UNION CARBIDE CORPORATION
METALS DIVISION
P. O. BOX 1029, GRAND JUNCTION, COLORADO 81501
Telephone (303) 245-3700

Central Files

M-25
ref K-8 #8
K-24 #15

February 1, 1978

Mr. R. A. Scarano
Fuel Processing and Fabrication Branch
Division of Fuel Cycle and Material Safety
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Docket: 40:299
Source Material License: SUA-648

Gentlemen:

Attached is the response to your questions on disposal of tailings below grade as requested in your letter dated January 5, 1978.

Sincerely yours,

P. C. Rekemeyer

P. C. Rekemeyer
Environmental Coordinator

PCR:bnw

Attachment

(8)

MEMORANDUM

Review of the Alternatives for Disposal of Mill Tailings Below Grade at the Gas Hills Facility

Union Carbide Metals Division

January 31, 1978

1.0 Scope

The NRC formally requested on January 5, 1978 that the Company provide information on alternatives for disposal of tailings in a pit near the mill area. The information requested relates to the capacity of usable pits in the vicinity of the mill, options for operating the pit to minimize subsurface contamination and data on the geohydrology of the area.

This memorandum provides the information requested by the NRC. In reviewing this document the following factors must be considered by NRC personnel:

1.1 The submission of this document is in response to the NRC request for information and does not commit the Company to pit disposal of tailings.

1.2 The design on the pit disposal system and the associated costs for each option are based on engineering estimates.

1.3 If a consultant's evaluation and report of the hydrology and geology of the pit areas is required in support of this memorandum it will require 2-4 months and cost approximately $35,000.

2.0 Summary

There are two adjacent pits approximately 4500 feet from the Gas Hills mill which could be utilized to dispose of 3.2 MM tons of mill tailings generated during the projected life of the plant.

The feasibility and estimated capital costs associated with the use of these pits both unlined and with a 45 mil supported hypolan lining were evaluated. The use of clay as a lining material was not considered as less than 20% of the required amount will be generated during the remainder of the mining program.

The preparation of the pit for lining can be done by building a ramp at a maximum slope of 2/1 against the existing pit wall or by cutting and filling from the perimeter to produce a 3/1 slope. Although either procedure can be used the viable technique at Gas Hills is to cut and fill to a 3/1 slope. As construction of an internal ramp reduces the pit volume by greater than 40%; thus not permitting its use to contain the tailings for the project mill life.

A comparison of costs for each case reviewed is summarized below:

Case	Description	Percent of Future Tailings Retained	Estimated Capital Cost ($)
I	Unlined Pit	100	450,000
II	Internal ramp built at a 2/1 slope. 45 mil supported hypolan liner	60	1,700,000
III	Cut and fill from the perimeter @ a 3/1 slope. 45 mil supported hypolan liner	100	2,400,000

These costs estimates in conjunction with an analysis of the geohydrology of the proposed disposal site indicate that of the 3, Case I represents the best choice and should receive further consideration.

3.0 Estimated Volume of Tailings to be Disposed of Over the Mill Life

The Gas hills facility has a projected life of 8 years. At the annual budgeted rate of 500,000 dry tons per year the plant will generate an estimated 410,000 cubic yards of tailings per year, or an accumulated volume over 8 years of 3,280,000 yd^3.

4.0 Potential Disposal Sites

There are two pits, A-9 and C-12, with a common boundary that can be used for below grade disposal of tailings during the projected life of the mill. Their combined volume is estimated at 3,300,000 cubic yards. This and other information is presented below:

Pit	Pit Volume (yd^3)	Area - Acres Top	Area - Acres Bottom	Average Height (ft)
A-9	2,100,000	28	12	100
C-12	1,200,000	17	11.5	100

These pits are shown on the topographical map number 127-77-1, Revision 1, attached. This disposal area ranges between 4000'-4500' in a southeasterly direction from the mill.

In the later operating sequence Pit A-9 would be filled first; and then it would overflow the dividing berm and raise the level in C-12.

When the level in C-12 reaches the top of the berm the common level will rise to the cut-off elevation of 6940 feet. At this elevation the level in the disposal area will be a minimum of 9 feet below grade.

5.0 Feasibility and Estimated Costs of Using Pits A-9 and C-12 Unlined, Clay Lined, or with a Synthetic Liner

5.1 Unlined Pit

The use of the pit in its natural state presents the least cost alternative for retaining the tailings during the projected mill life. The use of the pit will require the installation of a floating decant system at an estimated cost of $450,000 to maintain the liquid pool over the tailings at a minimum dpeth. The elements of the floating decant system are discussed in section 6.0.

The geohydrology of the pit area and the effect of seepage rates on the area are presented in Section 7.0.

5.2 Clay Lining of Pits A-9 and C-12

An estimate of lining the pit walls with caly at a minimum slope of 1½/1 shows that it will require approximately 1,350,000 yds^3 of clay. Since less than 20% of this quantity is available from the mining program this option was not considered.

5.3 Synthetic Liner for Pits A-9 and C-12

5.3.1 Site Preparation

In order to provide a surface on which a synthetic liner such as PVC, or hypolan can be laid the pit highwalls will have to be reduced from a nominal 1½/1 to 2/1 or 3/1. In addition a smooth surface will have to be prepared so that the liner will not rupture when compressed against a discontinuity.

The alternate sideslope specifications are dictated by the following criteria:

5.3.1.1 The liner manufacturer recommends no greater than a 2/1 sideslope. The method of construction dictates whether the slope will be 2/1 or 3/1.

5.3.1.2 If the existing sidewall of the pit is not disturbed and a ramp is built using overburden from the high wall towards the center of the pit a 2/1 slope can be attained. However, this results in a loss of volume in the pit.

5.3.1.3 If the pit wall is reduced from the perimeter by cutting and filling the maximum slope that heavy equipment can work on safely is 3/1. This operation does not change the volume of the pit, but it increases the area to be covered.

5.4 Evaluation of Building a Ramp in an Existing Pit Per 5.3.1.2

The effect of following the method described in 5.3.1.2 has been estimated for Pit A-9 at a slope of only 1½/1. The calculations show that the pit volume will be reduced by 850,000 yd^3 or 42.5%. Extrapolation of this data for pits A-9 and C-12 reduces the life from approximately 8 years to 3.5 years. In addition the following cost summary applies if a synthetic liner is to be installed.

Item	Estimated Cost ($)
Floating Decant System	450,000
Earthmoving - 850,000 yd^3 @ 1.00/yd^3	850,000
Liner Cost - 45 mil Supported Hypolan 587,000 ft^2 x \$0.75/ft^2	440,000
Total Cost	1,740,000

5.5 Evaluation of Reducing the Sidewall Per 5.3.1.3

The reduction of the sidewall by cutting from the perimeter and filling at the bottom of the pit has the advantage that the storage volume remains constant. However, the surface area that must be covered with a membrane increased from the 586,000 ft^2 to approximately 1,800,000 ft^2 or by a factor of 3 at the 3/1 side slope. A cost summary is presented below:

Item	Estimated Cost $
Floating Decant System	450,000
Earthwork - 545,000 yd^3 @ \$1.00/yd^3	545,000
Liner - 45 mil Hypolan - supported 1,800,000 ft^2 x \$0.75/ft^2	1,351,000
Total Cost	2,346,000

Although the cost for this option is approximately $600,000 higher than that in section 5.4 the life of the pit is approximately doubled.

6.0 Preliminary Design and Capital Investment for a Floating Decant System

6.1 Description of the Tailings Disposal System

The use of a pit for disposal of tailings approximately 4500 feet from the mill area will require the following equipment:

6.1.1 A flanged steel pipeline to carry the slurry from the mill area to the pit. The line will have to be supported along the length; and laid along the pit access road.

6.1.2 The liquor that separates from the tailings will form a pool at the low point. In order to recover this liquor for recycle to the plant a second pipeline will be laid beside the slurry line. However, the liquor pickup will be made using a decant pump supported on a floating platform. The connection between the decant liquor return line and the pump on the float will be made using a rubber pipeline.

The power supply for the pump will be supplied by the installation of a diesel generator, including oil storage facilities, along the rim of the pit. The decant pump will be wired to the generator.

6.2 Estimated Capital Investment for the Floating Decant System

The estimated capital costs for the facility are summarized below:

Item	Estimated Cost ($000's)
Pipe trestle at the plant	50
Decant pump and float	45
Pipe 5000 ft 6" steel, rubber lined including support system	100
Pipe 5000 ft 6" PVC including support system	85
Diesel generator and oil storage	40
Total Direct Cost	320
Engineering	65
Contingency @ 20%	65
Total	450

8.0 Environmental Considerations

Some of the environmental considerations that relate to the disposal of uranium mill tailings below grade are reviewed below.

8.1 Tailings Spills Due to Pipeline Failure

The route that the pipeline takes can be graded or ditched so that any spills will drain to the pit.

8.2 Contamination of Groundwater

The impact of seepage on groundwater or the subsurface environment has to be evaluated on a site specific basis.

If the pit is located in an impacted area with a favorable geohydrology, such as is the case at Gas Hills an unlined pit can be used.

In addition monitor wells can be installed to insure that the seepage does not exceed acceptable values. This monitoring system would also be required for a lined pit to check against membrane failure.

8.3 Reclamation on Mill Decomissioning

The disposal of tailings below grade simplifies the tailings reclamation program. There would be no need to stabilize the sides against wind and water erosion as with a conventional tailings pond.

After the tailings has dried out a clay cap could be used to reduce radon emanation. This could be covered with overburden, topsoil and revegetated.

The total cost of stabilization and maintenance would be reduced. However, no estimate had been prepared for this case.