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OFFICE OF THE STATE ENGINEER
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September 5, 2013

GROUND WATER
SEP 09 2013
BUREAU

Mr. David L. Mayerson
Mining Environmental Compliance Section
Ground Water Quality Bureau
New Mexico Environment Department
P.O. Box 5469
Santa Fe, NM 87502

RE: Homestake Mining Company, former Uranium Tailings Dam, Cibola County, OSE No. D-415, Water Rights No. 3700

Dear Mr. Mayerson:

Mr. James D. Head, P.E., of the Office of the State Engineer, Dam Safety Bureau (OSE-DSB) staff has completed a review of the 2013 Decommissioning and Reclamation Plan Update prepared by ARCADIS for the Homestake Mining Company (HMC). A copy of Mr. Head's review memorandum is enclosed for your information. I concur with the recommendations and comments and contained in the review memorandum.

Comments and discussion within the review memorandum were prepared from a dam safety perspective but recognize that a dam no longer exists at the Large Tailings Pile (LTP). That is, per the site descriptions of the LTP in the Decommissioning and Reclamation Plan Update, the former dam and the tailings contents have been re-contoured such that the former dam no longer exists and therefore water and/or additional tailings cannot be stored at the LTP site.

In our initial conversation you expressed concerns with the overall stability of the LTP being that, as part of the groundwater remediation process, HMC has included a tailings flushing program whereby uncontaminated water is injected into or near the top of the LTP in an attempt to remove contaminated water from the tailings pile. The enclosed memorandum discusses additional data needs because a comprehensive slope stability assessment is not possible without knowing if definable phreatic surfaces are present within the LTP. It is suggested that the NMED contact the HMC Grants office to verify if monitoring wells are situated at the top and downstream toe of the LTP. If wells are in-place, the next question is whether or not water surface elevations within the wells are being monitoring and recorded. If such water surface elevation data for the present configuration of the LTP exists, it can be used to make a determination concerning the need for a comprehensive slope stability evaluation of the LTP. If

pumping + injection could provide false data.

neither the wells nor the data exist, then a phased approach involving the installation of 3 to 5 monitoring wells is suggested as part of a stability analysis program. Water surface elevation data from wells installed in a preliminary phase can be used to make the determination as to whether or not more wells are needed and if a comprehensive slope stability evaluation of the LTP is warranted.

If further discussion would be helpful please feel free to contact James Head at (505) 383-4138 or myself at (505) 383-4134.

Sincerely,

Charles N. Thompson

Charles N. Thompson, P.E., Chief
Dam Safety Bureau

CNT/jdh

Enclosure

MEMORANDUM
OFFICE OF THE STATE ENGINEER
Dam Safety Bureau

DATE: September 5, 2013

TO: Charles N. Thompson, P.E., Chief, Dam Safety Bureau CNT

FROM: James D. Head, P.E., Dam Safety Engineer Manager

SUBJECT: Decommissioning and Reclamation Plan Update 2013, Homestake Mining Company Tailings Dam, Cibola County, OSE No. D-415, Water Rights No. 3700

This memorandum was prepared in response to concerns raised by the New Mexico Environment Department (NMED) pertaining to the overall stability of the Homestake Mining Company (HMC) uranium tailings stockpile (referred to as the large tailings pile, LTP) located along State Highway 605 and approximately 5 miles north of Milan, New Mexico. The latitude and longitude of the site are 35.243 degrees north and 107.864 degrees west, respectively. The LTP is the result of approximately 32 years of uranium mine tailings deposition behind a staged construction, perimeter (off-stream dam) embankment that was formerly regulated by the Office of the State Engineer Dam Safety Bureau (OSE-DSB). The former tailings dam was removed from the OSE-DSB jurisdictional inventory on March 23, 2006 as the result of a field inspection confirming that the perimeter embankment no longer stored water and had been re-contoured such that the embankment was no longer capable of impounding water and/or additional mine tailings.

As part of a decommissioning plan for the HMC uranium mine operation near Milan, the New Mexico Environment Department (NMED) has requested input from the OSE-DSB pertinent to the existing condition of the LTP in the context of dam safety as it relates to the on-going groundwater remediation process. As part of the remediation process, HMC has included a tailings flushing (water injection) program, whereby fresh (uncontaminated) water is injected into or near the top of the LTP in an attempt to drive contaminated water from the tailings pile into a seepage recovery system and nearby dewatering wells. By way of discussions with NMED staff, it is not apparent that all of the injected water is recaptured in the extraction wells and the seepage recovery system located in proximity to the downstream toe of the LTP. Water that is recovered is stored in evaporation ponds known as EP-1 and EP-2 located to the south of the LTP and a third pond, referred to as EP-3, located to the north of the LTP. These ponds are currently under OSE-DSB jurisdiction and are therefore routinely inspected in accordance with the frequency established by the OSE-DSB. According to Section 2.2.2.1 of the 2013 Decommissioning and Reclamation Plan Report prepared by ARCADIS (hereafter referred to as the DRP), the injection of water into the LTP is expected to continue through 2014 and extraction of water from wells in proximity to the LTP is currently planned through 2016. Per Section 2.2.2.2 of the DRP, the existing LTP occupies approximately 215 acres has slopes of 5 to 1 horizontal to vertical (h:v) and the original LTP was on the order of 85 to 90 feet high.

In the context of evaluating the DRP from a dam safety perspective the following sections, tables, and figures, and appendix of the DRP were reviewed:

- Section 2.2.2.1, Page 2-25: Mill Decommissioning and Reclamation History
- Section 2.2.2.2, Page 2-38: Tailings Pile Reclamation
- Section 2.2.2.3, Page 2-47: Surface Water Run-off Control – Onsite

- Section 3.5.4, Page 3-16: Precipitation
- Section 3.6.4, Page 3-24: Seismology
- Section 3.7, Page 3-25: Surface Water Hydrology
- Section 3.11.3, Page 3-34: Soil Borrow Areas
- Section 9.1, Page 9-2: Tailings Piles
- Section 9.2, Page 9-8: Ponds
- Section 9.9, Page 9-22: Surface Water
- Section 9.11.4, Page 9-31: Monitoring/Regulatory
- Section 11.2.2, Page 11-6: Instrumentation Program
- Table 2.2-5: Total Settlement Well Monitoring Data Measurements 2001 – 2011
- Figure 2.2-6: Cross Section Design of Re-contoured Small Tailings Pile
- Figure 2.2-7: Design Details, Reclamation Plan, Large Tailings Pile
- Figure 2.2-8: Settlement Monitoring Point Locations
- Figure 2.2-9: Site Drainages and Scour Trench Locations
- Figure 2.2-10: 100-year Floodplain (FEMA 2010) Map for HMC Project Area
- Figure 2.2-15: Release of Tailings from HMC Large Tailings Pile in 1977
- Figure 3.6-4: Map of Historical Earthquakes within 200 Miles of the HMC Project Site
- Figure 3.7-2: Drainage Map of the Vicinity of Homestake Grants Site
- Appendix F: Specifications for Reclamation Activities 1993 - 1995

Comments generated as a result of a review of the aforementioned sections of the DRP are as follows (comments shown are only for those sections of the DRP where comments were considered warranted from a dam safety perspective):

1. Section 2.2.2.1, Diversion levee, Page 2-29:

a. The level of flood protection is not included as part of the narrative for the diversion levee. This section of the DRP would be enhanced by including such (e.g.: 100-year, 24-hour duration precipitation event or whatever storm event was evaluated for the design).

b. The second paragraph on Page 2-32 makes reference to "contaminated borrow and fill used for recontouring the LTP...." The report could be further enhanced by including a figure or series of figures that fully depict the geometric configuration of the LTP subsequent to the recontouring effort. Currently, there is no such information included within the DRP. Having such information in combination with present day or recent piezometric surfaces is necessary to fully evaluate slope stability for the LTP.

2. Section 2.2.2.2, Pages 2-38 through 2-46, Tailings Pile Reclamation:

a. The second paragraph under Large Tailing Pile on Page 2-40 makes reference to Figure 2.2-7 for the LTP reclamation plan design details. From a dam safety perspective involving a comprehensive assessment of slope stability, the referenced figure is incomplete and does not exhibit the overall geometry of the LTP in its existing configuration, nor does it show the staged approach to construction of the dam and the material strength properties of the dam associated with the various stages of construction. A depiction similar to Figure 2.2-6 (Cross

Section Design of Re-contoured Small Tailings) shown prior to Figure 2.2-7 would be required for the LTP along with the corresponding shear strength parameters for any particular zone of the dam and the impounded tailings. A review of the 1980 Stability Assessment Report by D'Appolonia (on file with HMC) would expedite the assignment of shear strength parameters.

b. The last paragraph of Step 1 of the Stabilization of the LTP on Page 2-41 states "*Water is being re-injected into the LTP and extracted via a large number of wells located on the LTP as a means of flushing out contaminants present in the tailings.*" In the context of the stability of the various slopes that comprise the LTP, monitoring of the phreatic surface (akin to the groundwater table in natural ground) within the LTP is a requirement for developing slope stability models for cross-sections and/or embankment profiles of interest. If not already known, a discussion with HMC concerning their ability to use the injection wells as monitoring wells for defining phreatic surface elevations within the LTP is recommended. Given that the side slopes of the LTP have been reconfigured to 5:1 (h:v) as a result of the recontouring process, it not likely that slope stability issues will arise, however, information related to water surface elevations within the LTP are not apparent in the DRP and would be required if a detailed analysis involving slope stability of the LTP are to be considered as part of the full decommissioning/reclamation of the project.

c. Paragraphs 2 and 3 of Step 2 of the Stabilization of the LTP on Page 2-42 makes reference to the 5:1 (h:v) slopes performed by HMC as part of the recontouring process. Similar to a prior comment regarding cross-sections and/or profiles of the LTP, cross-sections and/or profiles of the LTP in its existing configuration should be included as part of the DRP.

d. Step 4 of the Stabilization of the LTP on Page 2-44 involves settlement monitoring. In the context of the tailings flushing program, information needs to be obtained from HMC concerning whether or not phreatic surface elevations within the LTP are also being monitored. Questions pertinent to slope stability of the LTP cannot be reasonably answered if phreatic surface elevations in the LTP are not known. If no monitoring is taking place, then an explanation justifying such in the context of slope stability should be provided from HMC.

3. Section 3.6.4, Seismology, Page 3-25: The last paragraph of this section refers to the Nuclear Regulatory Commission (NRC) evaluation of the HMC submittal of a reclamation plan revision prepared by AKG and Jenkins in 1993 and indicates that the seismic design of the LTP slopes are acceptable. Narrative within the paragraph further states that details of the NRC staff review were discussed in the Technical Evaluation Report (NRC 1999). From a dam safety perspective, it is not expected that any significant changes to the seismology or recommended Peak Ground Acceleration (PGA) is required, however, if it is determined that a significant portion of the LTP is saturated as a result of the current practice of tailings flushing, then a reevaluation of embankment stability may be warranted. If a reevaluation is deemed necessary, then updated seismology should be considered, particularly in the context of liquefaction given that most of the LTP is comprised of liquefiable material under saturated conditions.

4. Section 3.7, Surface Water Hydrology, Page 3-25: In the absence of the Updated CAP referred to in the first paragraph of this section, the OSE-DSB cannot render an opinion concerning the narrative within the DRP pertinent to surface water hydrology. The former dam that contained the storage ponds and tailings is no longer considered a dam being that it is reported to be incapable of storing water or tailings due to its reconfiguration as a result of the recontouring effort. It is not likely that updated hydrologic and flood routing analyses will alter the conclusions arrived at by those involved with the sizing of the division channel and/or berm and the extent of the present day erosion protection used to protect the LTP and the HMC facility as a whole.

5. Section 9.1, Tailings Piles, Page 9-2:

a. Depending on whether or not a significant portion of the LTP exists under saturated conditions ultimately dictates if slope stability analyses of the LTP in its current configuration is warranted. If updated slope stability is deemed warranted, then it should be considered for the list of remaining reclamation tasks under Section 9.1.1 on Page 9-3.

b. For the last paragraph of Section 9.1.1 on Page 9-4, the narrative revolves around settlement monitoring. Similar to prior inferences related to possible saturation of the LTP due to the tailings flushing process, monitoring of phreatic water surface elevations within the LTP is also recommended.

6. Section 9.11.4, Monitoring/Regulatory, Page 9-31: The last paragraph of this section on Page 9-32 includes "surveying and reporting tasks associated with monitoring of physical settlement of the LTP" among the monitoring activities scheduled to continue through the end of the project in 2022. Similar to prior comments related to slope stability of the LTP, monitoring of water levels in the LTP as a result of the tailings flushing process should also be considered. The continuation of water level monitoring can be reconsidered if it is found that water levels within the LTP are low enough such that slope stability is not impaired.

7. Section 11.2.2, Instrumentation Program, Page 11-6: This section is generic in its description of the instrumentation in that it indicates that the HMC Grants Reclamation Project currently has an instrumentation program that complies with 10 CFR 20.1501 (b) and (c). It is not apparent from this section as to whether or not the settlement monuments, seepage collection measurements, and/or any other devices are included among the items considered as instrumentation. In any case, monitoring wells on top of the LTP to verify the existence of phreatic surfaces within the LTP should be considered necessary if an assessment of slope stability is to be given consideration.

8. Table 2.2-5, Total Settlement Well Monitoring Data Measurements, 2001 -2011:

a. The subject table appears to present raw settlement data, not elevation data as inferred from the description within the table heading and therefore is misleading (i.e., Elevation, feet amsl, where amsl = above mean sea level). The data shown in the table appears to be cumulative settlement for a particular location/instrument for a specific year and although not described in the footnotes to the table, it is presumed that positive values are settlement values and

negative values represent heave (upward movement). The footnotes could be enhanced by including such.

b. Footnote "a" to the table appears to have a typographical error, that is, the top elevation of the D-2 monument is shown as 9995.29 feet whereas other elevations in proximity to D-2 appear to be on the order of 6660 feet.

c. The title "Total Settlement Well Monitoring Data Measurements" is somewhat misleading from a dam safety perspective in that "well" leads one to think that water surface elevations are being monitored.

d. Similar to other prior comments/discussion within this memorandum, monitoring of water surface elevations with the LTP is needed if an evaluation of slope stability is a concern to the NMED and NRC. That is, a table similar to Table 2-2.5 populated with water surface elevations within monitoring wells at predetermined locations on top of the LTP would be needed to accomplish a slope stability assessment of the LTP.

9. Figure 2.2-7, Design Details, Reclamation Plan, Large Tailings Pile: Although informative with regard to understanding the design details for the LTP, an additional figure similar to Figure 2.2-6 showing the Cross Section Design of Re-contoured Small Tailings Pile is needed if a slope stability assessment is deemed necessary for the LTP. It is further noted that several cross sections of the LTP would likely be necessary for a comprehensive slope stability assessment of the LTP, similar to what was done in the November 1980 Stability Assessment prepared by D'Appolonia Consulting Engineers, Inc.

10. Figure 2.2-10, 100-Year Floodplain (FEMA 2010) Map for HMC Project Area: It is recognized that either the FEMA floodplain map was superimposed on to the HMC Project Area Map or perhaps the other way around, HMC Project Map was superimposed onto the FEMA floodplain map. However, as presented, the inference is made that the majority of the south and west embankments along with portions of the EP-1 and EP-3 are inundated by the 100-year flood. A footnote that provides clarification concerning actual water levels as a result of the diversion and drainage channels would enhance the figure. Left as is, the figure infers that the LTP and evaporation ponds are subject to inundation from the 100-year event.

11. Figure 2.2-15, Release of Tailings from HMC Large Tailings Pile in 1977: The figure could be enhanced by including a footnote to the figure describing the areal extent in acres and the quantity (volume) of tailings released in 1977.

12. Appendix F, Specifications for Reclamation Activities 1993 – 1995: Technical Specification #B5 for Settlement Monument appears to be very comprehensive and meets the need for the settlement monuments. A similar specification for monitoring wells to be established at prescribed locations on top of the LTP and at the downstream toe (if not already established) will be necessary if a comprehensive slope stability evaluation of the LTP in its current configuration is deemed necessary.

James D. Head

James D. Head, P.E.
Dam Safety Bureau

jdh