U.S. Nuclear Regulatory Commission Request for Additional Information
Strata Energy, Inc. Ross ISR Project Application for a U.S. Nuclear Regulatory Commission Source and Byproduct Materials License

Section 1

1 Verify the Maximum Process-Flow Throughput and Annual Yellowcake Production

Please confirm that the application is a request for 7,500 gallon per minute maximum instantaneous process-flow throughput exclusive of restoration fluids, and a maximum annual production of dry yellowcake (U_3O_8) of 3 million pounds.

Basis: The maximum flow throughput and annual production will be included as a standard license condition. This RAI is intended to avoid confusion in the language for that license condition.

Section 2.1

2 Definition of Controlled Area

Please clarify Strata's definition of controlled and secured areas.

Basis: On Page 2-2, Strata defines "controlled areas" as a subset of a restricted area; however, that definition is not consistent with the definition of a controlled area in 10 CFR Part 20. The definitions used by Strata must coincide with those in the regulations.

3 Definition of Wellfield, Mine Unit, Module

Please clarify the extent of wellfields (production areas) and associated perimeter monitoring wells for each wellfield.

Basis: Figure 2.1-3 depicts the approximate wellfield perimeter areas and potential future wellfield development. The total area depicted in that figure encompasses over 640 acres and is quite generalized. For example, the areas include monitoring well rings but the staff is unable to verify the distance between the wellfield and monitoring well ring(s). Figure 3.1-2 delineates aerial distribution of the known and future recoverable mineral ore bodies within the license area, which is consistent with the total area of the proposed wellfields as listed in Section 3 of the application (90 acres).

Section 2.5

4 On-site Meteorology

Please expand the discussion on the on-site meteorology to include the following:

a) Provide justification or rationale that the location of the meteorological station 2 miles away and 150 feet above the CPP is adequate.

b) Explain what meteorological differences (i.e., wind speed, wind direction, etc.) can be expected to occur by locating the meteorological station as described by Strata versus the location of the CPP.

c) Explain how Strata arrived at the stability class used in the joint frequency distribution (JFD) (TR Section 2.5.1.2.3).

Basis: Regulatory Guide 3.63, Section C.1 states that quarterly and annual wind direction, wind speed, and atmospheric stability data should be compiled in joint frequency and joint relative frequency (i.e., decimal frequency) form for heights representative of effluent releases and those stability categories should be established to conform as closely as possible to those of Pasquill. Strata followed the format suggested in the regulatory guide to report the quarterly and annual JFD for each stability class, but did not report the relative frequency of each stability class. Strata should report results summarizing the relative frequency of each stability class that represents the 100% of the annual data collected (e.g., Class A 1%, Class B 10%, Class C 30%, etc.).

Further, Strata stated in ER Addendum 3.6-A that the meteorological report will include a JFD for the mine sites using Pasquill atmospheric stability classes, but does not discuss how the atmospheric stability class is determined. Regulatory Guide 3.63 Section C.1 states that methods such as insolation, cloud cover and wind speed (Pasquill-Gifford and similar methods), temperature lapse rate method, wind fluctuation method, split-sigma method, or Richardson Number, may be used to determine the atmospheric stability. Strata has provided insufficient clarity for the NRC staff to complete its evaluation of the meteorology data.

Although Strata stated in ER Addendum 3.6-A that "… no pronounced topographic features in the area that would create weather conditions significantly different between the meteorological station and the plant site," Strata has not provided sufficient justification for, or rationale behind, locating the meteorological station 2 miles from, and 150 feet higher than the proposed CPP, nor discuss the expected differences. The meteorological are fundamental parameters used in calculations by MILDOS. As stated in TR Sections 4.1.2 and 5.7.7.2, Strata used MILDOS calculations to estimate the maximum potential annual radiation dose to the public and will use the pre-operational baseline environmental monitoring program during operations to demonstrate compliance with 10 CFR Part 20 and Criterion 8 of Appendix A to 10 CFR Part 40.

Please revise Section 2.5 of the Technical Report to include the amended data documented in the February 2011 revision of Addendum 3.6-B of the Environmental Report (ML110800135) in addition to revisions to address this RAI.

5 Representativeness of the Long-term Meteorological Data

Please provide additional information to demonstrate that the on-site meteorological data are representative of long-term trends.

Basis: Strata collected data following guidance in Regulatory Guide 3.63; however, Strata did not demonstrate that the collection period for the on-site data was

representative of long-term conditions consistent with guidance in Regulatory Guide 3.63 or with NUREG-1569 Section 2.5.3 acceptance criterion (3). Strata compared the data collected at the Ross ISR Project to the data collected at the Gillette meteorology station. However, to demonstrate that the on-site data are representative of long-term conditions, Strata needs to demonstrate that the data collected at the Gillette station during the period of time which the Ross data were collected are consistent with the long-term data collected at Gillette as recommended in the regulatory guide. This Information is needed to demonstrate that adequate background data were collected per 10 CFR Part 40, Appendix A, Criterion 7.

Section 2.6

6 Additional Information for the Cross-Sections

Please project locations of ore bodies (as currently known) and model-predicted static and operational piezometric heads for the ore zone aquifer on the cross sections.

Basis: Strata provides an extensive collection of cross sections in Addendum 2.6-C. However, the cross sections do not include projections of ore bodies that would be subjected to ISR operations (as currently evaluated) or projections of the piezometric surface except at selected locations. This information is necessary to allow staff to understand the Strata's conceptual model of the project geology and hydrogeology consistent with guidance in SRP Section 2.6.2.

7 Former NUBETH R&D Project Injection Problems

Please provide additional supporting information for Strata's conclusion that the injection problems reported for the NUBETH R&D project are attributed to filtration issues.

Basis: Strata concluded that the injection problems at the former NUBETH R&D were attributed to filtration problems and that the technology available today would eliminate those problems. Based on the information supplied in the application, Staff cannot concur with the conclusion of Strata. Staff's review of historical documents for the NUBETH R&D project indicates that NUBETH requested a change from sodium-carbonate/bicarbonate-based lixiviant to an ammonium-carbonate/bicarbonate-based lixiviant near the end of the project. At that time, NRC staff approved this request in an Evaluation Report in which staff noted that the swelling and plugging of the aquifer may have been attributed to reactions between the sodium ion and clays in the formation (see Evaluation Report for Amendment 1 to License SUA-1331, ADAMS Legacy Library Accession No. 7905240855). This injection problem did not appear to hamper restoration efforts of NUBETH and thus is primarily an operational rather than safety issue. However, staff's safety evaluation must include an analysis that Strata has sufficiently addressed this issue and provided adequate assurances that safety will not be hampered if similar problems develop for a portion of a wellfield during future operations in accordance with 10 CFR 40.32(c).

8 Type Log

Please clarify the extent and thickness of the upper confining unit and the DM aquifer.

Basis: Figure 2.6-7 depicts a type log for the subsurface strata at the proposed Ross Project. While this type log may depict the geophysical signature of the ore zone, the type log is not located along any of the cross-sections lines (it is slightly off of Cross-Section D-D' (Figure 2.6-9 of the TR)). Also, the combined thickness of units LS through LN on the type log differs from that depicted on the cross-sections, and the DM aquifer is correlated to the "BFS" horizon on the type log but on Table 2.7-22 of the TR (and on several cross-sections) is also correlated with the FS unit. This information is required for staff to evaluate Strata's conceptual model of the geology consistent with guidance in SRP Section 2.6.3.

Section 2.7

9 Surface Water Quality/Stage for Stream in Basin B-13

Please provide additional information on the existing surface water quality and method used to estimate the 100-flood stage in the stream draining basin B-13.

Basis: Strata presents at least two cross sections for most streams in the watershed but not for the stream in basin B-3. This basin is important because the processing plant will be located within it. Because of the proximity of the processing plant to the stream, the probability for an impact to the stream could be slightly higher than other streams within the project area. Although a conservative baseline may be assumed without site-specific data, staff will require cleanup to that conservative baseline should the streams/soils be impacted in the future. Regulatory Guide 4-14 recommends sediment sampling upstream and downstream of the site for surface water passing through the site. NUREG-1569 Section 6.4.3(2) guidance for staff to evaluate background levels that are sufficient for conducting post-reclamation and final decommissioning radiological surveys and Section 5.2.3(8)(d)(v) guidance for staff to ensure permanent records on the site background levels are documented and maintained until license termination. Furthermore, information presented in the application is insufficient for staff to evaluate that the proposed engineering controls will be sufficient for safe operations during periods of high flow in accordance with guidance in NUREG-1623.

10 Small Depressions (Wetlands) Influenced by Groundwater

Please clarify and expand upon the statement on page 2-142 of the application that a significant number of the small depression areas identified in the wetland survey appeared to be "influenced by groundwater".

Basis: Strata discusses wetlands separate from surface water reservoirs but a comparison of reservoir sampling locations on Figure 2.7-7 with the delineation of wetlands on Figure 2.7-13 shows the relation, as would be expected (i.e., wetlands are commonly associated with surface water bodies). A generalized statement that a surface water body appears to be influenced by groundwater does not provide staff with sufficient understanding of the Strata's conceptual model of the pathway to the surface water bodies that is needed to establish a proper baseline from which future potential impacts are evaluated. Specifically, questions such as the following should be addressed:

a) Is the quality of a surface water body a result of groundwater discharge or residual concentrations due to evaporation of surface water?

b) Are the higher concentrations of various constituents in surface water at several upstream reservoirs a result of groundwater discharge or from surface water flow from an upstream location?

c) If the water quality at reservoir R-11 is derived from groundwater, is that groundwater from perched water table conditions?

The above specific information is needed for staff to evaluate the risks associated with environmental impact to the surface water reservoirs/wetlands consistent with guidance in SRP 2.7.1(1).

11 Conceptual Model of Regional Aquifer Quality

Please comment and/or provide additional information on Strata's conceptual model for the regional aquifer based on the following comments:

a) On Table TR 2.7-44, the list includes sampling at well "P21129P", however, the summary tables and location maps indicate the sample location is "P21128P"
b) Summarize the actual groundwater use of wells within 2 kilometers of the Ross Property. For example, Table TR 2.7-44 list wells "P71108W", SBWELL01" and "SBWELL02" as stock wells but the sampling field data indicate the wells are used for potable water supplies.
c) The highest uranium concentrations in groundwater at nearby wells were those detected at well P21128P, however, based on the total depth and report depth to water, the well appears not to be screened in the OZ aquifer.

Basis: Strata provides an analysis of the aquifers' water quality within the project area and nearby water supply wells which exceeds the minimum requirements for a materials license application. The information requested above is primarily for clarification of the data provided in the application for staff to complete its review in accordance with guidance in SRP 2.7.3.

12 Responses of the DM Aquifer to Pumping Tests at Well Clusters 34-18 and 14-18

Please clarify the "no effects" listing on Table 2 of Addendum 2.7-F of the Technical Report for the well in the DM aquifer during the pumping tests at well clusters 34-18 and 14-18.

Basis: In the narrative of the application, Strata lists a response at the DM well at location of well clusters 34-18 and 14-18, as "apparent" and "apparent minor" drawdown, respectively, which is not consistent with the no effects listing in the table. Strata attributed the "apparent" drawdown to boreholes but did not provide additional supporting evidence, e.g., survey of the nearby boreholes for abandonment, a second pumping test following abandonment, or numeric modeling of the impacts. The

information requested above is primarily for clarification of the data provided in the application for staff to complete its review in accordance with guidance in SRP 2.7.3.

13 Hydraulic Conductivity Calculations, Partial Penetration/ Asymmetry

Please clarify, justify and/or provide rationale for Strata's estimation of the hydraulic conductivity of the ore zone based on screen thickness.

Basis: Strata analysis of the pumping test data included calculations of the hydraulic conductivity using the screen thickness of the observation/pumping well. Because the well screen thickness is less than the aquifer thickness, the resulting hydraulic conductivity may overestimate the actual hydraulic conductivity of the aquifer. Conversely, analyzing data from a pumping well, which was the only well for several tests, may underestimate the hydraulic conductivity due to increased observed drawdown attributed to well efficiency. Strata did not discuss these factors in their evaluation as well as other factors (e.g., the effect of partial penetration of the wells and/or vertical anisotropy due to layering of mudstone with sandstone lenses). The information requested above is primarily for clarification of the data provided in the application for staff to complete its review in accordance with guidance in SRP 2.7.3.

Section 2.9

14 Background Radiological Characteristics

Please provide additional information to support the analytical error contention for results of the Pb-210 and Th-230 analyses on sediments from sampling location SW-1-SED.

Basis: Strata collected surface water samples in several large impoundments and selected stream channel locations within the project area. Although surface water is found throughout the year in the impoundments, Strata reports that the streams are ephemeral or intermittent. Because of the ephemeral nature of the streams, Strata modified their surface water sampling program from that recommended in Regulatory Guide 4.14 and as a result, did not include the analyses of Pb-210 and Th-230 for surface water at surface water sampling location SW-1. Results of sediment sampling along the stream channel at that location yielded elevated Pb-210 and Th-230 levels which Strata attributed to analytical error based largely on gross alpha levels. However, because of the limited data provided in the application, Staff can not verify that the analytical results are in error and thus determine that an adequate baseline has been established for the sediments in the stream in accordance with guidance in SRP Section 2.9.3.

Section 3.1

15 Surface Water Diversion around the CPP

Please provide additional information on the diversion of surface water around the central processing plant.

Basis: Strata plans to divert surface water south of the proposed CPP location. The information provided in the application consists of an estimate of the 100-year flood event and a figure with hydraulic calculations for the sizing of a proposed culvert. This information is insufficient for staff to complete its review as it does not clearly identify the contributing drainage area, channel depth, anticipated maximum flow depth, culvert inlet and culvert outlet structure, or the details of the calculations. (Note: Staff will evaluate the plans in accordance with applicable guidance in NUREG-1623).

16 Results of the Geotechnical Investigation

Please provide results of the geotechnical investigation for staff to review safety impacts of the proposed dewatering system in the area of the proposed CPP.

Basis: Strata proposes a conceptual system of a "containment barrier wall" and de-watering system to lower the water table in the area of the processing plant but did not provide details regarding the dewatering system itself. It is the staff's understanding that Strata performed a geotechnical investigation to gather site-specific information for the de-watering system design. Staff needs this information to evaluate the safety impacts of the system to verify that the dewatering system can operate safely and not negatively impact the other facilities located within the "containment barrier wall." The geotechnical investigation should address items such as: amount of water to be removed; number of wells needed; target water level; type of "containment barrier wall", handling of water removed from inside "containment barrier wall", monitoring features; and contingency plans if the "containment barrier wall" does not function as designed. As part of the investigation, please also provide rationale for selecting a site that requires extensive engineering controls for the CPP location. This information is needed for staff to determine that the proposed setting is consistent with guidance in Regulatory Guide 3.11, NUREG-1623 and NUREG-1569 Section 3.1.3.

17 Line Drive Drawdown

Please provide more information on the use and restrictions on the use of line-drive patterns and the ability to maintain an inward gradient.

Basis: On page 1-6 of the TR, Strata proposes line drive patterns in a wellfield where the ore body is narrow and elongated. On page 3-12, Strata states that during its modeling exercise, the line-drive patterns had greater flare and thus will minimize their use. In the numeric groundwater modeling report (Addendum 2.7-H), Strata only qualitatively states that the extent of flare is related to wellfield shape. The information supplied by Strata is insufficient for staff's evaluation of the potential fluid migration induced by the line drive patterns. This information is necessary for staff to evaluate Strata's proposed operation will be conducted in accordance with 10 CFR 40.41(c).

18 Oil-Reservoir Water Supply Wells

Please clarify, with sufficient detail, alternatives contemplated by Strata for ISR operations with or without the operation of on-site Merit Energy oil-reservoir water supply wells.

Basis: In Section 7.1.1.3 of the Technical Report, Strata indicates that the three water supply wells for the enhanced oil recovery may be affected by the ISR operations and Strata will work with the oil production company to provide an alternate supply of water or method for enhanced oil recovery. In Addendum 2.7-H, Strata states that the current goal is to discontinue use of the water supply wells prior to ISR operations but does not provide any supporting information for any alternative water supply. Strata notes that ISR operations in close proximity to the wells could affect the available capacities for the water supply wells and, in turn, that the water wells could impact ISR operations in close proximity. Staff cannot evaluate the safety implications of the operation of those water supply wells based on the data provided in the application. This information is necessary for staff to evaluate that Strata's proposed operation will be conducted in accordance with 10 CFR 40.41(c).

19 600-foot Spacing/distance to Wells in the perimeter ring

Please provide additional justification for adequacy of 600-foot spacing for wells in the perimeter ring.

Basis: On pages 3-19 and 5-82, Strata states that spacing of 400 to 600 feet is sufficient to detect hydraulic anomalies (associated with excursions). On page 5-83, Strata indicates that information to be contained within the wellfield data package includes sufficient justification for the spacing and offset distances for the perimeter well ring. In Addendum 2.7-H, Strata indicates that the spacing up to 600 feet is adequate to detect an excursion because the head changes at 600 feet are similar to those at 400 feet.

Staff has determined that the information submitted is insufficient to support a "default" spacing of 600 feet. First, the staff acknowledges that Strata did not specifically state that the 600-foot spacing was the "default" spacing; however, such an interpretation can be made on the presentation of data in the application (e.g., Figure 3.1-14 of the TR). Second, Strata's argument that the 600-foot spacing is adequate is based on model-predicted hydraulic heads and not based on timing for fluid migration during an excursion. Third, the argument that hydraulic head changes at 600 feet are similar to those at 400 feet is not sufficient to prefer the 600-foot distance over the 400-foot distance. A rationale for selecting 600-foot distance should be made based on an evaluation that the 600-foot distance is better than the 400-foot distance for an early detection of unwanted fluid migration. This information is needed for staff's evaluation guidance in SRP Sections 3.1.3 and 5.7.8.

Section 4.1

20 Radon Monitoring in the Buildings

Please provide justification for not using instrumentation designed to detect radon gas buildup in buildings consistent with review and acceptance criteria in SRP Sections 3.3.2 and 3.3.3, respectively.

Basis: In TR Section 4.1.2, Strata states that radon gas may potentially be released in the central processing plant (CPP) as a result of solution spills, filter changes, ion exchange (IX) resin transfer operations, and maintenance activities, and that routine

monitoring of radon progeny, as described in TR Section 5.7.3.2, will identify exposure levels and initiate corrective actions, if necessary, to ensure exposures of workers are maintained as low as reasonably achievable (ALARA) in accordance with 10 CFR 20.1101(b). Strata will only measure the radon progeny present at the time of sampling to demonstrate compliance with the regulatory occupational exposure limits. The proposed instrumentation will not be able to demonstrate ALARA. Strata has not described the instrumentation and control systems designed to detect radon gas buildup in buildings that are consistent with SRP Sections 3.3.2 and 3.3.3. The uranium industry has commonly used radon progeny continuous working level (CWL) monitors and alarms as warning devices and indicators of increasing radon progeny concentrations in processing plants. The monitors have allowed licensees to identify the progeny source and reduce elevated concentrations within the plant to ensure occupational exposures are minimized and maintained ALARA.

21 Engineering Controls to Limit Radon in the Buildings

Please provide the flow rate for each primary and redundant exhaust fan expressed volumetrically per unit time (i.e., cubic feet per minute, liters per hour, etc.)

Basis: In TR Section 4.1.2, Strata stated that redundant fans will be of identical size and capacity and will operate only when primary fans are down for repair or maintenance. Strata did not provide any flow rates for the primary and the redundant fans. Regulatory Guide 8.37, Section C.3.1 states that, when practicable, releases of airborne radioactive effluents should be from monitored release points (e.g. monitored stacks, discharges, vents) to ensure that the magnitude of such effluents is known with a sufficient degree of confidence to estimate public exposure. The flow rate(s) from fan(s) is one of several parameters that can be used to calculate and compute potential releases of radioactive material, including radon.

22 Emissions from the Drying and Packing Area

Please describe (1) how the air from the yellowcake drying and packaging area communicates within and outside the restricted area, and the air to the environment; and (2) how Strata will comply with 10 CFR 20.1101(d).

Basis: Strata stated in TR Section 4.1.3 that dryers emit no airborne particulates to the environment. Strata further stated that vented off-gas from the drying procedure will be filtered through a baghouse filter, and then cooled and scrubbed to remove small entrained particles and water vapor. Entrained particles in the baghouse fabric and scrubber water are returned to the process. The vacuum pump at the end of the off gas train discharges into the dryer room. NRC staff cannot determine how air in the yellowcake drying and packaging area communicates with the air within and outside of the restricted area of the facility, and specifically, air to the environment. Notwithstanding the statement in NUREG-1910, which states that the emission of radionuclides particulates from this technology is essentially zero, Strata needs to take into consideration the emission factors in Regulatory Guide 3.59, Appendix B to predict the estimated controlled releases from yellowcake facilities to demonstrate compliance with the dose constraint 10 CFR 20.1101(d) prior to operations.

Section 4.2

23 Liquid Waste Disposal Options

Provide additional information on the plans for disposal of liquid wastes as discussed below:

a) **General**: Strata has identified plans for disposal of brine waste by storage in retention ponds and eventual disposal in deep wells with the possibility of alternative disposal options. However, the technical report is not clear on the specific details on the plans for disposal of excess permeate waste. Strata only indicates that after placement in the retention ponds, the excess permeate may be used either as plant make-up water or disposed of through surface discharged, a land application system, or in the deep wells with the brine and any other byproduct material liquid wastes. Strata needs to provide a clear plan on which option(s) will be used for the excess permeate to enable staff to evaluate each option. The details of those options need to be completed and included in the report.

b) **Surface Discharge**: Strata is considering the option of obtaining a Wyoming Pollutant Discharge Elimination System (WYPDES) permit to discharge excess permeate to tributaries of the Little Missouri River. If this discharge is planned, Strata needs to make clear statements indicating so, and provide information consistent with the Standard Review Plan (SRP) Section 6.1.3, criterion (13), i.e. information to allow demonstration that doses are ALARA. Prior to license issuance Strata will need to provide evidence that it has obtained the necessary permits.

c) **Land Application**: Strata is considering the disposal option for the excess permeate by land application for crops**.** If land application is planned, Strata needs to make clear statements indicating so, and provide information consistent with SRP Sections 4.2.3, Criterion (1), and 6.1.3, Criterion (12). These criteria require, among other information, that Strata provide:

   (i) a description of the waste including its physical and chemical properties that are important to risk;
   (ii) a description of the proposed manner and conditions of waste disposal;
   (iii) an analysis and evaluation of pertinent information on the affected environment;
   (iv) information on the nature and location of other facilities likely to be affected; and
   (v) analyses and procedures to ensure that doses are maintained as low as is reasonably achievable and within the dose limits in 10 CFR 20.1301.

d) **Deep Wells**: Strata has received permits for 5 deep disposal wells for liquid wastes as a disposal option for excess permeate and brine. Use of deep disposal wells requires an NRC finding that Strata meets the requirements in 10 CFR 20.1301 and 20.2002. As identified in 10 CFR 20.2002, because Strata is seeking approval for a waste disposal method under this regulation, it needs to provide the following:

(i) a description of the waste containing licensed material to be disposed of, including the physical and chemical properties important to risk evaluation, and the proposed manner and conditions of waste disposal;
(ii) an analysis and evaluation of pertinent information on the nature of the environment;
(iii) the nature and location of other potentially affected licensed and unlicensed facilities; and
(iv) analyses and procedures to ensure that doses are maintained ALARA and within the dose limits of 10 CFR Part 20, including those in 10 CFR 20.1301.

e) **Deep Wells**: Strata has indicated that each deep well location would include a 250' by 250' pad of asphalt or gravel, and one or more storage ponds or tanks. Strata needs to provide more information on these potential tanks or ponds**,** including the type, number, and location of the storage facilities, and details of their design as necessary depending on their type. Note that any ponds proposed should contain the information identified in "f) Retention Ponds" below.

f) **Retention Ponds**: Ponds are planned as part of the waste storage infrastructure at the proposed Ross project area to manage permeate and brine inflows, to optimize disposal techniques, and to provide for waste storage in the event of accident conditions. Strata has indicated that final pond designs will be included in a separate facilities design report, submitted at a later date following further evaluation through geotechnical drilling programs. The information submitted by Strata is insufficient for staff to complete its review. Therefore, Strata needs to provide the following necessary information on the ponds:

Site and material characterization
Cell design
Configuration and location
Slope stability analysis
Settlement
Liquefaction potential analysis
Pond storage/freeboard analysis
Surface water diversion design
Erosion protection design (embankment slopes and diversion ditches)
Liner design
Leak detection system design
Hydrostatic uplift analysis
Containment barrier wall design and construction
Dewatering system design
Construction specifications
Quality control testing program (methods and frequencies)
Operational inspection plans
Closure plans

(Note: Staff recognizes that Strata committed to evaluating use of a double geosynthetic liner system in response to WDEQ's RAIs with regard to a Wyoming permit application. Staff is assuming that the text in the NRC license application will

be modified accordingly. If natural materials are to be used, the properties must be consistent with criteria listed in Regulatory Guide 3.11 Section C.1.)

g) **Retention Ponds**: Strata indicates that a minimum freeboard depth of 3 feet will be sufficient to capture direct precipitation resulting from the 100-year, 24-hour storm and protect the embankment from wave run-up. Regulatory Guide 3.11 indicates that if impoundments are designed to contain only direct precipitation that falls into the reservoir area, a single occurrence of the 6 hour probable maximum precipitation (PMP) may be used to determine storage capacity and freeboard requirements. Strata needs to provide justification for choosing an alternative storm event for its freeboard considerations.

Basis: Strata provided a general description of the potential disposal options for liquid byproduct material. The descriptions lacked detailed information for Staff to evaluate and find that each proposed option will be conducted to meet requirements of 10 CFR Part 20 and Part 40.

Section 4.3

24 Solid Byproduct Disposal Agreement

Please confirm that Strata understands that obtaining a solid byproduct waste disposal agreement prior to any construction will be included as a license condition should the license application be approved if a solid byproduct waste disposal agreement is not documented prior to completion of staff's review and issuance of a license.

Basis: In Section 4.3, Strata committed to acquiring a solid byproduct waste disposal agreement prior to construction; however, such an agreement has not been finalized at this time. Finalizing such an agreement needs to be done prior to commencement of operations at the facility.

25 Commitment to 10 CFR Part 71 Transportation Requirements

Please state that Strata will comply with applicable requirements of 10 CFR Part 71.

Basis: In Sections 4.3.3 and 5.7.6.3.1, Strata commits to ensuring that procedures will include careful control of all materials delivered to or transported from the proposed Ross ISR Project area in accordance with US DOT requirements, but does not refer to 10 CFR 71.5, Transportation of Licensed Material. That section references DOT regulations other than those specifically cited by Strata. Strata needs to document with sufficient clarity commitments for meeting applicable 10 CFR Part 71 regulations

Section 5.1

26 Corporate Organization

Please clarify the apparent discrepancy in the titles and duties for the "General Manager" and "Manager of Wyoming Operations" in Section 5.1.

Basis: The application describes the "General Manager" as the manager responsible for all uranium production activities at the various project sites. The General Manager is not shown in the organizational chart, Figure 5.5-1. However, there is a position labeled "Manager of Wyoming Operations," which is not described in the text.

27 QA Manager

Please revise the Organization Chart to identify the QA Manager.

Basis: The organization chart, Figure 5.1-1, does not identify personnel responsible for quality assurance as recommended in Regulatory Guide 4.15.

Section 5.2

28 SERP Documentation

Please provide additional information on the annual documentation on the SERP decisions to be supplied to NRC.

Basis: On page 5-14, Strata commits to submitting to NRC an annual report "summarizing" all SERP actions including replacement pages for the application. Staff is required to review the SERP actions during compliance inspections and a simple summary without supporting documentation may be insufficient for staff to review in preparation of the inspections.

Sections 5.4 and 5.5

29 Education and Training for an RSO-designee

Please provide a description of the training and education requirements for the Radiation Safety Officer (RSO)-designee in Section 5.4 and training program for the RSO-designee in Section 5.5. For an exception to the standard license condition that requires following Regulatory Guide 8.31, the following information should be included in the application:

a) Provide the training program for designees that is in addition to the standard radiation worker training required for all employees. Considering that Regulatory Guide 8.31 provides academic and experience requirements for radiation safety staff, the designee training should be a subset of the academic training, facility-specific training, and experience required by full radiation staff.

b) Please provide the objective manner in which Strata assesses a potential designee's ability to perform the required tasks. Strata must develop this assessment in a manner that will allow the NRC staff to determine compliance with Strata's commitments.

c) Discuss the manner in which Strata will document a designee's qualifications, to allow the NRC staff to determine whether a designee has successfully completed the required qualifications program and is maintaining such qualifications. Be clear in

describing training for proficiency in identifying radiation safety or other potentially hazardous problems that are part of the designee's duties.

d) Ensure academic studies, training and experience required to address unusual or emergency conditions because the designee is acting as an agent of the radiation safety staff, when the RSO and RST are not present at the facility. As such, certain unusual or emergency conditions may occur in the absence of the RSO and RST including leaks, spills, and skin contamination.

Basis: Strata stated that all operating procedures will be reviewed and approved in writing by the RSO (or qualified designee in the absence of the RSO) prior to being implemented and, in TR Section 6.4.5, a designee may replace the RSO or Radiation Safety Technician (RST) during decommissioning activities where a potential radiation exposure hazard exists. However, Strata has not described the training and education requirements of the designee in Section 5.4 nor the training program for the designee in Section 5.5. A standard license condition in uranium recovery licenses requires licensees to follow the guidance set forth in Regulatory Guide 8.31, "Information Relevant to Ensuring That Occupational Radiation Exposures at Uranium Recovery Facilities Will Be as Low as Is Reasonably Achievable" (as revised), or NRC-approved equivalent. This license condition requires a designee to meet the same education and training requirements as the RSO and RST unless an exception is approved. Strata will need to specify the education and qualifications, as well as the training program in order to be granted an exception to this standard license condition.

Sections 5.7.1 and 5.7.7

30 Verifying Estimates of Radionuclides in Effluent at Source Areas during Operations

Please discuss how, in accordance with 10 CFR 40.65, the quantity of the principal radionuclides from all point and diffuse sources will be accounted-for in, and verified by, surveys and/or monitoring.

Basis: In Section 5.7.1 of the TR, Strata states that during operations, it will use MILDOS-AREA calculations to estimate radionuclide source terms and calculate off-site dose to the public, in accordance with NRC guidance, such as Regulatory Guide 3.59 and NUREG-1569, and will report the calculated doses in its semi-annual report to the NRC, as required by 10 CFR 40.65. Justification for using MILDOS-AREA dose calculations to determine airborne source terms is based on the lack of evidence for public exposure from radon releases in excess of 10 CFR Part 20 limits during the past 30 years of ISR operational experience in the United States. Strata did not commit to measuring concentrations of radioactive material or radioactivity at the source areas to determine the total quantity of radionuclides, including Rn-222, released to the environment during operations to demonstrate compliance with 10 CFR 40.65, but plans to collect radon and air particulate samples as part of the operational environmental monitoring program at the site boundary to validate the modeling results.

Monitoring at the site boundary is insufficient to meet all guidance in Regulatory Guide 3.59 and demonstrate compliance with 10 CFR 40.65. While the staff agrees that

licensees are permitted to estimate doses (i.e., MILDOS-AREA), the calculations including assumptions of the source-area contributions, must be confirmed through periodic sampling; otherwise, the staff cannot verify with sufficient certainty that doses to the public are below the 10 CFR 20.1301 limits. The sampling of effluents is a clear recommendation in staff's guidance (e.g., Regulatory Guide 3.59 states that the staff prefers "reliable monitoring data when available") and will be required during operations.

Section 5.7.2

31 Beta Surveys

Please provide information that (1) demonstrates what the scan minimum detectable concentration (MDC) for alpha measurements is, and (2) relates the beta activity to the measured alpha activity.

Basis: Strata's plan to not conduct beta surveys is not consistent with 10 CFR 20.1501 (survey for potential hazards) or Regulatory Guide 3.46 (Standard Format and Content for ISRs). If Strata proposes to only survey for alpha, the applicant will need to (1) demonstrate what the static and scan MDC for alpha measurements are, and (2) either (a) propose measuring betas, or (b) relate the beta activity to the measured alpha activity. In order to have a relationship of alphas to betas, the applicant will need to account for all sources of alphas and betas, including potential alpha and beta sources that are not in equilibrium with the uranium. This would apply to personnel and the release of items for unrestricted use.

32 Radiological Survey Equipment

Please provide a list of both gamma exposure rate and beta dose rate meters and demonstrate how those meters satisfy the minimum specifications as proposed by Strata.

Basis: Strata states the minimum specifications for equipment to be used for external radiation surveys but does not include a listing of equipment that will used and how they meet those specifications consistent with guidance in NUREG-1569 Section 5.7.2.3.

33 Acton Levels for Personnel Dosimetry

Please describe action levels for the monthly or quarterly personnel dosimetry monitoring.

Basis: Strata did not establish, nor describe in the application, action levels for the dosimetry monitoring program above which the RSO should determine the cause and/or corrective actions. Establishing such actions levels for a monitoring program is found in guidance of Regulatory Guide 8.30, Section 4.6.

34 Categories for Personnel Dosimetry Monitoring

Please clarify the categories of personnel for the dosimetry monitoring program.

Basis: In Section 5.7.2.3 of the Technical Report, Strata states that regular plant workers will be provided personal monitoring devices (TLDs or OSLs) and, further, will issue dosimeters to all process employees and will exchange and have them analyzed on a quarterly basis. NRC staff cannot interpret what Strata means by "regular employees" or "all process employees". Is there a difference between these two groups of workers? Strata needs to be consistent in identifying the workforce and Strata needs to break down the workforce (including contractors and visitors) by category. It is recommended that Strata supply a table that list the different types of workforce and columns that identify those that will be issued personnel dosimetry (and bioassays) consistent with guidance in Regulatory Guide 8.34, Section B.1.2.

Section 5.7.3

35 Excluding Th-234/Pb-210/Po-210 from the Air Particulate Monitoring Program

Please provide justification for excluding Th-234, Pb-210, or Po-210 from the air particulate sampling program.

Basis: Strata stated that in order to establish that natural uranium isotopes are the exclusive alpha emitting radionuclides of concern in air, composite samples from several air particulate monitoring locations will be collected and characterized. According to Strata, these sample locations will adequately characterize various points in the process (e.g., lixiviant, precipitation, and drying/packaging areas). Strata will analyze the air samples for natural uranium, Th-230, and Ra-226. NRC staff notes that Strata did not include Th-234, Pb-210, and Po-210, which are U-238 and Rn-222 decay products that could be present in the CPP following spills or failure to prevent radon build-up in the building.

Whereas in a conventional mill Th-230 is in secular equilibrium with U-238 and U-234, it is unlikely to be measured in an ISR plant because thorium is extremely insoluble and not observed to appreciably leach from the ore into groundwater or lixiviant. The half-lives of U-234 and Th-230 are too long to generate build-up of Th-230 from the decay of U-234 in the plant. Therefore, Th-230 build-up within the CPP is unlikely, however, Th-234, a U-238 progeny and beta-emitter with a 24 day half-life, approaches secular equilibrium with U-238 within 90 days. Radon-222 decays to several solid particles that tend to be electrically charged and can deposit on surfaces or attach to dust particles and build-up in if the ventilation is not adequate to ensure complete air exchange. Lead-210 and Po-210 are longer lived radon progeny that may be detected in air samples. Although, Th-234 and Pb-210 are beta emitters, including these isotopes in the analyses may support Strata's assumptions on the presence of beta contaminants in the plant. By conducting isotopic analyses of air samples and including longer lived radon progeny Po-210 and Pb-210 in the analyses, the staff finds that Strata can obtain data to support Strata's assumptions (a) that radon will be the primary airborne radioactive material present and (b) that natural uranium will be the primary air particulate present to be used in dose calculations to comply with 10 CFR Part 20.

Section 5.7.6

36 Radiological Limits for Unrestricted Releases of Equipment and Material

Please clarify a commitment to an action limit for beta/gamma contamination limits for releases to unrestricted areas for equipment and materials.

Basis: Section 5.7.6.3 is lengthy and in the final paragraph, Strata states that applicable recommendations provided in Regulatory Guide 8.30 will be integrated into the Ross ISR radiation protection program. For releasing potentially contaminated items, Strata states in Section 5.7.6.3 of the Technical Report that the RSO or HPT will survey these items before they are released from the facility and discusses the merits of surface contamination limits from Regulatory Guide 1.86, Regulatory Guide 8.30, and NRC Policy and Guidance Directive FC 83-23, but does not commit to a contamination limit to be applied for release of equipment and materials from restricted areas for beta/gamma surface contamination. Strata needs to make a commitment with sufficient clarity to apply action limits for beta/gamma contamination limits for releases to unrestricted areas for equipment and materials in accordance with 10 CFR 20 Subpart F and NRC Policy and Guidance Directive FC 83-23.

Section 5.7.8

37 Excursion Monitoring

Please clarify the following statements regarding the excursion monitoring program:

a) on page 5-87, please clarify that, under item “1)”, the reference to the “deep and shallow monitor well" refers to wells in the underlying and overlying aquifer, respectively.
b) on page 5-87, text in item “3)” is not consistent with text on page under “Excursion Verification and Corrective Action” heading on page 5-90 with respect to potentially only two confirmatory samplings.
c) on page 5-89, the narrative states that Wyoming Guideline 4 permits “UCLs [to be] set at 20% above the maximum baseline concentration”. Please review this statement for accuracy.
d) on page 5-89, the narrative states that a UCL may be determined by adding 15 mg/L to the baseline average. However, this UCL calculation is limited to chloride (see Wyoming Guideline 4).

Basis: In accordance with guidance in NUREG-1569 Section 5.7.8.2, staff must evaluate whether procedures describing the excursion monitoring program are sufficient.

38 Baseline Data and Perimeter Well Ring in the Wellfield Data Packages

Please provide detailed information on procedures and process for compiling the baseline data in the wellfield data packages.

Basis: Strata proposes that the project consists of two mine units with a total number of baseline wells based on the total wellfield area within the two mine units. The total area

of the mine units occupies approximately 90 acres. Although NRC does not regulate the areal extent of "a wellfield", Staff is unclear on the process by which Strata will sequentially develop data for a mine unit. For example, will Strata install all production, injection and monitoring wells prior to commencing any principal activities? Will a single perimeter well ring serve each mine unit? If so, how will the perimeter wells provide timely detection of an excursion if the closest principal activity in that mine unit was up to one mile away from wells on that ring. If the wellfield baseline wells were based on the 24 wells, how would Strata handle outliers and the fact that several ore bodies would not have any baseline monitoring? Is baseline for a mine unit based on a wellfield average or well-by-well basis? Strata's conceptual layout of the wellfelds (e.g., Figure 3.1-1) indicating that perimeter well rings surround individual ore bodies and the text on page 5-88 suggesting baseline on a production unit basis, suggest that the basic baseline unit (a production zone within a perimeter ring) is on an ore body basis. That depiction differs from the concept that the basic unit is the mine unit.

In addition, Strata proposes that boreholes within the area of influence (AOI) of the wellfield aquifer testing will be abandoned. First, Strata does not define an AOI. Second, an AOI as was defined for the regional pumping test at 12-18 would not be adequate for a wellfield aquifer testing. Third, either by license condition or by commitment by Strata, to the extent practicable, all boreholes will be properly abandoned within 0.25 miles of a production unit. This information is necessary for staff to evaluate that Strata's proposed operation will be conducted in accordance with 10 CFR 40.41(c).

Section 6.1

39 Restoration Wells

Please clarify the wells used to establish restoration of the ore zone.

Basis: In Section 6.1 of the TR, Strata states that restoration baseline water quality will be based on representative recovery wells. In Section 3.16, Strata states that:

> "[the OZ] *baseline wells will likely resemble the observation wells installed for the multi-well aquifer test with more limited, gamma based completions. These wells will be utilized as recovery wells during ISR operations.*"

In Section 5.78, Strata indicates that the baseline wells consist of clusters with the ore zone wells screening the entire OZ aquifer. Typically, a selected set of injection and production wells are used to establish baseline, restoration and stabilization for a particular wellfield. If Strata is proposing special monitoring wells to establish baseline, restoration and stabilization, then Strata needs to commit that those wells will be completed at the same horizon as the injection and production wells and will be located within the production area. This information is needed for staff to evaluate that Strata's proposed program is sufficient to meet requirements of 10 CFR Part 40 Appendix A Criterion (5).

Section 6.2

40 Decommissioning Plan to Include Structures and Equipment

Please clarify that the final decommissioning plan will include the decommissioning of structures and equipment.

Basis: Strata commits to preparing a final decommissioning (and reclamation) plan in Section 6.2 of the Technical Report but discusses procedures for removal and disposal of structures and equipment in Section 6.3 of the Technical Report. The final decommissioning plan must include that information in Section 6.3 in accordance with requirements of 10 CFR 40.42 and Part 40 Appendix A, Criteron 9. The application must include with sufficient clarity that the structures and equipment will be included in any decommissioning plan.

Section 6.4 and Addendum 6.4-A

41 RESRAD Output

Please provide the actual output data from the RESRAD simulation output including all input parameters and dose results.

Basis: In Section 6.4 of the Technical Report, Strata states that RESRAD Version 6.3 computer code was used to model the proposed project area and calculate the annual dose from the current radium cleanup standard. The last sentence in Section 6.4.1 on pg. 6-51 states that additional specifics inputted into the RESRAD model, including assumptions are provided in Addendum 6.4-A. Strata provided a general summary of the input data but did not include the actual RESRAD output in Addendum 6.4-A. Staff cannot evaluate and confirm the radium benchmark dose in accordance with guidance of Appendix E of the SRP using the resident rancher scenario as identified by Strata in Section 6.4 without the actual output data.

Section 6.5

42 Financial Surety

Please clarify the following information in Section 6.5:

a) although Strata has committed to meeting surety requirements as presented in Criterion 9 of 10 CFR Part 40, Appendix A, it has not identified a specific surety mechanism. This needs to be done prior to operation.

b) Section 6.5 indicates that cost estimates for well monitoring are based on procedures set forth in Section 6.1.2.6 of this report. There is no Section 6.1.2.6. Strata needs to correct this inconsistency.

Addendum 2.7-H

43 SA Aquifer

Please clarify that the "SA" aquifer as defined in Addendum 2.7-H differs from the SA aquifer as defined by the narrative in Sections 2.6 and 2.7 of the TR.

Basis: The SA aquifer defined in Addendum 2.7-H consist of the thin soils or alluvium that cover bedrock. The SA aquifer as defined in application narrative is the uppermost aquifer within the bedrock or alluvium. This distinction will lead to confusion if a requirement of NRC staff is to monitor the SA aquifer.

44 Model-Predicted Heads in Perimeter Wells

Please provide additional discussion on the model-predicted heads in the perimeter ring

Basis: Strata stresses throughout the application that based on the modeling effort, the anticipated responses to the piezometric heads at the monitoring well ring will be a good indicator of wellfield imbalance. However, the model-predicted heads immediately upgradient of the southwestern wellfield are higher than the model-predicted heads prior to ISR operations (compare figures 4.11-4 with 4.11-1). Strata uses this information for justification for the distance to and spacing of the perimeter well ring (see RAI # 19).

45 Vertical Anisotropy

Please provide additional discussion on the appropriateness of the vertical hydraulic conductivities used in the numeric model

Basis: In the numeric model, Strata generally uses a ratio of vertical to horizontal hydraulic conductivities of 0.7 for the ore zone aquifer. However, given the inter-layering of sandstones and mudstones, the ratio is expected to be less, likely on the order of 0.01. Strata reports a sensitivity analysis based on varying the vertical hydraulic conductivity of the ore zone, the sensitivity analysis appears to be limited to the model areas outside of the proposed Ross Project license area. The vertical anisotropy may have impacts on the design of the monitoring program, flare and drawdown expected at the wells especially for partially penetrating wells.

Addendum 6.1-A

46 Excess Permeate

Please justify the rationale for the assumption that excess RO permeate will be re-injected into operational units if the restoration were to be conducted by a third party without any operational units.

Basis: On Page 11 and 26, Strata proposes that RO excess permeate will be reinjected into modules in operation. However, the financial surety is established on the assumption that a third party performs the decommissioning and thus it is highly unlikely that any units will be in operation.

47 Number of Monitoring Wells

Please provide supporting calculations for 162 monitoring wells used in the financial surety calculations.

Basis: Strata did not provide the basis for 162 monitoring wells included in the financial surety calculations.

48 Costs for Two Synthetic Liners

Please revise the financial surety calculations to reflect a double synthetic liner system.

Basis: Strata proposes a dual liner system where the underlying liner may be synthetic or natural clay material. For a conservative approach, Strata will need to include the costs should a double synthetic liner be the final design.

Administrative Items

a) Please provide reference for the statement that the Little Missouri River Basin is 9470 square miles on page 2-130. The U.S. Geological Survey lists the basin as 9550 square miles.

b) The first paragraph on Page 2-97 includes a reference to Section 3.4; however Section 3.4 of the technical report consists of references. Please correct the reference.

c) On page 2-103, the reference to Table 2.6-1 is incorrect. The reference should be Table 1 of Addendum 2.6-E. Please correct.

d) Please provide a citation for the statement that "[d]issolved solids concentrations increase with depth and distance from the recharge sources" on page 2-144.

e) Please provide a citation for the statement that "TDS [is approximately equivalent to] 0.65 EC" on page 2-158.

f) Please confirm that the stream designation at J3 on Table 2.7-5 is correct.

g) On Table 3.1-1, please revise the range of pH in the lixiviant as ">6 to 8". This error is attributed to a typographical error in the source document.

h) On Figure 5.7-1, please verify that the title in the title block is correct.

i) On Table 6.1-5, please verify the maximum value for pH.

j) Appendix A in Addendum 2.6-E is missing.

k) In Addendum 2.6-E, please verify the reference tables are correct.

l) Please provide a date for submitting a Quality Assurance Plan that Strata commits to providing “during the license application review process”.