May 14, 2008

Mr. Ken Milmine
Manager of Environmental
& Regulatory Affairs, Wyoming
Uranium One
907 N. Poplar, Suite 260
Casper, WY 82601

SUBJECT: LICENSE APPLICATION REQUEST - ENERGY METALS CORPORATION'S MOORE RANCH IN SITU LEACH URANIUM RECOVERY PROJECT - REQUEST FOR ADDITIONAL INFORMATION (TAC JU0118)

Dear Mr. Milmine:

By letter dated October 2, 2007, Energy Metals Corporation, US (EMC) submitted a Source Materials License application to the U.S. Nuclear Regulatory Commission (NRC) for the Moore Ranch Uranium Project, a proposed *in situ* leach (ISL) uranium recovery operation in Campbell County, Wyoming. By letter dated December 20, 2007, we informed you that we completed our acceptance review of your application and found it acceptable for technical review. NRC staff has now completed a detailed review of the Technical Report supporting your application. Our review has identified deficiencies in the Technical Report and we will need additional information from EMC in order for us to complete our review of your license application.

We identified significant concerns related to both groundwater and radiological protection. Our most significant groundwater concerns relate to the absence of underlying shale in a portion of the production zone, the effects of coal bed methane produced water on surface and groundwater, the unconfined conditions in the production zone, and the estimate of the number of pore volumes that will be required to restore the production zone. Our most significant radiological protection concerns relate to the design objective of the ventilation system and the adequacy of radiological environmental monitoring.

The additional information needed in order for us to complete our review is identified in the enclosure. Within 30 days, please either provide the information requested or inform us of the date you expect to provide the information. We are available to meet with you to discuss the requested information.

If you have any questions concerning this letter, please contact me, either by telephone at (301) 415-6629, or by e-mail at mhf1@nrc.gov.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html.

Sincerely,

/RA/

Myron Fliegel, Senior Project Manager
Uranium Recovery Licensing Branch
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No. 40-9073

Enclosure: Request for Additional Information

cc: G. Mooney, DEQ

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Request for Additional Information
Energy Metals Moore Ranch Uranium Project

2-1. Site Location and Layout (Section 2.1)

The applicant has not provided sufficient information regarding the site location and layout in section 2.1, to enable the staff to fully understand this topic and to support other reviews dependent on that understanding. Specifically, the following information should be provided:

a. the coordinates of the central processing plant and the distance to Casper and other major population centers;

b. the total area within both the proposed license boundary and restricted area;

c. a topographic map of the entire proposed licensed area; and

d. a map of the main processing area showing the topography, site drainage, layout of and access to buildings, and proposed roads.

2-2. Meteorology (Section 2.5)

The applicant has not provided sufficient information regarding the meteorological and atmospheric diffusion characteristics of the site in section 2.5. Specifically, the following information should be provided:

a. the applicant indicated that no onsite meteorological data was collected at the Moore Ranch site but instead, used meteorological data collected from Antelope Coal (ACC) and Glenrock Coal (GCC) to represent the Moore Ranch site. However, the applicant has not discussed its basis to assume that the data can be used to represent the Moore Ranch site without any data from the Moore Ranch site. Therefore, provide the justification to use the data from these two sites (ACC and GCC), without onsite meteorological data, to represent the Moore Ranch site.

b. The joint frequency data for each site (ACC and GCC) are shown in Table 2.5-9 and Table 2.5-10 of the Technical Report, respectively. However, the joint frequency data in Appendix E appears to be different from the data shown in Tables 2.5-9 and 2.5-10. Please explain the relationship between the joint frequency data from these tables (Table 2.5-9 and Table 2.5-10) and the joint frequency data in Appendix E of the Technical Report. Specifically, how was the joint frequency data generated in Appendix E and what time period does it represent? Also describe the instruments, locations and heights of the instruments, average inversion height, and annual average mixing layer heights.

c. Please discuss any bodies of water or special terrain features that may affect the meteorological conditions at the Moore Ranch Uranium Project site.

2-3. Geology and Seismology (Section 2.6)

The cross sections and some geologic descriptions provided in section 2.6 are insufficient to interpret the geology of the license area. Please provide the following:

a. All of the cross sections redrawn to a MSL datum with surface elevations clearly shown to ensure their proper interpretation with respect to site topography.

b. Where possible, develop cross sections using more and deeper boring logs to better define the presence or absence of overlying and underlying shales, and sandstones. At least one cross section should show the coal bed methane (CBM) production zone relative to the proposed mining zone.

c. Where possible, the cross sections should also be lengthened past the edges of the well fields to at least the locations of the proposed monitoring well rings.

d. Redraw cross sections to show the "60 sand" which is located below the "68 sand" and the shale layer which separates them. Provide an isopach of the "60 sand" if possible.

e. Provide more cross sections which show the two deeper sand zones, the "50 sand" and "40 sand", and isopachs if possible. These sands are noted on cross sections C-C' (one well log) and E-E' (three well logs), but their interpretation is questionable given the minimal number of logs used to define them.

f. The isopach for the shale overlying the "70 sand" indicates it is missing across about 500 feet in Wellfield 3, just west of cross section B-B'. Please confirm this observation. If true, address the impact of its absence on hydrology and excursion monitoring of Wellfield 3 to determine if mining can be undertaken. (see also RAI 2-7.e.)

2-4. Surface Water Hydrology (Section 2.7)

The analysis of the surface water hydrology in the proposed license area is currently insufficient to determine the potential for floods to disrupt the operation of the facility nor to interpret the impact of mining on water quality in and around the license area. Please provide the following:

a. Provide maps clearly showing the location, size and shape of surface water features within the proposed license area, including the area around the central plant facility. Provide maps showing areas inundated during major flood events.

b. Provide maps which show the NPDES permitted CBM produced water discharge points in or surrounding the license area which discharge into surface water features including drainages.

c. For each CBM produced water discharge point, provide NPDES permit volumes and water quality standards for discharge. Also describe the presence of structures or any other features which enhance groundwater infiltration at these CBM water discharge points.

d. Provide provisions for erosion protection against the effects of flooding from drainages Wash No.1 and Upper and Lower Wash No. 2 which pass near or through planned wellfields. All berms, culverts, rock riprap, drainage or diversion channels are suggested to follow a design which meets the requirements of 10 CFR Part 40, Appendix A.

e. Discuss the potential for flooding of the area around the central plant facility and the provisions to protect critical equipment and components.

2-5. Ground Water Hydrology – 72 sand aquifer (Section 2.7)

The applicant must provide a comprehensive description and explanation of the presence of the "72 sand aquifer" which appears to be an artificial perched aquifer created by coal bed methane (CBM) produced water discharge at the surface. If true, its compromised water quality may have implications for the operation of an ISL operation where it will be defined as both the surficial and overlying aquifer. Please provide the following:

a. EMC has identified the "72 sand" as the overlying aquifer. It is not clear to NRC if the "72 sand" aquifer is or has been historically present across the license area. Provide information on the presence or absence of this perched aquifer including the potentiometric surface in the "72 sand" over time as discussed in NUREG-1569.

b. It is possible that the "72 sand" may have received infiltration of CBM produced water at WPDES permitted surface discharge points in the license area. Provide information on the possible infiltration of CBM produced water to the "72 sand" in the past or explain why no CBM produced water would have entered or will enter the "72 sand" from CBM WPDES discharge points on the surface.

c. If EMC determines the "72 sand" has received infiltration from CBM produced water discharge, it may influence the water quality in the "72 sand" at different locations which receive the infiltration. This could affect the evaluation of ISL operation impacts on surface water, surface spills and how to monitor excursions to the "72 sand" monitoring wells. Explain how EMC will monitor surface water, spill impacts and the "72 sand" to separate CBM impacts from ISL impacts including how excursion indicators be chosen and upper control limits will be determined or justify why it will not be a problem and the proposed indicators are sufficient.

2-6. Ground Water Hydrology – unconfined aquifer (Section 2.7)

The unconfined aquifer in the proposed "70 sand" production zone is a unique setting for an ISL operation. The unconfined aquifer setting presents an entirely different hydrogeologic flow regime which has implications for well field balancing, communication with monitoring wells and overlying and underlying aquifes, excursion monitoring/correction, lixiviant behavior and restoration. Please provide the following information:

a. Only one potentiometric surface was provided for the “70 sand.” Provide the potentiometric surface in the “70 sand” over time as discussed in NUREG-1569.

b. EMC states the “70 sand” is unconfined across the license area. However, EMC used a confined analysis method to evaluate all of the Conoco pump tests and EM 2007 pump tests in the “70 sand.” Provide the details which show the confined analysis is an acceptable approach or revaluate the “70 sand” pump tests using an unconfined analysis to provide estimates of unconfined conductivity and specific yield for the “70 sand.”

c. The EMC pump tests show very small drawdowns and lack of response in observation wells over the license area in the unconfined “70 sand” even when pumping rates were large over many days. These pump tests confirm the small drawdown may make it difficult to demonstrate communication across the production zone, with monitoring wells and isolation from the overlying and underlying aquifers. Explain how future pump tests will be designed for the “70 sand” to provide adequate hydrogeologic characterization of the wellfields given this small drawdown. This may include the use of more pump tests with observation wells on closer spacing.

d. EMC acknowledges that reduced drawdowns are occurring in the unconfined aquifer in the “70 sand” in response to pumping. NRC staff is concerned this will impact wellfield balancing, excursion prevention/correction and excursion monitoring. Explain how EMC will operate the well fields to address the impact of small drawdowns on operations and excursion prevention/control or justify why it is not an issue.

e. NRC staff is concerned that lixiviant composition and flow could be impacted by the unconfined aquifer setting (e.g. added oxygen may evolve out of solution to create a gas and liquid phase in the ore body, which can lead to reduced permeability and preferential flow paths). Therefore, address in detail the implications to lixiviant composition and flow of the unconfined aquifer setting.

f. NRC staff is concerned that unconfined conditions may impact restoration if sweep can not be achieved in all zones in the “70 sand”. Explain how EMC will ensure sweep of all zones in the unconfined aquifer during restoration or explain why it is not an issue.

g. EMC has stated that recharge enters the “70 sand” one mile southeast of the license area. NRC is concerned that the influx of oxidized water entering the unconfined “70 sand” from the nearby recharge zone may impact the stability of the restoration if chemical or biological reductants are employed to achieve restoration. Explain how EMC will ensure stability in this case or why it is not an issue.

2-7. Ground Water Hydrology – 70 sand aquifer communication with 68 sand (Section 2.7)

The confinement of the "70 sand" is in question based on the acknowledged absence of the underlying shale between the "70 sand" and "68 sand" in a large portion of Wellfield 2, the potential absence of the underlying shale in Wellfield 1, and the absence of overlying shale on the isopach just northwest of Wellfield 3.

a. Provide the potentiometric surface variability in the "68 sand" over time as discussed in NUREG 1569 and determine the vertical gradients between it and the "70 sand" over the license area.

b. EMC states that in Wellfield 2, the "70 sand" and the "68 sand" coalesce in a large section. This is confirmed by isopachs, geological cross sections, and by pump tests. NRC staff is concerned that ISL operations in the "70 sand" in this wellfield will significantly impact the water quality in the "68 sand". Explain how EMC will prevent any excursions into the "68 sand" and monitor for excursions in the "68 sand" in Wellfield 2.

c. EMC indicated that there is potential communication between the "70 sand" and underlying aquifer "68 sand" in the southern portion of Wellfield 1 as shown by the Conoco pump test. Either confirm if there is communication or provide evidence of no communication. If communication exists, explain how EMC will prevent and monitor for excursions in this location.

d. EMC describes an unexplained drawdown of 25 ft in UMW 3 in Wellfield 1 in the "68 sand" starting in Feb. 2007 and continuing until mid-August. NRC staff is concerned that there may be a nearby unidentified pumping well which is impacting the "68 sand," given the characteristics of this drawdown and recovery. Provide an explanation for this drawdown during this period.

e. EMC shows that the overlying shale is missing on the isopach on the northwest side of Wellfield 3. NRC staff is concerned there will be communication between the "70 sand" and the overlying "72 sand" in this area during production operations. Determine whether there is communication of the "70 sand" with the "72 sand" where this overlying shale is missing. If you determine that there is communication, explain how EMC will prevent and monitor excursions into the overlying aquifer. If you determine that there is no communication, provide the basis for that conclusion.

2-8. Background Water Quality (Section 2.7)

The analysis of the surface water and ground water quality in the proposed license area is currently insufficient to interpret the impact of ISL recovery on water quality in and around the license area. Please provide the following:

a. EMC states that there are CBM discharge points in the license area. NRC is concerned that the baseline water quality in the surface water and overlying aquifer "72 sand" may have been and will be impacted by CBM produced water discharge. Provide the location, water quality, permitted volume and known

volume of CBM produced water discharged to the surface within the license area and an estimate of how much has infiltrated to the "72 sand". Provide an estimate of the location, predicted water quality and volume of CBM discharge to the license area during future ISL operations.

b. EMC states that surface water in the license area is impacted by CBM produced water discharge. NRC is concerned that the baseline surface water quality and surficial aquifer water quality have been affected CBM produced water. Explain how EMC can assess baseline surface water and surficial aquifer ground water quality when it is variably impacted by CBM discharge.

2-9. Air Particulate Monitoring (Section 2.9)

A total of four air particulate air sampling stations and 10 radon monitoring stations were identified in Figure 2.9-25**.** Background sampling station(s) are not identified in Figure 2.9-25. Regulatory Guide 4.14, Revision 1, April 1980, Table 1, (Type of Sample, Air), discusses three air sampling stations at or near the site boundaries, one air sampling station at or close to the nearest residence or occupiable offsite structure(s) (if within 10 km of the site), and one control air sampling station. Please describe the basis of the selection process for each air sampling location (particulate and radon) and how this comports with the guidance regarding location in Regulatory Guide 4.14 for the type of sample, i.e., air. Also, please identify or include a background or remote air sampling location.

2-10. Groundwater, Surface Water, Vegetation, and Food Sampling (Section 2.9)

The applicant has not provided sufficient information in section 2.9 regarding radiological sampling of the environs of the Moore Ranch site. Specifically, the following information should be provided

a. it is stated in section 2.9.8 that baseline groundwater sampling is conducted at eleven wells on a quarterly sampling basis. The wells are shown in Figure 2.9-34 of the Technical Report. Please identify which monitoring wells are considered up gradient and which monitoring wells are considered down gradient. Also, please identify or include a background or remote groundwater sampling location. Please include the dates when these groundwater samples were collected

b. it states in Section 2.9.8.2 that parameters in suspended form were also evaluated but can be found in Section 2.9.2.7.2 of the Technical Report. This information could not be found, as there is no Section 2.9.2.7.2 in Volume II of the Technical Report. Please provide this information.

c. it is stated in Section 2.9.9.2 that suspended surface water samples were evaluated but all results were below analytical reporting limits and the data, reporting limits, and other details can be found in Section 2.7.1, but this information could not be found in that section. Please provide this information.

d. it is stated in section 2.9.10 that vegetation sampling was collected from three locations in April 2007. The sample locations are depicted in Figure 2.9.38 of the Technical Report. The samples were analyzed for natural uranium, Th-230, Ra-226, Po-210 and Pb-210. Please describe the basis of the selection process for each vegetation sampling location and how this meets the guidance regarding location in Regulatory Guide 4.14 for the type of sampling (i.e., vegetation).

e. in Section 2.9.11, Food Sampling, it states, "Sampling of food items from the site such as meat from local grazing livestock is not planned at this time." Please explain why food sampling is not planned.

f. Please explain why fish samples were not collected.

3-1. ISL Leaching Process and Equipment (Section 3.1)

The applicant has not provided sufficient information regarding the ISL leaching process and equipment to enable the staff to fully understand this topic and to support other reviews dependent on that understanding. Specifically, the following information should be provided:

a. The number, design, operation, and monitoring of the wellfield header houses where fluids will be injected and recovered from well fields.

b. An in-depth discussion of how the bleed will be adjusted to maintain an inward gradient in the atypical unconfined aquifer conditions in the "70 sand" production zone. The discussion should account for the reduced drawdown anticipated in the unconfined setting and for dewatering and mounding of fluids at the production/injection wells.

c. Identify the locations for the underlying and overlying aquifer monitoring wells.

d. Present methods for timely detection and cleanup of leaks in the wellfield at wellheads and in surface and buried lines in the wellfield.

e. Provide a description of the number, location, design, and capacity of deep disposal wells.

f. Provide an explanation for how EMC will handle waste fluids should the disposal wells become inoperable short term or long term.

3-2. Central Processing Plant and Other Facilities – Equipment Used and Materials Processed (Section 3.2)

In addressing areas of the facility where fumes or gases may be generated, rather than just a reference to Section 7.3 of the application, which is focused on environmental impacts, the applicant should provide specific listing of each potential source of emission or release, the planned monitoring associated with the potential release, and the preventive/mitigative controls for the potential release.

3-3. Instrumentation and Control (Section 3.3)

The applicant provides only a cursory commitment to have instrumentation and controls to monitor production, injection, and waste flows, and to have instrumentation to alarm for system leaks. The descriptions of the process instrumentation and controls and radiation safety monitoring instrumentation need to be more detailed and specific, including their minimum specifications and operating characteristics (alarms, interlocks, etc.). Additional information on backup systems, monitoring criteria, and yellowcake dryer instrumentation and control (with specific reference to 10 CFR Part 40, Appendix A, Criterion 8) needs to be included. The descriptions should focus on how the instrumentation and controls are adequate to identify quickly and remedy all potential processing problems that can increase exposures to radiological and chemical hazards.

4-1. Gaseous and Airborne Particulates (Section 4.1)

The applicant has not provided sufficient information in section 4.1 regarding the effluent control systems for gaseous and airborne particulates. Specifically, the following information should be provided:

a. The applicant states that discharge stacks will be located away from building ventilation intakes to prevent introducing exhausted radon into the facility. Describe the locations of these discharge stacks and demonstrate how the locations of these discharge stacks will prevent introducing exhausted radon into the facility.

b. The applicant states that the work ventilation system will be designed to force air to circulate within the plant process areas. The ventilation system will exhaust outside the building, drawing fresh air in. Describe the work ventilation system in more detail. The discussion should include the number and locations of fans used to ventilate the facility, the intake flow rate into the facility, the exchange rate, operation during periods of extreme outdoor temperature, and how radiation monitors will be used to measure effluent releases. Also, describe the acceptable radiation monitoring criteria and flow rates for these systems.

4-2. Liquid Effluents (Section 4.2)

The applicant needs to provide the following additional information related to the liquid effluents at the proposed facility:

a. Provide information on the expected chemical and radiological composition of the liquid waste stream to be disposed of in the deep wells.

b. The applicant states that <u>two or more</u> deep wells will be installed as the <u>primary</u> liquid waste disposal method. Provide the basis for reaching a conclusion on the number of deep wells that will be needed for liquid waste disposal. If deep well disposal is the primary (i.e., not the only) method, provide plans for the secondary/other method for liquid waste disposal.

c. Provide the basis for stating that EMC believes deep well disposal is “preferable” to other liquid waste disposal options.

d. Provide the status of the application to Wyoming for the Class I UIC Permit.

e. Provide information on how EMC will ensure backup storage capacity for liquid waste in the event that the deep wells need to be shut down for a short time.

f. Discuss the health and safety impacts of the liquid system failures presented in Section 4.2.3.

g. As part of the discussion of potential spills from pipelines and well heads, provide the plans for inspection of these aspects of the facility, including frequency of inspection, and provide the contingency plans and procedures for responding to system failures resulting in liquid waste release, including notifications and recordkeeping.

h. Provide information on the ability of the sump system to handle the volume of the largest hazardous materials source.

4-3. Solid Wastes (Section 4.2)

Provide the details of a waste disposal agreement for 11e.(2) byproduct material disposal at an NRC or Agreement State licensed facility. The agreement should include commitments to notify NRC within 7 days if it is terminated and to submit a new agreement for NRC approval within 90 days of expiration or termination. Also, discuss why soils contaminated from operations (spills, leaks, etc.) are not included in the listing of contaminated solid wastes.

5-1. Corporate Organization and Administrative Procedures (Section 5.1)

Other than the RSO and the Radiation Safety Technicians, the description of the Moore Ranch organization provides no information regarding site management, i.e., the plant supervisor and those that report to that position. Please discuss the corporate organization to the site level management positions. This should include the independence of the plant supervisor, RSO, and SERP for raising significant safety issues to senior management, and show the integration among groups that support construction, operation, and maintenance of the facility.

5-2. Management Control Program – Cultural Resources (Section 5.2)

EMC has not provided sufficient discussion of how cultural resources will be preserved. Please provide additional discussion related to preservation of cultural resources (i.e., perform a cultural resources inventory before engaging in any development activity not previously assessed by NRC). Note that any disturbances associated with cultural resource surveys will be completed in compliance with the National Historic Preservation Act, the Archeological Resources Protection Act, and their implementing regulations. In

addition, please provide discussion related to the discovery of previously unknown cultural artifacts.

5-3. Management Control Program – Records Program (Section 5.2)

In section 5.2.3 EMC simply states that records will be maintained until termination. Please discuss which records will be maintained (i.e., as-built drawings and photographs of the facility structures, well fields, and storage areas); that the records will be maintained with appropriate safeguards against tampering and loss; and that they will be readily retrievable for NRC inspection. Note that reporting requirements should be in accordance with NRC regulations located in 10 CFR Part 40.

5-4. Qualifications for Personnel Conducting the Radiation Safety Program (Section 5.4)

Section 5.4 describes the qualification of key personnel conducting the radiation safety program. The applicant identifies the minimum qualification for the Radiation Safety Officer (RSO) to include a bachelor's degree or an associate's degree in the physical sciences, industrial hygiene, or engineering from an accredited college or university, or an equivalent combination of training and relevant experience in uranium mill/solution mining radiation protection. Regulatory Guide 8.31, Section 2.4.1, states that two years of relevant experience are generally considered equivalent to one year of academic study. However, the minimum educational qualification is not met if the candidate has only an associate's degree. Please describe how the applicant will meet the minimum educational qualification if the candidate only has an associate degree.

5-5. Effluent Control Techniques (Section 5.7.1)

The applicant has not provided sufficient information regarding the external radiation exposure monitoring program. Specifically, the following information should be provided:

a. This section discusses the effluent control techniques used by the applicant for Rn-222. However, there is no discussion of effluent control techniques for uranium. Therefore, discuss the radioactive effluents controls and monitoring (i.e., ventilation, confinement and/or filtration), for uranium, especially under non-routine operations (i.e., maintenance and emergency).

b. Radioactive effluents controls and monitoring for the laboratory and other areas (e.g., the control room and lunch room) are not discussed. Therefore, provide a discussion of radioactive effluents controls and monitoring for those areas.

c. The plant building will be equipped with exhaust fans to remove any radon that may be released in the building**.** However, the application does not discuss monitoring to determine the magnitude of effluents released, as suggested in Regulatory Guide 8.37. Discuss how the effluent control techniques will ensure that the magnitude of such effluents is known with a sufficient degree of confidence to estimate public exposure.

5-6. External Radiation Exposure Monitoring Program (Section 5.7.2)

The applicant has not provided sufficient information regarding the external radiation exposure monitoring program. Specifically, the following information should be provided:

a. Describe some of the possible major work activities in the plant and well fields and the anticipated exposure rate levels that may be expected in these areas.

b. Describe those areas onsite where elevated exposure rates are anticipated to be found.

c. Describe how the external radiation exposure monitoring program will be integrated with the exposure calculations.

d. Describe in more detail what is meant by the statement "Beta evaluations may be substituted for surveys using radiation survey instruments" and how this will be accomplished. What radiation instrumentation will be used to evaluate beta radiation levels?

5-7. Airborne Radiation Monitoring Program (Section 5.7.3)

The applicant has not provided sufficient information regarding the airborne radiation monitoring program. Specifically, the following information should be provided:

a. The location of airborne particulate and radon daughter sampling are depicted in Figure 5.7-1 of the technical report. However, according to Figure 5.7-1, no airborne particulate monitoring will be performed in the control/lunch room or the ion exchange area. Explain why airborne particulate monitoring is not necessary in the control/lunch room and ion exchange area.

b. Describe the frequency of airborne particulate sampling in the plant.

c. Describe the plans for documentation of radiation exposures and how they will be consistent with the requirements of 10 CFR 20.2102, 20.2103, 20.2106, and 20.2110.

5-8. Exposure Calculations (Section 5.7.4)

Provide more information regarding the statements in Sections 5.7.4.1 and 5.7.4.2 of the Technical Report, "The results of periodic time studies for each classification of worker or 100% occupancy time will be used to determine routine worker exposure times." More specifically, please describe what is meant by "results of periodic time studies for each classification of worker" and "100% occupancy time will be used to determine routine worker exposure times."

5-9. Bioassay Program (Section 5.7.5)

The applicant has not described the reporting and record keeping for occupational doses as suggested in Regulatory Guide 8.7. Please provide that information.

5-10. Contamination Control Program (Section 5.7.6)

The applicant has not provided sufficient information regarding the contamination control program. Specifically, the following information should be provided:

a. Describe the reporting and record keeping for occupational doses as suggested in Regulatory Guide 8.7.

b. Describe in more detail the contamination control for maintenance activities that may involve the release of interior surfaces of pipes, drain lines, or duct work as well as equipment or scrap.

c. Describe, and show on a map or maps, any restricted or controlled areas on the site and discuss access and egress procedures.

5-11. Airborne Effluent and Environmental Monitoring Program (Section 5.7.7)

The applicant has not provided sufficient information regarding the airborne effluent and environmental monitoring program. Specifically, the following information should be provided:

a. Regulatory Guide 4.14 states that for air, radon monitoring should be conducted at five or more locations and these locations should be the same locations as for air particulate monitoring. From Figure 5.7-2, it does not appear that all of the air particulates (triangle symbols) are the same location as the radon monitoring. Please demonstrate that at least five air particulate monitoring locations are within the same proximity as the radon monitoring locations. Also, identify in Figure 5.7-2, which location is the control location.
b. The application does not address soil sampling during operations. Discuss the soil sampling program during operations. Include a description of subsurface soil sampling. Identify the sampling locations, including addressing the suggestion in Regulatory Guide 4.14 that they be taken at the same locations that air particulate monitoring is conducted?

c. The applicant states that it will use environmental dosimeters and exchange them quarterly. Please identify the type of environmental dosimeter to be used for direct radiation and its lower limit of detection.

5-12. Groundwater and Surface Water Monitoring Programs (Section 5.7.8)

The groundwater and surface water monitoring programs have not been sufficiently described to determine if they will detect an excursion from the ISL operations in an effective and timely manner. Please provide the following information:

a. A corrected groundwater model which uses the true unconfined conditions in the "70 sand" to determine the location of monitoring wells in the production zone monitoring well ring.

b. The number and location of monitoring wells in the "60 sand" which will be the underlying aquifer in Wellfield 2, based on the communication of the 70 and 68 sands in a large section of this wellfield.

c. A justification for the use of chloride, conductivity and total alkalinity for excursion indicators in the overlying "72 sand" which may have elevated values similar to the production mining zone as a consequence of CBM produced water infiltration. Otherwise, please provide an alternate set of other constituents to be used as excursion indicators for the "72 sand."

d. A discussion of how EMC will conduct pumping tests to establish that each wellfield production zone is in communication with the monitoring well ring given the reduced drawdown in the unconfined aquifer which may not stress the production zone sufficiently to see communication.

e. A statement that EMC will also submit all wellfield hydrologic testing packages to NRC for review and approval before mining begins as EMC does not have a record of performance with NRC.

f. A standard operating procedure for sampling of the monitoring and private wells to ensure sampling is consistent for all wells during operations.

g. The location of the surface water sampling points and description of surface water sampling methods.

h. The location and permitted volume of CBM discharge at all surface water sampling points.

5-13 Quality Assurance (Section 5.7.9)

The applicant has stated that it will implement a quality assurance program but has not provided any details of that program. The applicant must propose a quality assurance program applicable to all radiological, effluent, and environmental monitoring programs.

6-1. Plans and Schedules for Groundwater Quality Restoration (Section 6.1)

The plans and schedules for groundwater quality restoration have not been sufficiently described to determine if they will achieve the required goals of restoration. Please provide the following information:

a. Demonstrate that the applicant will be able to return the groundwater quality to the NRC required restoration standard of baseline water quality or the standards listed in Criterion 5B(5)(b) of Appendix A to 10 CFR Part 40.

b. In Wellfield 2, the “70 sand” production zone and the “68 sand” coalesce in a large section of almost 1000 linear feet on cross section E-E’. Given the total absence of a confining layer between these sands, explain how lixiviant and restoration fluids will be prevented from moving freely from the “70 sand” into the “68 sand”. Also, explain how the 68 sand in this region will be restored if it becomes apparent during operations that the 68 sand has been significantly affected by lixiviant.

c. A description of biological reduction method to be used to achieve restoration for targeted constituents in the proposed wellfield mining zone including: the efficacy of the chosen method; additives and rates; how progress with be monitored; estimates of pore volumes required when using biological reductants; and how the stability of water quality in zones treated with biological reductants will be monitored and established.

d. An explanation of how the restoration methods proposed for Moore Ranch which have only been applied to confined aquifers will be successful in an unconfined aquifer like the “70 sand” production zone at Moore Ranch. Address issues including how to ensure contact of restoration fluids with all parts of the mined region including dewatered zones, predicting the behavior of each constituent in an unsaturated environment where oxygen will be present, and methods to ensure representative sampling. The applicant must address these issues and any others to ensure that the proposed restoration methods are suited to the unconfined aquifer setting and will achieve the primary restoration standard of return to baseline water quality for the entire production zone.

e. Report the specific pore volume for each well field and show the calculations and assumptions. In Wellfield 2, if you determine that the “68 sand” must be included in the production zone (see b. above); the pore volume estimate should include both the “70 sand” and the “68 sand” which coalesce in a large section in the center of the wellfield.

f. Justify in detail the six pore volumes estimate for each of the wellfields, which appears very low, using a basis of comparable field experience or revise the estimate. Reported field case pore volumes from the similarly situated COGEMA Irigaray ISL Units 1-9 ranged from 9.5 to 18.4 with an average of 14.6 to achieve restoration. If the applicant retains the estimate of six pore volumes, it should provide a substantial justification using analytical methods or numerical modeling. These estimates should also take into account unique issues presented by the unconfined aquifer setting at Moore Ranch and address any difference in pore volumes needed if biological reductants are used. Provide a new schedule for restoration if the estimated number of pore volumes for restoration is revised. (See also RAI 6-6.)

g. Provide a description of how the mining zone will be monitored during restoration to track the success of any restoration phase or techniques such as the addition of chemical or biological reductants.

h. Describe the deep disposal wells to be installed, the number of wells, their locations, their design, injection zone, and their capacity. Provide an estimate, with supporting analysis of how much waste water would be produced during

restoration and the ability of the disposal wells to handle the rates and volumes. In addition, describe how waste fluids will be handled if any or all of the disposal wells became inoperable. (See also RAI 4-2).

i. Address how EMC will detect and clean up spills of waste fluids from lines to the deep disposal wells in a safe, effective, and timely manner.

j. Provide a justification for the selection of a six month stability monitoring time period to determine restoration success. Additionally, provide the criteria which will be used to establish that the water quality in the restored zone is stable (e.g., no increasing trends that would threaten ground water quality if left unabated).

6-2. Plans for Reclaiming Disturbed Lands (Section 6.2)

The plans for reclaiming disturbed lands have not been sufficiently described to determine if they will achieve the required goals of reclamation. Please provide the following information:

a. A discussion of the pre-reclamation radiological survey regarding how it and the baseline survey will be used to identify potential contamination areas.

b. A reference a pre-operations topographic map in Section 6.2.4. In addition, EMC should provide additional discussion on the development of a post reclamation topographic map or provide an explanation of why one is not needed.

c. A discussion of plans for decommissioning non-radiological hazardous constituents as required by 10 CFR Part 40, Appendix A, Criterion 6 (7).

d. The EMC QA program discussed in Section 6.4.4 addresses only the need to require the soil testing laboratory to have a QA program. EMC should discuss or reference its own QA/QC program that needs to address all aspects of decommissioning, including procedures and confidence intervals.

6-3. Removal and Disposal of Structures, Waste Material, and Equipment (Section 6.3)

The applicant needs to provide the following additional information related to the removal and disposal of structures, waste material, and equipment:

a. Provide the details of a waste disposal agreement for 11e.(2) byproduct material disposal at an NRC or Agreement State licensed facility. The agreement should include commitments to notify NRC within 7 days if it is terminated and to submit a new agreement for NRC approval within 90 days of expiration or termination. (See also RAI 4-3).

b. EMC needs to include in its survey and decontamination procedures, a commitment that radioactivity along the interior surfaces of pipes, drain lines, and duct work will be determined by measurements at traps or other access points,

and a commitment that pieces or equipment that are too big to scan will be considered contaminated in excess of the limits.

6-4. Methodologies for Conducting Post Reclamation and Decommissioning Radiological Surveys (Sections 6.4 & 6.5)

The applicant needs to provide the following additional information related to the methodologies for conducting post reclamation and decommissioning radiological surveys:

a. Discuss how the background radiological characteristic data from Section 2.9 will be used in the post reclamation and decommissioning surveys.

b. In Section 6.4.1.3, Uranium Chemical Toxicity Assessment, it states, "No intake of contaminated food through the aquatic or milk pathways was considered probable. The applicant included all food pathways, but not the aquatic and milk pathway. Provide an explanation for why the milk and aquatic pathways were not considered probable and thus not included in the RESRAD calculations provided in Appendix C.

c. In Section 6.4.3, the applicant indicates that cleanup of surface soils will be restricted to a few areas where there are known spills and, potentially, small spills near wellheads. The applicant should justify why other areas where there may be small, unknown spills, are not considered for soil cleanup. Describe in more detail the surface soil cleanup verification and sampling in known contaminated areas and potentially contaminated areas, including more information about the gamma action level and how it will be demonstrated that other areas are not contaminated. In addition, the discussion should also include those well fields where no spills are known. Please discuss the type of radiation surveys and sampling that will be conducted in these areas.

6-5. Financial Assurance (Section 6.6)

The applicant needs to provide the following additional information related to financial assurance:

a. The financial assurance cost estimate should be presented in 2008 dollars or provide an adjustment for inflation from the 2006 dollar value currently used in the tables.

b. The financial assurance funding mechanism (i.e., surety bond, cash deposit, certificate of deposit, deposit of government securities, etc.) that EMC plans on using for the Moore Ranch project should be identified.

c. EMC needs to provide indication in Section 6.6 that it will 1) automatically extend the existing surety amount if the NRC has not approved the extension at least 30 days prior to the expiration date; 2) revise the surety arrangement within 3 months of NRC approval of a revised closure (decommissioning) plan, if estimated costs exceed the amount of the existing financial surety; 3) update the

surety to cover any planned expansion or operational change not included in the annual surety update at least 90 days prior to beginning associated construction; and 4) provide NRC a copy of the State's surety review and the final surety arrangement.

6-6. Financial Assurance Spreadsheets (Appendix D)

The following items in the Financial Assurance spreadsheets in Appendix D of the application need to be discussed, explained, or calculated further:

a. Provide the justification for using 6 pore volumes total. This number appears to assume that the well field is at the end of its productive life. Provide the required number of pore volumes to restore while the mine unit is still active. (See also RAI 6-1.f.)

b. Provide the justification for the flare factor, including discussion of why the value used for other sites is appropriate for the Moore Ranch site.

c. The $20,000 per year for spare parts does not appear to be carried through the equations in the cost estimate.

d. Groundwater Restoration, Table 1, of Appendix D, Total number of wells in well field – The total estimated number of wells should at least be equal to the current number of wells (i.e., 60 and not 55).

e. Groundwater Restoration, Table 1, of Appendix D, Item VII, Total Building Utility Cost does not sum from the correct row.

f. Groundwater Restoration, Table 1, of Appendix D – The current spreadsheet is based on 2.5 years of restoration, regardless of the amount of water treated (i.e., the number of pore volumes). The duration of restoration is a factor of the number of pore volumes needed. Provide the basis of tying the estimated number of pore volumes to duration. If the duration exceeds 2.5 years, the following time related costs need to be tied into the longer duration of restoration: V - Estimated restoration period, stability period, VII – building utility costs number of months, VIII – Vehicle Operating Costs average number of years, IX – Labor Costs number of years (current assumption is 6 months longer than restoration period).

g. Provide additional explanation of the elution costs (in Groundwater Restoration, Table 1, of Appendix D, Item IV), i.e., whether they fixed costs or are they tied to the duration and/or number of pore volumes. If they are tied to the duration and/or the number of pore volumes, these costs need to be recalculated.

h. Either provide costs in the surety for MIT testing and gamma surveys for the reclaimed areas or explain why those costs do not need to be included.

7-1. Accidents

Provide the information requested in section C.6. of Regulatory Guide 3.5. This includes an evaluation of various potential accidents, measures to be implemented to prevent the accidents, and emergency plans and training.