M/037/044

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RECEIVED
JUL 18 1988
DIVISION OF
OIL, GAS & MINING

July 11, 1988

Mr. Mel Swanson
P.O. Box 1383
Moab, Utah 84532

Re: Kelmine
Pilot Leach Proposal

Dear Mr. Swanson:

We have reviewed the correspondence and plans for the Kelmine pilot leach proposal and have the following comments:

Hydrogeology Comments:

We have reviewed the most recent submittal and a previous one dated November 21, 1985; both submittals fail to define ground water conditions beneath and in the vicinity of the Cub Mine dump. In order to facilitate our review and assess any need for a ground water monitoring system, the following information should be provided.

1. Depth to ground water
2. Type, number, and extent of aquifers
3. Ground water quality, and flow direction(s)
4. Downgradient ground water use and points of withdrawal or discharge

Design Comments:

1. General information concerning the cub mine waste dump must be provided for review such as its thickness, proximity to streams, drainages and wells, and the composition of the mine waste dump material.

2. The liner system for the leach pad has changed in its orientation but retains the same components. Please find attached a copy of some guidance for the heap leach pad liner system.

3. We have serious concerns about washed gravel of 3/4 inch plus size being located adjacent to a flexible membrane liner (FML). The liner manufacturer should be consulted to determine an acceptable maximum size material. This gravel should be *rounded* to prevent puncture of the FML.

4. The leak detection system must be designed so leakage will flow by gravity into a sump where it can be visually observed and sampled.

5. The leak detection collection piping must be spaced to provide coverage under the pad and launder and minimize the time required for a leak to be detected. The spacing would depend on the slope of the base for the leak detection zone.

6. The leak detection layer should be at least 6 inches thick to facilitate earthwork construction.

7. Verification of leakage from the leak detection system must be done by visual observation and according to the attached leakage notification criteria.

8. Neutralization of the spent ore must be verified according to the heap leach drainage spent ore neutralization criteria, copy attached.

9. Additional detail must be provided to clarify if the spent ore will be neutralized and reclaimed on the liner or if it is proposed that the neutralized ore will be removed and reclaimed and at another location on the cub mine waste dump.

10. The hydraulic design for the heap leach pad and the precipitation launder must be adequate to contain:

    a. Design storm event
    b. Complete leach pad drain down
    c. Working liquid inventory
    d. Design snow melt

11 The routing of all process piping must be shown with adequate provisions to contain all leakage or spillage in a lined impoundment.

12. Provisions for diversion of all surface runoff water around these facilities must be provided for.

13. Provisions for sediment control due to storm runoff for disturbed areas related to this project must be provided.

14. Provisions for the proper disposal of domestic wastewater from this facility must be coordinated with the Southeastern District Health Department.

15. Adequate compaction of the foundation below the secondary FML should be provided to ensure FML stability.

16. Construction quality control and "As-built" certification should be provided by a registered professional engineer in Utah, as a condition of the Construction Permit.

17. The 6,000 gallon acid storage tank should be constructed of a compatible inert material that will withstand acid corrosion.

18. Kelmine should also describe how materials are to be added or loaded onto the leach pad, precipitation launder, or storage area without damaging the FMLs.

19. The acid resistant potential of the flexible membrane liner and the clay liner must be established.

The plans and correspondence must be revised according to these comments and submitted to the Bureau of Water Pollution Control and to Mr. David Ariotti of the Southeastern District Health Department for further review.

Please call me at 538-6146 if there are any questions.

Sincerely,
Utah Water Pollution Control Committee

Don A. Ostler, P.E.
Executive Secretary

CGD/lme:ag

cc: David Ariotti, Southeastern Dist. Health Dept, Price.
Jim Adamson, Southeastern Dist. Health Dept, Moab
John Whitehead, Division of Oil, Gas & Mining
Terry McParland, Bureau of Land Management
Solid and Hazardous Waste
Loren Morton, Bureau of Water Pollution Control

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HEAP LEACH PAD LINER SYSTEM

1. A process solution collection system must be located immediately below the ore and immediately above the primary (flexible membrane) liner. It must be designed to convey the design leach flow with a maximum allowable head of twelve (12) inches. These design flow values including maximum application rate and maximum allowable head on the flexible membrane liner must be submitted for review and will become part of the operating conditions of the project. The system must consist of a high hydraulic conductivity media (Geotextile, drain net, gravel etc.) and a pipe collection system. If gravel is to be used it must be rounded and the maximum size shall be limited so the flexible membrane will not be damaged or a sand cushion must be provided. Provisions must be made to prevent clogging of the process solution collection system with fines. The solution collection system piping must be of adequate strength to withstand the weight of trucks and ore loaded upon it.

   In addition, the solution collection system must have a continuous gravity exit so the fluids will not pond on the flexible membrane liner. Pipe of suitable material must be installed at designated locations in the heap to monitor the process solution head, when start up operations begin. These measurements must be submitted to the Bureau of Water Pollution Control.

2. The flexible membrane liner (primary liner) proposed for the leach pad is acceptable and must meet the following requirements. The flexible membrane must meet the minimum requirements of the National Sanitation Foundation (NSF) standard No. 54.
   The flexible membrane must be protected above by the process solution collection system and below by the secondary liner. The liner must be installed at a minimum slope of 3 percent to provide a gradient for the process solution to flow towards the collection pipes. A duration liner/waste compatibility test must be conducted for all constituents in the process solution which will come in contact with the flexible membrane. Procedures indicated in most recent ASTM and EPA test methods will be acceptable if conducted over a reasonable period of time. If field seaming will be made with different or modified materials from the geomembrane this must be considered in the testing procedure. At the conclusion of the test a summary report must be submitted for review indicating the constituents tested, the physical properties of the liner that were evaluated, and the conclusions drawn. An operational condition of the permit will be that during the life of the project only those constituents tested for will be used in the process, unless additional compatibility testing is conducted. All flexible membranes, geotextiles, drainage nets etc. must be handled, stored and installed according to the manufacturers recommendations. All field seams must utilize the shingle effect when appropriate and be made according to the most stringent requirements of the manufacturer and must be tested as specified in ASTM Standard Practice D4437-84. Flexible membrane liner specifications must include as a minimum the following:

   a. type of liner material.
   b. thickness of the liner.
   c. proposed quality assurance procedures for installation.
   d. proposed quality assurance procedures for field seaming.

The design, construction and quality assurance must be certified by a registered professional engineer to meet the State requirements for a heap leach system. Appropriate assurances and guarantees to support this certification must be sent to the Bureau of Water Pollution Control. The quality assurance procedures proposed to insure that the flexible membrane liner will be constructed to fulfill the intent of its design must be submitted for review.

Weather conditions specified by the manufacturer within which construction of the flexible membrane liner will be allowed such as wind speed, precipitation, temperature range and soil moisture content must be included in the specifications. Based on this information the months when these conditions would generally prevail and construction would be allowed should be identified.

3. The Secondary liner must consist of at least twelve (12) inches of clay material with a maximum permeability rate of 1.0×10^{-7} cm per second laid in at least two (2) lifts.

If bentonite addition or other additives is required the amount needed to achieve the 1.0×10^{-7} cm/sec permeability must be based on the most coarse soil from the site to obtain the upper bound clay requirement. The following information for constructing the clay secondary liner with the addition of Bentonite must be submitted for review:

a. the amount of bentonite required.
b. proposed mixing procedure (agricultural disk, rototiller or pug mill)
c. moisture content and the density at which the lowest permeability occurs.

The design and construction Quality Assurance program for each lift of the secondary liner and the secondary liner foundation must be submitted for review. The foundation must be stable for the design height of the heap leach pile with limited differential settlement so the integrity of the liner system will not be compromised. The potential for geochemical reaction between leaching solutions and the clay material which might alter the properties of the clay must be evaluated.

4. The leakage detection/collection system located beneath the secondary liner must consist of a material with a permeability rate of 1.0×10^{-2} centimeters per second or greater laid on an acceptable base material with a permeability rate of 1.0×10^{-5} centimeters per second or less. The leakage detection/collection system must contain perforated piping which drain to the leakage collection sump. The leakage detection/collection system must cover the entire area beneath the heap leach pad. The head on the leakage required to cause the leakage to flow along the interface must be minimal. Piping must be compatible with the leakage fluids and must be of adequate strength to withstand the weight of the ore etc. to be loaded upon it. The system must be designed so it will not be contaminated by clay material when the secondary liner is constructed above it.

Once the site is excavated and prior to constructing the foundation for the liner system, an inspection must be conducted for springs, seeps etc. which may adversely impact the liner system. If any springs, seeps etc. are discovered a proposal for diverting this water must be submitted to the Bureau of Water Pollution Control for review and approval prior to resuming construction.

The equipment, procedures and techniques which will be used to place the ore on the liner system must be submitted for review.

Leakage Notification Criteria

1. 0-5 gallons per day (gpd) - Record volumes in log book and report to the Bureau of Water Pollution Control (BWPC) by phone within 24 hours, if leakage is detected.

2. 5-50 gpd - Record volumes and sample for pH and cyanide (CN-). Report findings to the BWPC by phone within 24 hours and in writing within seven 7 days.

3. 50-500 gpd - Reduce application rates. Report to the BWPC by phone within 24 hours and in writing within seven (7) days. Daily monitoring of leakage will be required with a monthly report being submitted to the BWPC.

4. Greater than 500 gpd - Discontinue use of that portion of the pad and provide to the BWPC within seven (7) days a description of the portion of the pad not being leached.

Heap Leach Drainage Neutralization Criteria

1. pH of 6.5 to 7.5
2. Weak acid dissociable (WAD) cyanides less than or equal to 0.20 mg/l.
3. Total cyanide less than or equal to 0.75 mg/l.
4. Metals content shall meet drinking water standards or surface water quality standards which ever is lower.

Heap Leach Spent Ore Neutralization Criteria

The following procedures shall be used to determine whether free cyanide (CN-) in the spent ore has been neutralized to a satisfactory level.

1. A sampling grid of the neutralized spent ore pile shall be submitted to the Bureau of Water Pollution Control for review and approval. The sampling grid shall contain a minimum of ten (10) sampling location.

2. The sampling to be analyzed from each sampling location shall contain 100 grams as an aliquot of samples taken as set forth below, except that no sample shall be taken within three (3) feet above the flexible membrane liner useless special provisions are made to avoid penetrating the liner or for sealing said penetrations:

   a. An ore pile 30 feet or less in depth shall have samples taken at 25, 50, and 75 percent of the depth.

   b. An ore pile greater than 30 feet in depth shall have samples taken every ten (10) feet of depth.

3. The maximum allowable free cyanide (CN-) shall not exceed the following levels in the filtrate portion of a 5/1 extraction.

   a. 90 percent of a least 10 samples shall contain less than 10 mg/l free cyanide (CN-) in the filtrate.

   b. None of the samples shall contain more than 20 mg/l free cyanide (CN-) in the filtrate.

4. For any sampling location that indicates a free cyanide level in excess of 20 mg/l in the filtrate, the aerial extent of the inadequately detoxified area shall be determined and detoxified so that the cyanide levels in that particular ore pile will comply with the limitation described herein.