November 27, 2002

Mr. William Paul Goranson, Manager
Radiation Safety, Licensing and
Regulatory Compliance
Rio Algom Mining LLC
6305 Waterford Blvd., Suite 400
Oklahoma City, OK 73118

SUBJECT: EROSION PROTECTION DESIGN FOR PONDS 1 AND 3 FOR THE AMBROSIA LAKE MILL TAILINGS SITE - LICENSE AMENDMENT 51, SUA -1473 (TAC NO. L52431)

Dear Mr. Goranson:

The U.S. Nuclear Regulatory Commission (NRC) staff has completed its review of the design of erosion protection for Ponds 1 and 3 at the Ambrosia Lake mill site. You submitted four separate designs and analysis under cover letters dated May 16, 2002, and September 26, 2002. Based on our review of the information submitted by you and on independent calculations, NRC staff concludes that the designs you have submitted have appropriately addressed the erosion protection along Ponds 1 and 3. Accordingly, Amendment 51 updates License Condition 37 of Source Materials License, SUA-1473 to reference these submittals. A detailed Technical Evaluation Report as well as the updated license is enclosed.

In many of the designs, especially for Pond 3, the design is dependent on an assumed final elevation and grade. Please be aware that the design is not valid if the final grade differs from that which you have assumed. In addition, you have not provided any information regarding the durability of the rock to be used in the erosion protection design. The rock should be good quality to meet the design which has been approved and rock durability information should be provided to NRC prior to placement. Finally, the design of the toe of Pond 3 (at Section 3) should be revisited to determine if the toe adequately protects against undercutting by the Arroyo del Puerto.

Other than the items stated above, the erosion protection design appears to be adequate to provide reasonable assurance of protection for 1000 years, as required in Criterion 6 of 10 CFR Part 40, Appendix A.

In accordance with 10 CFR 2.790 of NRC's "Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders," a copy of this letter will be available electronically for

public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Should you have questions regarding this matter, please contact the NRC project manager, Jill Caverly, at 301-415-6699 or by e-mail to JSC1@nrc.gov.

Sincerely,

/RA/

Daniel M. Gillen, Chief
Fuel Cycle Facilities Branch
Division of Fuel Cycle Safety
and Safeguards
Office of Nuclear Material Safety
and Safeguards

Docket No. 40-8905
SUA-1473

Enclosure: Technical Evaluation Report
Source Materials License, SUA-1473

cc: Art Kleinrath, DOE-GJ

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TECHNICAL EVALUATION REPORT
EVALUATION OF EROSION PROTECTION FOR PONDS 1 AND 3
AT THE AMBROSIA LAKE MILL SITE
DOCKET 40-8905
NOVEMBER 2002

SUMMARY:

During a 2001 inspection of the Rio Algom Mining LLC (RAM) Ambrosia Lake facility, a U.S. Nuclear Regulatory Commission (NRC) inspector observed rilling of the soil along the southern toe trench of the Pond #1 tailings impoundment. A follow-up visit identified additional areas of concern, including excessive rilling along the northern Pond 1 toe trench and the potential for head-cutting along the drainage area north of Pond 1 and Pond 3. In a letter dated May 16, 2002, RAM submitted for NRC review, a report that provides the design of head-cutting control and toe protection facilities to be constructed along the northern edge of Pond 1. Staff reviewed this report and met with representatives of RAM on August 28, 2002. As a result of concerns raised at this meeting, RAM submitted a report entitled, "Responses to Staff Questions on Erosion Protection Design for Pond #3 and Additional Arroyo del Puerto Investigations." This report responded to staff concerns about the determination of the probable maximum flood and possible erosion for the nearby arroyo. The final aspect of the design, which addresses the erosion protection for Pond 3, was submitted under cover letter dated September 26, 2002, "Design Report: Pond 1 South Embankment Toe Erosion Protection, Ambrosia Lake New Mexico." This Technical Evaluation Report documents the staff's review of RAM's proposed designs and provides the technical basis for the acceptability of the licensee's design.

INTRODUCTION

The first proposed design addresses rilling along the northern embankment of Pond 1. An apron is provided to mitigate the effects of a hydraulic jump formed as flow transitions from the steeper embankment slope to the flat toe surface. Additionally, the channel is designed to withstand longitudinal flow forces that are anticipated along the embankment toe. The second design addresses potential erosion on approximately 20 acres north of the north embankment of Pond 1 and potential erosion for the surface of Pond 3. The third report is the response to staff questions regarding erosion protection for Pond 3, determination of the probable maximum flood (PMF) and the effects of a local stream, the Arroyo del Puerto. The final report addresses erosion protection for the south embankment of Pond 1.

In general, criterion 6 of 10 CFR 40, Appendix A, requires stability of the tailings for 1000 years to the extent reasonably achievable and in any case for 200 years. Because the design storm is difficult to quantify for 1000 year design period, NRC guidance suggests using the probable maximum precipitation (PMP) and PMF for the design basis of erosion control features at mill tailings sites. The licensee has proposed that the design storm for the entire site will be the probable maximum precipitation event.

REPORT 1: DESIGN REPORT: POND 1 NORTH EMBANKMENT TOE EROSION PROTECTION - AMBROSIA LAKE MILL, NEW MEXICO

Pond 1 is a reclaimed tailings disposal site and was previously used for burial of byproduct material produced at the mill. During a May 2001 inspection, NRC staff observed rilling along the northern embankment of Pond 1. In addition, the inspectors noted concerns with the current design of the apron and identified the potential for head-cutting along the toe from flow along the planned diversion channel. The embankment of Pond 1 includes a radon barrier and an overlying rock cover that provides erosion protection. The proposed erosion protection system for the north embankment toe of Pond 1 involves an apron, which is designed to withstand a hydraulic jump that occurs as flow transitions from the steeper embankment slope to the flat toe surface, and a channel design that will withstand the effects of longitudinal flow that is anticipated adjacent to the embankment toe.

Design parameters and assumptions

The PMP was determined using methodology outlined in the U.S. Department of Commerce's Hydrometeorological Report No. 55A (HMR-55A). The 1-hour 1 square mile event is estimated to be 10.5 inches but is adjusted for elevation and duration. The final value was determined to be 9.5 inches for the 1-hour, 1-square mile local storm. However, an earlier prediction of the PMP, based on calculations for this site's reclamation plan, estimates the precipitation to be 9.6 inches for the same storm. In order to maintain consistency, the licensee chose to use the 9.6 inch value for the remainder of the design.

Erosion Protection Design

The north toe of the Pond 1 embankment requires an erosion protection apron for runoff from the pile as well as erosion protection for the longitudinal flow along the toe due to the moderate slope. The licensee determined the apron characteristics based on methods recommended in NUREG-1623, Appendix D, Section 6. The open channel flow requirements to control the runoff and longitudinal flow were computed in accordance with NUREG-1623, Appendix D, Sections 2 and 3.

The north apron drains a 13.4 acre catchment on the top of Pond 1. A slope of 5H:1V exists along the entire Pond 1 embankment toe. The current apron has experienced minor erosion indicating that a redesign of the apron is appropriate. For the catchment area, a time of concentration was calculated for each of two slopes, with respective slope lengths of 350 feet and 575 feet. These are the longest and shortest slope length for the north toe of Pond 1. Times of concentration of 1.5 minutes and 2.5 minutes were calculated for the short and long slope, respectively. A shortest incremental rainfall duration of 2.5 minutes was used for both slope lengths. This assumption is in accordance with NRC guidance put forth in NUREG/CR-4630. The Rational Method was used to determine the runoff volume for both slopes. Given the computed flow rate and assuming a concentration factor of 2.5, the design calls for the placement of rock with a d_{50} of 6.0 inches on slopes shorter than 350 feet and a d_{50} of 7.8 inches is called for on slopes with lengths between 350 feet and 575feet.

The area along the toe at the northern end of Pond 1 is moderately sloped and could produce erosive longitudinal flows. The licensee proposes an open channel that will collect and convey

the precipitation that falls on the embankment slope. The design makes use of methods presented in NUREG-1623, Appendix D, Sections 2 and 3.

The design subdivides the channel into two sections. The first, consisting of the upper 5.1 acres, is segregated due to its location and slopes. The time of concentration, developed using the maximum calculated flow length of 1195 feet, was determined to be 7.0 minutes. The 7.0 minute PMP is 5.09 inches according to the method by Nelson et al in NUREG-1623. The resulting peak flow for the upper section is 221cfs.

The remaining 8.3 acres of the embankment are included in a second subdivision. The time of concentration for this area, which was based on a maximum flow length of 2100 feet and takes into account the flow length from the upper section, was determined to be 9.5 minutes. The 10 minute PMP according to Nelson et al in NUREG-1623 is 5.95 inches. The rational method yields a peak flow of 480cfs for the entire system.

The channel/apron configurations were developed using flow calculations and methods discussed in NUREG-1623. The more protective method between the apron and channel were chosen to maintain the channel integrity during both flow scenarios. A Manning's roughness coefficient was developed using the procedures of Section 3 of NUREG-1623 and entered into the hydraulic design software, Flow Pro 2.0. Estimated channel widths of 8 feet (upper channel) and 20 feet (lower channel) were included as program input data. The guidance recommends that channel widths be greater than 15 times the d_{50} diameter. The corresponding D_{50} diameters were also included in the program. The program calculates the depth of flow in the channel while the remaining channel cross-section can be determined based on a typical trapezoidal cross section with a 2H:1V side slope. For this case, a channel depth of 3 feet was determined.

The existing erosion control apron will be removed and the sub-grade properly re-graded to ensure that embankment run-off flows into the proposed channel/apron.

Conclusion

Given the assumptions stated in the referenced report, staff concludes that the proposed design for the northern embankment toe of Pond 1 and the channel/apron is appropriate.

REPORT 2: DESIGN REPORT - POND 3 EROSION PROTECTION AND EROSION PROTECTION FOR THE AREA NORTH OF POND 1- AMBROSIA LAKE MILL, NEW MEXICO

This design report address three areas of the site that include potential erosion on approximately 20 acres north of the north embankment, the extension of the Pond 1 channel/apron, and the runoff area for Pond 3. Seven specific areas for erosion protection have been identified.

1. Toe erosion protection apron at the interface of Pond 1 and Pond 3;
2. Surface erosion protection for Pond 3;
3. Erosion protection for the east embankment of Pond 3;
4. Toe erosion protection of the area north of Pond 1;
5. Surface run-off protection for the area north of Pond 1;

6. Diversion channel construction along the northern limit of the area north of Pond 1; and
7. Discharge channel construction from the end of the Pond 1 north embankment channel/apron to the Arroyo del Puerto basin.

Method of analysis

The analysis in this report determined that the erosion protection should be based on runoff analysis for sheet flow down slopes and across pond surfaces in accordance with NRC guidance in NUREG-1623. The longitudinal flow requirements for the open channel were used to calculate the toe requirements for the control of runoff during a PMF event.

In order to estimate the PMF for the Arroyo del Puerto, a natural channel, the basin area was first calculated to be 57.6 square miles at the Ambrosia Lake mill. Next, the Soil Conservation Service's curve number for the Montanosa Mesa drainage basin, 73.4, was chosen due to this basins similarities to the Arroyo del Puerto basin. A lag time of 1.83 hours was chosen corresponding to 60 percent of the time of concentration. Several storms were investigated, including the 1-hour and 6-hour local storms and the 6-hour, 24-hour and 72-hour general storms. Analysis of the results showed that the largest PMF was produced during the 6-hour local storm that produced a peak flow of 75,200 cfs. Since earlier designs used a peak flow of 78,000 cfs, the licensee opted to use the higher value.

Using the storm value of 78,000 cfs, the licensee constructed a hydraulic model of the Arroyo del Puerto in the vicinity of the Ambrosia Lake mill. The purpose of the model was to determine the flood water elevation in the vicinity of Pond 3. The following assumptions were used:

1. Arroyo del Puerto was rerouted to a new alignment east of its existing position in the vicinity of the mill. The new channel rejoins the original channel near the north-east corner of Pond 9.
2. The Pond 3 embankment will be constructed to a final elevation of 6935 feet.
3. The existing groundwater trench is backfilled.
4. Pond 9 is assumed to be removed and regarded to a final elevation of 6917 feet.

Using the assumptions stated above and the calculated PMP and PMF, the main aspects of the erosion protection were analyzed. A brief description of each follows.

Toe erosion protection apron at the interface of Pond 1 and Pond 3

For the 31 acre catchment with a slope length of 520 feet, a time of concentration was calculated to be 1.92 minutes. A corresponding incremental PMP distribution of 2.5 minutes was used to calculate the corresponding PMP depth of 2.64 inches. Based on this flow, the methods of NUREG-1623 yield a d_{50} of 7.5 inches. Because the licensee has stone of larger diameter available, the final d_{50} was increased to 9.4 inches. Consistent with NRC guidance established in NUREG-1623, apron width is set at 15 times d_{50}, while depth is set at six times d_{50}.

Surface erosion protection for Pond 3

Because Pond 3 is not yet complete, the design is based on several assumptions. The licensee anticipated that the 33 acre area will have a 12-inch thick rock cover resulting in a final elevation of 6938 feet. A surface grade of 0.3 percent will prevent ponding of water and the maximum surface length is assumed to be 7000 feet. The modeling of the PMF in the Arroyo del Puerto shows the flow elevation to be 1 foot less than the top of the embankment. A time of concentration of 11.6 minutes was determined. Pond 1 embankment flows will be discharged onto the Pond 3 surface, therefore, the time of concentration for Pond 3 was calculated to be 13.52 minutes. The incremental rainfall duration was used to determine the PMP depth of 6.72 inches. The method of Abt et al from NUREG-1623 predicts a rock d_{50} of 0.4 inches and the licensee proposed a rock size d_{50} of 1.0 inches since it is easier to obtain.

Erosion protection for the east embankment toe of Pond 3

Assumptions were made about the location of the east embankment toe of Pond 3 because of the ongoing reclamation work at Pond 3. The elevation was assumed to be 6923 feet. The apron will dissipate energy from the 65 feet slope. Two precipitation events were analyzed to determine which event would produce the largest run-off at the site. The controlling forces came from the PMF in the Arroyo del Puerto. Because the flow was greater in the open channel, the Army Corps of Engineers method was used to determine the d_{50} of 12 inches. This method is consistent with NRC guidance.

Surface run-off protection of the area north of Pond 1

The 20 acres of undeveloped land adjacent to the north embankment of Pond 1 was investigated for the need of an erosion protection layer. Analysis of the PMP determined that an erosion protection rock layer was necessary to prevent head-cutting due to local rain events. The licensee proposes to re-contour the area to prevent erosion and provide effective rock cover. To achieve this, slopes of greater than 7.5 percent will be regraded to slopes equal to or less than 7.5%. A rock size of d_{50} equal to 2.2 inches was based on flow volume calculated from the rational method of 1.6 cfs/ft, incremental rainfall duration of 7.82 minutes and a PMP depth of 5.2 inches.

Diversion channel construction along the northern limit of the area north of Pond 1

Rainfall that falls on the area north of Pond 1 flows toward the Arroyo Del Puerto producing head-cut erosion that is directed west toward the mill site. The licensee proposes an engineered diversion channel be placed at the erosion location to prevent further degradation. The design segmented the channel into three sections to account for flows, slopes and terrains. The following is a summary channel segment characteristics.

Channel Segment	Time of Concentration (minutes)	Local Incremental Rainfall (in)	Basin Size (acres)	Segment Flow Rate (cfs)	Rock Size, d_{50} (in)	Bottom Width of Channel (ft)
0+00-9+00	6.6	4.8	2.2	97	9.2	3
9+00-17+00	8.3	5.4	7.4	288	9.2	20
17+00-27+01	13.2	6.7	16.3	497	9.2	28

The hydraulic model developed for the channel indicated that a hydraulic jump develops between the steep second segment and the flatter third segment. It was then concluded that the channel would require additional height to contain the jump for a distance of 25 feet at the jump location. Additionally, the apron requires that rock with a d_{50} = 17 inches be placed to a depth of 4.3 feet to accommodate forces associated with the hydraulic jump.

Discharge channel construction from the end of Pond 1 north embankment channel/apron to the Arroyo del Puerto basin.

Runoff from the north embankment of Pond 1 collects in an apron/channel that runs east toward the Arroyo del Puerto. The discharge channel transitions back to the arroyo with a transition section 25 feet long to convert the apron/channel to a normal channel with 2:1 side slopes. The next 25 feet, the channel rock size is increased to accommodate an expected hydraulic jump. The time of concentration was calculated to be 12.2 minutes and the incremental PMP depth is 6.5 inches. The catchment area is 15.7 acres, resulting in a discharge (using the rational equation) of 498 cfs. A rock d_{50}=9.2 provides adequate protection for the channel under the design conditions.

The purpose of the apron will be to slow the flow of the water before it reaches the native vegetation of the Arroyo del Puerto, thereby preventing scour of the native silty clays. The apron also handles discharges from the arroyo. Accordingly, the design flow is a sum of the discharge channel and that from the arroyo basin (995 cfs). A slope of 0.5 percent and width of 80 feet should adequately slow the flow to less than 4ft/sec. The scour depth of 6 feet has been included in the toe design as well as 25 foot wing walls.

Conclusion

The staff concludes that the designs proposed for the apron along Pond 1 and Pond 3 interface and the Pond 3 embankment, toe and surface and the north erosion protection areas are appropriate given the assumptions stated in the referenced report. Staff notes that the assumptions of final grade should be reviewed at the time of construction and that changes may require re-evaluation of the proposed design.

REPORT 3: RESPONSES TO STAFF QUESTIONS ON EROSION PROTECTION DESIGN FOR POND #3 AND ADDITIONAL ARROYO DEL PUERTO INVESTIGATIONS

In August of 2002, NRC staff raised their concern to the licensee that the estimated PMF of 78,000 cfs for the Ambrosia Lake mill site may be too low. Additionally, the staff noted that the Arroyo del Puerto may be subject to migration over the design period and its flows should be accounted for when sizing rock. In response to the first concern, that the PMF was underestimated, the licensee performed a sensitivity analysis in order to determine which variable may have a dramatic effect on the calculation of the PMF.

The calculation of the PMF from the PMP requires many parameters including type of storm, the geometry of the basin, the infiltration properties of the basin, as well as assumptions about the behavior of the flood peak as it travels through the basin. A sensitivity analysis was performed using the hydrologic model HEC-1. The three variables that would affect the peak flow significantly were reviewed. The variables included curve number, lag time and rainfall sequence. The licensee applied the most conservative bounds on the parameters and the results showed that the PMF could be as high as 126,000 cfs. However, the circumstances for this to occur were so unlikely that the value simply provided a high bound for the PMF.

The one variable which appeared to have an influence within a reasonable range was the lag time calculation. The lag time was adjusted based on a New Mexico method developed by the U.S. Geological Survey (USGS) which increased the calculated PMF. However, the methodology for USGS which lowered the lag time does not directly transfer to the current situation. The methodology was based on floods in smaller basins. Therefore, the licensee's conclusion was that the current estimate for the PMF is reasonable.

In addition to considering the PMF calculation, the licensee was also asked to review the possibility for lateral migration of the Arroyo del Puerto. The concern of staff was that the arroyo would migrate over time and eventually be located at the toe of the tailings impoundment. If that occurred, the erosive forces of the arroyo could undermine the toe of the tailings impoundment causing a failure. The licensee performed an analysis which determined that the maximum lateral migration of the outside banks would be approximately 3 feet per year.

Conclusion

Staff concludes that the PMF is within a reasonable range and has been appropriately used in the design of Ponds 1 and 3 erosion protection. However, the lateral migration of the Arroyo del Puerto at Section 3 should be re-evaluated for the possibility of undercutting of the Pond 3 toe. The toe may be sufficient to resist any erosion to the migrating stream but the licensee should revisit this matter prior to construction and should verify this with staff.

REPORT 4: DESIGN REPORT; POND 1 SOUTH EMBANKMENT TOE EROSION PROTECTION, AMBROSIA LAKE, NEW MEXICO.

The report was written in response to an NRC inspection in 2000 where concerns were raised about erosion and rock displacement on the south side of Pond 1. The assumption of the PMP as discussed in Reports 1 and 2 is the same for this report and design. This report analyzes the apron requirements based on run-off analysis for the south embankment of Pond 1 and determined the open channel requirements to control the run-off and longitudinal flow from the south embankment.

A 19-acre catchment that discharges along the southern end of Pond 2 had a corresponding time of concentration of 1.64 minutes and a PMP depth for a local storm of 2.64 inches. The Rational Method calculated the unit discharge to be 0.63cfs/ft for the 452 feet slope length. Assuming a maximum embankment slope of 20 percent and a concentration factor or 2.5, the rock d_{50} requirement is 6.7 inches.

The slope at the toe of the south embankment of Pond 1 may induce moderate flows along the toe. This condition was evaluated by placing an open channel/apron at the base of the slope that will catch the precipitation that falls on the embankment slope and runs off. Methods from NUREG-1623 were used to develop the characteristics of the channel. The channel configuration is based on a time of concentration of 11.4 minutes, the incremental storm depth of 6.3 inches, a peak flow of 579 cfs and a bottom width of 12 feet. The average existing slope of 2.3 percent requires a rock d_{50} of 7.5 inches and a depth of 4.5 feet.

A discharge apron is required where the flow runs onto native ground downstream from the pond. A toe will be constructed at the edge of the discharge apron to prevent scour. Wingwalls will extend for an additional 25 feet beyond the apron and are constructed with a rock toe keyed into bedrock. A filter rock should also be placed. The existing erosion control apron must be removed and the subgrade properly re-graded such that run-off from the embankment flow into the proposed channel/apron and toe apron.

Conclusion

The staff concludes that the design proposed for the south embankment of Pond 1 is appropriate given the assumptions stated in the referenced report.

CONCLUSION

Based on the review of the information submitted by the licensee and on independent calculations, the NRC staff concludes that the licensee has identified the appropriate floods for the design of erosion protection features at the site. However, staff notes that the assumptions, especially final grade assumptions, should be closely monitored during construction and if any changes occur then the design should be revisited for potential impacts to the initial designs. In addition, these designs are based on durable rock that should be verified prior to placement. If suitable rock is not available and oversizing is requested, it may be possible that the revised rock size will affect the performance of the design. The licensee will be responsible for providing updated calculations and redesigns accounting for the new rock size. Finally, the toe of Pond 3 (at Section 3) should be reviewed for the possibility of undercutting by the Arroyo del Puerto in the event the arroyo migrates to the toe of the pond.

Other than the items stated above, the erosion protection design appears to be adequate and to provide reasonable assurance of protection for 1000 years, as required in Criterion 6 of 10 CFR Part 40, Appendix A.

Source Material License, SUA-1473, has been updated in Amendment 51 to reference the submittals dated May 16, 2002 and September 26, 2002. The designs included in these submittals for specific areas of Ponds 1 and 3 supercede any other designs previously approved.

ENVIRONMENTAL IMPACT EVALUATION

An environmental assessment for this action is not required, since this action is categorically excluded under 10 CFR 51.22(c)(3)(i), and an environmental report from the licensee is not required by 10 CFR 51.60(b)(2).

REFERENCES

Goranson, W.P., Rio Algom Mining LLC, letter to NRC dated May 16, 2002, “Design Report for Pond 1 North Embankment Erosion Protection, Pond 3 Erosion Protection and Erosion Protection for the Area North of Pond 1" License No.: SUA-1473, Docket No.: 40-8905.

Goranson, W.P., Rio Algom Mining LLC, letter to NRC dated September 26, 2002, “Responses to Staff Question On Erosion Protection Design for Pond #3 and Additional Arroyo del Puerto Investigation” License No.: SUA-1473, Docket No.: 40-8905.

Goranson, W.P., Rio Algom Mining LLC, letter to NRC dated September 26, 2002, “Design Report; Pond 1 South Embankment Toe Erosion Protection” License No.: SUA-1473, Docket No.: 40-8905.

Johnson, T.L., 2002, Design of Erosion Protection for Long-Term Stabilization. Final Report, NUREG-1623, U.S. Nuclear Regulatory Commission, Washington, DC.

NRC FORM 374

U.S. NUCLEAR REGULATORY COMMISSION

MATERIALS LICENSE

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and the applicable parts of Title 10, Code of Federal Regulations, Chapter I, Parts 19, 20, 30, 31, 32, 33, 34, 35, 36, 39, 40, 51, 70, and 71, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations, and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee	
1. Rio Algom Mining LLC	3. License Number SUA-1473, Amendment 51
2. 67305 Waterford Blvd., Suite 400 Oklahoma City, Oklahoma 73118 [Applicable Amendment: 12]	4. Expiration Date Until terminated [Applicable Amend: 29]
	5. Docket No. 40-8905 Reference No.

6. Byproduct Source, and/or Special Nuclear Material	7. Chemical and/or Physical Form	8. Maximum amount that Licensee May Possess at Any One Time Under This License Unlimited
Uranium	Any	Unlimited

9. Authorized Place of Use: The Licensee's Ambrosia Lake facility located in McKinley, County, New Mexico.

10. This license authorizes uranium recovery in accordance with statements, representations, and conditions contained in submittals dated August 30, 1990, January 31, 1991, and January 13, 1998, with the exception that processing of conventional uranium ores shall not be performed without specific authorization from the NRC in the form of a license amendment. Anywhere the word "will" is used in the documents referenced above, it shall denote a requirement.

    Any changes to the mill circuit as described in Section 6.2 of the August 30, 1990, submittal or as authorized by subsequent license conditions shall require approval by the NRC in the form of a license amendment.

    [Applicable Amendments: 4, 10, 11, 21, 28, 40]

11. The licensee shall designate a Radiation Safety Officer (RSO) who will be responsible for the establishment and maintenance of a facility radiation protection program including personnel and environmental monitoring programs. The RSO shall possess minimum qualifications as specified in Section 2.4.1 of Regulatory Guide 8.31.

12. The licensee is authorized to possess byproduct material in the form of uranium process tailings and other byproduct wastes generated by the licensee's uranium processing operations. Mill tailings, other than small samples for purposes such as research or analysis, shall not be transferred from the restricted area without prior approval of the NRC in the form of a license amendment.

13. The licensee is authorized to operate mine water uranium recovery treatment facilities at Ambrosia Lake, New Mexico. These facilities include treatment plants at the main facility, Section 35-36, and

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License Number
SUA-1473

Docket or Reference Number
40-8905

Amendment No. 51

individual ion exchange units located above or underground at the Rio Algom Mining LLC mine sites. The radiological effluent monitoring and radiological safety program in effect at the licensee's mill shall include these water treatment facilities. All U.S. DOT requirements shall be followed in the transport of the ion exchange resin. A listing of the individual ion exchange units currently in operation shall be provided by January 1, 1987, and shall be updated at least annually thereafter.

14. Written standard operating procedures (SOPs) shall be established for all operational process activities involving radioactive materials that are handled, processed or stored. These procedures shall specify radiation safety practices to be followed. An up-to-date copy of each written procedure shall be kept in the mill area to which it applies for employee reference. All SOPs shall be reviewed annually to update procedures and be approved by the RSO to ensure that proper radiation protection principles are being applied.

15. The licensee shall be required to use a Radiation Work Permit (RWP) for all work where the potential for significant exposure to radioactive material exists and for which no SOPs exist. All RWPs shall be approved by the Radiation Safety Officer (RSO), or his designee qualified by way of specialized radiation protection training. The RWP shall describe the following:

    A. The scope of the work to be performed.

    B. Any precautions necessary to reduce exposures to radioactive materials.

    C. Supplemental monitoring required prior to, during, and after the completion of the work.

16. The licensee shall establish written procedures for all surveillance activities including in-plant and environmental monitoring bioassay analysis and radiation monitoring instrument calibration. These procedures shall be reviewed and approved by the RSO annually to ensure that proper and current radiation protection principles are being applied.

17. Occupational exposure calculations shall be performed in accordance with 10 CFR 19.13.b and 10 CFR Part 20, Subpart C and documented in accordance with 10 CFR 20.2106. Routine airborne ore dust and yellowcake samples shall be analyzed in a timely manner to allow exposure calculations to be performed in accordance with this condition. RWP ore dust and yellowcake samples shall be analyzed and the results reviewed by the RSO or his designee within two (2) working days after sample collection.

    [Applicable Amendment: 40]

18. DELETED by Amendment No. 4.

19. The results of all effluent and environmental monitoring required by this license shall be reported semiannually and in accordance with 10 CFR 40, Section 40.65, with copies of the report sent to the NRC.

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Monitoring data shall be reported in the format shown in the attachment to SUA-1473 entitled, "Sample Format for Reporting Monitoring Data." [Applicable Amendments: 25]

20. The results of sample analyses, monitoring surveys, equipment calibration, reports of audits and inspections, meetings, and training sessions required by applicable regulations or this license and any subsequent reviews, investigations, and corrective actions shall be documented. Unless otherwise specified in this license or in NRC regulations, all documentation shall be maintained for a period of five (5) years.

21. The licensee shall operate the tailings retention systems in accordance with the "Tailings Stabilization Report" submitted October 1, 1986, as approved by the NRC and in compliance with 10 CFR 40, Appendix A. Any changes in the tailings retention system that would significantly deviate from the above shall require the licensee to provide a written evaluation of the changes and obtain approval from the NRC in the form of an amendment to the license.

In addition, the licensee shall implement a tailings dam inspection program as specified in Section A3 of the submittal dated, November 12, 1986, with the exceptions that annual technical evaluations of embankment performance need not be performed, and daily inspections of the tailings embankments need only be performed on regularly scheduled work days.

[Applicable Amendments: 4, 21, 26, 40]

22. The licensee shall maintain an NRC-approved financial surety arrangement, consistent with 10 CFR 40, Appendix A, Criteria 9 and 10, adequate to cover the estimated costs, if accomplished by a third party, for decommissioning and decontamination of the mill and mill site, reclamation of any tailings or waste disposal areas, ground water restoration as warranted, and the long-term surveillance fee.

Annual updates to the surety amount, required by 10 CFR 40, Appendix A, Criteria 9 and 10, shall be submitted to the NRC by June 30 of each year. Along with each proposed revision or annual update, the licensee shall submit supporting documentation showing a breakdown of the costs and the basis for the cost estimates with adjustments for inflation, maintenance of a minimum 15 percent contingency fee, changes in engineering plans, activities performed, and any other conditions affecting estimated costs for site closure. The basis for the cost estimate is the NRC approved reclamation/decommissioning plan as supplemented by the NRC assumptions identified in License Condition No. 37, or NRC approved revisions to the plan. The attachment to this license, entitled "Recommended Outline for Site Specific Reclamation and Stabilization Cost Estimates" outlines the minimum considerations used by the NRC in the review of site closure estimates. Reclamation/decommissioning plans and annual updates should follow this outline.

The licensee's currently approved surety, Irrevocable Letter of Credit issued by the Imperial Bank of Commerce, New York Branch, in favor of the NRC, shall be continuously maintained in an amount no less than $11,925 million for the purpose of complying with 10 CFR 40, Appendix A, Criteria 9 and 10, until a replacement is authorized by the NRC.

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[Applicable Amendments: 18, 19, 22, 24, 30, 32, 36, 39, 41, 46, 47, 48, 50]

23. Prior to termination of this license, the licensee shall provide for transfer of title to byproduct material and land, including any interests therein (other than land owned by the United States or the State of New Mexico), which is used for the disposal of such byproduct material or is essential to ensure the long-term stability of such disposal site to the United States or the State of New Mexico, at the State's option.

24. The licensee shall have a contingency plan for responding to unexpected releases of liquids or tailings from the mill facility, tailings impoundments, and lined evaporation ponds and for the accidental release of uranium concentrates during shipment and transport.

25. Release of equipment or packages from the restricted areas for unrestricted release or disposal shall be in accordance with the attachment to SUA-1473 entitled, "Guidelines for Decontamination for Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct or Source Materials," dated, September, 1984.

26. Before engaging in an activity not previously authorized by the license, the licensee shall prepare and record an environmental evaluation of such activity. Should the evaluation indicate that such activity may result in a significant adverse environmental impact that was not previously assessed or that is greater than that previously assessed, the licensee shall provide a written evaluation of the activity and obtain prior approval of the NRC in the form of a license amendment.

27. The licensee shall implement an interim stabilization program for tailings areas as specified in the "Tailings Stabilization Report" submitted October 1, 1986, as modified by Section 4.6 submitted by letter dated, March 20, 1987. This program shall include written operating procedures and shall prevent or minimize dispersal of blowing tailings to the extent reasonably achievable and in accordance with Criterion 8 of 10 CFR 40, Appendix A. The effectiveness of the control methods used shall be evaluated in accordance with the procedure submitted by letter dated June 17, 1987. Corrective actions taken shall be documented in response to inspection findings.

    The licensee shall adhere to the interim stabilization schedule for cleanup of contaminated areas as addressed in the submittal dated October 15, 1987. [Applicable Amendments: 4, 7]

28. The licensee is hereby exempted from the posting requirements of 10 CFR 20.1902(e) for areas within the mill provided that all entrances to the mill are conspicuously posted in accordance with 10 CFR 20.1902(e) and with the words, "Any area within this mill may contain radioactive material."

29. The licensee shall submit a detailed mill decommissioning plan to the NRC at least six (6) months prior to the planned start of decommissioning activities.

30. Damaged yellowcake drums may be returned for disposal in Tailings Pond No. 2 as described in the licensee's submittal dated January 2, and March 5, 1987, October 6, 1989 and November 16, 1995. All

such disposal shall be documented. In addition, no drums shall be disposed within 150 feet of the dam crest. [Applicable Amendments: 2, 14, 34]

31. The licensee is authorized to process alternate feed materials (raffinate and calcium fluoride sludges) from Sequoyah Fuels Corporation's Gore, Oklahoma, facility in accordance with the submittals dated March 31, July 15, and August 6, 1987, and May 15, 1990, with the exception that the yellowcake product shall be maintained in slurry form or dried in accordance with Condition No. 38 of this license.

    [Applicable Amendments: 3, 5, 7, 28]

32. The licensee is authorized to dispose of and bury contaminated waste materials resulting from past milling operations into the disposal areas in accordance with the submittals dated July 20, 1995. The licensee may also dispose of and bury within these areas, byproduct materials as authorized by license conditions 30, 36, and 41. In addition, the licensee shall adhere to the following requirements. The licensee shall maintain detailed disposal records indicating quantities and locations of all waste material disposed in the disposal areas and prior to the disposal of any wastes, the licensee shall establish a detailed procedure to describe the handling, preparation, placement and covering of wastes in the specified disposal areas. The final design of the disposal areas, including drawings, calculations, analyses, and a list of materials included in the disposal areas, will be submitted to the NRC for approval prior to placement of the final cover.

    [Applicable Amendments: 6, 33, 37]

33. The licensee is hereby authorized to inject chemically fortified mine waters in accordance with their July 14, 1987 submittal. The following upper control limits shall be observed: calcium = 35 mg/l, sodium = 253 mg/l, sulfate = 450 mg/l, carbonate/bicarbonate = 303 mg/l, pH = 10.0 standard units. Should any of these limits be exceeded, based upon monthly sampling, the licensee shall immediately suspend injection of chemically fortified waters, notify the NRC, in writing within 5 days sample for the above parameters on a weekly frequency, and within an additional 25 days, submit a plan to remediate the situation.

    [Applicable Amendments: 8]

34. The licensee shall implement a groundwater compliance monitoring program containing the following:

    A. Sample Dakota Sandstone wells 17-01, 30-02, 30-48, 32-45, and 36-06 for antimony, arsenic, beryllium, cadmium, cyanide, lead, molybdenum, nickel, selenium, combined radium-226 and -228, natural uranium, thorium-230, lead-210, gross alpha, chloride, sulfate, nitrate, pH, and electrical conductivity.

        Sample Tres Hermanos A wells 31-01 and 33-01 for cyanide, molybdenum, nickel, selenium, radium-226 and -228, natural uranium, thorium-230, lead-210, gross alpha, chloride, sulfate, nitrate, pH, and electrical conductivity.

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Sample alluvium wells 5-03, 32-59, 31-61, and MW-24, for molybdenum, nickel, selenium, combined radium-226 and -228, thorium-230, natural uranium, lead-210, gross alpha, chloride sulfate, nitrate, pH, and electrical conductivity.

B. Comply with the following groundwater protection standards at Dakota Sandstone point of compliance well 30-02, 30-48, 32-45, and 36-06, with background being recognized at well 17-01: antimony = 0.05 mg/l; arsenic = 0.1 mg/l, beryllium = 0.01 mg/l; cadmium = 0.01 mg/l; cyanide = 0.04 mg/l; lead = 0.14 mg/l; molybdenum = 0.06 mg/l; nickel = 0.03 mg/l, selenium = 0.04 mg/l; gross alpha = 56 pCi/l; combined radium-226 and -228 = 5.0 pCI/l natural uranium - 0.02 mg/l; thorium-230 = 2.3 pCi/l; lead-210 - 1.9 pCi/l.

Comply with the following groundwater protection standards at Tres Hermanos A point of compliance well 31-01, with background being recognized at well 33-01: cyanide = 0.01 mg/l; molybdenum - 0.03 mg/l; nickel = 0.05 mg/l; selenium - 0.03 mg/l; gross alpha = 18.0 pCi/l; combined radium-226 and -228 = 5.0 pCi/l; natural uranium - 0.01 mg/l; thorium-230 = 4.3 pCi/l; lead-210 = 4.14 pCi/l.

Comply with the following groundwater protection standards at Tres Hermanos B point of compliance wells 31-66, 31-67, 36-01, and 36-02, with background being recognized at well 19-77: cyanide = 0.01 mg/l; molybdenum = 0.08 mg/l; nickel = 0.06 mg/l; selenium = 0.04 mg/l; gross alpha = 21.0 pCi/l; combined radium-226 and -228 = 7.4 pCi/l; natural uranium = 0.02 mg/l; thorium-230 =2.2 pCi/l; lead-210 = 0.9 pCi/l.

Comply with the following groundwater protection standards at alluvium point of compliance wells 32-59, 31-61, and MW-24, with background being recognized at well 5-03: molybdenum = 0.06 mg/1; nickel = 0.06 mg/l; selenium = 0.05 mg/l; gross alpha - 57 pCi/l; combined radium-226 and -228 = 5.0 pCi/l; thorium-230 = 3.1 pCi/l; natural uranium = 0.06 mg/l; lead-210 = 4.9 pCi/l.

C. Implement a corrective action program as described in the September 25, 1989, submittal with the objective of returning the concentrations of hazardous constituents to the concentration limits specified in Subsection (B). The program shall, at a minimum, consist of mine dewatering and maintenance and operation of the interceptor trench.

D. Submit, by August 1 of each year, a review of the corrective action program and its effect on the aquifers.

E. DELETED BY Amendment No. 42

[Applicable Amendments: 9, 11, 13, 15, 25, 35, 40, 42]

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35. The licensee shall submit to the NRC, copies of all correspondence with the New Mexico Environmental Improvement Division.

[Applicable Amendments: 11]

36. The licensee is authorized to dispose of byproduct material waste from the Rio algom Mining Corp. Smith Ranch in-situ leach facility in accordance with the submittals dated, February 19, 1990, and September 26, 1991, with the following modifications or additions:

A. The written procedures, included in the February 19, 1990, submittal shall be reviewed and revised in accordance with License Condition No. 14.

B. Prior to disposal of drums containing sludge material, the licensee shall obtain written confirmation from Rio Algom Mining Company that the drums have been verified to be full or the verification shall be performed by Ambrosia Lake personnel.

C. Drums containing wastes other than sludges shall be opened and the wastes disposed directly into excavated trenches.

D. All disposal activities shall be documented. [Applicable Amendments: 16, 23]

37. The licensee shall reclaim the disposal area as stated in the September 24, 1990, January 7, 1994, May 16, 2002, and September 26, 2002, submittals as supplemented by the following conditions. Though recognized as conservative, these conditions were assumed when evaluating the acceptability of the reclamation plan as submitted, and are identified pending submittal of acceptable design alternatives. Justification for any design alternatives must be submitted for NRC review and approval prior to implementation.

A. The radon barrier shall be constructed as specified in the licensee's September 28, 1990, submittal, as amended by the February 7, August 2, September 2, and November 4, 1994, submittals. Prior to placement of any material onto the interim cover, the procedure defined in the licensee's October 4, 1990, submittal for establishing the integrity of the in-place material must be performed.

B. DELETED by Amendment No. 19.

C. The relocated contaminated material shall be placed in lifts not to exceed 12 inches and compacted to at least 90 percent of the maximum standard dry density after a stable work base has been established.

D. In place density and moisture laboratory compaction, soil classification, and rock quality testing shall be performed in accordance with the licensee's September 23, 1990, submittal. If test procedures other than the sand cone test or oven dry moisture are used in the construction quality control, procedures that will be used to establish correlation between the tests must be submitted for NRC review and approval prior to implementation.

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E. A detailed cover design for Ponds 11-21 must be submitted for NRC review and approval. All contaminated materials in Pond 3 that are not covered by the reclaimed Pond 1 outslope shall be relocated to Pond 2 unless an erosion protection plan is submitted for NRC review and approval.

F. The settlement survey data shall be submitted for NRC review and approval prior to placement of the radon barrier on the interim cover.

G. The fresh water dam mill reservoir must be breached during final reclamation activities.

H. Settlement monuments shall consist of a steel bar welded to a 1-foot square steel plate, or equivalent, placed at least 3 feet below the surface.

I. The fill associated with the Pond 1 spillway shall be constructed to the same specifications and quality control program as the radon barrier material.

J. If a rock source other than the Homestake Quarry is selected, the licensee shall submit the results of durability tests as outlined in the Final Staff Technical Position on Design of Erosion Protection, August 1990, for NRC review and approval prior to placement of any of the material.

K. All rip rap shall be placed in a manner that prevents segregation of the material. The material placed shall be reasonably well graded and shall be within the following gradation specifications.

D_{50} = 1.0" D_{50} = 3.2"

Sieve Size	Percent Passing (by weight)	Sieve Size	Percent Passing (by weight)
3 inch	100	6 inch	100
2 inch	70-100	5 inch	78-100
1 inch	25- 55	4 inch	35-100
¾ inch	15- 40	3 inch	12- 45
½ inch	0- 25	2 inch	0- 20

D_{50} = 7.7"

Sieve Size	Percent Passing (by weight)
13 inch	100
12 inch	80-100
10 inch	49-100
8 inch	26- 54
6 inch	7- 32
4 inch	0- 13

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L. A minimum 6-inch bedding layer with a D_{50} of 1 inch shall be placed under all riprap on the disposal area having a D_{50} of 2 inches or larger.

The bedding material shall be reasonably well graded to prevent migration of the base material into the riprap. The quality of the bedding material shall be equivalent to that of the riprap.

M. A riprap filled toe trench shall be placed on the West side of Pond 2 where the existing steep slopes transition onto the flatter surface of Pond 2.

The licensee shall submit a proposed design of the trench for NRC review and approval prior to construction.

N. The spillway riprap shall be extended 45 feet onto the top of Pond 1 to prevent erosion.

O. Riprap with a D_{50} of 1 inch shall be placed in all areas of the South Diversion Ditch which are not excavated in rock.

P. As an alternative to the erosion protection design of the top surfaces of Ponds 1 and 2, which was approved in Amendment No. 18, the licensee may use a 3-inch layer of riprap having a minimum median stone diameter (D_{50}) of 1-inch.

[Applicable Amendments: 18, 19, 29, 31, 51]

38. The licensee is authorized to perform yellowcake drying in accordance with the submittal dated, October 22, 1990. In addition to commitments contained in the October 22 submittal, the licensee shall comply with the following:

A. Air sampling used to determine the exposure of yellowcake operators to airborne uranium shall include breathing zone sampling at the yellowcake barrelling station.

B. Water flow rates for the wet scrubber servicing the yellowcake dryer shall be checked and recorded hourly during operation and a range of flow rates established which assure optimum performance of the scrubber.

C. Detailed inspection, cleaning, and needed preventive maintenance shall be performed and documented at least annually on all yellowcake area emission control equipment.

D. Written procedures shall be reviewed and approved in accordance with License Condition No. 14.

[Applicable Amendments: 20]

39. The licensee shall conduct an annual survey of land use (grazing, residences, water supply wells, etc.) in the area within two miles of the mill and submit a report of this survey annually to the NRC. This report shall indicate any differences in land use from that described in the licensee's previous annual report, and shall specifically address occupancy of the Berryhill Ranch. The report shall be submitted by July 1 of each year.

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[Applicable Amendments: 21]

40. The licensee shall complete site reclamation in accordance with an approved reclamation plan and groundwater corrective plan, as authorized by License Condition Nos. 37 and 34, respectively, in accordance with the following schedules.

A. To ensure timely compliance with target completion dates established in the Memorandum of Understanding with the Environmental Protection Agency (56 FR 55432, October 25, 1991), the licensee shall complete reclamation to control radon emissions as expeditiously as practicable, considering technological feasibility, in accordance with the following schedule:

(1) Windblown tailings retrieval and placement on the pile - December 31, 1999. Areas inaccessible due to activities authorized by this license will be addressed during final mill decommissioning.

[Applicable Amendments: 38, 43]

(2) Placement of the interim cover to decrease the potential for tailings dispersal and erosion -

For impoundment No. 1 - Completed October 1990
For impoundment No. 2, excluding portions used for approved byproduct material disposal -Completed December 1992

[Applicable Amendment: 44]

(3) Placement of a final radon barrier designed and constructed to limit radon emissions to an average flux of no more than 20 $pCi/m^2/s$ above background -

For impoundment No. 1 - Completed September 1996.
For impoundment No. 2, excluding portions used for approved byproduct material disposal - Completed September 1996.

[Applicable Amendment: 44].

B. Reclamation, to ensure required longevity of the covered tailings and groundwater protection, shall be completed as expeditiously as is reasonably achievable, in accordance with the following target dates for completion:

(1) Placement of erosion protection as part of reclamation to comply with Criterion 6 of Appendix A of 10 CFR Part 40 -

For impoundment No. 1 - December 31, 2001
For impoundment No. 2, excluding portions used for approved byproduct material disposal - December 31, 2003

[Applicable Amendment: 45, 49]

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(2) Projected completion of groundwater corrective actions to meet performance objectives specified in the groundwater corrective action plan - December 31, 2043.

C. Any license amendment request to revise the completion dates specified in Section A must demonstrate that compliance was not technologically feasible including inclement weather, (litigation which compels delay to reclamation, or other factors beyond the control of the licensee).

D. Any license amendment request to change the target dates in Section B above, must address added risk to the public health and safety and the environment, with due consideration to the economic costs involved and other factors justifying the request such as delays caused by inclement weather, regulatory delays, litigation, and other factors beyond the control of the licensee.

41. In accordance with the licensee's submittals dated November 20, 1995, May 9, 1996, January 24, 1997, and February 13, 1997, the licensee is hereby authorized to dispose of 11e.(2) byproduct materials that are similar in physical, chemical, and radiological characteristics to the 11e.(2) byproduct material and associated wastes already within the impoundment subject to the following:

A. "Prior to the receipt of any material under this condition, the licensee shall provide an analysis of the costs of reclamation based on the disposal of the amount of byproduct authorized by this condition on a five (5) year forward basis and include that analysis into the annual surety update required by License Condition 22.

[Applicable Amendments: 37, 44]

B. Deleted by Amendment No. 44

C. Total annual receipt and disposal of 11e.(2) byproduct material shall not exceed 100,000 cubic yards (76,500 m^3) from all generators.

D. The total 11e(2) byproduct material to be disposed of from all generators is limited to 5.3 million tons (3.8 million yds^3).

E. Average annual Ra-226 concentrations of disposed material shall not exceed 1100 pCi/g (41 Bq/g) from any generator.

F. All contaminated equipment shall be dismantled, crushed, perforated or placed to minimize void spaces. Barrels shall be verified to be full prior to disposal. Barrels not completely full shall be filled or emptied and crushed prior to final disposal.

G. Byproduct material shall be free of standing liquids.

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H. All disposal activities shall be documented. The documentation shall include a description of the byproduct material, the disposal locations, and the results of pre-acceptance testing. The licensee shall maintain documentation until license termination.

I. The licensee shall submit a final reclamation plan upon the end of receipt operations.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Dated: November 27, 2002

Daniel M. Gillen, Chief
Fuel Cycle Facilities Branch
Division of Fuel Cycle Safety
and Safeguards
Office of Nuclear Material Safety
and Safeguards