DD-99-02

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS
Carl J. Paperiello, Director

In The Matter of	)	
ATLAS CORPORATION	)	Docket No. 40-3453
370 Seventeenth Street, Suite 3050	)	License No. SUA-917
Denver, Colorado 80202	)	
	)	(10 CFR 2.206)

DIRECTOR'S DECISION UNDER 10 CFR 2.206

I. INTRODUCTION

On August 2, 1988, Atlas Corporation (Atlas or licensee) submitted an application for a license amendment to revise its site reclamation plan for uranium mill tailings at its site in Moab, Utah. On April 4, 1994, notice of Receipt of Application and notice of Opportunity for Hearing on the application were published in the Federal Register. 59 FR 16665 (1994). On July 13, 1998, the State of Utah (State or Utah) filed the State's Request for Hearing and Petition for Leave to Intervene (Petition). By Memorandum and Order dated August 13, 1998, the Atomic Safety and Licensing Board determined that the petition was inexcusably late and would be treated as a petition under 10 CFR 2.206, in accordance with 10 CFR 2.1205(l)(2).

In its Petition, the State asserts that if Atlas were to proceed with its reclamation plan as approved by the U.S. Nuclear Regulatory Commission (NRC), it would not meet the requirements of 10 CFR Part 40, Appendix A. More specifically, the State asserts that the rock apron design (armoring the side slope and toe of the tailings pile) does not provide reasonable assurance against engineering failure at the Atlas Uranium Tailings Site, and thus does not satisfy Appendix A. As bases for its assertion it is stated that the unpredictability of flood

events, erosion, and vegetation growth along the river banks makes computation of the probability of river migration extremely difficult and that, therefore, conservatism should be built into how the tailings pile is armored. The State, furthermore, references an April 2, 1998, memorandum from its Department of Environmental Quality, Division of Radiation Control (DRC), wherein it is stated that: (1) there are two different conceptual designs for the Atlas tailings pile apron--one presented by Atlas and accepted by NRC, and the second presented by the U.S. Army Corps of Engineers (ACE); (2) assumptions and inputs to the conceptual models result in the size, gradation, and volume of rock necessary to protect the tailings pile from erosion by the Colorado River; (3) the DRC staff has concluded that the ACE approach is more protective of the tailings pile side slopes; and (4) the DRC staff disagrees with the NRC conclusion that the Atlas design provides the necessary protection of the tailings pile in the event of river migration. A letter acknowledging receipt of the Petition and its status for consideration pursuant to 10 CFR 2.206 was sent to the State on September 26, 1998.

II. BACKGROUND

In 1997, the NRC staff issued NUREG-1532 “Final Technical Evaluation Report for the Proposed Revised Reclamation Plan for the Atlas Corporation Moab Mill” (TER), presenting its evaluation of technical issues related to Atlas Corporation’s proposed reclamation plan for the uranium mill tailings pile. Among the issues considered was the ability of the proposed erosion protection design to prevent erosion from various flooding events over long periods of time. One of the features of the erosion protection design evaluated in the TER was the ability of the self-launching rock apron to prevent erosion of the tailings if the Colorado River were to migrate to the pile.

In the TER, the staff concluded that the rock apron provided adequate protection for the reclaimed tailings pile, in the unlikely event that the Colorado River migrated several hundred feet and reached the toe of the pile. The adequacy of the apron design was questioned by the State and the Grand County Council (GCC). In addition, the GCC funded a report developed by the ACE that indicated that the rock apron had not been designed properly. The GCC also solicited the opinions of vegetation and geomorphic experts and provided those opinions to the State. These reports, questions, and comments were transmitted to the NRC staff by the State by letters dated November 10, 1997, and January 9, 1998.

Because the 1997 TER only summarized the NRC staff review of the rock apron, a supplemental report (SR) was developed to address in detail the questions and concerns raised by the DRC. The SR addressed specific aspects of the staff review and provided a detailed technical basis for the staff's conclusions on the adequacy of the rock apron. The SR also addressed issues raised by the GCC and the ACE. Specific topics that were addressed included: (1) potential for erosion and migration of the Colorado River; (2) riprap size needed for the side slopes to protect from overland or overtopping flows; (3) riprap size needed to protect the side slope from velocities in the river; (4) rock volume needed; (5) river velocities; (6) vegetation/tamarisk growth and the effects on river flow velocities; (7) ACE design procedures, including specific discussions of computations and analytical methods; (8) potential for cohesive soils to affect the performance of the rock apron; (9) reasonable assurance requirements, NRC staff review procedures, and other regulatory requirements; (10) post-licensing monitoring and maintenance; and (11) other conservatisms in the design. Each of these factors was discussed in a degree of detail that was not provided in the TER. In addition, specific contentions and questions raised by the GCC, ACE, and/or DRC were addressed.

III. DISCUSSION

As discussed in the TER, the staff considers that an adequate design has been provided for the rock apron to be placed at the toe of the Atlas tailings pile side slope near the Colorado River. This conclusion is based on many factors, including evaluation of design details that are very site-specific.

For the Atlas site, the design of the rock apron is affected by three principal factors: (1) the velocity or shear stress that is used in various analytical methods to determine the rock size necessary to resist erosive forces; (2) the analytical methods that are used to determine rock size, layer thickness, and rock volume; and (3) the estimated scour depth that is used to determine volume of rock needed in the apron. For each of these factors, there may be several acceptable methods for estimating and calculating the parameters. For example, a designer could assume various combinations of values for velocity, shear stress, radius of curvature, or other inputs to a design method and arrive at different estimates of rock size and rock volume. Also, each parameter requires input data, based to a great extent on the assumed configuration of the river and other assumptions related to expected river velocities.

It should also be emphasized that there are many procedures for determining the rock sizes necessary to resist erosion. Over the years, various Government agencies and individuals have developed procedures that best suit their needs, given the degree of conservatism necessary, the risk to public health and safety, and other factors, such as cost. Use of any specific one of those procedures, including the ACE procedure, for determining rock size, is not necessarily “correct” nor required. It should be recognized that different

methods are used by different organizations and agencies. ACE's special need to protect embankments, where erosion or failure could immediately jeopardize many lives behind those structures, is not necessarily the needs of designers to provide reasonable assurance of tailings stability, or to meet the requirements of 10 CFR Part 40, Appendix A.

The staff considers it important to use input parameter values that can be reasonably expected to affect the rock apron (if the river were to migrate), not values that are based on very conservative assumptions. For many situations where streambank erosion is imminent, a bank configuration can be easily determined, based on observed conditions. However, in this case, the main river channel is hundreds of feet away and not threatening the tailings pile, and the rock apron must be designed for some future unknown configuration of the river. Therefore, the staff assumed that the river would retain its principal characteristics, even though it had migrated. Recognizing that exact characteristics would be difficult to predict, the staff assumed that the river would retain the same width, depth, radius of curvature, and velocity. It is also possible that the river would migrate and develop characteristics such as increased width, decreased depth, decreased velocity, and increased radius of curvature; such assumptions would result in lesser rock apron designs being protective of the pile.

In making assumptions such as those discussed above, the staff is required by 10 CFR Part 40, Appendix A, to have reasonable assurance of tailings stability. The staff is not required to make a determination with absolute certainty. Therefore, given the fact that river migration to the pile in itself is unlikely, the staff is required only to assume a reasonable configuration, not necessarily an extreme configuration that maximizes every design parameter or input to a

riprap design method. Recognizing that a considerable amount of judgment is necessary to predict design conditions at this site , such as river configuration or river velocity, it is not the position of the NRC staff to assume the most critical value for every input parameter that is used in every calculation. Reasonable assurance only requires that input parameters be selected within a reasonably conservative range of values of the parameter.

It should be emphasized that the staff does not consider the ACE analyses or design method to be incorrect or inappropriate. Rather, the staff considered that the input parameters selected for use in the analyses were overly conservative for this specific application and do not represent conditions that can reasonably be expected to occur if the river were to migrate to the rock apron. In the SR, the staff provided many reasons to support its conclusion that the licensee's design was adequate and provided extensive discussion to show that the ACE report overestimates the riprap sizes and quantity of rock required for the rock apron to provide reasonable assurance of tailings stability. In summary, based on independent analyses of the licensee's proposal and the information provided the DRC and ACE, the staff concludes that Atlas proposes to use a volume and size of rock that is larger than the volume and size computed by the staff.

Each of the assertions made by the State in the Petition have been addressed previously by the staff. The staff provided its initial findings in its TER and provided further details of the staff analysis in its supplemental report that was transmitted to the State by letter dated February 26, 1998. The staff has provided detailed technical bases for its conclusion that the design of the rock apron meets the requirements of 10 CFR Part 40, Appendix A.

The State was offered an opportunity to provide additional information to further address its assertions. The State indicated that no additional information would be provided for staff review or consideration.

Each of the State's assertions is addressed in the following discussions. Each assertion is stated and a brief summary of the staff's analysis is provided. If additional details are needed, they may be found in the staff's SR.

Assertion 1. The unpredictability of flood events, erosion, and vegetation growth along the river banks makes computation of the probability of river migration very difficult, and therefore conservatism should be built into the tailings pile design.

The staff agrees that the computation of the probability of river migration is difficult. However, the staff has concluded that the potential for migration of the Colorado River to the tailings pile is very low and has provided several bases supporting that conclusion. The staff has also concluded that adequate conservatism has been provided by the apron design to demonstrate that Part 40 requirements have been met and has provided detailed analyses and technical bases supporting that conclusion.

First, the staff examined aerial photographs of the Colorado River in this area, taken over a period of about 47 years. Those photographs verified that very little erosion has occurred over that period of time.

Second, the staff reviewed a report prepared by expert geomorphologists that addressed the river migration issue. In that report, it was concluded that river migration was unlikely and that lateral accretion, rather than erosion, has occurred in some areas near the pile. Those expert geomorphologists also examined aerial photographs and concluded that: "Review of available historical photographs indicates that the right bank...has remained remarkably fixed spatially." (Emphasis added).

Third, the staff has visited the site several times and has determined that only some minor erosion of the river banks has occurred and that this can be attributed to sloughing, rather than erosion from river velocities. In fact, it was this minor erosion that led the staff to question the original conclusion of the licensee that the river would not erode.

Fourth, despite the information available on channel stability, a conservative approach was taken by Atlas in its reclamation plan by assuming that the Colorado River would migrate to the tailings pile and by designing the erosion protection apron to account for that event. This approach eliminated the need for Atlas to conduct further detailed analyses of river migration and provided a design that exceeds the reasonable assurance requirements specified in Part 40, Appendix A.

Fifth, the staff examined the effects of increased vegetation growth on the erosion potential of the Colorado River. The staff performed independent calculations and concluded that the potentially increased density of vegetation and tamarisks in the floodplains of the river will not significantly affect river velocities. Staff computations indicate that the maximum velocity will be only slightly increased in the river channel near the tailings pile. Based on staff experience with vegetated floodplains and the widespread use of vegetation to stabilize channel

banks, it is also likely that increased vegetation density of the river will increase the erosion resistance of the channel banks and floodplain area near the tailings pile.

Assertion 2. There are two different conceptual designs: one presented by Atlas and accepted by the staff; and the second presented by the ACE.

The staff has recognized for some time that there are two designs and that the designs are different. In the SR, the staff addressed the ACE design and provided a detailed analysis of the ACE method and the use of various input parameters to the ACE method. The staff performed a detailed review of the analyses, provided in the ACE report, that were used to assess the rock requirements for the apron. The staff evaluated input parameters related to computation of scour depths, river velocities, increases in river velocities at channel bends, and factors of safety. The staff also examined the technical basis for the development of the ACE procedure, including the supporting laboratory data. The staff's analysis of the ACE report is also discussed in Assertion 3, below.

Assertion 3. Assumptions and inputs to the conceptual models results in differences in the size, gradation, and volume of rock necessary to protect the tailings pile from erosion by the Colorado River.

The staff has recognized that differences in input parameters can significantly affect the size and volume of rock required for the rock apron. Extensive discussion of the ACE report and the ACE design method were provided in the SR.

Based on its review of the ACE report, the staff concluded that the design parameters selected for use in the ACE calculations of rock size were very conservative and did not reflect conditions that are likely to occur at the rock apron if the river migrated to the tailings pile. Velocities, radii of curvature, and scour depths were based on conditions that currently exist upstream, but do not exist in the vicinity of the apron. Velocities that would affect the apron will likely be smaller, and radii of curvature greater, than those that currently exist upstream of the site. In addition, the methods used by ACE to determine design velocities, increases in velocities in bends, and scour depths are conservative and incorporate large factors of safety that may not be necessary to provide reasonable assurance that Appendix A requirements are met. The staff, however, concluded that if reasonable and likely, values of channel velocity and channel curvature are used in the ACE method, the rock apron design proposed by Atlas is acceptable, even if all the other ACE safety factors are taken into account.

Assertion 4. The DRC staff has concluded that the ACE approach is more protective of the tailings pile side slope.

The staff agrees that the ACE design is more conservative than the design approved and would protect the pile under more severe conditions if such conditions were to occur. Use of the ACE approach to determine rock size and volume results in larger quantity of larger rock. However, the staff has concluded that the design proposed by Atlas is acceptable and that more and larger rock is not required to meet the requirements of Appendix A.

In the SR, the staff provided an extensive discussion of how the reasonable assurance requirements are met by the proposed design. Further discussion was also provided on the

use of standard review plans and design procedures that reflect an approach to tailings management that incorporates an appropriate level of safety.

Of considerable importance in the NRC staff's assessment of Atlas' proposed design of the rock apron is the concept of "reasonable assurance." NRC regulations require (Part 40, Appendix A, Criterion 6) "...a design which provides reasonable assurance of control of radiological hazards to...be effective for 1000 years...." This requirement comes directly from U.S. Environmental Protection Agency (EPA) requirements in 40 CFR Part 192. These standards do not require absolute nor even near certainty.

Several reasons can be offered to justify the appropriateness of a "reasonable assurance" requirement, rather than a more conservative requirement. Of primary importance is that exposure to uranium mill tailings do not pose an immediate acute risk to the health and safety of individuals. Rather, the risk posed by tailings is from continual exposure to low levels of radioactivity and is a long-term cumulative risk. If control of tailings were lost (for example, if an earthquake beyond the design basis were to damage the cover and expose tailings), actions could be taken to repair the damage, with little likelihood of endangering individuals.

Additionally, uranium mill tailings disposal sites will be under perpetual government custodial care. If the features providing control of the tailings were damaged or compromised in the future, the government custodian could assess the situation and provide repairs. Although NRC standards require that the design for control of radiological hazards not rely on

maintenance, the concept of “reasonable assurance” does not preclude contemplation of government custodian actions in unusual or unlikely situations.

Finally, the rock apron does not have to withstand a single, severe event that could occur without warning at any time. This is unlike the situation in designing protection from earthquakes or severe precipitation. For those events, the protective design may not be tested for decades or centuries and then, in a very short time, have to perform with a design event. If the Colorado River were to migrate towards the tailings pile, it would occur over decades or centuries. There would be ample time to determine whether the assumptions used in the design of the rock apron (e.g., the scour depth, river curvature, river velocity, etc.) were correct or appropriate.

In summary, NRC regulations and EPA standards do not require the degree of certainty about the potential future threats to the rock apron that would require an extremely conservative design, but rather “reasonable assurance” that the design will protect the tailings pile.

Assertion 5. The DRC disagrees with the NRC conclusion that the Atlas design provides the necessary protection of the tailings pile. DRC asserts that the apron design does not meet the requirements of 10 CFR Part 40, Appendix A.

As discussed in the TER and SR, the staff performed detailed evaluations of the proposed design. Based on those evaluations, the staff concludes that: (1) a conservative approach was taken by Atlas in its reclamation plan by assuming that the Colorado River would migrate to the tailings pile and by designing the erosion protection apron to account for that

event; (2) the rock size of 11 inches proposed by Atlas for the rock apron is greater than the rock size of about 2.4 inches required to resist velocities produced by the Colorado River on the collapsed rock apron, based on the most conservative calculated channel velocity and considering the effects of channel curvature and increased shear forces on the outside of channel bends; (3) the volume of rock provided for the apron is acceptable; (4) the maximum river velocity that should be used for the design of the rock apron for reasonable assurance is approximately 5.2 feet per second (ft/sec), rather than the 6.9 ft/sec used by ACE; (5) the potentially increased density of vegetation and tamarisks in the floodplains of the river will not significantly affect river velocities in the channel; (6) the design parameters selected for use in the ACE calculations of rock size are very conservative and are not likely to reflect conditions that will exist at the rock apron, if the river were to migrate to the pile in the future; (7) cohesive soils that could adversely affect the performance of the apron are not significantly present; (8) the requirement of reasonable assurance of site stability for a period of 200-1000 years is met by the proposed apron design; (9) a post-licensing monitoring and maintenance program will be implemented for this by the long-term custodian and will help to assure that requirements are continuously met and to assure that any unexpected problems occurring at the site will be promptly detected and mitigated; (10) the current design includes an over-designed volume of 5.3-inch rock on the side slope of the tailings pile that would be available to also launch into any gaps formed in the launched 11-inch rock; (11) the riprap for the side slopes is designed for a precipitation intensity approaching the world record rainfall intensity; and (12) the riprap layer thickness exceeds the design criteria routinely accepted by the staff; and (13) the rock sizes that will actually be constructed will likely exceed the sizes proposed by Atlas.

IV. CONCLUSIONS AND RECOMMENDATIONS

The NRC staff has reviewed the concerns and issues raised in the State's Petition and has concluded that the rock apron design for the Atlas reclamation plan complies with 10 CFR Part 40, Appendix A. For the reasons discussed above, no basis exists for taking any action in response to the Petition. Accordingly, no action pursuant to Section 2.206 is being taken.

Dated at Rockville, Maryland, this 20 day of January, 1999.

FOR THE NUCLEAR REGULATORY COMMISSION

{Original signed by]

Carl J. Paperiello, Director
Office of Nuclear Material Safety
and Safeguards