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ASCabell, LFMB

OCT 21 1982

Docket No. 40-3453

MEMORANDUM FOR: William E. Manion, Chief, Financial Operations Branch, RM

FROM: William O. Miller, Chief, License Fee Management Branch, ADM

SUBJECT: TRANSFER OF FUNDS - ATLAS MINERALS

On August 27, 1981, we forwarded to you a $3,500 amendment fee (Check 25201; CD81-765), which was submitted by the subject licensee. The NMSS Licensing staff has informed us of the actual staff-hours required to review the application. Please transfer the funds to revenue as indicated below.

Licensee: Atlas Minerals License: SUA-917

Application Dated:		August 20, 1981
Fee Category:		2A
Amendment Issued:		September 3, 1981, No. 9
Fee Paid/Type:		$3,500 AA905 AMD-S
Total Fee Required:	$3,500	(101.5 staff-hrs. @ $38/hr. = $3,857)*
Refund Due:		None
Transfer the Amount Indicated From Deferred Revenue to Materials Revenue Account:	$3,500	From Account 1129 to AA905-AMD-S

Original Signed by
Wm. O. Miller

William O. Miller, Chief
License Fee Management Branch
Office of Administration

*For this case, the fee is limited to the amount collected in accordance with Section 170.31, Footnote 1(d) and 4.

OFFICE	LFMB:ADM	LFMB:ADM	LFMB:ADM	LFMB:ADM			
SURNAME	DWeiss/rej	ASCabell	CaHolloway	WOMiller			
DATE	10/ /82	10/19/82	10/ /82	10/ /82			

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

OCT 6 1982

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U.S.N.R.C.
LIC. FEE MGMT. BRANCH

DOCKET NO.: 04003453

MEMORANDUM FOR: WILLIAM O. MILLER, CHIEF
LICENSE FEE MANAGEMENT BRANCH
OFFICE OF ADMINISTRATION

FROM: P. GARCIA
URANIUM RECOVERY LICENSING BRANCH
DIVISION OF WASTE MANAGEMENT
OFFICE OF NUCLEAR MATERIALS
SAFETY AND SAFEGUARDS

SUBJECT: COSTS AND MANHOURS FOR LICENSING ACTION

THE CONTRACT COSTS INCURRED AND MANHOURS USED IN REVIEWING THE APPLICATION DATED 04/06/82 ARE TABULATED BELOW FOR LICENSE NO. SUA-917 .

1. NAME: ATLAS

2. A) CASEWORK CONTROL NO. 040034530225 Associated with casenumber
   B) MAIL CONTROL NO. 20301 040034530200
   C) TAC NO. 040034530215

3. A) COMPLETION DATE: 09/03/82
   B) AMENDMENT NO. 9

4. FINAL FEE TYPE IDENTIFIED BY NMSS: Minor Safety and Environmental

5. CONTRACT COSTS ASSOCIATED WITH THIS LICENSE APPLICATION:

   A) FOR ENVIRONMENTAL REVIEW $
   B) FOR SAFETY REVIEW $
   C) TOTAL CONTRACT COSTS $

6. TAC WORK BY NRR: HOURS

7. NMSS HOURS:

A) ENVIRONMENTAL REVIEW	0.0 HOURS
B) SAFETY REVIEW	50.0 HOURS
C) MATERIAL CONTROL	0.0 HOURS
D) PHYSICAL SECURITY	0.0 HOURS
E) TOTAL	50.0 HOURS

RECEIVED BY LFMB
Date 10/8/82
Log AM
By RMF
Orig. To
Action Compl.

Pete J. Garcia Jr.
P. GARCIA
PROJECT MANAGER

APPROVED: H. Pettengill
H. PETTENGILL, Section Leader
Uranium Recovery Licensing Branch
URANIUM RECOVERY LICENSING BRANCH

~~8211010536~~ 2pp.

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

OCT 6 1982

DOCKET NO.: 04003453

MEMORANDUM FOR: WILLIAM O. MILLER, CHIEF
LICENSE FEE MANAGEMENT BRANCH
OFFICE OF ADMINISTRATION

FROM: P. GARCIA
URANIUM RECOVERY LICENSING BRANCH
DIVISION OF WASTE MANAGEMENT
OFFICE OF NUCLEAR MATERIALS
SAFETY AND SAFEGUARDS

SUBJECT: COSTS AND MANHOURS FOR LICENSING ACTION

THE CONTRACT COSTS INCURRED AND MANHOURS USED IN REVIEWING THE APPLICATION DATED 08/28/81 ARE TABULATED BELOW FOR LICENSE NO. SUA-917 .

1. NAME: ATLAS

2. A) CASEWORK CONTROL NO. 040034530200
   B) MAIL CONTROL NO. 10303
   C) TAC NO.

   Associated with casenumber
   04003453021S completed 11/6/81
   04003453022S completed 9/3/82

3. A) COMPLETION DATE: 09/03/82
   B) AMENDMENT NO. 9

4. FINAL FEE TYPE IDENTIFIED BY NMSS: Minor Safety and Environmental

5. CONTRACT COSTS ASSOCIATED WITH THIS LICENSE APPLICATION:

   A) FOR ENVIRONMENTAL REVIEW $
   B) FOR SAFETY REVIEW $
   C) TOTAL CONTRACT COSTS $

6. TAC WORK BY NRR: HOURS

7. NMSS HOURS:

A) ENVIRONMENTAL REVIEW	0.0 HOURS
B) SAFETY REVIEW	3.0 HOURS
C) MATERIAL CONTROL	0.0 HOURS
D) PHYSICAL SECURITY	0.0 HOURS
E) TOTAL	3.0 HOURS

RECEIVED BY LFMB
Date 10/8/82
Log AM
By RMF
Orig. To
Action Compl

Pete J. Garcia Jr.
P. GARCIA
PROJECT MANAGER

APPROVED: J. Pettengill
H. PETTENGILL, Section Leader
Uranium Recovery Licensing Branch
URANIUM RECOVERY LICENSING BRANCH

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

DEC 29 1981

DOCKET NO.: 04003453

MEMORANDUM FOR: WILLIAM O. MILLER, CHIEF
LICENSE FEE MANAGEMENT BRANCH
OFFICE OF ADMINISTRATION

FROM: P. GARCIA
URANIUM RECOVERY LICENSING BRANCH
DIVISION OF WASTE MANAGEMENT
OFFICE OF NUCLEAR MATERIALS
SAFETY AND SAFEGUARDS

SUBJECT: COSTS AND MANHOURS FOR LICENSING ACTION

THE CONTRACT COSTS INCURRED AND MANHOURS USED IN REVIEWING THE APPLICATION DATED 08/20/81 ARE TABULATED BELOW FOR LICENSE NO. SUA-917 .

1. NAME: ATLAS

2. A) CASEWORK CONTROL NO. 040034530205 is
   B) MAIL CONTROL NO. 10303
   C) TAC NO.

Associated with
040034530200
040034530225

3. A) COMPLETION DATE: 11/06/81
   B) AMENDMENT NO. no amendment issued

4. FINAL FEE TYPE IDENTIFIED BY NMSS: 2A

5. CONTRACT COSTS ASSOCIATED WITH THIS LICENSE APPLICATION: n/a

A) FOR ENVIRONMENTAL REVIEW	$	n/a
B) FOR SAFETY REVIEW	$	n/a
C) TOTAL CONTRACT COSTS	$	n/a

6. TAC WORK BY NRR: n/a HOURS

7. NMSS HOURS:

A) ENVIRONMENTAL REVIEW	0.0 HOURS
B) SAFETY REVIEW	48.5 HOURS
C) MATERIAL CONTROL	0.0 HOURS
D) PHYSICAL SECURITY	0.0 HOURS
E) TOTAL	48.5 HOURS

12-30-81
A.M.
D.G.S.

Gregory Garcia for
P. GARCIA
PROJECT MANAGER

APPROVED: Gregory Garcia for
H. PETTENGILL, Section Leader
Operating Facilities Section II
URANIUM RECOVERY LICENSING BRANCH

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RETURN TO WMUR 467-SS

DISTRIBUTION: * w/attach
w/o attach

Docket Files 40-3453
40-4492
40-8084
40-8452

PDR
NRC Region IV
WMUR r/f
WMUR w/f (4) *
WM r/f (4)
NMSS r/f (4)
TLJohnson
BPFisher
HJPettengill *
JJLinehan
DEMartin
RDSmith
REBrowning
JBMartin *

WMUR:TLJ

SEP 10 1982

Docket Nos.: 40-3453
40-4492
40-8084
40-8452

MEMORANDUM FOR: Docket File Nos.: 40-3453
40-4492
40-8084
40-8452

FROM: T. L. Johnson, Project Manager
Operating Facility Section II, WMUR, NMSS

Harry J. Pettengill, Section Leader
Operating Facility Section II, WMUR, NMSS

SUBJECT: REPORTS OF SITE VISITS AND MEETING SUMMARIES

A. Meeting with Federal-American Partners

On April 12, 1982, the NRC staff met with Federal-American Partners (FAP) in Denver, Colorado to discuss various aspects of a proposed reclamation plan for existing Tailings Pond No. 1. FAP had requested the meeting to present various options for the design and stabilization of surface water hydrological features at this site. Attendees at the meeting were:

T. L. Johnson, NRC
Anand Prakash, Dames & Moore Co.
Brian Cundelan, Dames & Moore Co.
Niles Andrus, Federal-American Partners

We discussed various aspects of a proposed design for the diversion of Campsite Draw and Willow Springs Draw around the existing tailings pond. FAP presented draft plans and hydraulic computations for the diversion. The staff briefly reviewed the plan and computations and indicated

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several features which would have to be modified to meet long-term stability criteria. FAP indicated that they would make the necessary modifications and submit a revised plan. (The revised plan was submitted on April 21, 1982.)

B. Meeting with Rocky Mountain Energy Co.

On April 12, 1982, the NRC staff met with Rocky Mountain Energy Co. (RMEC) in Denver, Colorado regarding a proposed dam raise and reclamation plan for the Bear Creek site. Attendees at the meeting were:

H. Pettengill, NRC
T. Johnson, NRC
R. Williams, NRC Consultant
R. Yellich, RMEC
R. Medlock, RMEC

T. Johnson (NRC) discussed deficiencies that had been found in RMEC's submittals on the hydrologic design of the diversion channels. RMEC agreed to correct the deficiencies, make the necessary changes to the drawings, and to submit a revised reclamation design. The revised plans were submitted on May 6, 1982.

H. Pettengill and R. Williams discussed the projected seepage evaluation and identified potential seepage pathways through the N sand along the mill side of the tailings dam. RMEC proposed the location of additional monitoring wells to delineate this situation. RMEC submitted following information to resolve this potential seepage pathway on May 6, 1982.

C. Meeting with Rio Algom Corporation

On April 13, 1982, the NRC staff met with Rio Algom Corporation (RAC) at the tailings dam site. Present at the meeting were Bob Pattison and Merv Lawton (RAC); Ted Johnson and Harry Pettengill (NRC); and Roy Williams (consultant to NRC). The purpose of the meeting was to discuss

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RAC's available options based on our observations of the current state of the existing diversion channels. At this meeting the licensee proposed as an alternative to modifying the diversion structure or placing riprap to: 1) modify the Bisco Lake embankment and/or, 2) restrict the operating level in the lower impoundment as a means of assuring containment of the PMF, allowing no credit for the diversion channel. RAC indicated that they were not exactly sure what they would like to do. RAC requested that NRC give principal consideration to the design option which would give no credit whatsoever for the diversion ditch and would assume complete runoff into the lower impoundment from the entire drainage area above it. RAC believed that adequate freeboard would be available in the lower impoundment to allow operations to continue for several more years, assuming that the criteria of the new staff position paper (rather than Regulatory Guide 3.11) were used to determine the freeboard requirements. We indicated that this was an acceptable option and that the NRC would review this request.

Mr. Pettengill and Mr. Williams discussed the existing seepage problems, and proposed mitigative actions. (See attached trip report by R. Williams.) These issues were eventually resolved by the issuance of amendments 14 and 15 on September 3, 1982.

D. Meeting with Atlas Minerals Co.

On April 14, 1982, a meeting was held with Atlas Minerals to discuss specific options available with regard to seepage, monitoring, and interim and final stabilization of Moab Wash.

After arriving at the site Mr. T. Johnson walked the entire length of the Moab Wash Channel (on Atlas property). I made several observations pertinent to the hydraulic design of the channel:

1) The riprap placed along the dam embankment on the upstream end of the channel (Upstream of Section B as shown on Exhibit H of the licensee's submittal dated October 3, 1978) appears to be fairly

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well-graded and suitable to provide adequate protection for the embankment during a major flood event.

2) That portion of the channel in the vicinity of the barium chloride (BaCl) treatment ponds is physically located about 150 feet from the toe of the dam embankment. The capacity of this portion of the channel could be benefically lessened by decreasing the height of the berm (the berm is actually soil piled up randomly) between the channel and the mill area. Also, the height of the berm could be lowered downstream from the existing ore pile. By lowering the elevation fo the berm to an elevation less than that of the right bank of the channel (looking downstream), the amount of water to be carried (and thus the channel velocity) would be decreased, without significantly affecting the PMF water surface elevation.

3) The BaCl ponds should be filled to provide additional protection against flood erosion toward the tailings embankment. At the present time, the ponds appear to be about 8-10 feet deep and are almost empty.

4) At the upstream end of the BaCl ponds on the right bank of the channel, poor hydraulic conditions exist for the smooth passage of flow along the embankment toe. Undesirable flow currents could be formed in this area, increasing the likelihood of embankment erosion. This area should be regraded starting at the access road and progressing downstream to the BaCl ponds.

Discussions were held with Mr. Richard Blubaugh regarding the above observations and any modifications which could be made to Moab Wash to minimize the erosion protected. Mr. Blubaugh indicated that he would take the dose comments under construction and get back to us.

Dr.'s Williams and Pettengill reviewed with Atlas staff and their consultants the findings of a mill site seepage study and proposed monitoring program recently completed by Dames & Moore for Atlas. These

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Docket File Nos.: 40-3453
40-4492
40-8084
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issues are highlighted in the attached letter from R. Williams providing comments on the Atlas groundwater study.

Final resolution of both above issues were achieved by issuance of amendments 8 and 9 on August 11, 1982 and September 3, 1982, respectively.

Original signed by
H. J. Pettengill for
T. L. Johnson, Project Manager
Operating Facility Section II
Uranium Recovery Licensing Branch
Division of Waste Management

Original signed by

Harry J. Pettengill, Section Leader
Operating Facility Section II
Uranium Recovery Licensing Branch
Division of Waste Management

Attachment:
Letters fm R. Williams Providing Comments
on the Atlas Groundwater Study

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OFC	WMUR	WMUR	WMUR			
NAME	TLJohnson:mb	HJPettengill	BPFisher			
DATE	82/09/09	82/09/	82/09/			

WILLIAMS-ROBINETTE & ASSOCIATES, INC.

Hydrogeology
Mineral Resources Waste Management

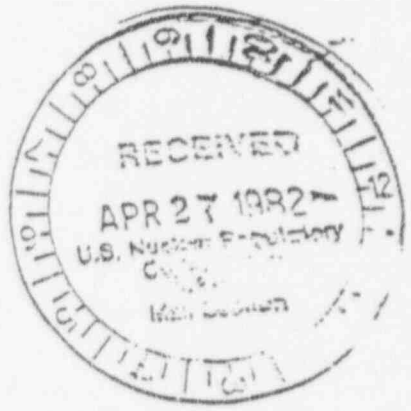
P.O. Box 48
Viola, Idaho 83872
(208) 883-0153
(208) 875-0147

Geological Engineering
Surface and Borehole Geophysics

add'l info
to open case
dist to PDR.

April 16, 1982

Task Order No. 16



Mr. Harry Pettengill
Uranium Resource Recovery Licensing Branch
U. S. Nuclear Regulatory Commission
7915 Eastern Avenue
Silver Spring, Maryland 20910

Dear Harry:

This letter constitutes my comments on a document entitled "Report of Phase I Work, Ground Water Monitoring Project, Uranium Mill Tailings Impoundment, Moab, Utah for Atlas Minerals." The report results from Dames and Moore Job No. 05467-030-06. The report is dated March 5, 1982.

The report is straight forward and comprehensive. In my opinion it describes adequately the information obtained from the drilling of a 406 foot deep exploratory well at the Moab site. I suggest the following minor changes in the draft however. The Introduction on page 1 states that four wells were completed within a single borehole at the site. This terminology in slightly misleading. What actually happened was that four piezometers were installed in a single 8-inch diameter casing that had already been installed in the well. The installation of four piezometers in an 8-inch casing is quite different from completing four wells at a site.

Page 5, paragraph 3, line 5 states "considering salinity variations there is negligible difference in the potentiometric surface of the four wells as would be expected from the lack of confining beds." The phrase "as would be expected for the lack of confining beds" should be deleted. It is not necessary for confining beds to be present in order to measure different potentiometric

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surfaces in four piezometers installed in a single well.

I agree that this well has demonstrated that the downward vertical movement of seepage or Colorado River water into and through the brine is unlikely. This does not mean, however, that Colorado River water or seepage cannot move downward to the top of the brine and then horizontally in some other direction. Consequently, the fourth sentence in the third paragraph on page 5 should be changed to read "Due to differences in the density of the brine and fresh water there is no potential for Colorado River water to move vertically downward [through the brine] without completely mixing with the deeper waters." I have added the phrase "through the brine". Similarly, the same phrase should be added to the next sentence between the word "downward" and "without". This sentence should then read "Similarly, tailings pond seepage with a total dissolved solids concentration on the order of 60,000 mg/l as reported by Atlas Minerals would not be able to move vertically downward [through the brine] without mixing with and attaining the same density as the seepage". In addition it is my opinion that the 60,000 mg/l figure for total dissolved solids in the seepage is unusually high. Tailings pond seepage water normally does not exceed about 35,000 mg/l total dissolved solids.

I suggest that the following sentences be added to the third paragraph on page 5. "Consequently, if downward movement of seepage or Colorado River water is occurring, it probably does not move downward beyond depths that reflect the top of the brine. Vertical or horizontal movement of river water or seepage could occur above the brine interface."

I agree with the Dames and Moore interpretation of the geophysical logs. The geophysical logs present very convincing evidence that there is very little grain size stratification in the material at the site to the depth of the boring (406 feet). It should be noted however that for future presentations and for most beneficial use of documents such as this, Dames and Moore should be encouraged to designate the horizontal scales on logging charts such as those presented in Plate A-1.

I agree with Dames and Moore's conclusions on page 6. There is negligible potential for either seepage or Colorado River water to move into or through the brine. Consequently, this information indicates that there is no need to locate the bedrock surface as was thought to be the case prior to the data which revealed the presence of the brine. It should be noted, however, that the subject boring did not locate the surface of the brine since conductivity measurements were not taken as the borehole proceeded downward. As a follow-up to the subject 406-foot deep hole, Dames and Moore and Atlas Minerals have proposed that three new wells be drilled at the site with two piezometers being installed in one of the wells. This proposal is included in the April 13, 1982, letter to Atlas Minerals from Dames and Moore. Well ATP-4-82 would be drilled north of the tailings pond and hopefully would reflect background concentrations of dissolved solids. It would be screened at 50 to 60 feet, the anticipated depth to the water table. Well ATP-2-82 would be drilled to the brine interface, approximately half way between the tailings pond embankment toe and the river along the southeastern side of the pond. One piezometer would be installed slightly above the brine interface and the

second would be installed approximately halfway between the brine interface and the water table. Well ATP-3-82 is proposed with perforations between 25 and 35 feet, approximately 200 feet off the southern most corner of the tailings pond. I suggest that the drilling of well ATP-4-82 and ATP-2-82 proceed as recommended. However, I do not see the need for ATP-3-82 because it is likely to reflect the same water quality as current monitoring well MW-1; consequently I recommend that it be deleted from the drilling program.

The water quality data presented in Table 1 (attached) is the most current of the ground water quality data available at the site for monitor wells 1, 2 and 3. Additional data are presented in a table for one shot sampling efforts in test pits 3, 4 and 5 in 1974 and for the Colorado River upstream from the tailings pond. These data are representative of other data available for monitoring wells 1, 2 and 3, but at different dates. Altogether the data indicate that seepage occupies all the storage capacity in the alluvial valley fill aquifer between the water table and the brine interface throughout the distance between the tailings pond and the Colorado River. A data base gap exists for the mill area but all indications are that seepage occupies this aquifer as well. The drilling of the 406-foot hole described above, in combination with these data, presents a reasonably clear picture with respect to the seepage condition at the site. The only two pieces of information missing are the depth to the brine interface and precise background water quality data at the site. Hopefully the new drilling program will answer these two questions and the ground water contamination situation at the site will be understood completely. Information available to date suggests that

a near steady state condition exists between the release of seepage from the tailings pond and the rate of movement of seepage to the Colorado River. Virtually all storage space has been occupied in the aquifer by seepage. The rate of discharge or the rate of flow of the seepage into the Colorado River is not yet known however. A water balance study at the mill site should provide a reasonable estimate of this discharge rate.

This concludes my remarks and recommendations with respect to ground water contamination by seepage at the Atlas Minerals Moab Mill. If you have need of additional information or if you have any questions, please call me at 208-885-6259.

Sincerely,

Roy E. Williams

Roy E. Williams
Ph.D. Hydrogeology
Registered in Idaho

REW:sl

cc: Mary Jo Mattia

WILLIAMS-ROBINETTE & ASSOCIATES, INC.

Hydrogeology
Mineral Resource Waste Management

P.O. Box 48
Viola, Idaho 83872
(208) 883-0153
(208) 875-0147

Geological Engineering
Surface and Borehole Geophysics

April 16, 1982

Mr. Harry Pettengill
Uranium Resource Recovery Licensing Branch
U. S. Nuclear Regulatory Commission
7915 Eastern Avenue
Silver Spring, Maryland 20910

Dear Harry:

This letter constitutes my trip report to the Rio Algom alkaline leach uranium mill near LaSal, Utah. The trip was conducted during the period of April 13 and 14. The work was done under Task Order No. 18. The primary subject of discussion during the site visit was the Dames and Moore report entitled "Report on Ground Water Investigations, Lisbon Mine near LaSal, Utah, Project No. 7144-018-06 dated February 20, 1981." The second primary subject of discussion was a pump back system that would be designed to mitigate the seepage problem that is known to exist at the site. Additional information discovered during the site visit shed considerable new light on the problem. This information consists of the fact that the company operates a mine at approximately 2500 feet beneath the tailings pond waste disposal area. The southwest limit of the extent of the mine is the approximately east-west trending trace of the Lisbon Valley fault. When the mine crosscuts intercept this fault, the mine produces poor quality water in sufficient quantities that mining cannot proceed further. It also was revealed at the site visit that several abandoned drill holes to the depths of either the fault, an aquifer hydraulically connected to the fault or to the mine have existed in the area in the past. Reportedly most of these drill holes have been plugged but there appears to be some uncertainty,

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particularly with respect to drill holes H-10 and H-38. I suspect that uncertainty exists also with respect to other drill holes. This information is pertinent because the deep drill holes may intercept the Lisbon Valley fault and conduct fluid from the tailings pond to the mine. An alternative interpretation is that the drill holes intercept and simply conduct tailings solution to the fault without reaching the mine. The status of this situation cannot be determined with the available data; however, it should be kept in mind that on the south side of the pond the possibility exists that seepage from the tailings pond is being drained downward through either the fault, the abandoned drill holes or combination thereof. This may explain the sharp gradient on the contaminated ground water mound along the south side of the tailings pond. On the north side of the tailings pond abandoned drill holes exist but they probably do not intercept the fault. In addition they may all be plugged. Nevertheless, on the north side of the tailings pond the contaminated ground water plume is spreading faster than on the south side. For this reason I suggested and the Rio Algom Corporation agreed to install certain recovery wells along the north side of the tailings pond. These are existing wells H-72, H-56, H-55, and H-77. It was agreed that these wells would be backsealed and opened in the Dakota Burro Canyon formation above the Brushy Basin shale. It was agreed that the wells would be pumped at as high a rate as possilbe without dewatering them. The company agreed to drill a new well to the Brushy Basin shale northeast of existing monitor well 7 and north of existing well H-55. The company agreed to monitor water levels and water quality in wells DMBO-1 monitor well 7, and the new monitoring well along the north permit boundary. The effect of pumping the aforementioned wells will be evaluated during this

monitoring program. Several other wells will continue to be monitored in the area and the affect of the pumping scheme on them evaluated. On the west side of the tailings pond I did not see the value of pumping a recovery well field system. The reason for this decision is that wells H-71, H-73 and H-72 do not appear to be contaminated on the basis of their chloride content. On the south side of the tailings pond the company agreed to monitor the existing wells and to add two new monitoring wells, all of which would be open to the Brushy Basin shale. The first of the two monitoring wells would be drilled southwest of monitoring well 1, south of the line connecting and halfway between monitor wells 2 and 6. The second monitoring well would be drilled south of monitoring well 2. These two wells are designed to provide more explicit data on the condition of the Dakota Burro Canyon sandstone above the Brushy Basin shale. Some confusions exists about the condition of the aquifer above the Brushy Basin shale in the vicinity of monitor well 1. These wells will be monitored and if it becomes obvious that a contaminated seepage plume is moving toward the company's south permit boundary, then a pumping program will be implemented.

The details of this drilling and recovery program will be submitted to the NRC by Mr. Bob Patteson of Rio Algom. Hopefully I will have the opportunity to review it when it arrives.

If you have any questions regarding this letter, please call me at 208-885-6259.

Sincerely,

Roy E. Williams

Roy E. Williams
Ph.D. Hydrogeology
Registered in Idaho

REW:sl
cc: Mary Jo Mattia

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

JUN 29 1982

WMUR:TLJ/PJG
Docket No. 40-3453

MEMORANDUM FOR: Docket File No. 40-3453

FROM: Peter J. Garcia, Jr., Project Manager
Operating Facility Section II, WMUR

SUBJECT: REVIEW OF ATLAS MINERALS' TAILINGS IMPOUNDMENT RECLAMATION PLAN

BACKGROUND

By letter dated May 29, 1981, Atlas Minerals submitted "Report, Conceptual Design and Cost Estimate, Tailings Pile Reclamation, Moab, Utah, for Atlas Minerals." Atlas submitted this report in support of their recent request to raise the tailings embankment at the Moab Mill. The discussion below outlines the staff's review of the reclamation plan.

PROPOSED RECLAMATION PLAN

Upon termination of milling operations, the licensee proposes to allow the tailings surface to dry for two years before beginning a phased reclamation program. The phased program will consist of various fill placement operations conducted at different times to bring the pile to its final reclamation configuration.

The licensee proposes that, during Phase I of the program, the existing 2H on 1V and 3H on 1V slopes will be graded and cut back to a maximum slope of 10H on 3V. The material from the cut back operations will be placed and compacted on top of the pile, and settlement monitoring devices and piezometers will be installed. The cut back operations will result in a minimum of 5 feet of non-slimes overlying slimes, with average thickness of non-slimes being 11 feet. Chemical stabilizers will then be applied to the surface of the reshaped pile.

When readings from the settlement monitoring devices have stabilized to indicate that settlement is essentially complete (readings will be taken at least monthly), the licensee will commence Phase II activities. Initially, the pile will be regraded to compensate for settlement. Ten feet of soil cover will then be placed and compacted on the tailings.

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After the soil cover is in place, rock cover will be placed on the 10H:3V side slopes. The vertical thickness of the rock cover will be two feet. Settlement monitoring devices and piezometers will be installed on the pile top, and chemical stabilizers will be applied.

The licensee will monitor instrumentation readings at least monthly until readings have stabilized to indicate that settlement is essentially complete. At that point Phase III operations will commence. Initially the pile will be regraded to eliminate any irregularities resulting from settlement. Municipal sludge will then be applied at the rate of 15 tons per acre to the 90 acre pile top, and worked into the upper three inches of the soil cover. The pile top will be seeded in the fall and summer, and fertilizer will be applied.

STABILITY REVIEW

The staff has reviewed long term stability aspects of the reclamation plan for comparison with the reclamation program specified in the "Final Environmental Statement Related to Operation of Moab Uranium Mill" (FES, NUREG-0453).

The maximum slopes of 10H:3V proposed by Atlas are in accordance with the slopes specified in the Atlas FES. The FES specified that erosion protection of the soil cover be provided by placing four inches of gravel on relatively flat areas of the pile and 12 inches of gravel on slopes. As discussed above, the licensee's proposed plan calls for revegetation of the pile top and placement of two feet of rock cover on the slopes.

The staff feels that revegetation of the pile top is acceptable because of the extremely flat slopes (less than 0.15%). Atlas has proposed the extra foot of rock cover on slopes to compensate for the fact that the on-site rock available does not meet the quality specifications presented in the "Final Generic Environmental Impact Statement on Uranium Milling." Research regarding the required quality and thickness of rock erosion protection is currently under way. On the basis of the limited information available, the staff feels Atlas' proposed rock cover is reasonable. However, conclusions from the ongoing research may necessitate modifications to the erosion protection aspects of the reclamation plan.

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ENVIRONMENTAL REVIEW

The staff has reviewed environmental aspects of the reclamation plan proposed by Atlas because of minor differences between the proposed cover and the cover specified in the FES.

The staff technical position on attenuation of gamma radiation from the reclaimed pile specifies that gamma radiation should be reduced to about the background rate. The FES for the Atlas mill states that 2.6 feet of packed earth will reduce gamma radiation to the background rate. The ten feet of compacted soil proposed by Atlas will therefore easily provide the required gamma attenuation.

The staff technical position on radon attenuation specifies that radon emanation from reclaimed impoundment areas be reduced to about twice the background level. The staff has computed the radon emanation rate for the reclaimed impoundment area. Calculations are presented in the attached appendix. The calculations are based on the conclusion specified in the Atlas FES that the background flux rate for the site is 1.6 pCi/m^2-sec.

The calculations indicate that the total radon flux from the reclaimed impoundment area would be approximately 1.8 times the background rate. The staff considers the calculated radon emanation rate to be acceptable and in accordance with the staff technical position.

RECLAMATION COSTS AND SURETY ARRANGEMENTS

Atlas has provided projected costs for implementation of their proposed reclamation plan. The staff has reviewed these costs and feel they are reasonable. The costs did not, however, include estimated costs for mill decommissioning.

Upon approval of the reclamation plan the staff concludes that it would be reasonable for the licensee to establish and submit for NRC approval surety arrangements such that an NRC approved surety could be in place within a six month period. The staff therefore recommends that Condition No. 24 should be amended to require that the licensee establish an NRC-approved financial surety arrangement by January 1, 1983, to cover all costs for mill decommissioning, decontamination, and site reclamation.

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CONCLUSION

Based on the safety and environmental reviews performed, the staff concludes that the reclamation plan proposed by Atlas in their May 29, 1981 submittal is acceptable. However, as indicated earlier, the conclusions from ongoing research may necessitate future modifications to the erosion protection aspects of the proposed plan.

The staff recommends that the amendment authorizing Atlas' proposed dam lift, if approved, include requirements that Atlas reclaim the tailings impoundment in accordance with their May 29, 1981 submittal and establish NRC-approved surety arrangements by January 1, 1983. Based on the above, the staff recommends that NRC approval of the dam lift include revisions of License Condition Nos. 22 and 24 as follows:

22. The licensee shall reclaim the Atlas Mill tailings disposal area in accordance with the May 29, 1981 submittal "Report Conceptual Design and Cost Estimate, Tailings Pile Reclamation, Moab, Utah, for Atlas Minerals." In addition, surety arrangements covering the tailings reclamation costs shall be maintained.

24. The licensee shall establish an effective, NRC-approved financial surety arrangement, by January 1, 1983, to cover all costs for mill decommissioning, decontamination, and site reclamation, and maintain these or other NRC-approved arrangements thereafter until this license is terminated by the NRC.

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Attachment:
Appendix - Calculation of Radon Emanation Rate

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APPENDIX

CALCULATION OF RADON EMANATION RATE

D.1 INTRODUCTION

The calculation of the radon emanation rate for the reclaimed impoundment area is based on diffusion theory. The effectiveness of a particular cover material in attenuating radon depends on the material's ability to restrict the diffusion of radon through it so that the radon gas decays to a solid daughter product before reaching the surface.

The material properties used to determine radon attenuation are the effective bulk diffusion coefficients (D) and porosities (P) of the cover material and of the tailings. Values of D may be measured experimentally for a given material at its ambient moisture level and expected degree of compaction. Alternatively, D can be estimated solely from the moisture content and porosity of the material, because the large variation (four orders of magnitude) in D from moisture content obscures the much smaller effects on the value of D from other soil properites.[1] Hence, the most important characteristic of cover soils is their ability to retain moisture.

With the moisture concentration in the cover soils, D may be estimated from the following empirical correlation of laboratory data:[1]

$$D/P = 0.106 \exp(-0.261\ M), \qquad (1)$$

Where M is the weight-percentage of soil moisture and D has units of cm^2/s. It is also possible, using Eq. (1), to express radon attenuation in terms of porosities and moistures of the tailings and cover. This correlation is mainly based on a limited amount of laboratory data, and it could possibly be modified slightly as additional data become available. The basic parameters characterizing the soils are the diffusion coefficient and the porosity. The equations given in the next section are expressed in terms of D and P, but for convenience Eq. (1) is used in select cases to give the moisture dependence explicity. The converted equations may undergo slight modification as more research is conducted by NRC and other organizations.

D.2 CALCULATION OF BARE RADON FLUX FROM TAILINGS SANDS AND SLIMES

The radon flux from the bare tailings source, J_0, is calculated in the following way:

$$J_0 = [Ra]\rho E(\lambda D_0/P_0)^{1/2} \times 10^4, \qquad (2)$$

where

[Ra] = concentration of Ra-226 in the tailings solids (pCi/g),

ρ = density of the tailings solids (g/cm^3),

E = emanating power of tailings (dimensionless),

D_o = effective bulk diffusion coefficient for radon in the tailings (cm^2/s),

P_o = porosity or void fraction in tailings solids (dimensionless).

The values for computing the bare tailings flux for the Atlas facility are as follows:

[Ra] = 699 pCi/g;

ρ = 1.6 g/cm^3,

E = 0.2,

D_o/P_o = 0.01314 cm^2/s.

The factor of 10^4 converts square centimeters to square meters, and the value of D_o/P_o = 0.01314 cm^2/s was obtained from Eq. (1) based on a tailings residual moisture of 8%. Substitution of the above values yields

$$J_o = (699\ pCi/g)(1.6\ g/cm^3)(0.2) \times (2.1 \times 10^{-6}\ s^{-1} \times 0.01314\ cm^2/s)^{\frac{1}{2}} \times 10^4\ cm^2/m^2 = 370.0\ pCi/m^2 \cdot s.$$

Equation (2) assumes effectively infinite depth of tailings. A factor given by $\tanh [\sqrt{\lambda/D_o/P_o}\ X_o]$, where X_o is the depth of tailings, is used to account for finite depth of tailings. However, in cases where the average depth of tailings is 3 m or more, the factor is effectively unity.

The calculation of separate radon emanation rates for tailings sands and slimes is based on the assumption that sands comprise 70% of the tailings and contain 15% of the radioactivity. Based on this assumption, the calculation of bare radon flux from sands and slimes yields the following values:

(1) Sands - 79.2 pCi/m^2-sec
(2) Slimes - 1047.0 pCi/m^2-sec

D.3 CALCULATION OF RADON EMANATION FROM IMPOUNDMENT AREA

The procedure for determining the radon emanation rate is established in Appendix P of ref. 2. Since the reclamation plan[3] stipulates that an average of 11 feet of tailing sands (8% moisture) be put in place over the slimes (12% moisture), followed by ten feet of silty sand (8% moisture), the determination of the total radon flux from the reclaimed impoundment area consists of the following stages:

1. Determine radon flux through the tailing sands layer and determine the composite diffusion coefficient of th tailing sands and slimes.

2. Determine the radon flux from the tailings following attenuation by the ten feet of soil cover.

3. Add the radon flux from the cover material.

The following equation is used to estimate the radon flux from the slimes following attenuation by the tailing sands:

$$J_1 = \frac{2\, J_0 \exp(-b_1 x_1)}{\left(1 + \frac{P_0}{P_1}\left[\frac{D_0/P_0}{D_1/P_1}\right]^{1/2}\right) + \left(1 - \frac{P_0}{P_1}\left[\frac{D_0/P_0}{D_1/P_1}\right]^{1/2}\right) \exp(-2b_1 x_1)}, \quad (3)$$

where

$b_1 = (\lambda P_1/D_1)^{1/2}$,

x_1 = thickness of the sand layer (cm), = 11 ft. x 30.48 cm/ft. = 335.28 cm

P_0 = porosity of the slimes,

P_1 = porosity of the sands.

Using Eq. (1), the following D/P values are computed:

$D_1/P_1 = 0.01314$ cm^2/s sands (8% moisture);

$D_0/P_0 = 0.0046$ cm^2/s slimes (12% moisture).

Assume that the porosities are equivalent for all materials. This assumption is reasonable because long-term mitigation is the topic. Using the above values and the previously calculated radon flux for the slimes, Eq. (3) yields $J_1 = 18.4$ pCi/m^2·s. The total radon flux from the surface of the tailing sands is therefore 18.4 + 79.2 = 97.6 pCi/m^2-sec.

Equation (3) can be written as

$$J_1 = J_0 f \exp(-b_1 x_1), \quad (4)$$

where

$$f = \frac{2}{\left(1 + \frac{P_0}{P_1}\left[\frac{D_0/P_0}{D_1/P_1}\right]^{1/2}\right) + \left(1 - \frac{P_0}{P_1}\left[\frac{D_0/P_0}{D_1/P_1}\right]^{1/2}\right) \exp(-2b_1 x_1)}. \quad (5)$$

Substituting diffusion coefficients for sands and slimes, we get $f = 1.26$.

The function f is useful in calculating the composite diffusion coefficient. This composite diffusion coefficient is computed by the following equation:

$$\frac{D_{sm}}{P_{sm}} = \sum_{i=0}^{m-1} \frac{D_i}{P_i} \left[1 - \exp(-a_i x_i) \right] \exp\left(- \sum_{j=i+1}^{m-1} a_i x_i \right) , \qquad (6)$$

where

$a_i = (\lambda P_i / D_i h)^{1/2}$,

x_i = depth of the ith cover soil,

$\exp(-a_0 x_0) = 0$

$h = \left[1 - \frac{1}{b_1 x_1} \ln f \right]^{-2}$.

Thus, the composite D/P is computed as

$$\frac{D_{s2}}{P_{s2}} = D_0/P_0 \cdot \left[-\exp(-a_1 x_1) \right] + D_1/P_1 \cdot \left[1 - \exp(-a_1 x_1) \right] ,$$

where

$D_0/P_0 = 0.0046$ cm^2/s,

$D_1/P_1 = 0.01314$ cm^2/s,

$x_1 = 332.64$ cm,

$a_1 = [\ 2.1 \times 10^{-6}$ s^{-1}/0.0046 cm^2/s x h].

Now

$$h = \left[1 - \frac{1}{b_1 x_1} \ln f \right]^{-2}$$

$$= \left[1 - \frac{1}{0.0214 \times 46} \ln (1.26) \right]^{-2}$$

$$= 1.12$$

and

$$a_1 = \left(\frac{2.1 \times 10^{-6}\ s^{-1}}{0.013\ cm^2/s \times 1.12} \right)^{1/2}$$

$$= 0.012$$

Equation (6) now becomes

$$\frac{D_{s2}}{P_{s2}} = 0.00008 + 0.01277 = 0.013\ cm^2/s.$$

At this point we have the composite flux $J_1 = 97.6\ pCi/m^2 \cdot S$ and the composite diffusion coefficient $D_{s2}/P_{s2} = 0.013$.

Now, recalculate f from Eq. (5), using the composite diffusion coefficient calculated above for D_o/P_o and the diffusion coefficient for the silty sand cover (based on 8% moisture) of 0.01314 cm^2/s for D_1/P_1.

This gives f = 0.93.

Using the composite flux for J_o and the value of f = 0.93, calculate J_1 from Eq. (4) as follows:

$J_1 = 97.6 \times 0.93 \times 0.014$

$= 1.27\ pCi/m^2\text{-sec}$

This gives the radon flux from the tailings after attenuation by the cover material. Assuming radon emanation from the cover soil to equal the background flux of 1.60 pCi/m^2-sec (see text), the total radon flux from the reclaimed impoundment area is as follows:

$$1.27 + 1.60 = 2.87\ pCi/m^2\text{-sec}$$

or 1.8 times background.

The above model and calculations do not present a significant departure from the previous NRC approach to mitigation of radon exhalation from tailings piles. The revisions consist mostly of making the diffusion coefficients more sensitive to moisture and depth. Appendix P of Ref. 2 highlights the techniques used here as well as a more simplified approach for single layers.

REFERENCES FOR APPENDIX D

1. V. C. Rogers et al., "Characterization of Uranium Tailings Cover Materials for Radon Flux Reduction," NUREG/CR-1081, March 1980.*

2. U.S. Nuclear Regulatory Commission, "Final Generic Environmental Impact Statement on Uranium Milling," Report NUREG-0706, Washington, D.C., Project M25, September 1980.*

*Available for purchase from the NRC/GPO Sales Program, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, and the National Technical Information Service, Springfield, VA 22161.