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Conoco Inc.
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July 13, 1982

Mr. Thomas Flemming
Project Manager
U.S. Nuclear Regulatory Commission
7915 Eastern Avenue
Silver Spring, Maryland 20910

RE: Sand Rock Mill Project - Docket No. 40-8743 - Responses to NRC Request (dated November 3, 1982) for Additional Geohydrology Data

Dear Mr. Flemming:

Enclosed are Conoco's responses to the NRC's request for additional geohydrology data on the above project referenced in Dan Martin's letter of November 3, 1981, and discussed in our meeting of October 14, 1982. The data and figures supplied will hopefully clarify the following:

- Describe more clearly the relationship of the piezometer wells and the lithologic units encountered in the evaporation pond area and the Pit 35N area.
- Present water levels in the piezometers in both areas.
- Illustrate the placement and/or elevation of the 70 sand water table, ore zone backfill and clay liner, and tailings in Pit 35N.
- Verify previous Conoco estimates of long-term seepage into Pit 35N after the tailings site is reclaimed.
- Describe the placement and the areal extent of the tailings in the evaporation pond, the extent of the excavation required for the pond, and the normal operating and emergency water levels in the pond.
- Describe design and construction details of the bentonite slurry cutoff trench proposed for the evaporation pond.
- Verify the existence of the unsaturated and saturated regions in the 70 sand.

With reference to Comment No. 4 in the NRC letter of November 3, 1981, and due to the fact that Conoco's initial interpretation differed from the NRC's interpretation of last week, Conoco is continuing to develop a worst-case seepage estimate in the evaporation pond area. This estimate should be forwarded to you during the week of July 19, 1982.

If you have any questions or require any additional information, please call me at (303) 575-6044 or Terry Quigley at (303) 575-6069.

Sincerely,

Duane W. Bollig

Duane W. Bollig

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Comment:

1. Provide a report on the E-coal and sand lenses aquifer for the Pit 35N area. This report should include but not be limited to the following:

   A. Data to supplement hydrographs of wells in the 70 sands and the period of record of piezometric levels for these wells.

   B. Hydraulic properties of zones above the 70 sands that may be hydrologically significant (E-coal and Sand lenses).

   C. Analysis of head buildup due to influent seepage into the pit and seepage outflows through the pit sides and bottom.

   Show all environmental effects that this water flow into the tailings has on the groundwater during the mill operation and after the mill site reclamation. If the environmental effect on the groundwater is degrading, show to what extent and if possible provide engineering measures to eliminate and degradation.

2. Cross sections of Pit 35N and the evaporation pond showing the following:

   A. Hydrostratigraphic units.

   B. Tailings disposal pit and the evaporation pond physical boundary limits.

   C. Backfill and Liner locations for Pit 35N.

   D. Piezometer and well locations. Include hydrostratigraphic data points and completion details.

   E. Water levels in piezometers.

   F. Water tables.

   G. Potentiometric surfaces.

Response:

Presentation of Piezometer and Geohydrology Information

Two new cross sections A-A' and B-B' (see Figure 2) have been produced that present the location and the screened interval of the piezometers with respect to the lithologic units in the Pit 35N area. The cross sections have been drawn around the pit, generally between the crest and toe of the pit wall. The location of the cross sections and the drill holes used to construct them are presented in Figure 1.

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The cross sections also present the following information:

- The water level in each piezometer per Sand Rock Mill ER Table 2.7-2.
- The water table elevation in the 70 sand per ER Figure 2.7-4.
- The elevation of the top of the ore zone backfill and compacted clay liner that will be placed as part of the tailings disposal system.
- The elevation of the top of the final tailings surface.

Tabular water level data for a number of the 70 sand wells within the permit area are presented in ER Table 2.7-6. Well locations are presented in ER Figure 2.7-3. These water level data supplement hydrographs presented in the Sand Rock Mill reference document Hydro (1980).

Cross sections showing piezometer locations and screened intervals in the evaporation pond area are included with the discussion presented in Comment No. 5 of this submittal.

Hydrologic Properties of the Lithologic Units Overlying the 70 Sand

Well completion data for the piezometers installed in the Pit 35N area are presented in ER Table 2.7-2. Hydrologic properties of the overlying mudstones, sandstone lenses, and lignite seams, as well as the saturated and unsaturated portions of the 70 sand, are presented in ER Table 2.7-4. With the exception of the major sand units (labeled in the table as 70SS, 68SS, etc.) all other lithologic units described overlie the 70 sand ore zone.

Analysis of the Head Buildup Due to Seepage Into the Reclaimed Tailings Pond

In the Pit 35N area, as shown in Figure 2.7-4 of the Sand Rock Mill ER, the natural groundwater flow has a gradient in the Northeast direction.

Using the available logs of the drill holes and wells in the area, the cross-sectional area of the exposed sandstone lenses and lignite seams above the 70 sand (see Figure 2) along the side of the proposed pit have been calculated. The results are as follows:

A. Upstream side of the pit (southwest half of pit from drill hole 1677 SW to 1283 - see Figure 1)

Sandstone Lenses:	73,800 ft^2
Lignite Seams	10,600 ft^2
Total	84,400 ft^2

B. Downstream side of the pit (Northeast half of pit from drill hole 1677 NE to 1283)

Sandstone Lenses	106,500 ft^2
Lignite Seams	11,600 ft^2
Total	118,100 ft^2

The field test results presented in ER Table 2.7-4 have suggested that the sandstone and the lignite seams have representative hydraulic conductivities of 15.5ft/yr and 1.1 ft/yr respectively.

Considering an average hydraulic gradient of 0.008 ft/ft, which is the average hydraulic and structural gradient of E coal in the area, as the typical flow gradient and the "upstream" exposed area as the flow cross-sectional area, the inflow to the pit can be estimated as follows:

$$Qi = (73{,}800\ ft^2 \times 15.5\ ft/yr + 10{,}600\ ft^2 \times 1.1\ ft/yr) \times 0.008\ ft/ft = 9{,}244\ ft^3/yr =$$
0.13 gal/min.

One should keep in mind that the calculated flow, very likely, has been overestimated for the following reasons:

1. All the lignite seams and the sandstone lenses are not saturated, therefore only a fraction of the exposed area should have been used in estimating the flow rate.

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2. Since not all the exposed area is perpendicular to the natural hydraulic gradient, the direct application of Darcy's law in this case tends to overestimate the seepage flow rate.

This small amount of seepage will have no significant effect on the groundwater during the mill operation or after reclamation. During the mill operation, this seepage will be collected, along with the majority of the tailings solutions, in the under drain and sump system, and will be pumped to the evaporation pond. After reclamation, the inflow of 0.13 gpm is insignificant when compared with the groundwater flow in the 70 sand below Pit 35N, estimated at approximately 25 gpm (based on an average permeability, gradient, and cross sectional area of 2,000 ft/yr, 0.006 ft/ft, and 150,000 ft^2, respectively).

Water Head Build-up in the Pit After Reclamation

Two extreme cases have been considered for the analyses:

(1) All the flow into the pit from the upstream direction would accumulate in the pit and there would be no out flow from the pit:

The approximate horizontal area of the pit is about 1.6×10^6 ft^2 and a porosity of 15% has been estimated for the uranium tailings. The rate of the water head build-up in the pit with an inflow rate of 9,244 ft^3/yr can be found from the following computations:

$$\frac{9{,}244 \text{ ft}^3/\text{yr}}{1.6 \times 10^6 \text{ ft}^2 \times 0.15} = 0.04 \text{ ft/yr}$$

(2) No flow would move downstream through the downstream side of the pit surface but would seep through the clay liner at the bottom of the pit:

A 3'-thick clay liner has been proposed to separate the tailings from the backfill materials at the bottom of the pit (see Figure A, attached). The top of the ore zone backfill will be at least 10' above the historical water level in the 70 sand.

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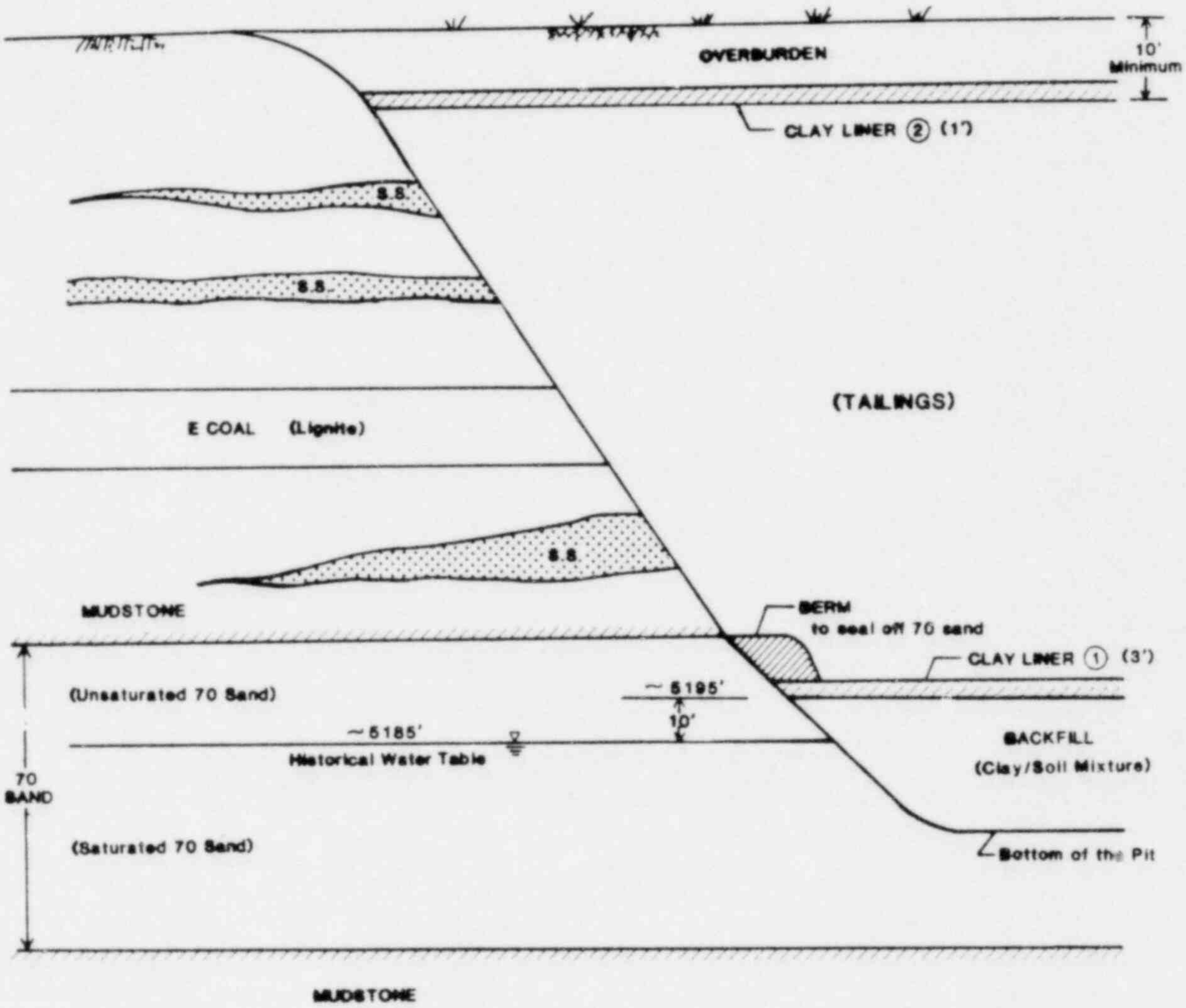

FIGURE A. SCHEMATIC SKETCH OF PIT 35N AFTER RECLAMATION

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Therefore an unsaturated zone of about 10 ft would exist between the bottom of the clay liner and the water table in the 70 sand (or in the backfill).

The surface area of this clay liner is approximately 1.6 x 10^6 ft^2 and the hydraulic conductivity of the clay has been estimated as 0.14 ft/yr.

The water head build-up required to produce a vertical percolation rate of 9,244 ft^3/yr (0.13 gpm) through the clay liner can be estimated as follow:

$$9{,}244^{ft^3/yr} = 0.14^{ft/yr} \times h^{ft}/3^{ft} \times 1.6 \times 10^6\ ft^2$$

$$\text{or } h = \frac{9{,}244 \times 3}{0.14 \times 1.6 \times 10^6} = 0.12^{ft}$$

The results from both cases indicate that the average buildup of water in the tailings would be insignificantly small.

References:

Hydro-Engineering, Hydrology of the Evaporation Pond and Tailings Disposal Areas for the Sand Rock Project, 1980.

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Comment:

3. Provide cross sections for pump tests showing hydrostratigraphic units and all wells for that particular pump test superimposed on them. The superimposed wells should show locations, completion and screen interval.

Response:

The following Figures D-5-3, D-5-6, and D-5-9 present cross sections through Pit 34, Pit 35N, and Pit 35S (the open pits), respectively. These cross sections have been revised to show the location and screened intervals of the following pump test wells used by Hydro Engineering:

885	1806
886	1815
888	1816
1805	1817

Well completion data for these wells is presented in the Sand Rock Mill ER Table 2.7-3. The permeabilities and other aquifer properties are summarized in ER Table 2.7-4.

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Comment:

5. Provide a detailed report and drawings (plan view and cross sections) of the evaporation pond clay liner and slurry trench which show the following:

   A. A thru G, excluding C of No. 2 above.

   B. Plan view should show mudstone, sands, coal and aluvium after pond excavation.

   C. Clay liner and Slurry trench location.

   D. Slurry trench detail

   E. Construction method and sequence.

   F. PMF water line.

   G. Expected tailings location in the evaporation pond (boundary lines)

   H. Operating water line.

   I. Tailings Beach location.

Response:

Additional Piezometer Information

Several of the figures presented in the NRC reference document to the Sand Rock ER - Chen, 1980 (a) - have been revised to show the additional geohydrology information requested.

Figure 148B presents cross sections along the main and secondary embankments. Figures B-1, B-2, and B-3 present cross sections across the evaporation pond area. The cross section locations are shown in Figure 150B. These cross sections have been revised to show the following:

- o Location and perforated interval of piezometers installed in the evaporation pond area.

- o Water levels in the piezometers per Sand Rock Mill ER Table 2.7-1, Basic Completion and Water Level Data for the Evaporation Pond Area (Area 10).

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w/ ltr dtd
7/13/82

- o Evaporation pond excavation limits.

Evaporation Pond Plan View

A plan view of the evaporation pond is presented in Figure 3. This figure has been revised to show the following:

- o The area of sandstone bedrock around the perimeter of the pond that will be exposed by the pond excavation and will be covered with a compacted clay liner and/or intercepted by a bentonite slurry cutoff trench.

- o The Normal High Water Line (NHWL) for maximum normal operations - 5300 ft elevation.

- o The PMP High Water Line (PMP HWL) for maximum normal operations plus the PMP flood series event - 5305 ft elevation.

Bentonite Slurry Cutoff Trench

The following Attachment A is an excerpt from the Sand Rock Mill ER reference document - Chen 1980 (b) - that describes the construction details and specifications for the bentonite slurry cutoff trench. Conoco is proposing the cutoff trench, a compacted clay liner, or a combination of the two to isolate the sandstone bedrock found at the surface in the evaporation pond area from the pond solutions. These three alternative methods are presented in Figure 4.

Tailings Placement

Initially, tailings will be deposited along the main embankment (south side of pond) and the dike embankment (southwest side of pond). The total volume of three years of tailings is approximately 2.5 X 10^6 BCY (1.9 X 10^6 cubic meters). Working just with averages, this volume would cover the 115-acre (46-hectre) pond with an average thickness of approximately 15 feet (3 meters).

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In reality, the majority of this volume will be in the southern half of the pond. However, the finest fraction of the tailings, the slimes, will probably be carried to the opposite end of the pond from the point of discharge; and it's reasonable to assume that almost the whole pond area will be covered by some size fraction (sands, silts, clays, etc.) of the tailings. If necessary, the tailings can also be deposited from the northern edge of the pond, in order to get the required volume. Approximately 20 acres (8 hectres) of sand beach will result.

References

Chen and Associates, Inc., Geotechical Investigation for the Proposed Evaporation Pond and Tailings Disposal Area for the Sand Rock Mill Project, Campbell County Wyoming, 1980 (a).

Chen and Associates, Inc. Technical Construction Specifications for Tailings Dams for the Sand Rock Mill Project, Campbell County, Wyoming, 1980 (b).

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