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MEMORANDUM

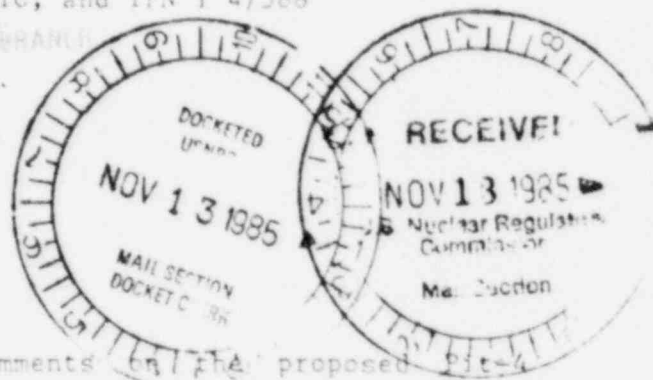
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TO: Getty Petrotomics, Permit Nos. 342, 351C, and TFN 1 4/388

FROM: Susan Hogg, Chief Hydrologist *SHH*

DATE: November 1, 1985

SUBJECT: Review of Proposed Pit-4 Impoundment



Introduction

Petrotomics submitted responses to initial comments on the proposed Pit-4 Impoundment October 2, 1985. This memo reviews these responses and the overall hydrology concerns associated with the proposed impoundment.

Discussion

The Pit-4 Impoundment is proposed as a livestock and wildlife watering reservoir. The surface area of the impoundment will be approximately 9.5 acres with a capacity of 349 acre-feet. The water will be approximately 100 feet deep.

Water Level

A numerical model (McDonald and Harbaugh, 1984) was used to simulate the final water level and water quality in the impoundment. Groundwater supplying the Pit-4 Impoundment derives from the Wind River Aquifer. The final water level is predicted to be approximately 6,954 feet msl and should be within 1 foot of final elevation after 50 years. The water level will not increase greatly for the next 7 years due to pit dewatering in the area. When dewatering operations cease, however, (in 7 years) there is expected to be a fairly rapid increase in the water level, reaching approximately 6,945 feet msl in 15 years.

Water Quality

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Water quality in the Pit-4 Impoundment was also modeled using the McDonald and Harbaugh (1984) model. An average TDS of 4,700 mg/l was applied to the southern grid while a TDS of 1,330 mg/l was applied to northern grids to be input into the model. These data are based on averages of wells in the respective areas that are completed in the Wind River Aquifer (Wells P4-1 - P4-7). A final TDS of approximately 4,200 mg/l is predicted to occur in Pit-4 after approximately 130 years. Presently TDS levels are at 2,400 mg/l which will increase to 3,200 mg/l in 7 years. This higher rate of TDS increase is caused by pit dewatering to the north (Pit 33 and Area 3) which results in relatively more water entering the Pit-4 Impoundment from the south (the high TDS area). Following mine dewatering TDS will decrease to about 2,900 mg/l at year 13 and then slowly increase to the final level of 4,200 mg/l after 130 years.

The Pit-4 Impoundment should be a viable reservoir for livestock and wildlife watering with respect to heavy metals and radionuclides. This is based upon present water quality in Pit-4 and water quality conditions over a period of

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years in surrounding reservoirs. Heavy metals present in some wells surrounding Pit-4 are not apparent in the Impoundment water. Apparently the metals do not stay in solution in the impoundment. Re-dissolving of these constituents under anaerobic conditions is the most likely mechanism for these constituents to become available in the water.

The potential for possible thermal stratification and development of anaerobic conditions was examined. Testing of existing pits in the Shirley Basin indicated that heavy metals and radionuclides should remain adsorbed to sediments and precipitated complexes and would therefore not be available to migrate into the groundwater or the upper portions of the lake. Dissolved oxygen concentrations remained within 80 percent of saturation and pH remained above or equal to 6.6 indicating that the solution Eh would not be conducive to solubilization of potentially toxic inorganic compounds or radionuclides. Anaerobic conditions did not occur during the season of most stable and prolonged stratification (winter) in the Sullivan Pit (deeper than Pit-4). Therefore, it is most likely that anaerobic conditions will not occur at all.

Tailings Pond Seepage

The proposed Pit-4 Impoundment is located to the northeast of the Tailings Pond facility at this site. The tailings pond currently has a seepage plume extending to the northeast toward Pit-4. Although it has not been conclusively demonstrated, it is likely that tailings seepage is entering Pit-4 and will continue to do so for some time. The seepage plume is in a shallow aquifer zone above the Wind River Aquifer.

A well completed in the shallow aquifer close to Pit-4 (Well 46-SC) indicated Sulfate and TDS concentrations of 3,780 mg/l and TDS of 4,760 mg/l respectively in April 1985. These values are similar to the average TDS (4,700 mg/l) used as input to the model used to predict final water quality in the Pit-4 Impoundment. The "high" TDS in the southern area was utilized in the model throughout the 150 years of simulation. It is anticipated that the tailings seepage will be greatly reduced, if not ceased, long before this time (possibly 10-20 years) due to a recently installed pumpback system and an enhanced evaporation system on the tailings pond. It is probable that seepage that is currently close to Pit-4 was there prior to installation of the pumpback system.

Water quality in the Wind River Aquifer is normally in the 500 mg/l range but deteriorates basinward away from recharge areas. These are two possibilities as to why the water quality in the Wind River Aquifer on the south side of the Pit-4 Impoundment is degraded with respect to "average" quality:

- 1) Tailings seepage may have contaminated the Wind River water.
- 2) There is a heavily mineralized pyritic zone in this area.

It is most likely, given the current tailings seepage conditions, that the tailings liquor has reached the Wind River Aquifer in this area.

It appears, therefore, that although seepage is probably entering the Pit this has been adequately accounted for in the model used to predict final water quality in the Impoundment and that the seepage should not affect the long-term role of the Impoundment.

Monitoring

Petrotonics is currently monitoring Pit-4 Reservoir. Monitoring is proposed to continue twice a year, once in spring, and once in late summer. At the time of late summer sampling the full suite of Guideline 8 (1980) parameters will be analysed for and water-level elevation will be surveyed for the first 5 years of the impoundment. An abbreviated list of parameters will be analysed for in the spring sampling:

Radium 226	Sulfate
Total Uranium	pH
Chloride	TDS
Water Level Elevation	Dissolved Oxygen

The abbreviated list may be amended if an excessive concentration of a parameter is apparent in the late summer samples.

To monitor for possible stratification and development of anaerobic conditions, samples collected in early spring should be obtained from at least one areal cross section across the pond (at least 3 sample points per cross section) with at least 3 samples obtained from different depths (lower, middle, and upper) at each sample point. If stratification has occurred, then this should be repeated in the late summer sampling.

Final evaluation of the success of the Pit-4 Impoundment should be based on an analysis of the full suite of Guideline 8 parameters with the primary parameters being TDS, radium-226, water level, Wind River Aquifer piezometric surface. Status of the tailings seepage should also be considered.

Conclusions and Recommendations

It appears that the proposed Pit-4 Impoundment will be a successful livestock and wildlife watering reservoir.

I recommend approval with the following considerations:

1. Attention should be given to the tailings seepage, i.e., reduction of the head available should be encouraged through the enhanced evaporation system and the pumpback system.
2. The P4 series wells and Well 46SC should continue to be monitored for water level and quality. Additional (at least 2) shallow aquifer wells should be installed in the vicinity of the P4-1, P4-4, P4-7, and 46SC Wells.
3. Possible contamination of the Wind River Aquifer from tailings seepage and possible mitigation of this seepage should be examined.

4. Monitoring for possible development of water stratification and development of anaerobic conditions should be conducted as described previously.
5. To ensure radionuclides are not entering the environment via soil particles derived from clay sediments in the impoundment it is recommended that if the water level in the impoundment drops significantly to expose sediments, a "downwind" soil sampling survey be undertaken immediately prior to the final evaluation of the Impoundment success. The soil survey should include analyses of Radium-226, Uranium, Thorium, and Lead-210. An evaluation of these parameters relative to background and levels should be made.
6. An acceptable Alternative Plan for the Pit-4 Impoundment should be submitted.

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cc: Roy Spears
Cindy Bosco
Bill Kearney
Phil Fucel, WQD

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