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.

Response:

Discharge stacks will be located on the leeward side of the building and ventilation intakes will be on the upwind side of the building to ensure exhausted radon is not taken back into the facility from prevailing winds.

Section 4.1 was revised to include the above information

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.

Response:

The work area ventilation system will consist of 4 fans with a capacity 10,000 cfm each. 2 fans will be located in the ion exchange area, one fan will be located in the resin transfer area, and one fan will be located in the precipitation area. The air exchange rate of the four fans is approximately 1.25 air exchanges per hour. During extreme cold outdoor temperatures, the ventilation system will provide adequate work area ventilation if doorways need to be shut. Buildings will be heated during winter months to maintain temperatures in the plant area. Section 4.1 was revised to include the above information.

See response to RAI 5-5(c) for radiation monitors, effluent releases, criteria, and flow rates.

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.

Response:

The anticipated liquid waste stream is non-hazardous under the Resource Conservation and Recovery Act. The anticipated water chemistry of the injected waste stream is presented in Table 4-1. Minor concentrations of corrosion inhibitors, scale inhibitors, and/or biocides may be used as needed to maintain the well in optimum condition. These waste streams are benefication wastes, exempt from RCRA regulation under the Bevill Amendment found in 40 CFR 261.4(b)(7).

Table 4-1 Summary of Anticipated Waste Stream Water Quality

Chemical Species	Estimated Range of URANIUM ONE Waste Stream Water Quality Minimum (mg/l)	Maximum (mg/l)
pH	6	9
Ammonia as Nitrogen	50	500
Sodium	150	3,000
Calcium	200	1,000
Potassium	10	1,000
Bicarbonate as HCO3	1,500	4,000
Carbonate as CO3	0	500
Sulfate	80	2,000
Chloride	200	4,000
Uranium as U3O8	1	15
Ra-226 (pCi/l)	300	3,000
TDS	4,000	15,000

Section 4.2.1.1 was revised to include this information on waste stream water quality.

b. The applicant states that two or more deep wells will be installed as the primary 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.

Response:

See previous response to RAI 3-1(e).

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

Response:

Deep well disposal is preferable to other liquid waste disposal options for the following reasons:

- Liquid waste disposed of through deep wells is secluded from human contact eliminating risk to human health.
- Large evaporation ponds have the potential for leaks and impacts to the environment. Also, a much larger volume of 11(e)(2) byproduct is created through use of evaporation ponds.
- Land application methods have the potential to impact surface media from prolonged discharge and would require extensive treatment to meet land application standards.

Section 4.2 was revised to include the basis described above.

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

Response:

A Class V Underground Injection Control Permit for these wells was submitted to the Wyoming Department of Environmental Quality-Water Quality Division (WDEQ-WQD) on May 12, 2008. Comments were received from the WDEQ-WQD on July 29, 2008 and responses to those comments are anticipated to be submitted back to the WDEQ-WQD in October of 2008.

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.

Response:

See previous response to RAI 3-1(e).

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

Response:

Should a leak in the wellfield buildings, pipelines, or at wellheads occur, the primary health and safety hazards presented by the spilled mining solutions would be ingestion or inhalation of the spilled liquid or dried residue, direct gamma exposure, and release of radon gas. These hazards would primarily apply to EMC personnel responding to the spill. Section 5 discusses in detail the administrative controls that will be implemented by EMC to maintain radiological exposures as low as reasonably achievable, including employee training and the use of standard operating procedures (SOPs) or radiation work permits (RWPs). All employees will receive training in the proper response to solution spills during radiation worker training. SOPs and/or RWPs will specify worker monitoring and protective equipment requirements for spill response.

Spilled mining solutions will contain elevated concentrations of uranium, radium-226, and trace metals. Although these concentrations are not high enough to present a significant health and safety risk when absorbed in soil, they could present an increased hazard in areas where spilled solutions may pond or build up over time. All cleanup of spilled material will be performed with proper protective equipment. If soil cleanup of a spill area is necessary due to the exceedance of the soil concentration limits in 10 CFR Part 40, Appendix A, engineering controls will be used to minimize the generation of dust. Direct gamma radiation exposure is not expected to be a significant hazard from solution spills due to the low concentrations of gamma-emitting radionuclides in the mining solution. Radon may be a hazard in enclosed spaces (e.g., within a headerhouse) but this hazard can be controlled through the use of ventilation (Section 4.2.3.1 was revised with the above information)

The potential health and safety hazards from spills within the Central Plant are similar to those discussed in section 4.1.1.1 above. However, the Central Plant will be equipped to handle liquid spills. The building will include sumps that will recover spilled solutions and direct them to the wastewater system. Building ventilation will control the radon released by spilled solutions (Section 4.2.3.2 was revised with the above information).

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.

Response:

Each Mine Unit will have a number of headerhouses where injection and production wells will be continuously monitored for pressure and flow. Individual wells, along with main trunk lines, may have high and low flow alarm limits set in the header house. All monitored parameters and alarms will be observed in the control room via the computer system. In addition, each wellfield building will have a "wet building" alarm to detect the presence of any liquids in the building sump. High and low flow alarms have been proven effective in detection of significant piping failures (e.g., failed fusion weld).

Occasionally, leaks (typically small) at pipe joints and fittings in the wellhouses or at the wellheads may occur. Until remedied, these leaks may drip process solutions onto the underlying soil. Surface and subsurface soil at a solution mine may become contaminated by leaks and spills of process solutions. Although the specific concentration of radionuclide's in these process solutions is relatively low, the concentration of contamination in the soil may exceed regulatory limits if the solution is confined to a small area or if there are multiple spills in the same location. EMC will implement a program of continuous wellfield monitoring by roving wellfield operators and will require periodic (at a minimum of daily) inspections of each wellfield that is in service or in restoration. Small leaks in wellfield piping typically occur in the injection system due to the higher system pressures. These leaks seldom result in soil contamination. Following repair of a leak, EMC will require that the affected soil be surveyed for contamination and the area of the spill documented as required by the NRC. The soils potentially impacted by a spill of injection or production fluid are typically sampled and scanned for Gamma radiation. The surface extent of any spill will be delineated horizontally by use of a field GPS system. If contamination is detected, the soil is sampled and analyzed for the appropriate radionuclides. Contamination may be removed immediately if concentrations exceed regulatory requirements or left in place and documented for future clean up (if necessary) during the decommissioning phase of site closure. Section 4.2 was revised to include the above information.

Reporting of excursions and corrective actions will be conducted as described in Section 5.7.8.

The WDEQ-LQD will be verbally notified (per telephone or email) within 24 hours of discovery of a spill of ISR process fluids exceeding 420 gallons. A written report will be provided to the WDEQ-LQD within 5 days of discovery containing the information described in WDEQ-LQD Rules and Regulations, Chapter 11, Section 12(a)(B)(ii).

The NRC will be verbally notified (per telephone or email) within 48 hours of discovery of a spill of ISR process fluids reportable to the WDEQ-LQD. A written report will be provided to the NRC within 30 days of discovery containing the information required per NRC License Conditions.

Other unanticipated spills of reportable quantities from chemicals bulk storage areas will be reported to the WDEQ in accordance WDEQ-WQD, Rules and Regulations, Chapter 17, Part E and 40 CFR 302 (CERCLA).

Other operational reporting and applicable requirements include the following:

- Corrective Actions and Compliance Schedules- WDEQ-LQD Rules and Regulations, Section 13 and NRC License Conditions.
- Quarterly Monitoring Reports- WDEQ-LQD Rules and Regulations, Section 15.
- Annual Operations Reports- WDEQ-LQD Rules and Regulations, Section 15.
- Well Abandonment Reports- WDEQ-LQD Rules and Regulations, Section 15

- Deep Disposal Well Monitoring Reports- Done in accordance with UIC injection well permit issued by the WDEQ-LQD.
- NRC Semi-Annual Report- Done in accordance with NRC License Conditions.

New Section 4.5 was added to include the above reporting information.

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

Response:

As described in Section 4.2.3.3, a concrete curb will be built around the entire process building. This pad will be designed to contain the contents of the largest tank within the building in the event of a rupture. Any spill of plant fluids will be contained within the containment allowing for all fluids to drain to the sump system and be pumped to the waste disposal system.

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.

Response:

EMC is currently in discussions with several potential companies licensed to accept 11e(2) byproduct material from the Moore Ranch Project. A disposal agreement will be in place prior to start of operations.

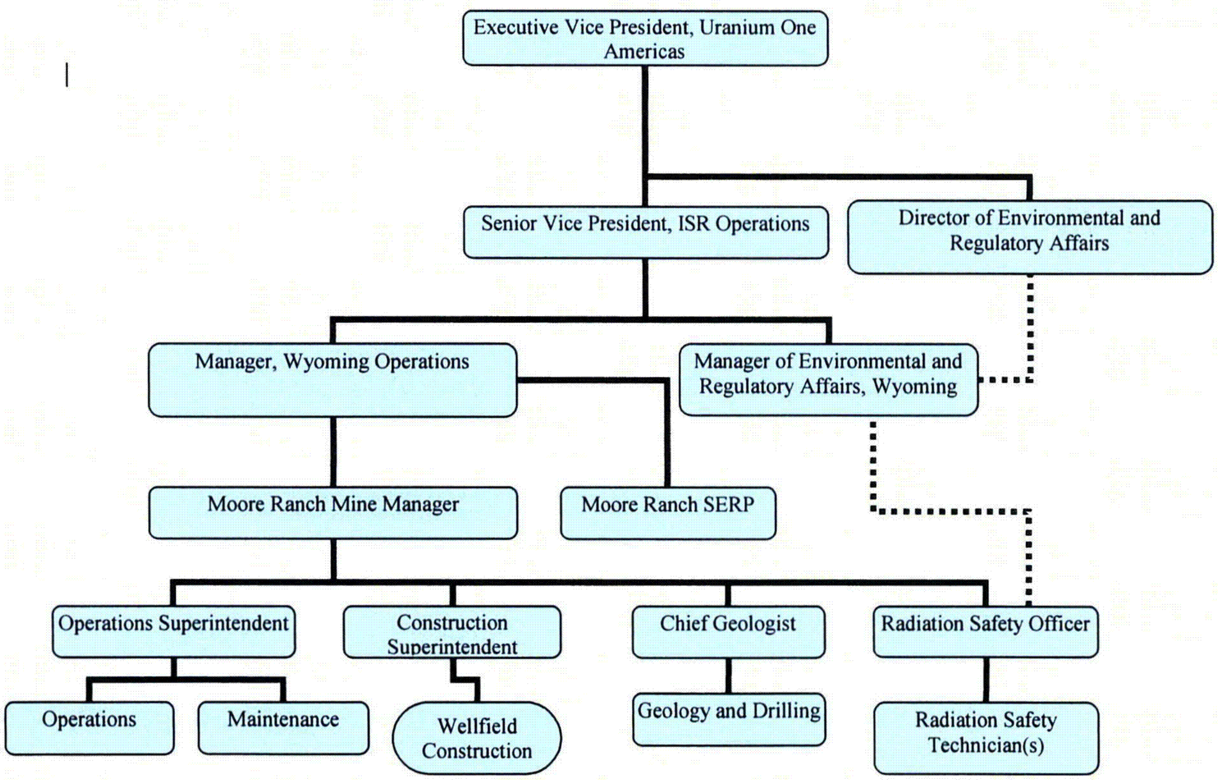
See response to previous RAI 4-2(g) for discussion on soils contaminated from operations.

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.

Response:

The organizational chart in Section 5.1 was revised to reflect site level management positions as shown below. Position descriptions for the site level management were also provided in Section 5.1



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.

Response:

A Class III Cultural Resource Survey was conducted for the entire area within the proposed license boundary. Section 2.4 and Appendix A contains results of this survey.

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.

Response:

The following specific records will be permanently maintained and retained until license termination:

- Records of disposal of byproduct material on site through the deep disposal wells as required in 10 CFR §20.2002 and transfers or disposal off site of source or byproduct material;
- Records of surveys, calibrations, personnel monitoring, and bioassays as required in 10 CFR §20.2103;
- Records containing information pertinent to decommissioning and reclamation such as descriptions of spills, excursions, contamination events, etc. including the dates, locations, areas, or facilities affected, assessments of hazards, corrective and cleanup actions taken, and potential locations of inaccessible contamination;
- Records of information related to site and aquifer characterization and background radiation levels;
- As-built drawings and photographs of structures, equipment, restricted areas, well fields, areas where radioactive materials are stored, and any modifications showing the locations of these structures and systems; and
- Records of the radiation protection program including program revisions, standard operating procedures, radiation work permits, training and qualification records, SERP proceedings, and audits.

The RSO will be responsible for ensuring that the required records are maintained and controlled. Hard copies of all records will be maintained on site in a controlled environment to protect them from damage or deterioration and will be available for NRC inspection. Electronic copies may be maintained in addition to hard copies with backup protection. Duplicates of all records will be maintained in the corporate office or other offsite location(s).

Section 5.2.3 was revised to include this information.

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.

Response:

Two years of relevant experience are generally considered equivalent to 1 year of academic study. For example, an RSO candidate with an Associates Degree would also require an additional 4 years of relevant experience to meet this education requirement. Section 5.4.1 was revised to include this description.

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 nonroutine operations (i.e., maintenance and emergency).

Response:

Final processing of uranium to produce yellowcake will be performed in a vacuum dryer. As described in Section 4, there are no emissions from these systems. By design, vacuum dryers do not discharge any uranium when operating. The vacuum drying system is proven technology, which is being used successfully in several ISR sites where uranium oxide is being produced. Air particulate controls of the vacuum drying system include a bag house, condenser, vacuum pump, and packaging hood.

The bag house is an air and vapor filtration unit mounted directly above the drying chamber so that any dry solids collected on the bag filter surfaces can be batch discharged back to the drying chamber. The bag house is heated to prevent condensation of water vapor during the drying cycle. It is kept under negative pressure by the vacuum system.

The condenser unit is located downstream of the bag house and is water cooled. It is used to remove the water vapor from the non-condensable gases coming from the drying chamber. The gases are moved through the condenser by the vacuum system. Any particulates that pass through the bag filters are wetted and entrained in the condensing moisture within this unit.

The vacuum pump is a rotary water sealed unit that provides a negative pressure on the entire system during the drying cycle. It is also used to provide ventilation during transfer of the dry powder from the drying chamber to fifty-five (55) gallon drums. The water seal of the rotary vacuum pump captures entrained particulate matter remaining in the gas streams.

The packaging system is operated on a batch basis. When the yellowcake is dried sufficiently, it is discharged from the drying chamber through a bottom port into drums. A level gauge, a weigh scale, or other suitable device will be used to determine when a drum is full. Particulate capture is provided by a sealed hood that fits on the top of the drum, which is vented through a sock filter to the condenser and the vacuum pump system when the dried yellowcake is being transferred.

The system will be instrumented sufficiently to operate automatically and to shut itself down for malfunctions such as heating or vacuum system failures. The system will alarm if there is an indication that the emission control system is not performing within operational specifications. If the system is alarmed due to the emission control system, the operator will follow standard operating procedures to recover from the alarm condition. If the dryer is loaded, yellowcake will not be packaged until the emission control system is returned to service within specified operational conditions. Similarly, if the dryer is empty, it will not be reloaded until the emission control system is returned to service.

To ensure that the emission control system is performing within specified operating conditions, instrumentation will be installed that signal an audible alarm if the air pressure (i.e. vacuum level) falls below specified levels, and the operation of this system is checked and documented during dryer operations. In the event this system fails, the operator will perform and document checks of the differential pressure or vacuum every four (4) hours. Additionally, during routine operations, the air pressure differential gauges for other emission control equipment will be observed and documented at least once per shift during dryer operations.

During dryer maintenance, all work will normally be performed under an RWP unless a standard operating procedure has been prepared and approved. The RWP will specify control measures to minimize the release of airborne particulates, including but not limited to removal of yellowcake from system components and establishing airborne radioactivity areas before maintenance is begun.

During emergency situations such as fire or severe weather, the yellowcake dryers will be shut down in a safe configuration until the emergency has passed. Vacuum systems will be left in operation and the dryer room(s) will be closed as potential airborne radioactivity areas.

Section 5.7.1.1.2 was added containing the above discussion on radioactive effluent controls for uranium.

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.

Response:

Laboratory areas will be used for the analysis of groundwater and process samples. Most of the analytical load for the laboratory will consist of routine semimonthly analysis of monitor well samples for chloride, conductivity, and total alkalinity. In laboratory areas where reagents are in use or fumes could be generated by the analytical method in use, laboratory fume hoods will be used to control emissions. Process samples will be analyzed within the restricted area and fumes hoods will be used as necessary to control emissions. New Section 5.7.1.1.3 was added to Section 5 containing the above description of effluent controls for the laboratory.

As shown on revised Figure 3.2-1, there will not be a lunch room located in the restricted area of the plant.

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.

Response:

Monitoring for combined plant and wellfield releases at the site airborne monitoring stations will be accomplished through the use of Track-Etch radon cups as discussed in Section 5.7.7. Monitoring for radon gas releases from the plant building and ventilation discharge points is not practicable. 10 CFR §20.1302 allows demonstration by measurement or calculation that the total effective dose equivalent to the individual likely to receive the highest dose from licensed operations does not exceed the annual dose limit of 100 mrem. Regulatory Guide 8.37, section 3.3 notes that where monitoring effluents points is not practicable, a licensee should estimate the magnitude of these releases and include these estimated releases in demonstrating compliance with the annual dose limit.

As discussed in Section 7.3, EMC has used MILDOS-Area to model the dose from facility operations resulting from releases of radon gas. The central plant will include pressurized downflow ion exchange columns, which do not routinely release radon gas except during resin transfer and column backwashing. In these systems, the majority of radon released to the production fluid stays in solution and is not released. The radon which is released is generated by occasional venting of process vessels and tanks, small unavoidable leaks in ion exchange equipment, and maintenance of equipment. For the purposes of determining the source term for MILDOS-Area, radon gas release was estimated as 10% of the radon-222 in the production fluid from the wellfields and an additional 10% in the ion exchange circuit in the central plant. Release of radon-222 at this concentration did not result in significant public dose. The maximum TEDE of 0.8 mrem/yr. was located at the northwest property boundary and is 0.8 percent of the public dose limit of 100 mrem. The closest resident to the Moore Ranch facility received an estimated TEDE of 0.7 mrem/yr, which is 0.7 percent of the regulatory limit.

The MILDOS model inputs will be used to estimate the radon gas released to the environment, which will be reported in the Semiannual Radiological Effluent and Environmental Monitoring Reports required under 10 CFR Part 40.65. Section 7.3.1.1 discusses the factors and equations used to estimate source term contributions to the total radon effluent releases from Moore Ranch. These individual source terms include radon released due to production releases during operations, restoration releases, new wellfield releases, and releases due to resin transfer. On a semiannual basis, the actual operational history of the Moore Ranch facility will be used to estimate the actual radon gas releases due to operations for the period. The following specific data for each reporting period will be applied to the source term estimate methodology to determine radon gas releases:

Production Releases: Actual average production flow rate and operating factor for the period.

Restoration Releases: Actual average restoration flow rate and operating factor for the period.

New Wellfield Releases: Total number of new wellfields started up during the period.

Resin Transfer Releases: Total number of resin transfers from satellite facilities during the period.

Section 5.7.1.1.1 was revised to include the discussion above.

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.

Response:

Based on the experience of other ISR operations, EMC believes that it is not likely that any employee working at the Moore Ranch Plant will exceed 10 percent of the regulatory limit (i.e., 500 mrem/yr).

- The typical wellfield dose rate will not exceed background gamma exposure rates except immediately adjacent to wellheads and headerhouses, where scale formed on the inside surfaces of piping may contain radium-226, resulting in increased gamma exposure rates. Experience at operating ISR facilities indicates that annual doses for wellfield workers generally do not exceed 1 percent of the regulatory limit (i.e., 50 mrem/yr.).
- Process plant workers will be exposed to elevated gamma exposure rates during operations and maintenance activities in the central plant including work in Radiation Areas. Experience at operation ISR facilities indicates that annual doses to process plant workers are generally less than 10 percent of the regulatory limit.

Although monitoring of external exposure may not be required in accordance with §20.1201(a) due to the low exposure rates typically encountered at ISR facilities, EMC will issue dosimetry to all process plant employees and will exchange them on a quarterly basis.

Section 5.7.2.2 was revised to reflect the information described above.

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

Response:

See previous response.

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

Response:

Results from personnel dosimetry will provide the individual Deep Dose Equivalent (DDE) for use in determining Total Effective Dose Equivalent (TEDE). The TEDE is defined in Regulatory Guide 8.30 as the sum of the DDE and the committed effective dose equivalent (CEDE) for internal exposures. Determination of the CEDE is discussed in further detail in Section 5.7.4.

Sections 5.7.2.2, 5.7.3.1, and 5.7.3.2 were revised to reflect this description.

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?

Response:

The beta dose rate on the surface of yellowcake just after separation from ore is negligible. Over a period of several months, the beta dose from aged yellowcake increases due to the ingrowth of protactinium-234 and thorium-234. EMC plans to ship yellowcake on a schedule that minimizes the dose from aged yellowcake.

EMC will perform beta surveys at least once for each operation and whenever there is a change in procedures or equipment that may affect the beta dose. Beta contamination surveys will be performed using a Ludlum Model 2224 portable scaler/ratemeter with a Ludlum 43-1-1 alpha/beta scintillator probe or equivalent. . Beta dose rate surveys will be performed with a Ludlum Model 44-6 sidewall G-M detector or equivalent.

As discussed in Regulatory Guide 8.30, beta evaluations may be substituted for surveys using radiation survey instruments based on two figures provided in the Regulatory Guide. These beta evaluations are based on curves that represent the increase of the beta dose rate over time due to the ingrowth of protactinium-234 and thorium-234 (Regulatory Guide 8.30, Figure 1) and the decrease of beta dose as the distance from the source increases (Regulatory Guide 8.30, Figure 2).

Section 5.7.2.2 was added to Section 5 to include this detail on beta evaluations.

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.

Response:

The lunch room was removed from Figure 5.7-1. Plant workers will utilize lunch room areas in the main office or maintenance buildings. Figure 5.7-1 was revised to include an office instead of a lunch room and was also revised to show airborne particulate monitoring in the control room and office areas.

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

Response:

Section 5.7.3.1 was revised to reflect that samples will be obtained using area samplers on a monthly frequency.

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.

Response:

See next response.

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."

Response:

In general, 100% occupancy time will be used to determine exposures. Using this method, each classification of worker is assumed to have spent their entire work shift in the survey area(s). Note that the length of work shifts may vary by worker classification. Plant operators will generally be working on a shift schedule to provide full time coverage and this may result in some variation from the standard 40-hour week schedule. Maintenance, wellfield, and part-time workers may not spend a full shift in the restricted area(s). The occupancy time determinations will be based on the actual scheduled time in the restricted area for each occupational group.

This approach generally results in a conservative (i.e., higher than actual) estimate of internal exposure to airborne natural uranium because it does not account for time the employee may have spent outside the work area, such as during breaks and meals. Alternatively, the RSO may perform a time study to determine the average time of exposure for each classification of worker. Under this approach, the RSO will have a representative population of each classification of worker track their time spent in different areas of the facility. The time study will be performed for an extended period (usually one month) and will provide the RSO with a percentage of time spent in each area for each classification of worker. If time studies are employed to determine time of exposure, they will be updated annually to account for any changes.

Sections 5.7.4.1 and 5.7.4.2 were revised providing this additional information on 100% occupancy time.

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.

Response:

For employees that are monitored for internal and/or external exposure, recording and reporting of monitoring results is required in 10 CFR §20.2106(a) and §20.2206(b), respectively. Records of exposure monitoring results will be maintained for each monitored individual on an NRC Form 5 or equivalent.

In addition, 10 CFR §20.2104 requires a determination of the individual's current year dose at other facilities. EMC will obtain prior dose histories for all employees. EMC will obtain an NRC Form 4 signed by the individual to be monitored, or a written statement that includes the names of all facilities that monitored the individual for occupational exposure to radiation during the current year and an estimate of the dose received. EMC will attempt to verify the information provided by the individual. EMC will also attempt to obtain records of the individual's lifetime cumulative occupational radiation dose. This lifetime dose may be based on a written estimate or an up-to-date NRC Form 4 signed by the individual.

In accordance with 10 CFR §19.13(b), monitored employees will be advised in writing on an annual basis of their calculated TEDE. Additionally, any employee may request a written report of their exposure history at any time. These reports will be provided within 30 days of the request and will provide the information outlined in 10 CFR §19.13.

Section 5.7.4.5 was developed to include the above information on reporting and record keeping for occupational doses.

It should be noted that bioassays are not used for exposure determination and that a response in accordance with Reg Guide 8.7 is not appropriate in this section. Additional text was added to Section 5.7.5 to point out that the bioassay program confirms the air monitoring and internal exposure determinations discussed in Section 5.7.4.1.

Special urine samples may be obtained based on circumstances as determined by the RSO. These circumstances may include known or suspected ingestion, failure of engineering controls, or damage or failure of respiratory protection equipment. Action levels for urinalysis will be established based upon Table 1 in USNRC Regulatory Guide 8.22. Routine determination of internal exposure will be performed using the results of air monitoring to estimate uranium intake as discussed in Section 5.7.4.1. In the event that positive bioassay results confirm an intake, the RSO will conduct an investigation into the circumstances and make a determination whether internal exposure for an individual should be determined based on bioassay results. Internal exposure determinations based on bioassay results will be performed based on the guidance in USNRC Regulatory Guide 8.9. Section 5.7.5 was revised to include the above 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.

Response:

See Previous Response.

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.

Response:

Employees that enter a restricted area will be required to sign in on an access log and note their name and the time entered. Upon leaving the restricted area, employees will be required to monitor themselves for radioactive contamination or take a shower and change their clothing in accordance with Regulatory Guide 8.30. The monitoring will consist of a visual examination to detect any visible yellowcake and an instrument survey to ensure that any suspected contamination is below the acceptable limits. If the contamination limit is exceeded, personnel must decontaminate their skin and/or clothing, repeat the survey, and notify the RSO. The RSO will investigate of the cause of the contamination and take corrective action, if appropriate. Employees will be trained during initial radiation safety training to self-monitor using a rate meter with an alpha scintillation detector. The results of the personnel survey will be recorded on the access log at the survey station. The RSO will routinely observe employees leaving the restricted area to ensure that proper personnel contamination survey methods are employed. Restricted areas include the central plant and drum storage areas as shown on Figure 2.1-3. All wellfield areas will be controlled areas as defined in 10 CFR §20.1003. Wellfield areas are shown on Figures 2.1-2 and 3.1-2

Decontamination of surfaces will be guided by the ALARA principle to reduce surface contamination to levels as far below the limits as practical. Particular attention will be given to equipment and structures in which radiological materials could accumulate in inaccessible locations including piping, traps, junctions, and access points. Contamination of these materials will be determined by surveys at accessible locations. Items that cannot be adequately characterized or that are too large to be scanned will be considered contaminated in excess of the limits and will be kept within the restricted areas until they are no longer required and are disposed at a properly licensed facility.

Uncontaminated materials, equipment, tools, instruments, and other materials will be surveyed for alpha contamination before removal from the restricted and controlled areas. The RSO, the radiation safety staff, or properly trained employees will perform surveys of all items removed from the restricted areas with the exception of small, hand-carried items described above. The release limits will be set as specified in *"Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses For Byproduct or Source Materials"*, USNRC, May 1987. The release limits for alpha radiation for these guidelines are as follows:

- Removable alpha contamination of 1,000 dpm/100cm^2
- Average total alpha contamination of 5,000 dpm/100 cm^2 over an area no greater than one square meter
- Maximum total alpha contamination of 15,000 dpm/100 cm^2 over an area no greater than 100 cm^2.

Section 5.7.6 was updated with this additional information on contamination control.

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

Response:

See previous response maps of restricted or controlled areas and for 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.

Response:

Baseline radon monitoring station locations were selected prior to placement of air particulate monitoring stations. Air particulate station locations were slightly different from "associated" radon monitoring stations due to logistical issues related to the availability of hard line electrical power for long-term site monitoring. Although some of the radon stations do not exactly coincide with air particulate station locations, in each case there is one or more radon station reasonably close by each air particulate station. The radon monitoring portion of Section 5.7.7 was revised to reflect selection of monitoring stations described above.

There were no known residences within 10 km of the site so a fifth air particulate station was not considered applicable according to the protocols outlined in Table 1 of Regulatory Guide 4.14. Also, the control/background air particulate location was chosen to be on site rather than at a location "remote from the site". This is consistent with footnote (c) to Table 1 which states a need for the background location to be representative of site conditions. That footnote also states that the background air particulate station should be upwind of the site. Because of the large amount of area included within the boundaries of this ISR site, it seemed reasonable to place the background station within site boundaries, but at considerable distance upwind of operational areas (it is currently located at least 1 mile west/southwest of the plant location and wellfield areas). This also seemed to be a practical background location as it is readily accessible and hard line electrical power was available.

The control/background air particulate and radon monitoring stations are represented by ID numbers MRA-4 and MR-1 (as respectively shown in Fig. 2.9-25 and 5.7-2). Again, these locations are generally upwind of the plant location based on annual prevailing wind directions presented in the earlier response to comment 2.10 (d).

Regulatory Guide 4.14 calls for a minimum of 5 radon sampling stations, each located at the five recommended air particulate sampling stations. Because of the very large size of the site, 10 radon monitoring stations were used instead of the recommended 5 stations. Furthermore, each air particulate sampling station has at least 1 radon monitoring station in the general vicinity. Baseline Rn-222 results indicated a relatively minor degree of spatial variability in radon concentrations across the site. Because additional radon monitoring stations are placed in many locations around the site, any significant localized changes in conditions due to ISR operations should be detected and can be compared against pre-operational baseline data and where applicable, against data from the nearest air monitoring station or other stations.

Additionally, a description of operational air particulate environmental monitoring was inadvertently omitted from the original application. The following description of operational air particulate monitoring was added to Section 5.7.7:

> Potential air particulate releases from the central plant processes will be monitored at the same air monitoring locations (MRA-1 through MRA-4) that were used for baseline determination of air particulate concentrations as described in Section 2.9.6. Sampling locations are shown on Figure 5.7-2. These locations were selected as recommended in Regulatory Guide 4.14, which calls for a minimum of three air monitoring stations at or near the site boundaries, one station at or close to the nearest occupiable structure with 10 km of the site, and one station at a control or background location. Monitoring will be performed using low volume air particulate samplers. Filters will be collected weekly to help prevent dust loading and will be composited on an approximate quarterly basis to provide respective estimates of average radionuclide concentrations as specified in Regulatory Guide 4.14. Each quarterly batch of air filters from the four monitoring stations will be submitted to a contract laboratory for analysis of Ra-226, U-nat, Th-230, and Pb-210. Results of the operational air particulate monitoring program will be reported in the semi-annual effluent reports required by 10 CFR § 40.65.

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?

Response:

Operational soil sampling will be conducted on an annual basis. Locations will include each of the 4 air particulate sampling locations located within the site boundaries. Samples will be collected as discrete grab samples of surface soils as indicated in Table 2 of Regulatory Guide 4.14, and will be analyzed for U-nat, Ra-226, and Pb-210. Sampling depth will be 5 cm for consistency with Regulatory Guide 4.14 baseline soil sampling surveys conducted at the site. Regulatory Guide 4.14 does not indicate subsurface sampling during operational phases of the site.

The surface and subsurface soil portions of Section 5.7.7 was updated to reflect operational soil monitoring described above.

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.

Response:

The environmental dosimeter used for direct radiation measurements will be the InLight dosimeter from Landauer. The InLight has a lower limit of detection of 0.1mrem. The direct radiation monitoring in Section 5.7.7 was revised to include type of dosimeter and the 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.

Response:

Numerical groundwater models have been developed that represent the unconfined conditions in the 70 Sand. The models are based on isopachs developed from site borings and water level data collected from site monitor wells. Aquifer properties used in the model were developed from site pumping tests. Model simulations supporting the monitor well network and full description of the model development and model simulations is provided in Appendix B4 "Numerical Modeling of Groundwater Conditions Related to Insitu Recovery at the Moore Ranch Uranium Project, Wyoming" (Petrotek 2008).

Section 5.7.8 was revised to include this information.

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.

Response:

The area of Wellfield 2 where the 68 and 70 sand coalesce is considered one aquifer and the underlying aquifer in this area will be the 60 sand. Additional monitor wells may be placed in the 68 sand around the area where the two sands coalesce to provide increased monitoring of any potential impacts to areas of the 68 sand outside of the coalescing area. Monitor wells will be placed in the underlying 60 sand in the wellfield 2 area at a spacing of 1 well per 4 acres. The final number and location of these underlying wells will be determined during final wellfield planning and submitted to the WDEQ-LQD in the Wellfield Package.

Section 5.7.8 was revised to include this information.

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."

Response:

As demonstrated in the previous response for 2-5(b), Infiltration from CBNG produced water and subsequent elevation of potential excursion indicators in the 72 sand is not apparent at this time. Hence, the use of chloride, conductivity and total alkalinity is appropriate given baseline groundwater quality characteristics.

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.

Response:

A numerical groundwater flow model has been developed, calibrated and validated to site conditions that replicates the unconfined conditions present across portions of the License Area. The model was used to design pumping tests that would adequately stress the 70 Sand such that hydraulic communication can be demonstrated between monitor wells and the production zone. A simulation of such a pump test was conducted. The simulation demonstrates that multiple pumping tests will be required to establish hydraulic communication between the production area and the monitor well ring. Simulations and full description of the model development and model simulations is provided in the Appendix B4 report "Numerical Modeling of Groundwater Conditions Related to Insitu Recovery at the Moore Ranch Uranium Project, Wyoming" (Petrotek 2008b).

Section 5.7.8 was revised to include this information.

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.

Response:

NRC staff has requested that EMC submit a statement that all wellfield hydrologic test packages will be submitted to NRC for review and approval before mining begins since EMC does not have a record of performance with NRC. In recent discussion with Staff to clarify the intent of this request, EMC was informed that Staff intends to require this of all new licensees and that this requirement could potentially be applied to existing licensees. The stated reason was that groundwater protection issues for ISR facilities have a high level of public interest and NRC must retain a role in groundwater protection for new licensees. Staff indicated that the review and approval would not necessarily require a license amendment but could simply consist of a review by Staff and a letter approving the hydrologic test package. Staff also indicated that at some undetermined point in the future, this submittal and approval requirement could be relaxed depending on site and licensee-specific conditions.

EMC does not believe that such a commitment should be required by NRC staff for the following reasons.

1. An original, primary goal of the issuance of performance-based licenses to ISR facilities was to streamline the wellfield approval process.

Before the first performance-based licenses were issued to ISR facilities beginning in 1995, NRC reviewed and approved each wellfield package. These reviews routinely took over six months for NRC staff to complete. Due to the phased nature of ISR mining, this delay between the collection of all hydrologic data required for a wellfield and the final approval by NRC staff resulted in significant operational impacts at most ISR facilities.

The concept of performance-based licensing for ISR facilities was originally proposed following the announcement by NRC in 1993 that they intended to close the Uranium Recovery Field Office (URFO) in Golden, Colorado and move all uranium recovery activities to Headquarters in Rockville, Maryland. In response to industry concerns, Chairman Selin directed that NRC form a Transition Oversight Team (TOT) to provide for a smooth transition from URFO to Rockville and to look at ways to reduce the regulatory burdens on uranium recovery licensees. In June 1993, TOT raised the idea of Performance Based License Conditions (PBLC) as an approach whereby an operator would not need NRC review and approval provided that guidance qualifications were met and that the proposed action was within the bounds of the environmental and technical review incorporated in the license. Licensees suggested that NRC should consider allowing the approval of new wellfields under a performance based license condition. Throughout the remainder of 1993 and 1994, NRC and licensees worked together to develop an acceptable PBLC. In 1995, the Highland Uranium Project license was converted to a performance-based license. In 1996, the NRC approved a PBLC for the Cogema Irigaray/Christensen Ranch Project. Both of the performance based licenses allowed the licensee to develop and open new wellfields within the licensed area without seeking NRC approval for each new field.

In the thirteen years since NRC began issuing performance based licenses to ISR facilities, EMC is not aware of any instances of the improper approval of new wellfields by a licensee. EMC has provided detailed information required for the development of new wellfields in the Moore Ranch application. The requirement that EMC submit these wellfield packages for NRC staff approval until a "record of performance" is established at some indeterminate point in the future will essentially negate the benefits of the performance-based licensing approach for EMC.

2. NRC staff will be hard-pressed to review these wellfield packages.

NRC staff has recently stated that they expect up to 14 applications for new or expanding ISR facilities in the next several years and that staff resources will be stretched to meet the demands created by the review of these license applications. Presumably, most of the new licensees will not have a "record of performance" with NRC staff and will also be asked to submit wellfield packages for NRC review and approval. In addition, Staff has indicated that existing licensees may also be required at some point in the future to submit their wellfield packages for NRC approval. It is conceivable, even likely, that with the current and projected workload, the NRC staff will not be able to meet the licensing schedule they have set for themselves and review a multitude of wellfield packages in a timely manner.

3. **NRC will have the opportunity to review wellfield hydrologic testing packages because under a performance-based license, this information will be contained in the proceedings of the EMC SERP.**

The approval of a new wellfield is considered a change under the performance-based license condition and must be approved by the EMC SERP. The SERP must evaluate the proposed change in comparison with NRC regulations, license conditions, evaluations made by NRC in the environmental impact statement/environmental assessment, and commitments made by EMC in the license application and incorporated by reference in the license.

NRC requires significant detail in license applications to reach decisions that will protect public health and the environment. Section 5.7.8 of the Moore Ranch Technical Report provides a detailed discussion of prerequisites required for the initiation of operations in a new wellfield including:

- Procedures for the installation, development, and characterization of new monitor wells and the determination of upper control limits for excursion detection and control;
- Procedures for the installation, development, and characterization of production zone wells and the determination of restoration target values; and
- The content required by the Wyoming Department of Environmental Quality (WDEQ) for the Wellfield Hydrologic Data Package including the results of hydrologic testing that including pump test raw data, drawdown match curves, potentiometric surface maps, water level graphs, drawdown maps and when appropriate, directional transmissivity data and graphs. The Wellfield Hydrologic Data Package must contain sufficient information to show that wells in the monitor well ring are in adequate communication with the production patterns.

Furthermore, EMC provided references to the WDEQ regulatory requirements and guidance that EMC will adhere to for new wellfield development. These commitments will be considered by NRC in the licensing basis, which must be reviewed by the EMC SERP before approval of any change. If the requirements for a new wellfield discussed in Section 5.7.8 cannot be met for some reason, a license amendment will be required.

SERP proceedings must be maintained on site for inspection by NRC. In addition, an annual report to NRC is typically required by license condition that summarizes SERP deliberations.

4. **Regardless of the lack of a “record of performance” that EMC may or may not have with NRC staff, the wellfield hydrologic test packages are required by, and approved by, the Wyoming Department of Environmental Quality.**

The WDEQ rules specify the content of the wellfield packages that must be submitted for approval for each new wellfield. EMC notes that the NRC does not have similar detailed regulatory requirements for the informational content required in wellfield development packages. Staff concerns are apparently related to public concerns raised during the Hydro Resources, Inc. licensing hearings in New Mexico. EMC notes that there is no history of uranium recovery using in situ methods in the State of New Mexico. In Wyoming, the WDEQ has developed a detailed, mature regulatory program based on decades of experience with ISR mining in the State. If EMC prepared and submitted a substandard wellfield package to WDEQ due to our lack of experience or no "record of performance", the WDEQ would not approve such a wellfield package.

5. **NRC staff has been directed by the NRC Commissioners to rely on the State UIC programs where possible to relieve dual jurisdiction impacts on licensees.**

This request by NRC staff disregards the direction provided by the NRC Commissioners repeatedly since 1999 in this regard. Although a Memorandum of Understanding has never been reached with the WDEQ, the NRC routinely relies on the review of wellfield packages conducted by the staff at WDEQ and other State UIC programs for existing ISR operations and has done so since the first performance-based licenses were issued in the mid 1990's. EMC could conceivably argue that a requirement for new licensees to submit to an additional level of regulatory scrutiny as compared to current operations would place EMC at a competitive disadvantage. As previously noted, ISR mining involves a phased approach. Individual wellfields are installed and developed at significant expense and over an extended period of time in order to be approved and ready for production as earlier wellfields are depleted. In order to allow for an additional regulatory review process with no certainty over the length of time required, EMC will need to accelerate the installation of wellfields. This will require additional equipment and manpower and commitments of capital in advance of operations that are not required of existing NRC ISR licensees.

Despite the fact that there is not an MOU between the NRC and the WDEQ, EMC believes that NRC can rely on the detailed EMC and WDEQ program described in the Moore Ranch application. This reliance is particularly defensible since NRC and the ISR industry have an extended history of allowing the development of new wellfields under a performance based license condition. If NRC Staff requires further details in Section 5.7.8 of the Technical Report concerning the contents of the Wellfield Hydrologic Data Package required by the WDEQ, EMC is prepared to respond.

Based on the previous discussion, EMC believes that NRC should not abandon the performance-based licensing approach to wellfield development. If NRC determines that a change of policy is required, then as a matter of equity it should apply to all new and existing ISR operations. EMC is willing to discuss further the implications of this RAI item with Staff.

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

Response:

Groundwater samples are critical to meeting environmental protection goals at ISR uranium mines. The results of these samples are used to monitor operational environmental protection efforts and to determine whether restoration activities are successful. In order to ensure the accuracy of these monitoring efforts, strict compliance with groundwater sampling procedures is necessary. This section provides instructions on water level determination, proper well sampling techniques, sample preservation and documentation, and QA/QC requirements. These requirements will be followed for all samples obtained from private wells and monitor wells.

The accurate determination of the static water level in monitor wells provides important information concerning aquifer conditions. Well static water levels are monitored using an electrical measuring line (an “e-line”). An e-line is a device that measures electrical conductance with two electrodes contained in a shielded probe. The probe is mounted to a graduated strip to allow measurement of water levels. The probe is slowly lowered into the well. When the probe contacts the water surface in the well, the circuit is completed and an audible device is actuated. The sampler will take water level readings of all wells before sampling.

It is generally not possible to measure water level in existing private wells without disassembly of pumping and piping systems. If possible, the water level will be measured. If it is not possible to measure water level, the well will be purged for at least five minutes to evacuate any lines or existing pressure tanks of stagnant water. If any particulate matter is identified in the water, the well will be allowed to flow until it no longer contains any particulate.

During regional well sampling, all readings should be reported to within at least one tenth of a foot and preferably to within a hundredth of a foot. It is important to check the e-line length by measuring with a steel tape after the line has been used for a long time, when the length has been altered due to repairs, or after it has been pulled hard in an attempt to free the line. If an e-line’s length is altered by these causes, a correction factor should be written on the side of the e-line so readings may be properly adjusted.

Water that remains in the well casing between samples may not be representative of the formation water quality. The quality of water left in the casing between samples may be changed by sorption or desorption from casing materials, oxidation, or biological activity. Purging is required to remove this stagnant water and allow formation water into the well screen.

The well must have a sufficient volume of water removed to induce the flow of formation water through the well screen. Two approaches to purging are provided in ASTM Guide D 4448. The first approach requires purging a large volume of water. ASTM Guide D 4448 recommends that three to five casing volumes be purged for the high volume method, while one casing volume may be acceptable if a lower purge rate near the recharge rate of the well is used. The second approach recommended in ASTM D 4448 requires the removal of stagnant casing water until one or more indicator parameters are stable. Stabilization is considered achieved when the measurements of all parameters are stable within a predetermined range. Parameters that EMC will monitor include pH, temperature, and specific conductivity.

For high and medium yield wells, EPA recommends a minimum purge volume of three casing volumes. For low yield wells, EPA also allows a smaller minimum purge volume of one casing volume if the flow is near the recharge rate of the aquifer.

The Wyoming LQD in Guideline 8, Section IV.A.4.b requires withdrawing at least two casing volumes of water prior to sampling. The sampler will document the pumping rate and the purging time. The LQD alternatively allows purging the well until pH, conductivity, temperature, and water level readings remain constant. The field sampler will document the changes in each field parameter against time in a tabular form. If recharge cannot match minimal pumping rates in a low permeability aquifer, then a sample can be retrieved by pumping the well dry once and then bailing the water that subsequently enters the well.

Accurate records of well purging will be maintained to document the number of casing volumes purged from the well before sampling. These records will include the casing volume (gallons), the pumping rate (gpm), and pumping start and stop times. The pumping rate can be determined with a flowmeter or by timing how long it takes to fill a 5-gallon bucket or other container of a known volume.

The following formula will be used to calculate the number of gallons contained in one casing volume:

Casing Volume (Gals) = (Height of water in well in ft) x (Radius of the well^2 in inches) x (π) x (0.052)

Where: $\pi = 3.1416$

The height of the water in the well = the total depth (TD) of the well in feet minus the depth to water in feet.

Field meters will be used to measure pH, specific conductance, and temperature of water samples. The use, calibration, and care of these meters will be in accordance with the owner's manual recommendations.

The groundwater sample will be taken as soon as the well is adequately purged. If the well was pumped dry during purging, the sample will be obtained as soon as adequate formation water is present in the casing. The sampler will record the following sampling data on a field sampling sheet:

- Identification of the well;

- Well depth;
- Static water level depth and measurement techniques;
- Well yield;
- Purge volume, pumping rate and volume per casing volume;
- Time well purged;
- Collection methods (bail or pump);
- Field observations (such as well condition, sample color, sample smell, sound);
- Name of collector; and
- Climatic conditions, including air temperature.

Once a water sample has been taken, the quality of the sample begins to degrade with time. Because of this, all samples will be kept cool and some must be preserved in order to lengthen the acceptable holding time. The contract laboratory will be consulted when determining proper preservation techniques for samples that require off site analysis. Samples to be analyzed for dissolved metals will be filtered to < 0.45 microns to remove suspended solids that may affect the results.

Preservative (acid) will be added to sample containers either before or immediately after collection and filtration, if required, of samples. The following Table provides a summary of the sampling and preservation recommendations for analytes typically of concern in groundwater. Field sampling personnel will consult the bottle and preservation list provided by the contract laboratory to ensure that the appropriate sample preservation method is used.

Parameter	**Volume Required (mls)**	**Preservative**	**Holding Time**
Dissolved Metals	250	Filter (0.45 µm), then add HNO_3 to ph<2	6 months
Total Metals	250	HNO_3 to ph<2	6 months
Alkalinity	100	Cool, 4°C	14 days
Chloride	50	None Required	28 days
Conductance	100	Cool, 4°C	28 days
Fluoride	50	None Required	28 days
Ammonia as N	50	H_2SO_4 to pH<2, Cool, 4°C	28 days
Nitrate + Nitrite	50	H_2SO_4 to pH<2, Cool, 4°C	28 days
Nitrate	50	Cool, 4°C	48 hours
Nitrite	50	Cool, 4°C	48 hours
pH	25	None Required	Analyze immediately
TDS	500	Cool, 4°C	7 days
TSS	500	Cool, 4°C	7 days
Sulfate	100	Cool, 4°C	28 days
Lead-210	1000	HNO_3 to ph<2	6 months

Parameter	Volume Required (mls)	Preservative	Holding Time
Polonium-210	1000	HNO_3 to ph<2	6 months
Radium-226	1000	HNO_3 to ph<2	6 months
Uranium	1000	HNO_3 to ph<2	6 months

Chain of Custody (COC) forms will accompany every sample sent to off-site contract laboratories. The chain of custody will contain at a minimum the type of sample, the sample identification number, the preservation techniques (if any), the name of the sampler, the date and time the sample was taken, the name(s) of individuals who handled the sample and when they passed it on to another person, and the required analysis.

This information on well sampling methods was added to Section 5.7.8.2

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

Response:

The locations of operational surface water sampling points are shown on Figure 2.7-1.

Surface water samples are collected using methods similar to groundwater. Samples are collected in the appropriate container(s) and field measurements for pH and conductivity are performed and documented using the techniques described in groundwater sampling methods.

The sample bottle must be rinsed with the sample water. The bottle is then filled with the mouth of the sample bottle pointed down stream to prevent collecting debris. If samples involve analysis that requires filtration, collect water in a clean bucket for transfer to the filter apparatus. Treatment of sample containers, preservation techniques, holding times, and shipping techniques are identical to those used for groundwater samples previously described.

Section 5.7.8.2 was revised to include the surface water sampling methods described above.

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

Response:

The previous responses to RAIs 2-4.c and 2-8.a detail locations and permitted volumes for CBNG discharges in the license area.

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.

Response:

Section 5 was revised to include the general Uranium One Quality Assurance Plan for Wyoming ISR Operations, which is provided in Addendum 5-A.

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.

Response:

The primary goal of the groundwater restoration efforts will be to return the groundwater quality of the production zone, on a wellfield average, to the preoperational (baseline) water quality conditions using Best Practicable Technology. Recognizing that restoration activities are not likely to return groundwater to the exact water quality that existed prior to in situ operations (as discussed in Section 6.5.1), a secondary restoration standard of class of use will be applied. The secondary standard of class of use will be applied only after restoration using BPT no longer shows significant improvement in groundwater quality and continuing restoration activities would not provide a significant benefit. The pre-mining baseline water quality and class of use will be determined by the baseline water quality sampling program which is performed for each wellfield, as compared to the use categories defined by the WDEQ, Water Quality Division (WQD). Baseline, as defined for this project, shall be the mean of the pre-mining baseline data after outlier removals. Restoration shall be demonstrated in accordance with Chapter 11, Section 5(a)(ii) of the WDEQ, Land Quality Division Rules and Regulations and NUREG-1569 Section 6. Section 6.1.1 was revised to include this restoration criteria.

Additional analysis has been performed based on the comparison of the Energy Metals Corporation Moore Ranch ISR uranium project and the COGEMA Irigaray and Christensen Ranch ISR uranium projects. Both COGEMA sites have completed production and restoration operations. The Irigaray site has received approval of aquifer restoration from the Wyoming Department of Environmental Quality (WDEQ) and from NRC. COGEMA has submitted a Wellfield Restoration Report for the Christensen Ranch project that is currently under review by WDEQ and NRC. These two ISR projects are located within the same geologic trend as the Moore Ranch Project. Hydrogeologic characteristics of Irigaray and Christensen Ranch are also similar to Moore Ranch.

Table 6-1.a(1) summarizes geologic, hydrogeologic and water chemistry properties of the Irigaray, Christensen Ranch and Moore Ranch ISR projects. All three of the projects target uranium ore within fluvially deposited channel sands of the Eocene Wasatch Formation. Depths to the ore bearing units are similar in each site (100 to 500 feet below ground surface). Hydrologic properties of the sites are also similar although aquifer transmissivity and hydraulic conductivity are generally higher at Moore Ranch.

One primary difference between the sites is that the production zone aquifer at Moore Ranch is unconfined whereas at Irigaray and Christensen Ranch, confined conditions exist in the production zone aquifer. However, recent hydrologic testing and numerical modeling indicate that unconfined conditions will not result in extensive dewatering of the production zone aquifer within well patterns during normal operating rates. Any dewatering that may occur locally can be readily reversed by "pulsing" of well patterns to ensure all portions of the aquifer that are contacted with lixiviant will also be contacted with restoration fluids/methods.

As noted, aquifer properties determined from site hydrologic tests indicate that transmissivity and hydraulic conductivity of the Moore Ranch production zone are generally greater than those properties at both Christensen Ranch and Irigaray. The increased hydraulic conductivity may be the result of generally coarser grain size, less consolidated sediments, less pervasive cementation, or any combination of these factors. Regardless of the cause of the increased transmissivity/hydraulic conductivity at Moore Ranch, this phenomenon should enhance aquifer restoration activities. Higher transmissivity will allow for easier transfer of water during production and restoration operations (higher production/injection rates). Greater volumes of fluids can be moved through the impacted aquifer in less time when the transmissivity/hydraulic conductivity is higher.

Baseline water quality of the three sites are generally similar although the Moore Ranch site is more of a calcium sulfate to calcium bicarbonate water type whereas Irigaray and Christensen Ranch are predominately sodium sulfate type water. TDS and sulfate levels are similar for all three sites. Trace minerals arsenic, manganese, and selenium and radionuclides uranium and radium–226 are in the same range at all three sites. Based on these similarities and the projected use of similar lixiviant, it is anticipated that post-mining water quality at Moore Ranch will generally be similar to post-mining water quality at Christensen Ranch and Irigaray.

Preliminary leach amenability tests have been completed on samples collected from the Moore Ranch production zone. The water chemistry after an equivalent of 30 pore volumes of leaching is summarized in Table 6-1.a(2). Although the test was not designed to approximate insitu conditions of permeability, porosity and pressure, the results provide an indication of the leachability of uranium and other associated minerals. The water quality analysis at the end of the test provides a general sense of water quality that may be present at the end of production at Moore Ranch. Also included in the table is the post-mining mean concentration of key water chemistry constituents from Irigaray and Christensen Ranch. The table shows that the water quality from the amenability testing is of similar or better quality than post-mining water quality at Irigaray and Christensen Ranch. Note that chlorides and sulfates tend to be very low in the amenability test leachate. The uranium concentration in the leachate is similar to the range observed in post-mining water at Christensen Ranch and Irigaray. The leach amenability tests indicate that Moore Ranch post-mining water quality will be similar to or better than post-mining water quality at Christensen Ranch or Irigaray.

Based on the comparison of geologic, hydrologic and water chemistry properties of Irigaray, Christensen Ranch and Moore Ranch, it is reasonable to expect that aquifer restoration can be achieved at Moore Ranch.

NRC staff has requested that EMC demonstrate the ability to return groundwater quality to the standards listed in Criterion 5B(5)(b) of Appendix A to 10 CFR Part 40. The criterion specified in this request requires that groundwater quality be returned to the values listed in the table in paragraph 5C if the background level of any constituent listed in the table is below the concentration listed (in effect, return groundwater to background or Table 5C, whichever is higher). The table lists the following constituents and concentrations that are included in the baseline water quality parameters presented in Table 6.1-1 of the Moore Ranch application.

Parameter (units)	Concentration from 10 CFR Part 40 Appendix A	Current EPA MCL	WDEQ Domestic Class of Use Standards
Arsenic (mg/l)	0.05	0.01	0.05
Barium (mg/l)	1.0	2.0	2.0
Cadmium (mg/l)	0.01	0.005	0.005
Chromium (mg/l)	0.05	0.1	0.1
Gross Alpha (pCi/l) (excluding uranium and radon)	15	15	15
Mercury (mg/l)	0.002	0.002	0.002
Lead (mg/l)	0.05	0.015	0.015
Combined Radium-226 and Radium-228 (pCi/L)	5	5	5
Selenium (mg/l)	0.01	0.05	0.05

These concentrations were based on the maximum concentration limits (MCLs) established by EPA as primary drinking water standards. It should be noted that the standards in Criterion 5B(5)(b) are dated and have been superseded by more recent MCLs promulgated by EPA. Specifically, the MLC for arsenic is 0.01 mg/l (as of January 2006), the MCL for barium is 2.0 mg/l, the MCL for cadmium is 0.005, the MCL for chromium is 0.1 mg/l, the action level for lead (based on the treatment technique) is 0.015 mg/l, and the MCL for selenium is 0.05 mg/l. These current EPA MCLs are shown in the table above.

For some of the constituents, the baseline concentrations expected in an in situ uranium deposit will exceed the concentration listed in Table 5C. Where baseline does not exceed the specified concentration, the WDEQ class of use standard is comparable to the current EPA concentrations (except for arsenic). Regional baseline monitoring show that groundwater within the mining zone is generally within the current EPA MCLs and WDEQ domestic class of use standard for all of the parameters listed in the table above, with the exception of radium-226 and radium-228. Therefore, the secondary standard of class of use currently specified in NRC guidance in NUREG-1569 is equivalent or better than the standards listed in Criterion 5B(5)(b) for the Moore Ranch Project based on regional baseline groundwater quality in planned mining aquifers. As expected, baseline radium-226 and 228 concentrations in the mining zones exceed the EPA MCL and standard for all of the WDEQ classes of use (5 pci/L for domestic, agriculture, and livestock classes of use) by greater than 50 times in some instances. More detailed sampling will be conducted for each wellfield to establish the restoration target values and class of use for each of these parameters.

NRC is in the process of preparing a proposed rule to revise Appendix A to specifically address groundwater protection and restoration at in situ leach uranium recovery facilities. In COMSECY-07-0015, NRC staff noted that EPA had recently taken the position that the generally applicable standards contained in 40 CFR Part 192 under UMTRCA applied to groundwater protection at in situ leach facilities and recommended that NRC "*proceed to prepare a rule that will conform to the generally applicable EPA standards in 40 CFR Part 192...*" Staff also recommended that "*as part of the rulemaking effort, the staff will update its guidance; the revised guidance will include discussion of use of a State's class-of-use designation in the ACL process.*" In the Staff Requirements for COMSECY-07-0015, the Commission approved the resumption of the rulemaking process for groundwater protection at in situ leach uranium extraction facilities to conform to 40 CFR Part 192.

Staff has insisted in discussions with EMC that the standards in 10 CFR Part 40 Appendix A *currently* apply to restoration at in situ leach facilities and that EMC must demonstrate the ability to meet these criteria. With regard to the current applicability of these standards, EMC disagrees. The groundwater protection requirements in Appendix A were specifically written to address conventional tailings facilities and will require revision to apply to in situ facilities, which is the purpose of the current rulemaking. There are a number of reasons that the current standards are not appropriate including the outdated criteria in table 5C and the question of where the point of compliance is for an in situ wellfield located in an exempted aquifer. The Commission recognized that the requirements of 40 CFR 192 were generally applied through the use of license conditions. There is no explicit policy statement by the Commission in the Staff Requirements Memorandum or in the voting record for SECY-07-0015 that would indicate that it is now Commission policy to apply Appendix A to groundwater protection at in situ facilities until after the rulemaking process has been completed.

Regardless of the question of the current applicability of Appendix A criteria to in situ wellfields, EMC believes that the current staff guidance contained in NUREG-1569, which EMC has demonstrated the ability to meet, generally conforms to Appendix A as currently written (i.e., baseline, class of use standards that for all constituents other than radium-226 and radium-228 are the MCL, or ACLs). Although the final criteria in the future revision of Appendix A cannot be predicted with certainty, EMC believes that the proven ability to meet the NUREG-1569 criteria using the proposed best practicable technology will also meet the criteria forthcoming in the proposed rule.

Table 6-1.a (1) Geologic, Hydrologic, and Water Quality Properties- Irigaray, Christensen Ranch and Moore Ranch ISR Projects

	Irigaray	Christensen Ranch	Moore Ranch
Permit Area	700 Acres	14,000 Acres	7,100 Acres
Wellfield Area	9 Mine Units - 30 Acres	5 Mine Units - 200 Acres	2 Mine Units - 65 Acres
Geology			
Basin	Powder River Basin	Powder River Basin	Powder River Basin
Location within basin	West central-east of basin axis	West central-east of basin axis	Southwest
Depositional Setting	Fluvial/channel sands	Fluvial/channel sands	Fluvial/channel sands
Formation	Eocene-Wasatch	Eocene-Wasatch	Eocene-Wasatch
Regional Dip	NW at 1 to 2 1/2 degrees	NW at 1 to 2 1/2 degrees	NW at 1 degree
Formation Lithology	Interbedded sandstone, siltstone and mudstone with thin coal beds	Interbedded sandstone, siltstone and mudstone with thin coal beds	Interbedded sandstone, siltstone and mudstone with thin coal beds
Primary Ore Bearing Unit	Upper Irigaray Sandstone	K Sandstone	70 Sand
Lithology of ore bearing unit	fine to crse gr, poorly srtd, arkosic sd	fine to crse gr, mod srtd, arkosic sd	v. fine to v. crse, well srtd, arkosic sd
Ore bearing unit thickness	75-130 ft	50 - 210 ft	50 -120 ft
Ore type	Roll Front	Roll Front	Roll Front
Ore thickness	15-25 ft	15-25 ft	< 25 ft
Depth to ore zone	100 to 300 ft	250 to 500 ft	180 to 250 ft
Porosity	23-29%	26 - 29 %	26%
Overlying confining unit thickness	15-25 ft	5-150 ft	5-150 ft
Underlying confining unit thickness	10-30 ft	20-70 ft	3-50 ft
Hydrology (Ore bearing unit)			
Groundwater Flow Direction	Northwest	Northwest	North
Hydraulic Gradient	0.005 ft/ft	0.004 to 0.010 ft/ft	0.004 ft/ft
Transmissivity (ore bearing unit)	40 to 136 ft²/d	33 to 139 ft²/d	23 to 711 ft²/d
Hydraulic Conductivity	0.37 to 1.4 ft/d	0.32 to 1.6 ft/d	1.4 to 13.8
Storativity	2.70E-04	4.5E-05 to 1.3E-03	5.3E-06 to 4.4E-03
Groundwater Velocity	0.019 to 0.03 ft/d	0.0086 to 0.043 ft/d	0.021 to 0.21 ft/d
¹Baseline Water Chemistry (Ore Bearing Unit)			
Water type	Sodium Sulfate	Sodium Sulfate	Calcium Sulfate to Calcium Bicarbonate
TDS (mg/l)	270-1050	400-1200	300-1200
Sulfate (mg/l)	130-630	230-680	76-665
Calcium	1-34	10-50	72-236
Sodium (mg/l)	95-280	150-280	13-62
Bicarbonate (mg/l)	5-144	130-210	159-317
Manganese (mg/l)	0.05-0.19	0.01-0.05	<0.01 - 0.06
Selenium (mg/l)	0.001-0.415	0.003-0.03	<0.001 - 0.12
Arsenic (mg/l)	0.001-0.105	0.002-0.01	<0.001 - 0.005
Uranium (mg/l)	0.0003-18.5	0.034-0.376	0.015-0.884
Radium (pCi/l)	0-250	63-430	<1 - 309

Table 6-1.a(2) Comparison of Baseline and Post Mining Water Quality at Christensen Ranch and Irigary with Leach Amenability Tests Results for Moore Ranch Samples (After 30 Pore Volumes)

	Christensen Ranch MU2-MU6			Irigaray MU1-MU9			Moore Ranch Bottle Roll Tests		
Major Ions mg/l:	Baseline Mean	Post Mining Mean	Net Difference	Baseline Mean	Post Mining Mean	Net Difference	4052C	4053C	Mean
Ca	12	298	286	7	199	192	10.9	7.1	9
Mg	1.7	57.5	55.8	0.8	45.7	44.9	2.3	2.3	2.3
Na	158	702	544	126	827	701	586	594	590
K	4	11	7	2	9	7	1	2	1
CO3	28	1	-27	15	<2	-13	57	63	60
HCO3	106	1775	1669	78	1343	1265	1220	1200	1210
SO4	272	930	658	182	639	457	6	1	3.5
Cl	7.8	141.0	133.2	12.6	277	264.4	1	1	1
TDS	515	3284	2769	378	2451	2073	1280	1230	1255
Cond. (umho/cm)	813	4283	3470	648	3795	3147	1870	1870	1870
Alk. (as CaCO3)	95	1442	1347	98	1101	1003	1100	1090	1095
pH (units)	8.77	7.51	-1.26	9.09	7.06	-2.03	8.65	8.67	8.66
Trace Metals mg/l:									
As	0.006	0.037	0.031	0.003	<0.5		0.013	0.005	0.009
Fe	0.054	0.883	0.829	0.015	<1.1		0.05	ND	< 0.05
Mn	0.018	0.631	0.613	0.005	1.249	1.2	ND	ND	ND
Mo	0.072	0.100	0.028	0.004	<1.07		ND	ND	ND
Ni	0.050	0.066	0.016	0.000	<1.02		ND	ND	ND
Se	0.004	0.071	0.067	0.000	0.247	0.2	0.006	ND	<0.006
Radiometric									
U (mg/l)	0.017	14.01	13.99	0.031	7.41	7.38	14.40	2.72	8.56
Ra 226 (pCi/l)	55.5	412.4	356.9	0.9	200.5	199.6	51.9	29.5	40.7

ND - Non Detect
40520 - Composite sample from 193 to 213 feet
40530 - Composite sample from 225 to 255 feet

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.

Response:

EMC will adequately monitor the underlying 68 Sand during all phases of production and restoration to identify any impacts resulting from ISR. Additional monitoring wells will be placed within the 68 Sand in areas where the 68 and 70 Sands coalesce. EMC will attempt to minimize any impacts initially through hydraulic control during operations. If any impacts are detected, EMC will respond with additional engineering controls (such as overpumping to remove excursion fluids) as needed. Further, any impacts to the 68 Sand resulting from EMC's ISR operation will be mitigated during restoration to the same degree as impacts to the 70 Sand. As needed, groundwater sweep, RO and any other methods successfully applied to restoration of the 70 Sand will be used to restore the 68 Sand.

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.

Response:

The biological reduction method has not been determined at this time. Biological reduction has been successful in trial use at other ISR sites. Further evaluation is needed to determine the biological reduction method and field implementation for the Moore Ranch Project. Therefore, the reference to biological reduction has been removed from Section 6.

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.

Response:

As previously described in the response to RAI 2-6(f), pulsing of extraction/injection wells will result in contact of restoration fluids with all parts of the mined production zone. Numerical modeling simulations were used to illustrate how pulsing will complete sweep of the mined zone. Results of the simulations are attached. Full description of the model development and model simulations is provided in the report "5 Spot Pump Test, Results, Analysis and Modeling, Moore Ranch Uranium Project," (Petrotek 2008a) provided in Appendix B3.

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.

Response:

Based on the determined flare factor of 1.5 and a porosity of 0.2, the pore volumes for Wellfields 1 and 2 are 65,511,727 gallons and 94,151,490 gallons respectively. Section 6.6 was updated accordingly with the pore volume estimates.

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.)

Response:

There are several reasons to expect that restoration can be achieved with fewer pore volumes (PVs) of treatment and reinjection or disposal as described below.

Additional evaluation is provided with respect to the number of PVs of treatment that will be required to achieve restoration of the production zone aquifer. Table 6-1.f(3) presents a summary of the restoration schedule and volumes for Irigaray and Christensen Ranch. As shown on the table, the average number of PVs extracted and treated/reinjected/or disposed was 13.6 for Irigaray and 12.4 for Christensen. However, several points are presented that suggest that the number PVs required to restore the aquifer at Moore Ranch will be less than what was required at Christensen Ranch and Irigaray. Circumstances at both those ISR projects resulted in increased PVs to achieve restoration goals including the following:

- Production and restoration were not conducted sequentially, and were plagued with extended periods of shut-in and standby, with delays of up to several years in some cases;
- Groundwater sweep, the initial phase of restoration, was often largely ineffective and in some cases may have exacerbated the problem; and
- RO was continued in some wellfields after it was apparent that little improvement in water quality was occurring.

Restoration was not performed immediately following the completion of production, and in some cases, there were long periods of inactivity during the production and restoration phases. At Irigaray, production was interrupted for a period of almost six years in MU1 through MU5 [Figure 6-1.f(1)]. Similarly, there was a three-year break in production in MU6 through MU9, when the operation was in standby status. Restoration did not commence at MU1 through MU3 until a year after production had ended. At MU4 and MU5, restoration operations did not begin until two years following production Restoration commenced shortly after the end of production at MU6 through MU9. However the project was on standby status between the completion of groundwater sweep and the beginning of the RO phase of production, resulting in a break of one to two years, depending on the MU. Restoration was initiated sooner after the end of production at Christensen Ranch, with the exception of MU3 and MU4. However, there were periods of standby between groundwater sweep and RO treatment/injection of up to a year. These delays between and during production and restoration operations most likely increased the number of PVs required to complete aquifer restoration. Uranium One will commence restoration activities upon completion of production within a wellfield.

Results of the effectiveness of groundwater sweep (or lack of it) were clearly demonstrated in the Christensen Ranch Wellfield Restoration report (CRWR) (COGEMA 2008). Example plots from that report of mean wellfield water quality at the end of mining, groundwater sweep, RO and stabilization monitoring are attached. Plots of TDS for MU3, MU5 and MU6 (Figures 5-7, 5-8 and 5-7, from the respective Mine Unit Data Packages of the CRWR), indicate minimal improvement following groundwater sweep at MU3 and MU5 and an actual increase at MU6. Following application of RO, the TDS values at MU5 and MU6 decreased to levels below the target Restoration Goal. Uranium increased in MU5 and MU6 following groundwater sweep (Figures 5-12 and 5-13 from the respective Mine Unit Data Packages of the CRWR), and then was significantly lowered during RO. Approximately 1.8. 4.8 and 1.5 PVs of groundwater were removed from MU3, MU5 and MU6, respectively, during groundwater sweep. This water removal was totally consumptive by design, in that none of it was returned to the aquifer. Based on the results, minimal benefit, if any, was derived from this phase of restoration. Eliminating groundwater sweep, an unnecessary, ineffective and consumptive step in the restoration process, will reduce the number of PVs required to reach restoration goals.

In some cases, RO was continued longer than necessary or at least longer than any improvements to water quality were occurring. A review of the uranium and conductivity trend plots from the Irigaray recovery wells during restoration (included in the Irigaray Mine Wellfield Restoration Report (COGEMA 2004) show this to be the case. Figures 4-4 through 4-7 from the Irigaray report show that RO was often continued for several PVs beyond the point that water quality had stabilized. The additional PVs of RO resulted in no direct benefit to aquifer water quality and only resulted in consumptive use of the groundwater resources. RO typically results in disposal of approximately 20 percent of the recovered groundwater with reinjection of the remaining 80 percent following treatment. Terminating RO once water quality has stabilized will minimize the consumptive use of groundwater and reduce the number of PVs of treatment.
[MG1]
One additional strategy proposed by Uranium One to reduce the volume of water required to restore the aquifer is groundwater transfer. Groundwater transfer was described in section 6.1.3.1 of the Moore Ranch Uranium Project License Application-Technical Report (Uranium One, 2007). Groundwater transfer entails the transfer of water from a wellfield commencing restoration to another wellfield that is beginning production. Baseline water quality is pumped from the wellfield beginning production and then injected into the wellfield that is starting restoration. Concurrently, the higher TDS water from the wellfield in restoration is pumped and then injected into the wellfield beginning production. The objective of groundwater transfer is to blend water in two wellfields until they have similar water quality. Groundwater transfer has much of the benefit of groundwater sweep without the large consumptive use of water.

The net result of each of these strategies (immediate restoration following production, elimination of groundwater sweep, terminating RO once restoration is achieved or water quality has stabilized, and groundwater transfer) should reduce the number of PVs required to achieve aquifer restoration. It is difficult to quantify how effective each of these strategies will be until actual field measured data become available. Substantial justification of the number of PVs estimated for restoration of Moore Ranch following ISR mining using analytical methods or numerical modeling, given the degree of uncertainty that exists in many of the parameters that would be used in such a demonstration, does not seem appropriate at this time. The preferred approach is the one presented in this response; to use existing analogs to the site, and to adjust the PV approximation based on "lessons learned" from those sites.

Table 6-1.f(1) Production and Restoration Schedule and Volumes, Christensen Ranch and Irigaray ISL Uranium Projects

Christensen Ranch Production/Restoration

	Production[1]	GWS	RO	Recirculation	Stability Monitoring	Total Volume Restoration (million gallons)	Total PVs Restored	PV of GWS	PV of RO	PV of Recirc
MU2	Jul-93, May-97	May-97, Jul-99	Oct-00, Mar-02	Apr-03, Mar-04*	Apr-04, Jan-05	394	14.4	2.2	10.8	1.4
MU3	Mar-89-Jun-95	Mar-97, Sep 98	Feb-99, Aug-02	Feb-04, Sep-04*	Oct-04, Jul-05	443	19.6	1.8	16.4	1.6
MU4	Jun-94, Aug-97	Aug-97, Jul-98	Apr-01, Mar-03*	Mar-03, Apr-04	Apr-04, Jan-05	250	12.6	1.9	9.8	1.0
MU5	Jun-95, Mar-00	Aug-00, Jun-01	Feb-01, Nov-03	-	Nov-03, Aug-04	757	10.1	4.8	5.3	0.0
MU6	Jan-97, Jun-00	Sep-00, Feb-03	Oct-03 May-05	-	Jun-05, Mar-06	757	6	1.5	4.5	0.0
					Average	520.2	12.6	2.4	9.4	0.8

1 - Lixiviant was Sodium Bicarbonate with gaseous O2
* Included H2S injection

Irigaray Production/Restoration

	Production[2]	GWS	RO	Recirculation	Stability Monitoring	Total Volume Restoration (million gallons)	Total PVs Restored	PV of GWS	PV of RO	PV of Recirc
MU1 - MU3	Oct-78, Oct-81 Aug-87, Jun-89	May-90, Apr-91	Apr-91, Oct-92	Oct-92, Nov-92	Dec-92, Sep-93	216	18.4	4.2	13.2	1.1
MU4 - MU5	Oct-78, Oct-81 Aug-87, Jun-89	Jun-91, Oct-95	Oct-95, Aug-98	Aug-98, Sep-98	Oct-98, Jul-99	142	13.9	3.4	9.5	1
MU6	Jun-86, Feb-90 Aug-93, Nov-94	Jan-96, Aug-98	Jul-00, Oct-01	Oct-01, Nov-01	Dec-01, Aug-02	127	9.5	1.4	7.1	1
MU-7	Jan-86, Feb-90 Aug-93, Nov-94	Apr-95, Sep-97	Feb-00, Jul-01	Jul-01, Aug-01	Aug-01, Jun-02	169	14.3	1.6	11.7	1
MU-8	Feb-86, Feb-90 Aug-93, Nov-94	Apr-95, Sep-97	Mar-99, Jun-00	Jul-00, Aug-00	Sep-00, Jun-01	55	12.5	1.4	10.2	0.9
MU-9	Mar-86, Feb-90 Aug-93, Nov-94	Apr-95, Sep-97	Nov-98, Apr-00	May-00, May-00	Jun-00, Jan-01	110	13	1.7	10.7	0.6
					Average	140	13.6	2.3	10.4	0.9

2 - Lixiviant was Ammonium Bicarbonate with Hydrogen Peroxide in MU1-MU5 from 1977 to May 1980. Thereafter Sodium Bicarbonate with gaseous O2 was utilized.

PV - Pore Volume
GWS - Groundwater Sweep
RO - Reverse Osmosis and Reinjection
Recirc - Recirculation

Figure 6-1.f(1) Production and Restoration Sequence Irigaray Mine Units 1 through 9

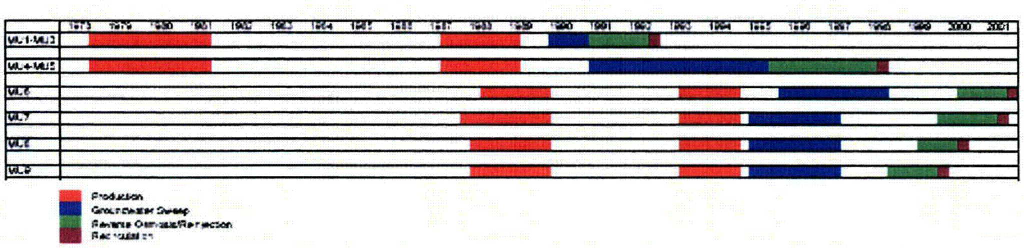


Figure 5-1.f (2): Production and Restoration Sequence, Christensen Ranch Mine Units 2 through 6

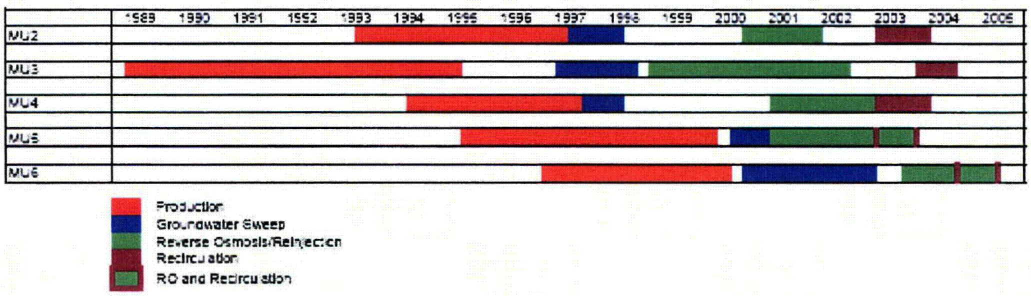


Figure 5-7. Mean TDS Concentration-Post Mining Through 4th Stability Round
Mine Unit 3, Christensen Ranch, Wyoming, Cogema Mining, Inc.

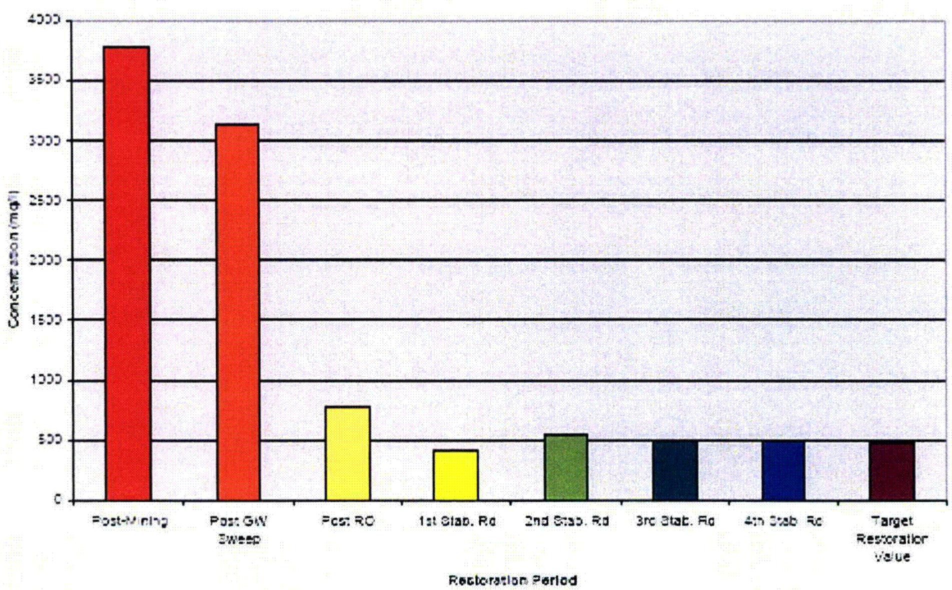


Figure 5-8. Mean TDS Concentration-Post Mining Through 4th Stability Round
Mine Unit 5, Christensen Ranch, Wyoming, Cogema Mining, Inc.

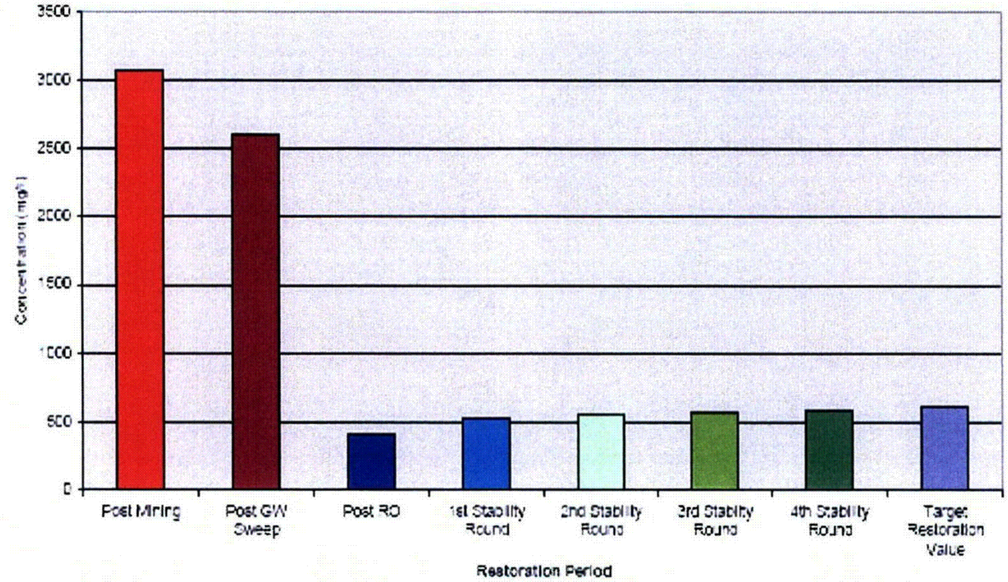
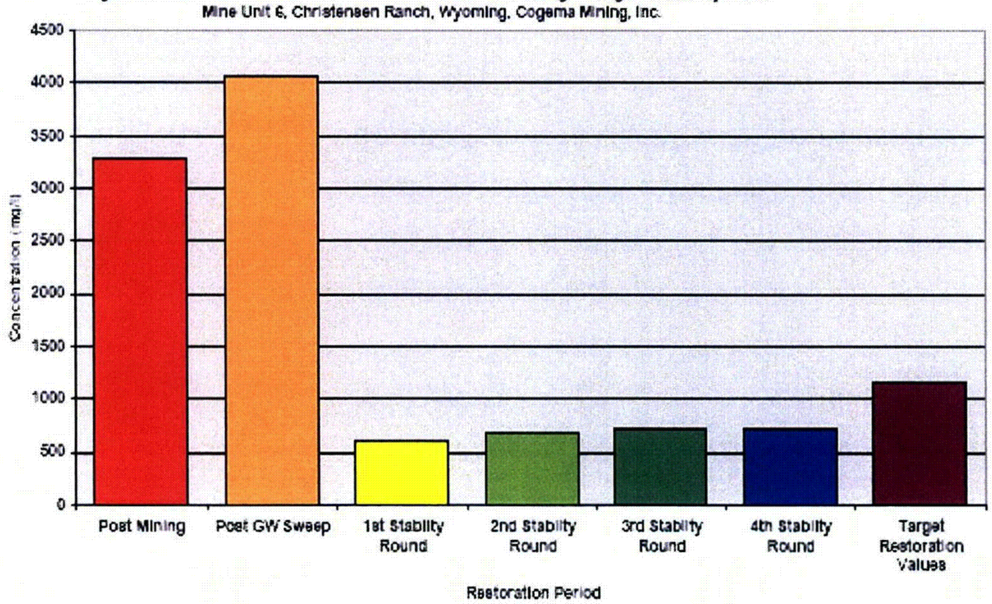


Figure 5-7 Mean Total Dissolved Solids Concentration-Post Mining Through 4th Stability Round
Mine Unit 6, Christensen Ranch, Wyoming, Cogema Mining, Inc.



Figuire 6-12. Mean Uranium Concentration-Post Mining Through 4th Stability Round
Mine Unit 6, Christensen Ranch, Wyoming, Cogema Mining, Inc..

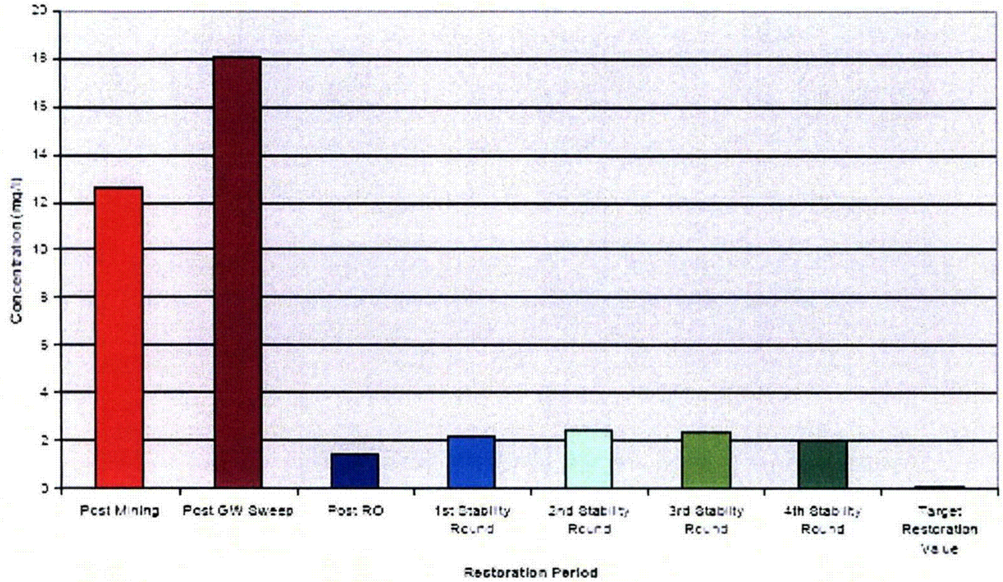


Figure 5-13 Mean Uranium Concentration-Post Mining Through 4th Stability Round
Mine Unit 6. Christensen Ranch, Wyoming, Cogema Mining, Inc.

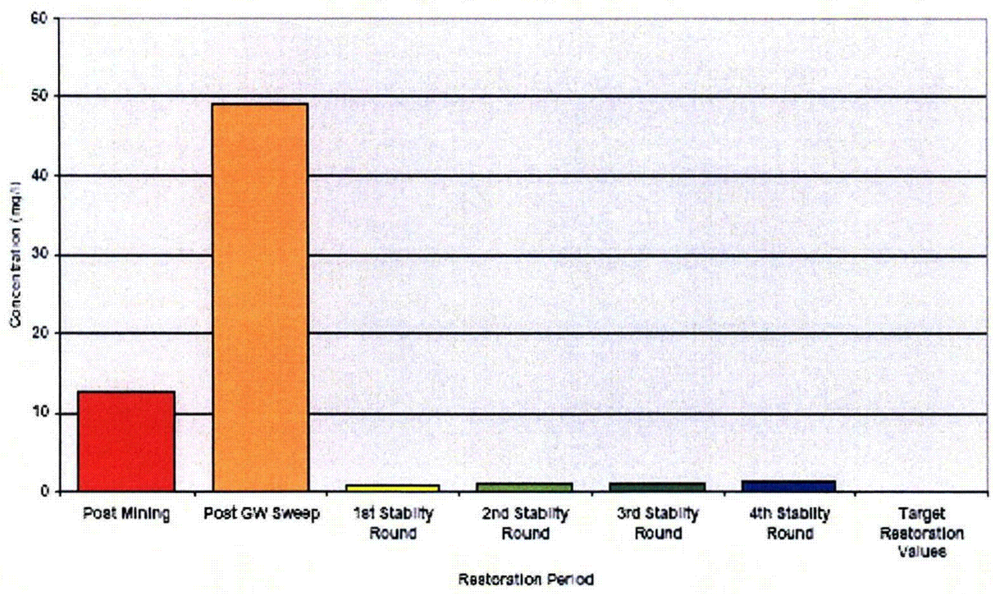


FIGURE 4-4
CONDUCTIVITY AND URANIUM TRENDS
PRODUCTION UNIT 6, RO PHASE
(MONTHLY RECOVERY WELL AVERAGES)

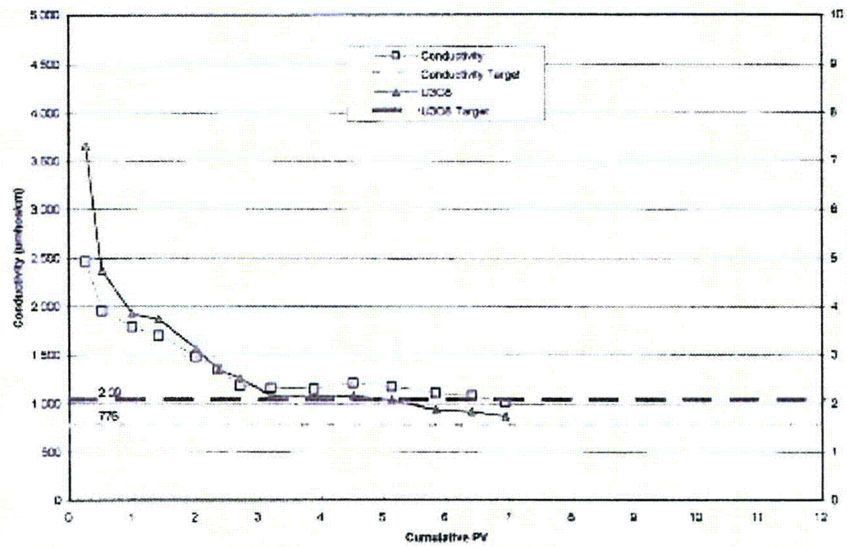


FIGURE 4-5
CONDUCTIVITY AND URANIUM TRENDS
PRODUCTION UNIT 7, RO PHASE
(MONTHLY RECOVERY WELL AVERAGES)

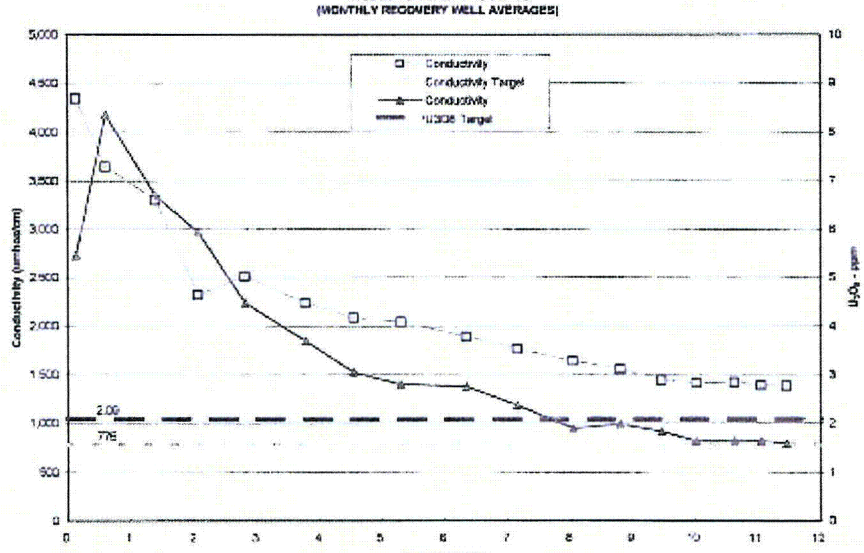


FIGURE 4-6
CONDUCTIVITY AND URANIUM TRENDS
PRODUCTION UNIT 8, RO PHASE
(MONTHLY RECOVERY WELL AVERAGES)

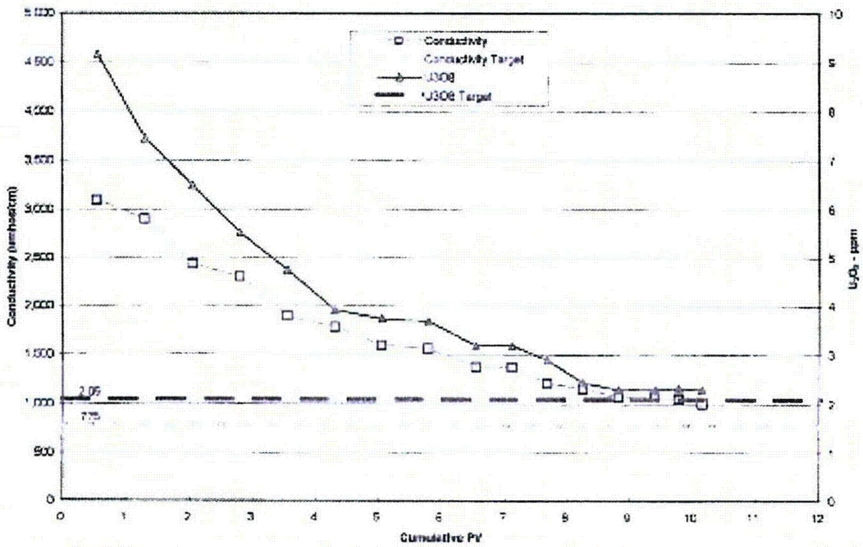
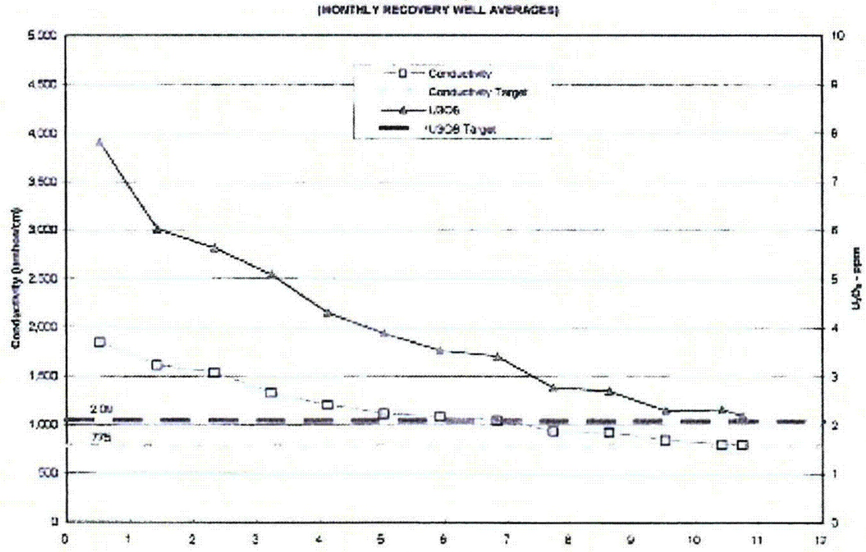


FIGURE 4-7
CONDUCTIVITY AND URANIUM TRENDS
PRODUCTION UNIT 9, RO PHASE
(MONTHLY RECOVERY WELL AVERAGES)



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.

Response:

The mining zone will monitored on a frequent basis adequate enough to determine success of restoration, optimize efficiency of restoration techniques, and determine any areas of the wellfield that need additional attention. Samples will be monitored for all of the parameters shown in Table 6.1-1 at the start of restoration and all or selected parameters through restoration as needed.

Section 6.1.7.2 was revised with this information.

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).

Response:

See response to 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.

Response:

The wells will be equipped with a high-level shutoff switch on the injection tubing to prevent operation of the pumps at pressures greater than the Limiting Surface Injection Pressure. In addition, the wells will be equipped with a low-pressure shut-down switch on the surface injection line that will deactivate the injection pump in the event of a surface leak. Finally, the wells will include a high/low pressure shutdown switch with a pressure sensor on the tubing/casing annulus. This switch will stop the injection pump in the event of either (1) a tubing leak or (2) a casing, packer, or wellhead leak. This information was added to Section 4.2.3.3.

See response to RAI 4-2(g) for clean of spills.

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).

Response:

The six month stability monitoring period is specified in WDEQ-LQD Guideline 4. The criteria to establish restoration stability will be based on wellfield averages for water quality. A determination of aquifer stability should be made upon the "trends" in the data; i.e., a stable aquifer should not exhibit rapid upward or downward trends or be oscillating back and forth over a wide range of values. The data is evaluated against baseline quality and variability to determine if the restoration goal is met and if the water is restored at a minimum to within the class of use. If increasing trends are confirmed during the stability period for all or part of a wellfield, then an evaluation of the potential cause of the increasing trends will be conducted and corrective actions will be taken, including continued restoration using Best Practical Technology if needed.

Section 6.1.7.2 was revised to include the above information.

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.

Response:

Pre-reclamation radiological surveys will be conducted in a manner consistent with the baseline radiological surveys so that the data can be directly compared for identification of potentially contaminated areas. For example, a comprehensive gamma scan of the site will be performed, including conversion of raw scan data to 3-foot HPIC equivalent gamma exposure rate readings and/or to estimates of soil Ra-226 concentration. These data sets will be kriged in GIS to develop continuous estimates across the site, making direct spatial comparisons with baseline survey maps possible for any given area at the site. Both qualitative assessments and quantitative statistical comparisons between kriged data sets can be made to assess significant differences, taking into account potential magnitudes of estimation uncertainty. In cases of identified contamination at the soil surface, subsurface soil sampling will also be conducted to determine the vertical extent of contamination that would require remediation under applicable soil cleanup criteria.

Final status surveys after any remediation has occurred will also be conducted such that results can be directly compared to pre-operational baseline survey data. As with pre-reclamation surveys, final status gamma scan data will be converted to 3-foot HPIC equivalent gamma exposure rates and/or to estimates of soil Ra-226 concentrations, then kriged using GIS for comparative assessments against pre-operational baseline data. For aspects of the final status survey, pre-operational baseline data may be used instead of a physically separated reference area to provide information on background conditions for statistical comparative testing. Subsurface sampling will be conducted as part of the final status survey only if residual subsurface contamination is known to remain after any remediation has been completed. Other post-operational environmental monitoring data such as sediments, surface waters, groundwater, air particulates, radon, and vegetation may also be compared quantitatively and/or qualitatively against pre-operational baseline data.

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.

Response:

As stated in Section 6.2.4, no major changes in the topography will result from the proposed mining operation. Therefore, a final contour map is not required As a result, the pre-operations contour shown on Figure 2.1-2 will generally show post-mining contour. The reference to Figure 2.1-2 was added to Section 6.2.4.

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

Response:

All waste that could pose a threat to human health and the environment will disposed of offsite. This will effectively control, minimize, or eliminate post-closure escape of nonradiological hazardous constituents, leachate, contaminated rainwater or waste composition products to the ground or surface waters, or to the atmosphere.

Section 6.3.2 was revised to include the above information.

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.

Response:

See response to RAI 5-13

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).

Response:

See response to 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.

Response:

This commitment was added to Section 6.3.2.1.

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.

Response:

Please see response to 6-2 (a.)

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.

Response:

Intake of contaminated food through aquatic pathways is not likely since surface water bodies on the site are ephemeral in nature and do not support aquatic species. Intake of contaminated milk is likewise not likely as no dairy livestock are located within or near the permit boundaries. Thus, these pathways were not included in the RESRAD calculations.

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.

Response:

Pre-reclamation surveys will also be conducted as described in Section 6.2.1 in areas where known contamination has occurred or the potential for unknown soil contamination exists. This statement was added to Section 6.4.3.

Also, See previous response to 6-2(a).

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.

Response:

Appendix D has been updated with a new reclamation cost estimate in 2008 dollars.

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.

Response:

The financial assurance funding mechanism will be in the form of an Irrevocable Letter of Credit. Section 6.6 was updated to include the anticipated surety mechanism.

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.

Response:

Section 6.6 was revised to include the statements requested above.

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.)

Response:

See response to 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.

Response:

The simulations described in the Appendix B4 report "Numerical Modeling of Groundwater Conditions Related to Insitu Recovery at the Moore Ranch Uranium Project, Wyoming" (Petrotek 2008b), indicate a horizontal flare factor of approximately 1.2, and it is assumed that the vertical flare will be similar. This results in a total wellfield flare factor of 1.4 to 1.5. Accordingly, EMC is using a flare factor of 1.5 for the surety estimate attached in Appendix D.

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

Response:

Appendix D has been updated with a new reclamation cost estimate in 2008 dollars.

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

Response:

Appendix D has been updated with a new reclamation cost estimate in 2008 dollars based on current design and number of wells.

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

Response:

Appendix D has been updated with a new reclamation cost estimate in 2008 dollars providing new building utility costs.

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).

Response:

Numerical modeling results indicate that it will take longer than 2.5 years to complete restoration, because of the limited saturated thickness of the aquifer and the need to balance drawdown between the two wellfields during concurrent production and restoration phases. Assuming 6 pore volumes of groundwater is required to reach restoration goals, modeling estimates indicate it will take approximately 4 years to restore Wellfield 1 and 6 years to restore Wellfield 2 included limited Groundwater sweep. Note that Wellfield 2 now includes what was previously Wellfields 2 and 3 in the License Application. This results in a larger pore volume calculation than would be the case if the wellfields were considered separately. Results of the simulation and full description of the model development and model simulations is provided in the Appendix B4 report "Numerical Modeling of Groundwater Conditions Related to Insitu Recovery at the Moore Ranch Uranium Project, Wyoming" (Petrotek 2008b).

Section 6.1.4, Figure 6.1-1, and Figure 3.1-6 were revised to reflect updated restoration schedules

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.

Response:

Appendix D has been updated with a new reclamation cost estimate in 2008 dollars including updated CPP operation costs based on ISL operating experience.

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.

Response:

Appendix D has been updated with a new reclamation cost estimate in 2008 dollars including MIT costs during restoration and for gamma surveys for decontamination.

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 accidents, and emergency plans and training:

Response:

An evaluation of potential accidents is contained in Section 7.5. An accident evaluation of fire and explosions has been added to Section 7.5. Revisions were also made to section 7.5 to address prevention, mitigation, emergency response, and training measures for the potential accident scenarios described.