Enclosure 1

Geotechnical Engineering Program
Civil Engineering Department

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Madonna Krug
Nuclear Regulatory Commission
Mail Stop 483SS
7915 Eastern Avenue
Silver Spring, Maryland 20555

Subject: BOKUM Mineral Resources
Our Reference E4.04b

Dear Madonna:

This is to document the questions which we raised during the conference call earlier today.

1. A series of questions were raised relating to the overall water balance and evaporation capabilities of the tailings management system. In particular, residual water contents in tailings, after decanting the pond fully, will have a large influence on the amount of water to be disposed. Initial estimates of the residual water contents were 40%. In subsequent Designer Memoranda these estimates were lowered to 33%. Further conversations with Ray Waggoner and Gayle Billings indicate that the residual water content will be on the order of 25%.

The lower figure of 25% is comparable to values of residual water contents for other tailings which have been passed over belt filters. Consequently, I believe it would be very difficult to achieve this low value of water content merely by decanting from the pond. However, the lower estimate of residual content in the tailings is conservative from the viewpoint of the water balance because it will result in a greater quantity of water required to be evaporated. On the other hand, the lower value of residual water content is unconservative from a reclamation point-of-view because it will cause greater periods of time to be required prior to equipment being able to go onto the surface for relamation purposes.

2. We requested a schedule showing the sequencing of the operations. This schedule should indicate construction of various trenches and evaporation ponds. It should also indicate the quantity of water required to be disposed of at any particular time and should also indicate the area available for evaporation. It is recommended that a stage-volume rating curve be compiled for each evaporation pond.

Although some assumptions will be necessary in order to construct this sequencing schedule, it is believed that various ponds can be established and a range of conditions can be shown. Such a schedule is necessary to indicate

where and at what time problem areas may be expected. Furthermore, because some evaporation ponds will be constructed on top of old reclaimed trenches, this schedule is necessary to indicate that both an evaporation pond and an underlying trench are not being relied upon at the same time.

Also in this sequencing schedule, the capabilities of the system for surging tailings water during times of low evaporation should be indicated.

3. In my previous letter to you dated October 5, 1979 I indicated that the computations for required depth of liner and the time required for the wetting front to move through that liner were unconservative. Those computations did not take into account the contribution to total head due to suction in the clay soil. Those computations should be reviewed in light of the proposed liner system. Improved estimates of seepage losses should be calculated.

4. Comments were made regarding Designer Memoranda No. 5 and 7. In Designer Memorandum No. 7 the estimated height of capillary rise in tailings did not account for segregation of tailings and zones within the trenches of very fine materials. Furthermore, the analysis did not include osmotic potential and the effects of salt concentration in the tailings water. It is recognized the the phenomenon of water migration under these potentials is complex and at the present time it is doubtful whether rigorous methods of analysis exist that would enable moisture migration and salt migration to the surface of the cover to be predicted. Nevertheless, the rise of salts through the tailings cover may provide serious constraints on the ability to establish a self-sustaining vegetative cover. This is particularly true in the arid environment of the project site.

Our discussion during the conference call indicated that this point has already been discussed with consultants to the State of New Mexico. I agree that the final design of reclamation cover must await observations on the initial reclamation of Trench No. 1. Prior to that time, approval for a vegetative reclamation plan should be regarded as tentative. The possibility of the requirement for a riprap cover for erosion protection must be considered.

5. The shear strength values that were used for the establishment of factors of safety for slope stability of the trench wall utilized unconfined compression and unconsolidated undrained test results. These test results, I believe, will provide adequate shear strength values for short term stability. However, they do not provide indications for the stability of the pit wall after time periods sufficient for drainage of negative pore fluid pressures in the shale. The stability of the pit walls over the time periods required for them to remain open should be investigated.

Seepage of water from the tailings into the trench wall will reduce the shear strength of the shale. The influence of this on the stability of the trench walls should be investigated.

6. In Designer Memorandum No. 12 it is stated that strength data on the compacted embankment fills for the evaporation pond cannot be obtained until Trench I has been excavated. Prior to design of embankment fills for the evaporation ponds, compaction, compressibility and shear strength data on the unweathered shale is necessary. It is suggested that samples of the unweathered shale be obtained from test pits and the necessary material properties be obtained for design purposes. This data is also necessary prior to review of the evaporation ponds.

The above comments represent our questions on the basis of the materials submitted. During the course of the review if additional questions become evident, we will forward them to you. If you have any questions concerning this, please call either one of us.

Very truly yours,

Steven R. Abt
Instructor

John D. Nelson
Professor

JDN/rv

HYDROLOGIC ENGINEERING COMMENTS
AND QUESTIONS
BOKUM RESOURCES CORPORATION
BELOW GRADE DISPOSAL AREA

Enclosure 2

1. Evaluations of ponding should be based on PMP series precipitation durations of 6 hours or greater. {See also previous transcript pages 1309-1313 of May 1979.} The following series should be used for estimates where the volume of runoff controls the outcome of the analysis:

PMP (6-hour)	=	15.5 inches
Antecedent	=	6.2 inches
100-year	=	1.9 inches
		23.6 inches

2. Provide the bases for the 100-year flow estimates. Of special concern are the design flows for the toe ditches on the evaporation ponds.

3. Confirm that all liquid discharges from the reservoir areas are to be monitored prior to release.

4. The PMP (and subsequent PMF) will exceed the capacity of the toe ditches and damage the embankments of the evaporation pond. Provide erosion protection (riprap) at critical locations, or document that failures would not result in releases outside the reservoir watershed (i.e., the failure or overflow release would be retained by the dam). For either alternative, provide the bases for the supportive analyses.

5. The previous plan called for wind wave protection of embankments by tailings beaches. No such approach is now possible. Provide embankment protection (riprap) for all embankments subject to wave action. Provide the bases for the design. (Note that the potential for concurrent damage to the evaporation ponds precludes credit for the rapid discharge of the impounded flood waters.)

6. Please correct, as necessary, the stage-elevation curves (Figure 2-D.M.10) to reflect infringement of the evaporation ponds and other features. Correct other assessments, including freeboard, effected by the change.

7. Provide the hydrologic design bases, including embankment protection, for all proposed evaporation ponds.

8. Provide the hydrologic design bases for the reclamation channels. Include the bases for slope protection to resist later migration of Cañon de Marquez. Discuss the realignment of Arroyo Hondo, explaining why it is not being returned to the original course.

9. The evaporation estimates used for pond water budget assessments are apparently based on an average annual lake evaporation estimate of 50 inches per year. This over-estimates the evaporation loss by omitting the average

annual precipitation. Correct all assessments based on the water budget estimates to reflect this change.

10. The apparent effect of comment 9 is to increase the demand for surface evaporation capability (i.e., enlarged pond surface). Please ensure that the information requested in other questions and comments is provided for any newly proposed features.

11. Clarify the design of the evaporation pond liner with respect to the thickness. Specifically, define the terms "minimum construction width" (see figure 1, DM 12) and specify whether the liner will be a minimum of 5 feet thick.