1.0 SUMMARY AND CONCLUSIONS

By letter dated October 25, 2006, Homestake Mining Company (HMC) submitted to the U.S. Nuclear Regulatory Commission (NRC) a proposed design for a new evaporation pond for the Grants Reclamation Project (HMC, 2006). Additional submittals by HMC dated February 7, 2007 (HMC, 2007a), July 18, 2007 (HMC, 2007c), and March 17, 2008 (HMC, 2008) addressed NRC comments and requests for additional information. HMC currently operates a groundwater reclamation system to restore the groundwater to the approved groundwater protection standards. HMC seeks approval to construct a third evaporation pond at the project site to provide flexibility during operation of the groundwater reclamation system.

NRC staff reviewed HMC's submittals, including the Engineering Design Report, Groundwater Detection Monitoring Plan, and Environmental Report (ER). NRC staff determined that HMC's amendment request adequately addresses the applicable regulatory requirements.

2.0 BACKGROUND

2.1 Site History

The Homestake facility is a conventional uranium mill site undergoing reclamation. Uranium processing started in the late 1950's and continued until 1990. Reclamation activities started in 1993 (NRC, 1996). Currently, the site configuration includes the large tailings pile (LTP), small tailings pile (STP), two evaporation ponds, a number of groundwater injection and collection wells, an ion exchange treatment building for groundwater remediation, a reverse osmosis (RO) treatment facility, and several administrative and maintenance buildings.

Groundwater remediation is mandated by 10 CFR Part 40, Appendix A. The current Corrective Action Program (CAP) consists of groundwater recovery and injection with treatment of the effluent through the use of evaporation ponds, an ion exchange process, and the RO system. The goal of the groundwater CAP is to restore the groundwater to levels as close as practicable to the up-gradient groundwater quality background levels. This is accomplished by pumping contaminated groundwater to either the RO plant or one of the two existing evaporation ponds (HMC, 2006). The two evaporation ponds at the site are at, or near capacity, and HMC is
proposing to build a third evaporation pond (EP3) to allow them to run their RO system at its
designed capacity. The groundwater protection standards for the Grants Reclamation Project
are identified in License Condition 35. It is anticipated that with the addition of EP3 the
groundwater cleanup objectives will be reached in 2017.

2.2 Proposed Action

HMC proposes to construct EP3 to enhance the operation of the groundwater remediation
system. In its submittal, HMC evaluated three potential locations for EP3. HMC proposed the
Alternative B site location which is located approximately 1,800 ft north of County Road 63.
Alternative B is located outside the currently licensed boundary; therefore, HMC’s license will
need to be modified to include the footprint of EP3. The currently licensed site boundary will be
expanded by approximately 185 acres (HMC, 2006).

3.0 TECHNICAL EVALUATION

This technical evaluation is focused on geotechnical engineering, hydrology, and radiation
protection for the construction, operation, and eventual decommissioning of EP3.

3.1 Geotechnical Engineering

3.1.1 Introduction

HMC seeks approval to construct and operate EP3 at the Grants Reclamation Project site. EP3
will have the following characteristics:

(1) an impact area of approximately 33 acres;
(2) a square perimeter embankment of approximately 4,000 feet (ft) in total length;
(3) a maximum height of 12.2 ft;
(4) no spillway or external runoff;
(5) a maximum water surface area of 26.5 acres;
(6) a maximum operating capacity of 265.7 acre-ft;
(7) a double high density polyethylene (HDPE) liner system with a leak detection layer;
(8) outer slopes of 5H:1V and inner slopes of 3H:1V; and
(9) a planned life span of 10-12 years at which time it will be decommissioned.

The staff review included an assessment of: (1) information related to the evaporation pond site;
(2) characterization of the foundation materials; and (3) design and construction details of the
evaporation pond.

3.1.2 Site Characterization

The subsurface investigation included a series of eight test pits excavated to between 5 and 7 ft
below the existing ground surface. Bulk samples were obtained from the test pits for laboratory
testing. The investigation was performed to identify the foundation soil types and engineering
properties for the borrow material that will be used to construct the perimeter berm for EP3. The
design calls for excavating approximately 4 ft of soil from the footprint of the pond and using this
material to construct the perimeter berm. Test pit logs and the results of the laboratory testing
were included in Attachments B and C of the Design Report.
In addition to the eight test pits, previous investigations in the vicinity of the EP3 area included soil borings in 1994 and well construction logs. The information contained in the previous investigations confirms the shallow soil data from the recent test pits. Geotechnical engineering properties determined from laboratory testing include the soil classification, gradation characteristics, liquid limit, plastic limit, plasticity index, moisture content, maximum dry density, and optimum moisture content.

HMC has adequately described the geotechnical engineering characteristics of the site. Geotechnical engineering characteristics were determined using acceptable sampling techniques. The investigation was conducted with acceptable standards and engineering practices. Laboratory testing techniques were performed in accordance with the appropriate ASTM standards. The geotechnical engineering characterization of the site is sufficient to support engineering assessments related to prevention of waste migration and performance of the pond embankment. On the basis of the information presented in the application and the review of the site characterization, the NRC staff concludes that the characterization information provides an acceptable basis to enable the staff to make a finding on compliance with applicable criteria in 10 CFR Part 40, Appendix A.

3.1.3 Slope Stability [Criterion 5A(5)]

The application was prepared to address the requirements of New Mexico Administrative Code (NMAC), Title 19, Chapter 25, Part 12, Rules and Regulations Governing Dam Design, Construction, and Safety. According to 19.25.12.9A of NMAC, EP3 is classified as a small dam with a low hazard potential. The geometry of the perimeter embankment has been outlined in Section 2.1 of this Technical Evaluation Report (TER).

NMAC does not require a stability analysis or seismic design/analysis for a small dam with a low hazard potential. However, NRC’s regulations do not provide for any exception to the requirement to demonstrate stability. Therefore, a simple static and dynamic stability analysis is necessary and has been provided by HMC. The stability analysis was performed for the critical cross section at the southern most corner of EP3. The perimeter embankment reaches its maximum height of approximately 12 ft in this corner. The material properties, critical cross section geometry, and loading cases used in the stability analysis are representative of the site conditions. The analysis was performed using a widely available computer program and appropriate solution techniques. The results of the analyses indicated the minimum factor of safety for the analyses exceed the 1.5 and 1.0 minimum values for static and pseudo-static analyses used in standard practice.

Based on the information presented in the application and the review conducted of the slope stability analysis for the evaporation pond, the staff concludes that the results of the slope stability analysis provide an acceptable basis to demonstrate compliance with the applicable criterion in 10 CFR Part 40, Appendix A.

3.1.4 Settlement [Criterion 5A(5)]

Soil excavated from the bottom of the evaporation pond will be placed and compacted to form the perimeter embankment. Construction of the perimeter embankment will increase the stresses within the foundation soils. This increase in stress will result in settlement of the foundation soils.
Appendix B of the design report presents the settlement analysis resulting from construction of the perimeter embankment. The material properties, thicknesses, and loading conditions are representative of the site conditions. The methods used to calculate the anticipated settlement are appropriate for the perimeter embankment and foundation conditions at the site. The results of the settlement analysis are properly documented and indicate that the perimeter embankment will settle approximately 0.29 inches (in).

Based on the information provided in the application and the review conducted of the settlement resulting from the perimeter embankment construction, the NRC staff concludes that the settlement calculations presented demonstrate compliance with the criterion in 10 CFR Part 40, Appendix A, applicable to stability.

3.1.5 Liquefaction Potential [Criterion 5A(5)]

The staff has evaluated the liquefaction potential of the materials that will be used to construct the perimeter embankment for EP3. The design calls for excavating the bottom footprint of the pond (approximately 25 acres) to a depth of about 4 ft. This material will then be moved to the perimeter, placed and compacted to form the perimeter embankment. A geotechnical investigation consisting of a series of test pits was completed to identify the soil types that will be encountered during construction. At all eight of the test pits, the upper 2.5 to 3 ft of soil was classified as inorganic clay of low to moderate plasticity (CL material). Beneath this clay layer, the soil was found to be a fine to medium grained sand with some silt. HMC has indicated that liquefaction is not a concern at the site for several reasons. The soils are unsaturated to a depth of at least 40 ft, the underlying soils are not susceptible to liquefaction, the double liner within the pond prevent saturation of the near surface soils, and soils used in the pond embankment will be mixed and compacted to 95 percent of the Modified Proctor maximum dry density.

Based on the staff’s review of the data available in the design report, the NRC staff concludes that liquefaction potential is adequately addressed and demonstrates compliance with the criterion in 10 CFR Part 40, Appendix A, applicable to stability.

3.1.6 Freeboard [Criterion 5A(4)]

The staff has reviewed HMC’s analysis for the prevention of overtopping of the perimeter embankment. EP3 consists of a perimeter embankment, with no spillway, that will not receive storm water runoff other than what falls directly into the pond (the embankment surrounds the entire pond and provides a method for deflecting runoff around the pond). Potential mechanisms for overtopping of the pond include direct precipitation and wave run-up.

Section 2.5 and Appendix F of the design report address the spillway design flood and probable maximum precipitation (PMP). The HMC design is based on the requirements of NMAC Section 19.25.12.11.C.3, which addresses the design flood for a perimeter embankment dam with no spillway and no external drainage area. The PMP was estimated to be 13.32 in, which is less than the design freeboard of 2 ft. Therefore, the design appears to be adequate to retain the PMP without failure.

The wave run-up analysis is presented in Appendix C to the design report. The analysis is based on the requirements of NMAC 19.25.12.11.C.15. The wave run-up calculation is based
on the EP3 geometry, wind speed, fetch, and embankment slope. For a 100 mile per hour wind, the required freeboard to prevent overtopping was found to be 1.2 ft. The design freeboard of 2 ft will meet this requirement.

Based on the information presented in the design report and Appendices C and F, the NRC staff concludes that the analyses related to freeboard/overtopping present information needed to demonstrate compliance with the criterion in 10 CFR Part 40, Appendix A, applicable to overtopping.

3.1.7 Liner and Leak Detection [Criterion 5E(1)]

The staff has evaluated the components of HMC’s design related to the liner system for EP3. The bottom and interior side slopes of EP3 will be covered with a double HDPE liner with a leak detection system between the two geomembranes. From top to bottom, the liner system components are as follows:

1. 60 millimeter (mil) HDPE geomembrane (primary liner);
2. 0.2 in thick geonet (leak detection layer);
3. 40 mil HDPE geomembrane (secondary liner); and
4. 6 in thick layer of native soil scarified and compacted to 95% of Modified Proctor maximum dry density.

The liner system cross section that HMC is planning to install for EP3 is similar to the liner system cross section that has been used at Evaporation Pond 2 (EP2) for the last 13 years. HMC has indicated that the liner system at EP2 has performed as specified with only minor maintenance issues. As similar materials and construction techniques are planned for EP3, it is likely that the performance of EP3 will be similar to EP2. HDPE liners are formulated to withstand the chemical characteristics (i.e., pH, chloride, metals, etc.) that are likely to be encountered in the HMC groundwater. Additionally, Technical Specification EP3.2, Section 2.1 requires that the HDPE material used in EP3 be formulated to resist ultraviolet and ozone degradation.

In addition to the liner system cross section, the design calls for a grading plan that creates a series of ten low points along the northeast and southwest sides of EP3 (five on each side). As shown on drawing EP3-2, the grading pattern divides EP3 into a series of ten cells with a low point located in each cell. At each of these low points, the design calls for a leak detection sump where the geonet provides a pathway for water to flow into clean sand. A 6 in diameter HDPE pipe follows the 3H:1V up to the top of the perimeter embankment (see drawing EP3-4). This pipe allows for the liquid levels within the sump to be checked, and for liquid to be removed from the leak detection layer. The combination of the sumps and grading plan allow for the location of a possible leak to be narrowed down to an individual cell before implementing a repair. HMC has indicated that they will follow the same inspection and corrective action procedures that are used for pond EP2. Inspection procedures include lowering a pump into detection sumps on a weekly basis to check for leakage. If leakage is detected in excess of the action leakage rate of 775 gallons per acre per day, a leak detection survey will be conducted. Liquids collected within the sumps will be pumped back into EP3.
Based on the information presented in the application and the review of the liner system design, the staff concludes that the design demonstrates compliance with 10 CFR Part 40, Appendix A, criterion related to leakage.

3.1.8 Closure (Criterion 6)

The staff reviewed the components of the design for EP3 related to closure/decommissioning. It is anticipated that EP3 will be a temporary facility in operation for between 10 and 12 years. After completion of groundwater remediation activities, EP3 will be closed and decommissioned.

Section 4.9 of the ER discusses the decommissioning and closure of EP3. Closure activities will include moving remaining sediments, pond liners, and other contaminated materials to EP1 for final disposal. At this point, soils beneath the EP3 footprint will be surveyed to ensure that the area is suitable for release in accordance with Criterion 6(6) of 10 CFR Part 40, Appendix A. Contaminated soils will be moved to EP1. The footprint of EP3 will be regraded and revegetated to provide long term stability. A letter dated 7 February 2007 letter discusses revising the reclamation plan upon approval of the revised CAP.

The staff concludes that the closure/decommissioning activities meet the requirements of 10 CFR Part 40, Appendix A applicable to closure.

3.1.9 Construction Considerations

The staff has completed its review of the construction considerations for the EP3 project. The items reviewed by NRC staff include: (1) engineering drawings EP3-1 through EP3-5; (2) soil balance calculations; (3) specification EP3.1 (Construction of Evaporation Pond); and (4) specification EP3.2 (Installation of Evaporation Pond Liner).

HMC will employ appropriate construction techniques for EP3. Material placed to form the perimeter embankment will be placed in 8 in-thick loose layers, and will be compacted to an average thickness of 6 in. Each lift of soil will be conditioned as required to achieve an in-place dry density of at least 95 percent of the maximum dry density. The fill shall contain no particle larger than 3 in; this limit decreases to 0.5 in within 6 in of the finished HDPE geomembrane liner subgrade surface. In-place density will be measured once every 2,000 yards (yds) of fill placement. Moisture-density relationships and soil gradation/classification will be performed every 10,000 yds of borrow soil, with additional testing required if the borrow soil type is visibly different from the previously identified and tested borrow soils. The NRC staff confirmed the soil balance for the site; it is not anticipated that outside soil will be needed to complete the perimeter embankment.

For placement of the liner system, samples of the geomembrane will be obtained for conformance testing. This testing will be performed for the following geomembrane properties: density, carbon black content, carbon black dispersion, thickness, tensile yield strength, elongation at yield, break strength, and elongation at break. The contractor will also be required to provide documentation of the quality control testing performed during production of the geomembrane. Non-destructive seam testing will be performed on all field seams over their entire length via either vacuum box testing or air pressure testing. Destructive seam testing will be performed once for every 500 ft of seam length.
The licensee has adequately described the construction considerations by: (1) providing a complete set of construction drawings; (2) describing the borrow material that will be used to construct the perimeter embankment; and (3) including appropriate laboratory and field testing for the earthwork and HDPE geomembrane components of construction. Appropriate records will be maintained for construction activities. The staff concludes that these construction considerations will facilitate compliance with the relevant 10 CFR Part 40, Appendix A criteria.

3.1.10 Finding

The licensee has adequately addressed all key geotechnical areas required for demonstrating an acceptable plan for constructing EP3. From a geotechnical engineering standpoint, HMC has demonstrated compliance with applicable criteria in 10 CFR Part 40, Appendix A.

3.2 Hydrogeology

3.2.1 Introduction

The groundwater characteristics at the Homestate site have been comprehensively studied over the past 20 years or more. An extensive groundwater compliance and groundwater corrective action program is actively occurring at the HMC site. The addition of EP3 is intended to enhance the corrective action program. HMC has not requested additional groundwater consumption or diversions from the New Mexico Office of the State Engineer beyond what is already permitted. Additional hydrologic studies prior to construction and operation of EP3 are not required.

3.2.2 EP3 Groundwater Monitoring

Licensees are required, by Criterion 7 of Appendix A to 10 CFR Part 40, to conduct a preoperational monitoring program to provide complete determination of background (baseline) water quality data. Throughout the construction and operating phases of the mill, an operational monitoring program must be conducted to measure or evaluate compliance with applicable standards and regulations; to evaluate performance of control systems and procedures; to evaluate environmental impacts of operations; and to detect potential long-term effects. Criterion 7A requires HMC to have a detection monitoring program for the initial purpose of detecting leakage of hazardous constituents from the disposal area and to implement corrective action and compliance monitoring programs.

NUREG-1620, Rev. 1, Section 4.1.3 (3)(b), instructs staff to ensure that geochemical conditions and water quality are characterized sufficiently to determine background (baseline) water quality. NUREG-1620, Rev. 1, Section 4.4.3 (8), instructs staff to ensure that effective corrective action and compliance monitoring programs are provided and that the licensees monitoring programs are adequate to evaluate the effectiveness of ground-water cleanup and control activities, and to monitor compliance with ground-water cleanup standards.

A detection monitoring program will be required to monitor EP3 for the leakage of hazardous constituents. Groundwater monitoring wells in the uppermost aquifer are proposed by HMC at two locations down gradient of EP3. The first location is an existing monitoring well DD that is located very near the south corner of EP3, and the second location will be a newly installed well near the middle of the southeast side of EP3. Both wells will monitor constituent concentrations
in the alluvial aquifer down gradient of EP3 since groundwater flow is primarily to the south in this location. Constituents will be analyzed for the parameters in HMC's current groundwater protection standards listed in license condition (LC) 35 of NRC Source Materials License SUA-1471. The monitoring wells will provide the capability to help detect pond liner failure that could lead to the contamination of local groundwater. Monitoring well DD has a long monitoring history as has the entire alluvial aquifer up gradient of the Grants site (HMC 2007b). Additional preoperational monitoring of well DD will not be required. This is consistent with NUREG-1620 Section 4.1.3 (3), which states that background water quality may already be defined by a condition in the license. If this is the case, the reviewer should rely on those background limits as the regulatory limits applicable to the site. Monitoring of the new well to determine baseline water quality will begin prior to completion of construction of EP3 as discussed in Section 4.8 of the HMC ER. Due to the extensive monitoring of the alluvial aquifer up gradient of the Grants site, a minimum of two quarterly preoperational baseline samples will be required prior to operations of EP3 as opposed to a year of preoperational sampling. The operational detection monitoring program will continue on these two wells as outlined in LC 35 of NRC Source Materials License SUA-1471.

3.2.3 Finding

The staff has reviewed the proposed groundwater detection monitoring plans for the proposed EP3 at the HMC site. This review included an evaluation using the review procedures in Section 4.1.2 and 4.4.2 and the acceptance criteria outlined in Section 4.1.3 (3)(b), and 4.4.3 (8), of NUREG-1620, Rev. 1. The licensee has made an acceptable determination of baseline water quality. The proposed operational groundwater detection monitoring program will provide reasonable assurance and verification that the EP3 is operating properly and not resulting in conditions that could lead to contamination of the local groundwater.

3.3 Public and Occupational Health

3.3.1 Radiation Protection Program

HMC continuously samples suspended particulates at six locations around the reclamation site. Samples are analyzed for natural uranium, radium-226, and thorium-230. Radon gas is monitored on a continuous basis at eight locations. Gamma exposure rates are continuously monitored through the use of optically stimulated luminescence dosimeter badges at seven locations. Air sampling results are reported in the Semi-Annual Monitoring Report. The last monitoring period was for January through July 2007 and all constituents were below regulatory levels (HMC 2007b).

NRC staff reviewed HMC’s existing radiation protection program to ensure it was adequate to meet the requirements of 10 CFR 20.1101 with the inclusion of the new evaporation pond. The new evaporation pond is similar to that of the two approved evaporation ponds already on site and will have similar radiological properties.

3.3.2 Finding

NRC staff reviewed the airborne monitoring program to ensure it was adequate to determine occupational and public doses considering any potential contribution from the new evaporation pond.
The NRC staff have determined that HMC’s radiation protection program is commensurate with the scope and extent of the licensed activities to ensure the requirements of 10 CFR 20.1201 and 10 CFR 20.1301 are met.

4.0 RECOMMENDED LICENSE CONDITIONS

Based on the safety and environmental review, the following modification to license amendments are recommended to facilitate the construction, operation, and monitoring of EP3:

License Condition 35:

A. Implement the groundwater monitoring program shown in Table 2 (8-99) submitted September 29, 1999, except that under “Reversal Wells,” delete Well KF and replace with Well DZ, and except that Well CW2 will remain in the sampling program monitoring annually for the G list of parameters, and Cr is to be deleted from the D and F lists of parameters. Well DD and one additional monitoring well to the middle of the southeast side of EP3 (to be named later) is to be added to the Table list and will be monitored semi-annually for the B and F list of parameters. The additional well is to be installed and monitored quarterly for at least two quarters prior to EP3 becoming operational to determine background water quality for the well.

License Condition 35:

D. Operate evaporative ponds EP1, EP2 and EP3, and enhanced evaporation systems located in each pond as described in the June 8 and 28, 1990; and July 26, August 16, August 19, September 2 and 15, 1994; October 25, 2006; February 7 and July 18, 2007, submittals. Monitoring and mitigation measures for EP3 contained in the HMC Environmental Report dated January 30, 2007, are incorporated into this LC by reference.

License Condition 37:

B. The final reclamation of the area that includes the small tailings pile and the three evaporation ponds will include the disposal of the contaminated groundwater restoration materials and precipitated solids from the evaporation pond. The small tailings pile and evaporation ponds will be reconstructed and covered with radon barrier material. The placement of the barrier on the small tailings pile shall be done in accordance with the material types, thicknesses, and placement criteria described in Homestake Mining Company’s Final Radon Barrier Design for the Small Tailings Pile, transmitted to the NRC in August 1996.

License Condition 43:

Before engaging in any developmental activity not previously assessed by the NRC, the licensee shall administer a cultural resource inventory. All disturbances associated with the proposed development will be completed in compliance with the National Historic Preservation Act (as amended) and its implementing
regulations (36 CFR 800), and the Archaeological Resources Protection Act (as amended) and its implementing regulations (43 CFR 7).

In order to ensure that no unapproved disturbance of cultural resources occurs, any work resulting in the discovery of previously unknown cultural artifacts shall cease. The artifacts shall be inventoried and evaluated in accordance with 36 CFR Part 800, and no disturbance of the area shall occur until the licensee has received authorization from the NRC to proceed.

In the event that bones or prehistoric or historic archaeological materials are uncovered during construction or earth-disturbing activities, cease work immediately and protect the remains from further disturbance. If bones are found, immediately notify local law enforcement and the Office of the Medical Investigator pursuant to 18-6-11.2C (Cultural Properties Act NMSA 1978).

In accordance with 18-6-11.2C and/or 36 CFR 800.13(b) (Protection of Historic Properties), notify the State Historic Preservation Officer (SHPO) or the State Archaeologist, immediately.

In either case, the Agency and the SHPO, in consultation with an archaeologist who holds state unmarked human burial excavation and survey permits, will determine the necessary steps to evaluate significance, document, protect or remove the material or remains, in compliance with law. Call the SHPO or State Archaeologist at (505) 827-6320.

REFERENCES


