorate, workers and visitors to the site could become exposed to contaminated dust. Likewise, if utility lines have to be repaired and the excavation activities damage a vapor extraction system, occupants could be exposed to unhealthy levels of volatile organic compounds (VOCs). This article reviews types of institutional controls; explores the critical issues associated with the creation, implementation,

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and enforcement of institutional controls; and also proposes some solutions for improving the effectiveness of institutional controls.

What Are Institutional and Engineering Controls?

As noted above, institutional controls are legal or administrative mechanisms that may limit use or access to property to eliminate exposure to hazardous materials and to ensure the effectiveness of ongoing remedial activities. There are essentially two broad categories of institutional controls: proprietary controls and government controls.

Proprietary controls are private contractual mechanisms that are contained in a deed or other instrument used to transfer title to property. Absent specific statutory authority, most jurisdictions require that there be a conveyance of some form of property interest to create an enforceable proprietary control. Thus, where a site owner conducts a cleanup but does not intend to sell or lease the property, it may be difficult to create a proprietary interest because no conveyance has occurred. There are several common forms of proprietary controls: restrictive covenants, easements, deed restrictions, reversionary interests and equitable servitudes.

Restrictive covenants are promises by a landowner to take or refrain from taking certain actions. For example, an affirmative covenant may be a promise by an owner to maintain a fence that surrounds a former hazardous waste disposal site. Alternatively, a restrictive covenant can be in the form of a promise not to use groundwater or conduct certain activities at a site. If the covenant "runs with the land," it can be enforced against subsequent landowners. Restrictive covenants are normally used with multiple parcels to mutually benefit the properties. They may not be suitable to impose institutional controls on a single property or where the restriction is intended to benefit the public instead of the property subject to the covenant.

Easements are a right to a "limited" use or enjoyment of the land of another. An easement usually creates a benefit for one parcel of land (the "dominant estate") and an obligation or burden for another (the "servient estate"). When an easement attaches to the land such as a right of access for a landlocked parcel, it is known as an "appurtenant easement." In contrast, easements that are granted to a particular party such as utility easements are known as "easements in gross." An affirmative easement grants a right to use land of another, while a negative easement restricts lawful uses of land. An easement could be granted to allow someone to come onto a brownfield site to inspect the integrity of a cap or monitor groundwater. If the property owner violates the easement, the holder of the easement may bring suit to restrain the owner. Local governments or other institutions have been reluctant to become holders of easements to contaminated property out of fear that they may be construed to be a CERCLA owner or be sued for failing to properly exercise or enforce the easement by a person who becomes exposed to contaminants.

EPA has acknowledged that institutional controls will play a key role in future cleanup remedies.

Deed restrictions are obligations or promises by a property owner to constrain the use of land in a certain way. Like restrictive covenants and easements, deed restrictions must comply with certain formalities to be enforceable. There must be a written instrument that satisfies the applicable statute of frauds, the parties must intend that the deed restriction attach to the land, it must "touch and concern" the land, and there must be "privity of estate." Generally, use of the phrases " run with the land," "in perpetuity," or "successors and assigns" will satisfy the requirement that the parties intended the restriction to attach to the land, but applicable real property law should be consulted. In addition, subsequent conveyances of property must generally contain a specific reference to the restriction in the new deed (i.e., the deed book and page number where the encumbrance was recorded). If the new deed does not contain such a reference, the restriction may not be enforceable against the new owner. Thus, property owners creating deed restrictions may have to review and approve the language of future deeds.

Reversionary interests are a conditional right to future enjoyment of property that is presently owned or occupied by another person. An owner conveying contaminated property may enforce a use restriction or covenant by establishing a reversionary interest so the land will revert to the grantor (or designee such as a regulatory agency) if the conditions are violated. Generally, only the original owner or its successors may enforce this right. The underlying presumption behind this type of proprietary control is that the future landowner will have an incentive to maintain the institutional control because it does not want to lose the property. Obviously, reversionary interests will not be an effective institutional control if the future owner determines the site contamination no longer makes the property valuable or if the grantor has no interest in reclaiming the property. Moreover, a former owner may have little interest in monitoring the site or making sure the controls are obeyed.

Equitable servitudes are restrictions on the use of land that is enforced in equity against future transferees of the property. The restriction creating the servitude may take the form of a promise, covenant or reservation. The servitude must generally be memorialized in writing, be intended to restrict uses of the land as opposed to preventing an individual from taking certain actions and the transferee must take the land with either actual or constructive notice of the servitude.

Government controls are restrictions used by state and local governments that limit the use of property. These controls are exercised through planning and zoning maps and ordinances, subdivision plats, building permits, siting restrictions and groundwater use restrictions in the form of well-drilling prohibitions or well use permits.

* Though not technically considered institutional controls, informational notices can be an effective mechanism for limiting exposure to contaminants. The purpose of these informational tools is to advise future owners and users of hazards existing at the property. These notices do not impose affirmative obligations on owners of property but, instead, require that warnings of site hazards be conveyed to the public. Examples of such warnings may be deed notices, publishing legal notices in local newspapers and posting of warning signs at the property. However, because title searches may sometimes only search back to the most recently recorded warranty deed, a prospective purchaser may not be aware of an older deed notice. Moreover, tenants usually do not conduct title searches prior to taking possession of property. To address this problem, some communities have also established registries of hazardous waste sites or Geographic Information Systems (GISs) that can inform the public about contaminated sites. Public health departments have long used advisories to try to warn the public about certain kinds of risks. However, the problem with these advisories is that they are not completely effective because some will not receive or understand the warnings or will choose to ignore them. Therefore, these informational tools are generally not effective as institutional controls. In addition, some states have enacted transfer laws that require sellers to notify prospective purchasers of contamination at property to be conveyed.

Traditional enforcement actions also may be used to create institutional controls. Use restrictions or restrictive covenants may be embodied in enforcement documents such as administrative orders, consent decrees, No Further Action (NFA) letters, and Covenants Not To Sue (CNTS).

The most important factor for ensuring effectiveness of institutional controls is the existence of a reliable enforcer.

Selecting Institutional Controls

The first important issue to be addressed is the selection of the particular institutional control. Section 121 of CERCLA contains cleanup criteria that EPA must consider when selecting a remedial action. The criteria do not explicitly refer to institutional controls. In addition, the section also expresses a preference for permanent on-site treatment of contaminants. Thus, it would appear at first glance that CERCLA would preclude remedial strategies employing institutional controls. However, Section 121 also provides that cleanups should be cost-effective and that the cleanup criteria should be achieved to the "maximum extent practicable." This language suggests that this institutional control may be appropriate where permanent treatment is not feasible. Indeed, in the preamble to the 1990 amendments to the NCP, EPA did allow for the use of institutional controls when more permanent or active treatment would be impractical. 55 Fed. Reg. 8706 (Mar. 8, 1990). The preamble to the 1990 amendments stated that institutional controls were a necessary supplement when some waste is left in place, as it is in most response actions. *Id.*

Unfortunately, the type of institutional controls that are to be used at a site are not determined early in the remedy-selection process. In the past, EPA site managers assumed that contaminated properties would be used for residential purposes when they developed exposure assumptions and exposure pathways during the performance of the Remedial Investigation (RI). These hypothetical exposure scenarios were then used to select remedial alternatives and preliminary remediation goals. However, under EPA's 1995 Land Use Directive, site managers may now identify "reasonably anticipated land uses." While the need for land use restrictions may be referred to generally in the proposed remedial plan that is reviewed during the public comment period, the specific institutional controls that may be required at a site are usually not identified until after the public participation period has been completed and a Record of Decision (ROD) has been issued. Unless the ROD identifies institutional controls, the selection of institutional controls will likely take place during the consent decree negotiations between EPA and potentially responsible parties (PRPs) in which the public or the affected community have little or no opportunity to participate.

The appropriateness of the institutional controls will often be predicated on the "reasonably anticipated land uses" that were identified early in the remedial investigation stage. However, it is often very difficult to anticipate future land use. EPA site managers are supposed to review zoning maps, comprehensive plans and development patterns when developing the reasonably anticipated land use. The purpose of zoning is to separate incompatible types of land use by regulating the activities that can be conducted on properties, as well as the size and location of structures on the property. Zoning systems are designed to have some flexibility to compensate for economic changes in a community. As a result, relying on zoning and land use planning may not be a reliable predictor of the future use, nor serve as an appropriate enforcement mechanism when long-term institutional controls are required because zoning plans can change over time. Property owners can request to have sites rezoned, seek zoning variances or challenge local zoning restrictions. There can also be discrepancies between zoning ordinances and zoning maps. Moreover, the broad zoning classifications usually contained in zoning ordinances are not designed to protect the public from the types of risks that might be posed by former industrial properties. For example, some jurisdictions use cumulative zoning where industrial classifications can allow more restrictive uses. In such jurisdictions, a property could be used for residential purposes even though the area is zoned for commercial uses. In addition, in some areas industrial/commercial classifications allow uses such as day care centers where vulnerable populations may be present. Thus, in many areas, zoning may not be effective as an institutional control.

This problem of identifying reliable land use assumptions and late selection of institutional controls is not limited to the CERCLA program. The procedure that EPA has adopted for conducting RCRA corrective actions is modeled after the CERCLA remedy-selection process and suffers from the same flaws. When transferring military bases, DOD will consider a range of reasonably likely land uses during the remedial selection process taking into account current land use, current zoning classification, unique property attributes and surrounding land uses. DOD has indicated in the past that it expects the community and the local land use agency to take the environmental conditions of the property, the planned remedial actions and any technological or resource limitations into account when developing reuse plans for the property. Under many of the state brownfield or voluntary cleanup programs, the public is given limited opportunity to participate in the identification of land use assumptions and land use controls. However, some states require that the proposed land use restrictions be published in local newspapers to provide the public with an opportunity to comment while a few also mandate that various local government agencies be given notice of the restrictions as well.

The type of institutional control that is appropriate may depend on the type of contaminants, the nature of the contamination, and the expected longevity of the contamination. The type of control that may be appropriate for a site with petroleum-contaminated soil that may degrade in a few years may not be appropriate for a site with uranium tailings that will remain hazardous for thousands of years. Likewise, a site contaminated with relatively immobile metals may require different controls from a site with a groundwater plume of solvents or methyl tertiary butyl ether (MTBE) which is rapidly migrating away from the site. Institutional controls that may effectively prevent on-site exposure may not work well for off-site contamination. For example, at some CERCLA sites, radioactive or metallic dust from tailings may have been carried by the wind far beyond the boundaries of the site or may have been used as fill for streets and buildings in the community.

Creating Institutional Controls

EPA cannot create institutional controls under federal law. As a result, while the obligation to create land use controls may be contained in a federal consent decree, EPA must rely on actions under state property law or the general police power of local governments to create the controls. As discussed earlier, proprietary-type institutional controls require a conveyance of property. Where a property owner has entered into a settlement with EPA, the agency will try to address this problem by requiring the landowner to convey an easement for the purpose of allowing the agency to enforce the terms of the settlement. State environmental agencies usually face the same constraints, although some state voluntary cleanup programs or brownfield programs have statutorily created easements in favor of the state environmental agency that run with the land.

States vary on how to establish institutional controls. Many states do not require the restriction to be recorded but simply provide that the restriction be contained in a NFA letter, certificate of completion or a remediation agreement. Some states will not require the filing of use restrictions in the chain of title if it can be shown that there are adequate local government controls that reliably can be used to minimize exposure to hazardous substances. This will probably be most useful when dealing with contaminated groundwater because permits are often required before a drinking water well may be installed. For example, some states have established groundwater "Classification Exception Areas," in which the agency recognizes that groundwater is contaminated but will not be used for drinking purposes.

Those states that require institutional controls to be recorded rely on different types of instruments. While some states require that the restrictions be placed on

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the deed itself, others simply require that the owner of the property record a restrictive easement or covenant acceptable to the environmental agency. These particularly useful where a current landowner agrees to create institutional controls but there is no conveyance of property. Some states have developed forms with statutory-specific language that cannot be modified.

The instrument creating a proprietary control such as a restriction or easement must be in recordable form, which means it generally needs to be notarized. While the recorders' offices will generally not allow an instrument to be filed that does not comply with the local recording requirements, sometimes such documents are found in the chain of title. Even if the document is recorded, any defect—including lack of notarization—can prevent the restriction from being enforced against subsequent landowners.

The instrument should contain a specific recitation of the work that has been performed at the site, describe the engineering controls that will remain at the site and their specific location, the specific uses that are to be prohibited and permitted, the specific remediation goals to be achieved for the restrictions to be lifted (e.g., groundwater contaminant concentrations), and the instrument that will be used to terminate the restrictions. The language should track that wording contained in an enforceable agreement or other decision-making document (e.g., ROD). If only portions of the property are subject to use restrictions, the instrument should clearly limit the restrictions to those affected portions of the site. The instrument should not refer to the entire property but specific lots and blocks unless the entire site is subject to the restriction.

Citizen complaints were the most common means for discovering violations of institutional controls.

Enforcing Institutional Controls

Perhaps the most important factor for ensuring effectiveness of institutional controls is the existence of a reliable enforcer. Environmental agencies will perform detailed risk assessments for developing remedial actions but except for groundwater monitoring programs, there is virtually no post-construction analysis to determine if an institutional or engineering control is effectively preventing the affected community from exposure. Thus, it is important that the instrument creating the institutional control identify the party who will have the right to enforce the restrictions and be responsible for maintaining and repairing the controls. Responsibilities of the enforcer may include making periodic site inspections to ensure that prohibited activities are not taking place; checking the integrity of caps, fencing and other barriers; ensuring that site use has not extended into prohibited areas; and inspecting drinking water wells to make sure that they are not being used.

When relying on governmental controls, EPA and state environmental agencies often look to the local government to ensure that the institutional controls are properly enforced. However, local governments often lack the experience, resources and inclination to verify compliance to enforce land use controls arising out of agreements between private parties. Likewise, applications for building permits or subdivision plats generally only require evidence of ownership. Local agencies may not review the underlying deeds to determine if the proposed uses violate any existing deed restrictions. In fact, according to a 1998 report issued by the International City/County Management Association, 72 percent of the local government bodies surveyed did not search titles before making zoning changes. Christine Gaspar and Denise Van Burik, International City/County Management Association, *Local Government Use of Institutional Controls at Contamination Sites* 15 (1998).

This report illustrated additional problems with using zoning to enforce institutional controls. It found that while local governments primarily rely on zoning to enforce institutional controls, the principal enforcement mechanism used by the majority of respondents was simply making sure that the land use was consistent with zoning maps. Most of the respondents indicated that they did not conduct any formal inspections to confirm compliance with the controls. In fact, the report revealed that citizen complaints were the most common means for discovering violations of institutional controls. Approximately two-thirds of the local entities surveyed felt that it was likely that current owners could breach institutional controls without the local government learning of the violation for several years.

Further complicating the effectiveness of government controls is the fact that it is usually county governments and not local officials that are responsible for recording deeds and other land use restrictions. Thus, local government authorities may not even be aware of the existence of institutional controls. Accordingly, it is advisable for town attorneys and managers to establish an information exchange with the county governments and perhaps even establish procedures for enforcing institutional controls in their building or zoning codes.

The passage of time can also impact the effectiveness of zoning as an institutional control. A property may have been used as a manufacturing facility in the earlier part of the century and then may have been converted into a shopping center or store. After the store goes out of business, a developer may want to build residential units on the property, or the town may want to build a school or allow a day care center to be operated. With the passage of time, there might not be any institutional memory or adequate records alerting the zoning board that the site might be contaminated. As a result, the board may grant a petition to reclassify the property for residential or commercial use without taking measures to ensure that occupants are not exposed to contaminants at the site.

Enforcement of proprietary controls can be more problematic. The enforcement of these forms of institutional controls can be undermined by traditional doctrines of real property law that favor the free alienability of land and disfavor the enforcement of restrictions against owners who take title long after the restriction was imposed. Under real property law, the grantee is usually the only party who has the right to enforce a property interest. If the grantee fails to enforce the provisions of the instrument, it might be difficult to compel compliance unless another party is granted enforcement authority.

It may be difficult to implement and enforce a proprietary form of institutional control that requires the consent of multiple landowners. For example, an owner of property that is contaminating groundwater may agree to an institutional control prohibiting the use of drinking water wells on its property and the adjoining properties but it may be difficult to enforce that restriction on the surrounding property owners. Likewise, proprietary controls also may not be effective where a deep-pocket PRP must obtain the consent of an adjacent property owner and the adjacent owner seeks a significant sum of money in exchange for agreeing to the deed restriction. Similarly, a tenant who has agreed to implement an institutional control may not be able to obtain the consent of its landlord to impose a use restriction on the property or the landlord may ask for compensation that the tenant may not be able to afford. If the institutional control requires a future land use that is different from the currently zoned use, a different remedy may be more appropriate.

Because real property law generally requires a conveyance to establish an enforceable property right, environmental agencies may not be able to enforce proprietary controls. As a result, some states require that the property owner grant a right of access and an environmental easement to the state environmental agency, and other states have enacted legislation creating statutory land use restrictions or easements. Some of these statutes even provide that the restrictions will be enforceable even if they do not comply with some of the common law technicalities. To be enforceable against new owners, though, restrictive covenants must "run with the land." Instruments creating the control containing phrases like "run with the land," "in perpetuity" or "successors and assigns" may be sufficient, but it is important to review the requirements of the local real property law to determine what language is required.

Because real property law generally requires a conveyance to establish an enforceable property right, environmental agencies may not be able to enforce proprietary controls.

Even if an easement or use restriction can be enforced between an environmental agency and a current owner, it is unclear if community groups or local governments could enforce a restriction that the owner fails to implement or maintain. Likewise, if the easement holder fails to bring suit in a timely manner to enforce the violation of an institutional control, the restriction may be deemed to have been terminated and third parties may not be able to enforce the use limitation. Similarly, a use restriction may not be enforceable against a lender who is holding a mortgage that was perfected prior to adoption of the use restriction. Technically, if such a lender forecloses on the property and then sells the property, the use restriction may not be enforceable against the transferee although this may have little practical effect because the transferee may not be able to obtain title insurance. For this reason, some states require the grantor to have a subordination agreement executed by lenders, lien holders, lessees and other owners of previously perfected property or possessory interests. Some states require the purchaser, lessee or transferee to acknowledge that institutional controls may be required. It is important to make sure that executing a subordination certification does not waive rights to object to implementation of such remedy.

There also can be problems enforcing institutional controls that may be created through an enforcement tool, such as administrative orders or consent decrees. While these orders can be enforced against the named parties or signatories, they generally do not create or convey a property interest. Therefore, the provisions of the orders usually may not be enforceable against subsequent owners or occupiers of the property even where the buyer or tenant has actual notice of the restriction.

Environmental authorities may try to navigate around this problem by requiring that notice of transfers of the title or possessory interests in the property be given to the agencies and that transferees agree to be bound by the terms of the orders. In addition, most NFA letters and CNTS generally provide that the releases from liability will be revoked if mandated institutional controls are not maintained. However, in states where innocent landowners may not be liable for preexisting contamination, the state environmental authority may only bring an enforcement action against the recipient of the NFA or CNTS. To address this problem, some state environmental statutes now require enforcement orders imposing use restrictions to be recorded and that such recorded orders "run with land."

A few state environmental agencies are also required to maintain registries of properties where hazardous wastes have been disposed or where use restrictions have been imposed. Often, the state environmental agency must approve transfers or changes in use of listed sites. However, given limited resources, enforcement can be difficult if the owner does not provide the required notice to the state prior to conveying the property.

Maintenance of long-term institutional controls can be costly and in some cases may exceed the initial construction costs of the remedy. Consequently, creation of some form of financial assurance mechanism or insurance should be considered. If the facility is regulated as a RCRA treatment, storage or disposal facility, it is possible that the RCRA financial assurance requirements may be used to ensure that adequate funding is available to maintain the institutional controls. Financial assurance is also a common feature of CERCLA remedies.

Modification or Removing Institutional Controls

Another important issue is the mechanism for modifying or terminating land use controls. Modification may be necessary to excavate soil for an expansion of a building or to repair utility lines. If the new land use will require additional remediation, the parties need to agree on who will pay for the additional work. Usually the party who desires the change will bear the costs of the additional cleanup.

When controls are no longer needed to protect human health or the environment, the instrument should also identify a process for removing the controls. Only a handful of states have forms of releases that must be executed by the state environmental agencies to terminate the institutional controls. In the rest of the states, it may be unclear what document has to be presented to the local records clerk to prove that the remedy has been completed and the institutional controls can be released. Though the parties could provide that the institutional controls will automatically terminate upon the achievement of certain standards such as levels of contamination, a better practice would be to require the recording of a separate instrument terminating the controls. This could be a release similar to the satisfaction of mortgage that is filed when a mortgage is paid off or the issuance of an NFA letter.

Because of the growing importance of institutional controls, the technical adequacy of cleanup remedies may be affected by local land use factors over which EPA and state environmental agencies have no control. To ensure that remedies are being sufficiently protective of human health and the environment, the NCP could be revised so that selection of land use is incorporated into the formal remedy-selection process. If institutional controls are to be used, the exact conditions of the restrictions should be set forth in the ROD so that the public can have ample opportunity to comment on the appropriateness of the restrictions. The ROD should also identify the parties who will be responsible for the long-term maintenance of the controls. Consent decrees or administrative orders for a site utilizing institutional controls should provide that failure to abide by the terms of the institutional controls would be a violation of the order and trigger stipulated penalties. Alternatively, a permit could be issued specifically for the creation and enforcement of institutional controls. If EPA intends to continue to rely so heavily on institutional controls, the agency might even consider creating a new office that would track the implementation and maintenance of institutional controls and perhaps provide resources to local governments to help them establish systems for monitoring institutional controls. EPA might also consider creating financial assurance requirements to ensure that funding will be available for the long-term maintenance of those institutional controls.

At a minimum, states should establish databases or a GIS that list the properties subject to institutional controls or flag existing contaminated sites so that they can be easily identified. Local governments and utilities should be required to review these registries which could be made available through the Internet or perhaps placed on compact disks with read-only memory (CD-ROMs). These registries should provide detail on the specific locations, quantity, and types of contamination so local permitting or planning agencies can ensure that proposed activities will not disturb the contaminants. They should also describe residual contamination that might exist under streets or buildings constructed on contaminated fill or dust so that maintenance or repair work done by utilities and road departments do not inadvertently expose workers and residents to unhealthy levels of contaminants.

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October 26, 2000

Cooper H. Wayman
Senior Legal Counsel
U.S. Department of Energy
Grand Junction Office
2597 B 3/4 Road
Grand Junction, CO 81503

RE: Split Rock Site, Jeffrey City, Wyoming

Dear Mr. Wayman:

Thank you for the time and attention which you and other members of the Department of Energy (DOE) staff gave Lou Miller and me during our meeting in Grand Junction on October 13, 2000. Prior to that meeting, copies of maps, deeds, land use restrictive covenants and access easements and related documents and material were supplied to you and the DOE staff concerning the property at the Split Rock site which would be transferred to the DOE for long term care upon Western Nuclear's (WNI) NRC license termination.

At that meeting and in your letter of October 18, 2000, you requested a narrative description and discussion of the various ownerships, institutional controls (ICs) and any restrictive covenants applicable to the various segments on the colored maps supplied at the meeting. You requested that the discussion delineate that which would be conveyed to DOE at the time of license termination.

In summary, and at the outset, it should be stated that for all colored sections on the map, an interest in real property will be transferred to the DOE by WNI which will forever allow the DOE to prevent any one from drilling or utilizing a water well for domestic consumption.

I will discuss the five color coded areas one by one.

The blue color coded area is presently owned by the United States and that property is presently administered by the Bureau of Land Management (BLM). Since the United States already owns that property, title transfer is not an issue. What needs to be accomplished at the time of license termination is an inter agency transfer of administration between the BLM and the DOE.

The pink color coded property is owned in fee by Western Nuclear. Western Nuclear proposes to transfer, in fee, the property which is color coded in pink to the DOE at the time of license termination. It should be noted that all property underlying the reclamation cover of the reclaimed tailings site is on property color coded either pink or blue.

WNI presently owns the subsurface of the land color coded green. The ownership interest in the land exists for all of the land located seven feet beneath the surface. That interest and estate in the real property owned by WNI is referenced as the dominant estate on the deed conveying that property interest to WNI. Additionally, WNI purchased and owns an access easement on, over and through the land in order to "drill or put in place monitoring wells and to collect samples of ground water and to take such corrective action as may be necessary or required under the provisions of the Uranium Mill Tailings Radiation Control Act, or as may be required by any federal or state agency having jurisdiction, in order to protect the public health and safety, and the environment." WNI will transfer, by deed, the interest in real property which it currently owns to the DOE upon license termination. Any person entering the land below seven feet would then be a trespasser on federal property. Thus, the enforcement mechanism to prevent the drilling of any well on the property would be the same as it would be on the property color coded blue and pink. Anyone entering the property below seven feet would be trespassing on federal lands and the DOE's enforcement remedies would be the same as for fee lands.

Moreover, the subsurface owner (WNI, then DOE) has unlimited access to the surface via easement for any activity required pursuant to UMTRCA or for any required purpose necessary to protect the public health and safety and the environment.

The land which is color coded yellow depicts where WNI has purchased an interest in that land, denoted a land use restrictive covenant and access easement. WNI presently owns an easement and covenant servitude, which is a real property interest, on the yellow coded property. That ownership interest is in grantors chain of title and will forever burden the subject property. Moreover, it is specifically set forth in the document of conveyance that the interest which was conveyed shall be a burden on the property and "shall run in favor and provide benefit to the land described in Exhibit A-2 and Western Nuclear, Inc. and its successor owners...".(i.e. DOE) The land described in Exhibit A-2 is land which is color coded pink and is presently owned in fee by WNI. It is also land where the reclaimed tailings site exists (the original source term for any by-product material). As you can observe, the covenant which WNI purchased provides that "permitting, drilling, building, opening, or utilizing any new water well in or upon the land... will not be allowed except upon prior consent of Western Nuclear, Inc. or its successors." The document of conveyance also grants an easement on, over and through the subject land identical to the one described for the land color coded green.

The covenant and easement servitudes will be conveyed to the DOE at the time of license termination. In the sense that land ownership is the ultimate institutional control, the ownership interest in the land color coded yellow which has been described is an institutional control. As you are aware, conservation easements and environmental covenants have wide spread and absolute acceptance in the law. Such servitude benefits may be granted to third parties and do not even have to run with adjoining land. (Although that is not the case in this instance.) As you are aware, there has been wide spread use of such servitudes in Colorado and Wyoming. The Elk River Valley in Routt County is a noted example of conservation and environmental covenants being purchased by the Nature Conservancy and local governmental entities to restrict future development of the valley and limit its use to agricultural purposes. The owners of those ranches have sold a right to a third party to restrict any future use or utilization of their property for other than agricultural purposes. That restriction on the use of ranch property can be enforced by the purchaser of the restriction and its successors in interest. Likewise, in the instant case, the restriction on ever being able to drill a well can be enforced by the purchaser of the restriction and its successor in interest, to wit: WNI and its successor in interest, the DOE.

These types of servitudes (institutional controls) are durable and enforceable. "A servitude is valid unless it is illegal, unconstitutional, or violates public policy." §3.1 Restatement of the Law Third, Property (Servitudes) (ALI 2000) The obvious type of servitude which does not pass muster is a restrictive covenant in an housing development or subdivision which prohibits purchase based upon race, color or creed. Any legitimate restrictive use set forth in a covenant or easement can be enforced.

The land on the map which is color coded red has the same status as that just discussed for the land color coded yellow except that the restrictive covenant prohibits any water wells which could be used for domestic consumption. Arguably, stock wells could be permitted. It should also be noted that passive restoration of the ground water will occur within 50 to 75 years for the area coded in red.

The servitudes discussed in this transmittal are as durable and enforceable as other easement and covenant servitudes which we verbally discussed-such as road or pipeline rights of way, utility easements, etc. They are all interests in real property which the seller has transferred to a third party and which restrict the future use of seller's land.

The only land within the Proposed Long-Term Control Area wherein a real property interest would not be conveyed to DOE upon license termination is the cross-hatched white area denoted Red Mule. This land area is presently comprised of 13 different owners, some of whom live on the property and have domestic wells. Some of the property is vacant. For this parcel, WNI has proposed providing an alternative water supply. Such an alternative water supply would not be needed, if at all, for at least 100 years. However, the cost of the alternative water supply would be funded by WNI at the time of license termination. There is no doubt that the site custodian can guarantee that anyone in Red Mule can be made aware if and when site derived constituents adversely affect the ground water. An up gradient monitoring well checked on a periodic basis will provide ample warning.

There is also no doubt that future residents of Red Mule can be guaranteed an alternate water supply. The water supply could be from the Jeffrey City water supply via pipe or from an alternate well from the south. Notification and an alternate water supply does provide reasonable assurance for the protection of public health, safety and the environment. Reasonable assurance does not require the ability to keep people from using contaminated water if they are on notice and have a cost free alternative.

Even though it may have been provided you before, for additional reference, I enclose a copy of a 1/7/2000 transmittal from WNI to the NRC which discusses Red Mule and institutional controls. I also enclose a copy of a letter from Anthony T. Thompson to the NRC which discuses the adequacy of WNI's institutional controls. Finally, I enclose a copy of DOE's March 2000 Long-Term Surveillance and Maintenance Program Report which outlines DOE's undertakings for monitoring institutional controls.

Very truly yours,

SHAVER & LICHT

Harley W. Shaver

HWS/vw

Enclosures

c: Arthur Kleinrath w/enc.
John-Peter Gilmore w/enc.
Donald Metzler wo/enc.
Mark Plessinger w/enc.

bcc: T. Thompson
L. Coete
L. Millee