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Administrative Rules Coordinator
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Attorney General's Office
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[sent via e-mail to paula.wilson@deq.idaho.gov]

RE: Support for Changes to Idaho Cyanidation Rules (IDAPA 58.01.13)

Dear Ms. Wilson:

The following letter has been prepared supporting efforts to modify the Idaho Department of Environmental Quality's Rules for Ore Processing by Cyanidation ("the Rules") as outlined in Idaho Administrative Procedures Act (IDAPA) 58 Title 01, Chapter 13 (58.01.13). Tierra Group International, Ltd. (Tierra Group) is an engineering design and consulting firm specializing in the design, permitting, operation, and closure of mining infrastructure such as tailings storage facilities (TSFs), heap leach facilities (HLFs), water storage dams, process ponds, and waste rock storage facilities (WRSFs). Tierra Group serves as the Engineer of Record (EoR) for constructed TSFs in Nevada, California, and Missouri as well as internationally. Tierra Group is currently preparing the design of the Stibnite Gold Project TSF for Midas Gold in Idaho. Tierra Group also provides third-party design and construction review services for TSF projects and has recently reviewed TSF designs and operations in Nevada, Arizona, and Montana. Tierra Group's engineers have experience both preparing and reviewing designs in various jurisdictions within the United States and internationally to ensure compliance with best practices and local regulatory requirements.

1.0 Regulatory Background

The liner system requirement contained in IDAPA 58.01.13.200 for facilities, regardless of the stored solution's cyanide concentration, with greater than 12 inches of hydraulic head on the primary liner includes the following components (described from top to bottom):

- 80-mil (0.080 inches or 2.0 mm) HDPE primary liner (or Department approved equivalent);
- Drainage media layer (gravel, sand, or geosynthetic material) to provide leak detection and recovery capability on the secondary liner;
- 80-mil HDPE secondary liner (or Department approved equivalent); and
- 12 inches (minimum) of compacted low permeability soil liner, placed in two 6-inch lifts, containing no particles with a diameter greater than 0.75-inch and have a maximum coefficient of permeability of 10^{-6} cm/sec (or Department approved equivalent).

2.0 Idaho Cyanidation Rules Observations

Tierra Group supports the intent of the Rules, which is to “establish requirements for water quality protection which address performance, construction, operation and closure of that portion of any cyanidation facility that is intended to contain, treat, or dispose of process water.” In addition, the Rules are ”intended to ensure that process water and process-contaminated water generated in ore processing operations that utilize cyanide as a primary leaching agent and pollutants associated with the cyanidation process are safely contained, controlled, and treated so that they do not interfere with the beneficial uses of the waters of the state and do not endanger public safety or the environment.”

Tierra Group offers the following observations:

- The Rules do not differentiate between different types of cyanide storage facilities (i.e. TSFs, HLFs, or process ponds) and the nature of the material (hydraulic characteristics) being stored in direct contact with the liner system when assigning required design components. Facilities are differentiated in both Nevada regulations and in Arizona’s Aquifer Protection Permit (APP) program in which both prescriptive Best Available Demonstrated Control Technology (BADCT) design parameters (requirements differentiated between precious and base metal operations) and individual (or site- and facility-specific) design parameters may be proposed for use;
- The Rules do not account for the concentration of cyanide in the process water being stored in the facility; and
- Certain prescriptive measures may have the unintended consequence of increasing the risk of release and potential impacts. A leak detection layer with high hydraulic conductivity between the primary and secondary synthetic liners in TSFs with more than one foot of hydraulic head on the primary liner may reduce the level of protection provided by the liner system over the TSF’s life because the conductive layer creates a hydrologic connection between potential leaks in the primary liner with any leaks in the secondary liner.

2.1 Facility Differentiation

When assessing potential leakage from a lined facility, the nature of the material being stored above the liner system is extremely important and will impact the overall performance of the liner system. The following is offered as a brief comparison:

- TSFs, as the name implies, store tailings produced during the milling of ore. The tailings are generally very fine-grained (sand-, silt-, and clay-sized particles) and exhibit a very low hydraulic conductivity (ability to transmit water). Very often, the consolidated fine-grained tailings at the base of a TSF in direct contact with the liner system, will exhibit a saturated hydraulic conductivity less than $1x10^{-6}$ centimeters per second (cm/sec). The very low hydraulic conductivity of the tailings provides an additional protective measure against leakage from the TSF through any liner defects, as process water cannot be efficiently delivered to the defect due to the low hydraulic conductivity of the tailings overlying the liner;
- A HLF stores either run-of-mine or crushed ore on lined containment. A cyanide solution is then sprinkled on the stacked ore to liberate gold from the ore transporting it (in solution) through the stacked ore and collected at the base of the facility (above the liner). Above liner collection systems, that typically include a combination of pipes and gravel-sized material, capture the gold-bearing solution. High hydraulic conductivity of heap leach ore needs to be maintained to allow solution to be applied and (more importantly for the operator) recovered

from the stacked ore during operations to recover the gold that has been leached from the ore. HLFs are designed to maintain high hydraulic conductivities above the liner system, which allows relatively unhindered delivery of process solution to any defect in the liner system; and

- Process solution ponds store cyanide-containing solutions, often at or around concentrations used in HLF operations. The ponds store water directly in contact with the liner system, resulting in the greatest potential leakage rate through a liner defect due to, in essence, an infinite source of solution delivery to any defect in the liner system.

Arizona's APP program provides facility designers an opportunity to use either prescriptive BADCT design parameters (requirements differentiated between precious and base metal operations) or individual (or site- and facility-specific) design parameters. Designs incorporating the prescriptive measures are reviewed and approved in a more timely manner as compared to those choosing to propose individual (site- and facility-specific) design measures. The decision to use the prescriptive or site-specific parameters is made by the design engineer and owner.

Facility design requirements should consider the actual facility type, including the nature of the material being stored above the liner and how it may impact potential leakage through the liner, when assigning design criteria. The Rules currently encourage a pre-application consultation with IDEQ to present the conceptual facility design for permitting; IDEQ would have sufficient time to evaluate proposed site-specific facility design criteria ensuring adequate measures are in place to protect waters of the state.

2.2 Process Water Cyanide Concentration

TSFs generally contain very low cyanide concentrations, while HLFs and process solution ponds generally store solutions with much higher cyanide concentrations. As the consequences of a leak are greater at greater cyanide concentrations, required facility components should account for the cyanide concentration of the process solution being stored within the facility and corresponding impacts if solution is released from the lined facility. For example, a pregnant solution pond (high cyanide concentration) near a waterway would merit a more conservative design than a stormwater pond located away from a waterway.

2.3 Prescriptive Measures' Unintended Consequences

Requiring prescriptive measures in all facilities may introduce unintended consequences related to long-term facility performance. As an example, the requirement to include a leak detection layer between primary and secondary liners introduces a high permeability layer that conveys leakage through the primary liner in the leak detection layer to a collection sump, where collected leakage is pumped out and returned to the TSF. In the long-term, when conveying leakage to the collection sump in the leak detection layer, hydraulic connection may be established between the primary liner leakage source and a secondary liner leakage source, resulting in increased leakage through the secondary liner into the environment. Due to the leak detection layer's high permeability above the secondary liner, the volume of water that can be delivered to the secondary liner leakage source is much higher than if a low permeability media were in direct contact with the liner.

An additional unintended consequence of constructing liner systems with multiple layers includes increased risk of damage to the underlying liner components when installing additional layers (e.g. leak detection layer and primary liner). Installing each liner system layer requires additional access on the previously deployed liner by installation personnel. Increasing the amount of activity on the liner system increases the probability (and risk) of installation-related damage occurring.

3.0 Recent Design and Permitting Experience

Tierra Group serves as the EoR for several TSFs designed, permitted, and constructed in Nevada, including two TSFs at Barrick's Goldstrike Mine near Elko, Nevada. Tierra Group understands that Idaho's Cyanidation Rules are modeled after Nevada's regulations and provides several recent examples of designed, permitted, and constructed TSFs in Nevada.

The permitting, design, construction, operation, maintenance, and closure of TSFs in Nevada is jointly governed by the Nevada Division of Environmental Protection (NDEP) and the Nevada Division of Water Resources (NDWR), Dam Safety Division. The NDEP is principally charged with protecting waters of the state (maintaining water quality), while NDWR is responsible for the stability of the impounding structure (dam). Regulations related to dam safety are contained in the Nevada Administrative Code (NAC), Chapter 535 (NAC 535 [2016]), while the regulations related to water controls (maintaining water quality and protection of waters of the state) are contained in NAC 445A. Unlike Idaho's rules, Nevada regulations differentiate liner design requirements, specifically the need for leak detection, between TSFs, HLFs, and process solution ponds. This has been the case in Nevada since before the Idaho rules were revised. Under the Nevada rules, all process solution ponds require double synthetic liners with leak detection; HLFs (the actual pad area) may require leak detection over all or parts of the facility depending upon foundation conditions and the depth of impounded solution over the liner system. TSFs do not require leak detection if a low permeability liner system such as a synthetic liner with low permeability subgrade (which can be provided through use of GCL) is provided.

Barrick Goldstrike's TSF No. 3 (TSF3) and North Block Tailings Storage Facility (NBTSF) are permitted for construction and operation through Stage 6 and Stage 12, respectively. Barrick is currently increasing tailings storage capacity by building raises at both TSFs (TSF3 Stage 4 and NBTSF Stage 11).

3.1 Barrick Goldstrike NBTSF

The NBTSF was originally designed and permitted through both the NDEP and NDWR in 1993. The facility was originally designed to be built in five stages using development rock from nearby open pit mining activities and a downstream construction method. The design was later modified (1997) to include a total of nine stages. In 2013, Stage 10 was permitted and in 2014, Stages 11 and 12 were permitted to increase storage to approximately 300 million tons (Mt). The original liner design incorporated a 60-mil HDPE liner underlain by a minimum of 12 inches of compacted low permeability (maximum permeability of 1×10^{-6} cm/sec) soil on the embankments and in the impoundment area. During the design of Stage 7, it was recognized that remaining local borrow sources could not meet the permeability specification for the underliner soil. The liner section was modified, on the embankments only, to allow a minimum of 10 feet (measured perpendicular to the slope) of soil with a slightly higher permeability (maximum permeability of 1×10^{-5} cm/sec). During the design of Stage 8, two modifications were made to the liner profile: a GCL was incorporated into the design (immediately under the primary liner) and the primary liner was changed from 60-mil HDPE to 60-mil LLDPE. The LLDPE was selected due to its superior elongation characteristics and improved dimensional stability under exposed conditions (primarily significant changes in temperature through the course of the year). The composite liner system consisting of a primary 60-mil LLDPE liner underlain by GCL and a "buffer zone" (fine-grained soil, maximum particle size of 1-inch) has been used for Stage 8, 9, and 10 raise construction and will be used during Stage 11 raise construction. As Goldstrike treats the entire ore stream with cyanide, the cyanide levels in NBTSF approach 25 ppm WAD.

3.2 Barrick Goldstrike TSF3

TSF3 was originally designed and permitted through both the NDEP and the NDWR in 2011. TSF3 is planned to be constructed in six stages using development rock from nearby open pit mining and a downstream construction method. The facility is designed to store approximately 95 million tons (Mt) of tailings. The facility is fully lined with a primary 60-mil linear low-density polyethylene (LLDPE) liner underlain by a GCL. On the embankments, the liner profile consists of a primary 60-mil LLDPE liner underlain by a GCL, which in turn is underlain by “buffer zone” (fine-grained soil, maximum particle size of 1-inch) to provide a transition zone beneath the liner to the development rock in the embankment.

4.0 Closing

Ore processing facilities, specifically facilities that store cyanide-bearing process solution that could degrade waters of the state upon release, need to be designed to ensure the risk of release from the facility is minimized. In some cases, prescriptive or “one size fits all” approaches to facility design adequately address all contributing factors to mitigate the risk of release and potential impacts to waters of the state. However, in other cases, the application of the prescriptive measures may have the unintended consequence of increasing the risk of release and potential impacts. Specifically, the need for providing a leak detection layer (a layer with high hydraulic conductivity between the primary and secondary synthetic liners) in TSFs with more than one foot of hydraulic head on the primary liner may have the unintended consequence of reducing the level of protection provided by the liner system over the TSF’s life (accounting for both operations and closure timeframes).

A permitting process that critically reviews the design of each facility proposed for storing cyanide-bearing solution is required to ensure waters of the state are protected. Including a provision within the permitting process that allows both the use of the prescriptive design requirements and an alternative, site- and facility-specific risk-based design evaluation, allows site-specific and operation-specific considerations to be addressed in facility containment. It should be recognized by those going through the permitting process that use of prescriptive design criteria will allow a more timely and cost-effective means of getting a facility design approved. The proposed use of site- and facility-specific risk-based design criteria will require additional review time and potentially additional fees to ensure an adequate level of review is provided for the design.

Modifying Idaho’s existing Rules for Ore Processing by Cyanidation as contained in IDAPA 58.01.13 to allow facility designers to propose alternative, or site- and facility-specific, design criteria will allow for maximum protection of waters of the state. Under the proposed modification, IDEQ will still review and approve all proposed designs and ensure each facility minimizes environmental risk through the implementation of appropriate engineering practices from design through construction, operation, and closure of the facilities.

Sincerely,

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