



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

Docket 756
40-3453

JUL 01 1977

MEMORANDUM FOR: Leland C. Rouse, Chief
Fuel Processing and Fabrication Branch
Division of Fuel Cycle and Material Safety, NMSS

THRU: Leon L. Beratan, Chief
Site Safety Standards Branch
Division of Siting, Health and Safeguards Standards, SD

FROM: Richard W. Turnbull, Engineering Geologist,
Site Safety Standards Branch, Division of Siting, Health
and Safeguards Standards, SD

SUBJECT: ATLAS MINERALS URANIUM MILL

Enclosed is a report presenting basic details of the events and conditions leading to the shutdown, design modifications, and subsequent license amendment of the Atlas Minerals Uranium Mill, during the period June 20 through June 24, 1977.

It is the position of the geotechnical engineers assigned to the case, that the facility be allowed to operate as per the license amendment dated June 24, 1977 (Enclosure 2).

Richard W. Turnbull

Richard W. Turnbull, Engineering Geologist
Site Safety Standards Branch
Division of Siting, Health and
Safeguards Standards, SD

Enclosures:

1. Report on Atlas Minerals Uranium Mill Tailings
Dam Inspection and Evaluation
2. License Amendment

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ENCLOSURE 1

REPORT ON ATLAS MINERALS URANIUM MILL TAILINGS DAM INSPECTION AND EVALUATION

On June 20, 1977, Atlas Minerals Uranium Mill was notified by the Region IV office of I&E that they were in violation of specific operating license requirements. At 7:30 p.m., on the same day Atlas voluntarily shut down operation of the mill to prevent further compounding of problems specifically related to operation of their tailings impoundment system pending further review of conditions and possible license amendments.

The condition which led to the shutdown was that the edge of the liquid in the pond had come closer to the embankments than the 250 ft. specified in the license. Leon L. Beratan and Richard W. Turnbull of the Site Safety Standards Branch, Office of Standards Development conducted an onsite evaluation of the immediate safety and the conditions of the tailings pond embankments, and discussed and evaluated the proposed remedial measures, based on the information made available by Atlas and visual inspection. Upon arrival, a brief reconnaissance of the tailings dam area revealed that the pond edge in several places was much closer to the dikes than 250 feet specified and, that the pond was 1 to 2 feet deep and in direct contact with the upstream face of the west embankment. Earth moving operations to raise, widen, and reinforce this west dike were underway, and had been since June 21, 1977.

Shortly after our arrival, we met with William Badger, General Superintendent of Atlas Minerals, and representatives of Dames & Moore, geotechnical consultants for Atlas, to discuss and evaluate the design, existing conditions, and the immediate safety of the tailings dam. Atlas claimed that since operation had been shut down, the pond had receded approximately 6 feet and was continuing to recede. Dames & Moore revealed that design specifications had not been met in certain sections of the dam; borings revealed that tailings used in dike construction were not homogeneously distributed throughout the dike cross-sections but were, in some places, segregated into lenses of coarse (sand) and finer (slimes) materials. Since these materials have different shear strength values (ϕ sand $\sim 38^\circ$; ϕ slimes $\sim 33^\circ$) NRC suggested that such segregation of materials would result in actual dam stability being less than that assumed in design which assumed homogeneous mixing and distribution of sands and no trapping of the slimes in the embankment. We requested that Atlas (Dames & Moore) perform analyses assuming the worst possible case, i.e., the embankment section consists entirely of slimes ($\phi = 33^\circ$, $c = 0$) and the pond liquid is at the embankment crest level. In addition, a wedge theory analysis assuming horizontal layers of slimes was requested.

Other discussions at this meeting evolved around the existing and proposed design of the tailings dikes and west embankment, the strength properties of the tailings and borrow materials, the effects of pond levels on embankment stability, observed seeps, seismic design, and tailings distribution.

This meeting was followed immediately by a reconnaissance of the tailings pond and impoundment area. We were accompanied by Atlas and Dames & Moore personnel and inspected the impoundment area including the west embankment and the crest of most other embankments. Remedial construction in progress on the west embankment was observed. Other observations made were:

1. Pond liquid was actually in contact with the upstream face of the west embankment; we were informed by Dames & Moore that the liquid in contact with the embankment was from 1 to 2 feet deep;
2. Pond liquid was closer to the embankment than the required 250 feet;
3. Evidence of seepage existed at the downstream base of the west embankment; ponding of liquid and flourishing vegetation were observed. The source of the seepage was obscured by remedial earthwork in progress;
4. Imported material used to construct the west embankment consists of reddish brown silty sands with many cobbles and boulders with a small percentage of clay;
5. Evidence of seepage existed on the downstream face and lower bench of the north embankment; liquid was flowing through a drain pipe at a rate of about 1 gpm; the slope and bench immediately below the drain pipe was saturated;
6. The borrow material is highly erodible as evidenced by a high concentration of erosion rills in dike cover material; some rills were up to 1 foot deep by 1 foot wide.

That evening all concerned parties met to hear the results of the requested worst case stability analyses. However, Atlas informed us that the results of the analyses were not yet available. It was requested that Atlas bring the results of the stability analyses and other data to the meeting scheduled in the Office of NMSS-NRC, on Friday, June 24, 1977.

At this meeting the stability analyses were discussed and evaluated. The worst case analysis resulted in a static factor of safety of 1.3 which is below the allowable of 1.5. However, actual conditions in the embankment are better than those portrayed in the worst case analysis and are more like the idealized case used originally which yielded a factor of safety of 1.6+. In our judgement, the worst case analysis is too conservative and

actual conditions will yield a factor of safety of 1.5 or better. We conclude that this structure in its present condition presents no hazard to the health and safety of the public.

Proposed remedial construction and licensing actions were also discussed and evaluated. Design changes to improve the tailings disposal system were agreed upon and amendments to the license are presented in Enclosure 2.

It is our opinion that the design modifications described in Enclosure 2, when implemented will provide a safe impoundment area.

Richard W. Turnbull

Richard W. Turnbull
Engineering Geologist
Site Safety Standards Branch
Office of Standards Development

Leon L. Beratan

Leon L. Beratan, Chief
Site Safety Standards Branch
Office of Standards Development

ENCLOSURE 2

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ENCLOSURE 2

June 24, 1977

FCPF:RAS
40-3453
SUA-917, Amendment No. 4

Atlas Minerals
ATTN: William P. Badger
General Superintendent
P. O. Box 1207
Moab, Utah 84532

Gentlemen:

Pursuant to Title 10, Code of Federal Regulations, Part 40, Source Material License No. SUA-917 is hereby amended to authorize the operation of the tailings disposal impoundment area in accordance with the statements, representations and conditions specified in your application and enclosure of June 24, 1977.

All other conditions of this license shall remain the same.

As a result of discussion with Atlas Minerals Division Management in our office June 24, 1977, Atlas Minerals is committed to providing a comprehensive review of tailings management alternatives specific to the Moab, Utah facility by July 31, 1977.

In addition, Atlas has expressed a commitment to ensure increased managerial attention to NRC license conditions and regulations to establish an improved compliance posture.

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With the issuance of this amendment to Source Material License No. SUA-917, you are authorized to resume operations with the understanding that a minimum freeboard of 6 feet presently exists and will be maintained in the tailings retention system.

FOR THE NUCLEAR REGULATORY COMMISSION

Leland C. Rouse, Chief
 Fuel Processing & Fabrication Branch
 Division of Fuel Cycle and
 Material Safety

OFFICE →	FCPF <i>mb</i>	FCPF	FCPF <i>LC</i>			
SURNAME →	RAScarano:mb	FLoma <i>FL</i>	LCRouse			
DATE →	6/24/77	6/24/77	6/24/77			

Docket No. 40-3453

Atlas Minerals
Division of Atlas Corporation

P.O. Box 1207 Moab, Utah 84532

June 24, 1977

United States Nuclear Regulatory
Commission
Washington, D.C. 20555

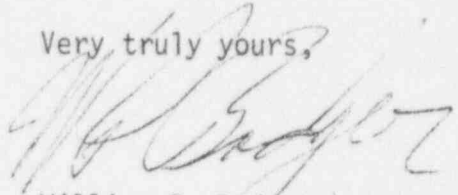
Attention: Leland C. Rouse, Chief
Fuel Processing & Fabrication Branch
Division of Fuel Cycle and
Material Safety

Gentlemen:

Atlas Minerals is hereby requesting that Source Material License SUA-917, Docket No. 40-3453, be amended to incorporate the enclosed tailings pond design modifications and changes in operating controls. Modifications to the embankment system will begin immediately and be complete within 90 days. A qualified geotechnical engineer will inspect the construction of the embankment modifications on a weekly basis.

Further, operation of the resin-in-pulp circuit will be discontinued and there will be no discharge of tailings effluent to the Colorado River.

Very truly yours,


William P. Badger
General Superintendent

WPB:mb

Enclosure

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DESIGN CRITERIA FOR IMPROVEMENTS
OF TAILINGS DISPOSAL SYSTEM AT
ATLAS MINERALS MILLING OPERATIONS,
MOAB, UTAH

The design criteria for the improvements of tailings pond is to include (1) modifications of the embankment section along the western edge of the tailings pond; (2) construction of an overburden fill to be placed at the seepage area located along the north embankment toe; and (3) a freeboard requirement for the entire embankment perimeter and a minimum crest-to-pond-water-edge distance at all embankment areas other than the western embankment area.

Western Embankment Section

Along the western embankment area of the tailings pond the design criteria for improvements are shown on Figure 1 and include the following:

1. A minimum freeboard requirement of 6 feet must be met at all locations.
2. A 2-foot minimum cover of rip-rap material is required for wave-erosion protection over the entire upstream slope. The material will consist of well-graded river run gravel with pieces of a maximum size of one foot.
3. A crest width of 20 feet must exist at all embankment sections.
4. Beach sand tailings will be placed against the upstream slope and along the natural ground surface adjacent to the existing toe of embankment slope with the dimensions as shown on Figure 1. The tailings fill material will have particle sizes such that there will be no greater than 7% by weight passing the No. 200 sieve.
5. Filter material of river run gravel with gradation sizing designed in accordance with U.S. Corp of Engineers criteria. The dimensions of placement will be as shown on Figure 1.
6. Overburden material will be placed over the beach sand with minimum cover of 8 feet. The overburden will be of natural near-site sand and silt and will be placed to the dimensions shown on Figure 1. The fill should be placed in 12 inch lifts (loose state) and compacted to a dry density of at least 90% of the maximum density as determined by the AASHTO T-99 method of compaction.

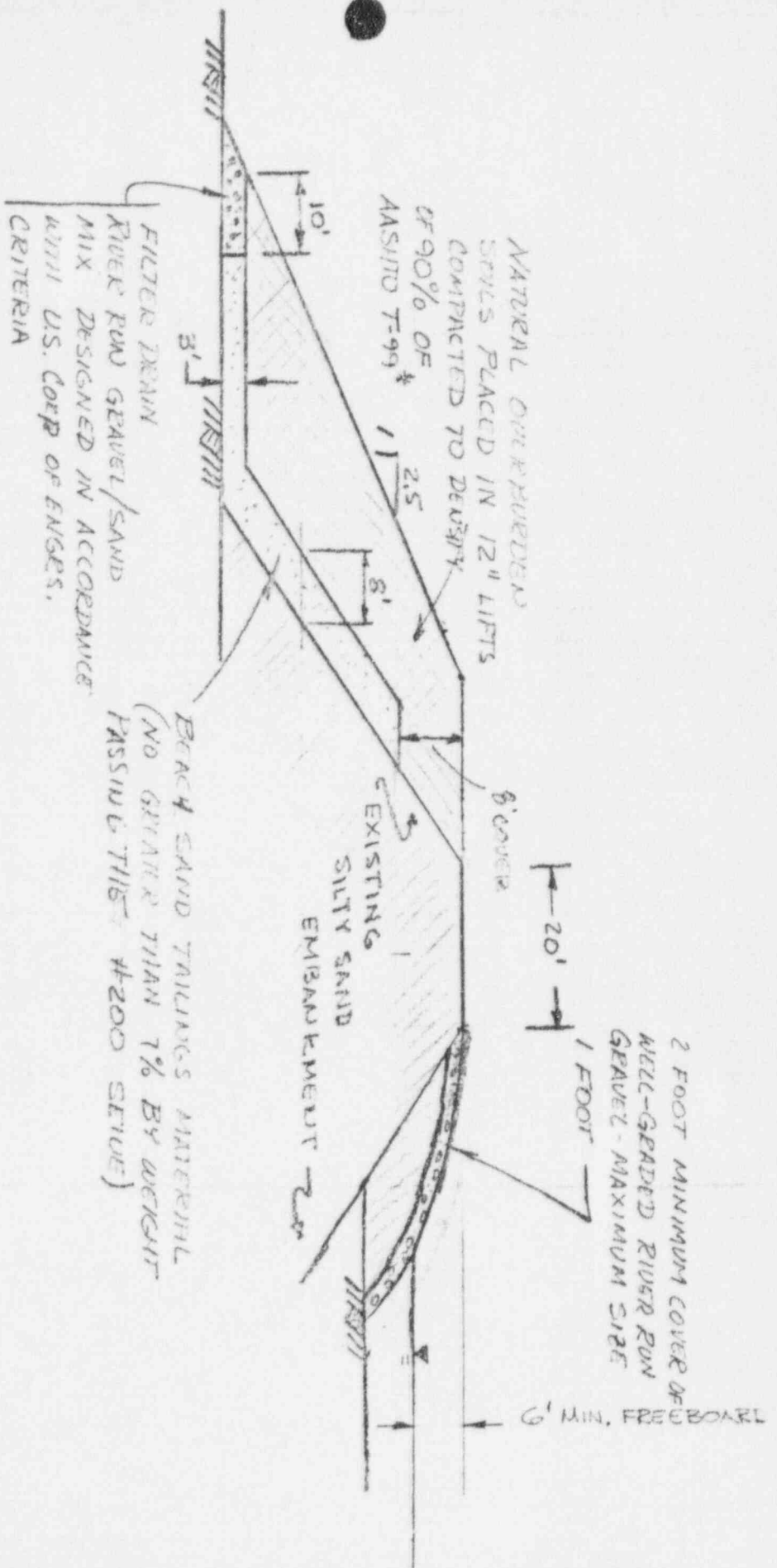
Seep Area at North Embankment Area

Construction of an overburden fill will be placed over the seepage area located at the north embankment toe. The construction requirements and dimensions are shown on Figure 2 and include the following:

1. An overburden fill of well-graded river run gravel will be placed over the seep area a distance of at least 50 feet in all directions from the seep. The minimum fill thickness of 5 feet will be met over the above stated area. The maximum particle size of the material will be one foot.
2. A perforated drain pipe will be placed as shown on Figure 2 and drained by pipe to a sump pumpback system located near the downstream toe of slope.

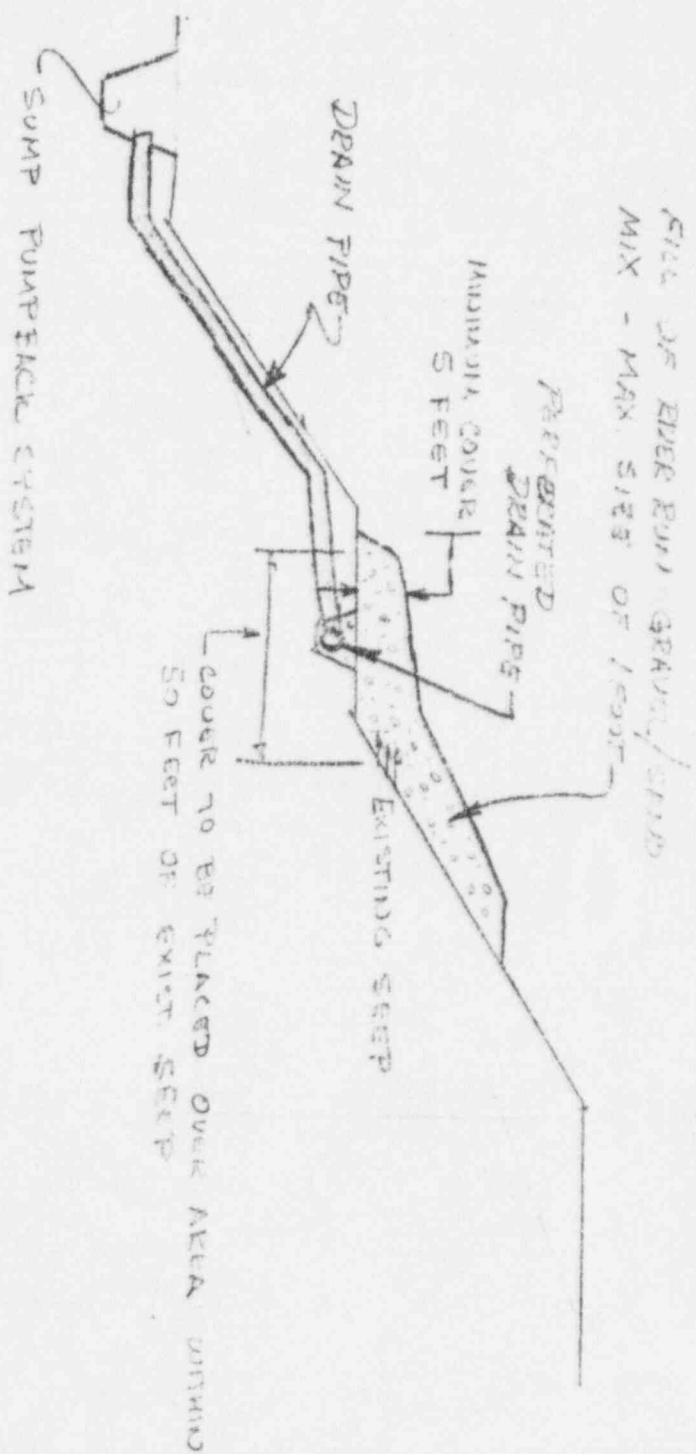
Operational Requirements for Poned Liquids

The operational requirements for the ponded liquids will be such that a minimum freeboard of 6 feet must be maintained at all locations along the embankment crest. Along the embankment other than the west embankment area a minimum distance of 150 feet from the crest-of-the-embankment to the edge-of-water must be maintained. The rip-rap material along the western embankment must extend at least 50 feet into the beach areas on either side of the water retention embankment.



AASHTO T-99 METHOD OF CONSTRUCTION

TYPICAL SECTION -
BEST AVAILABLE AREA



OVERBORDEN CONSTRUCTION TO BE
PLACED AT SEEP - NORTH EMBANKMENT

Figure 2