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ENVIRONMENTAL ASSESSMENT
SOIL DECOMMISSIONING PLAN
FOR RIO ALGOM MINING LLC'S URANIUM MILL TAILINGS SITE
AMBROSIA LAKE, MCKINLEY COUNTY, NEW MEXICO

February 2006

Source Materials License SUA-1473
Docket No. 40-8905

PREPARED BY

U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS
DIVISION OF FUEL CYCLE SAFETY AND SAFEGUARDS

Enclosure 1

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1.0 INTRODUCTION

By letter dated January 19, 2005, Rio Algom Mining LLC (Rio Algom) sent to the U.S. Nuclear Regulatory Commission (NRC), a *Soil Decommissioning Plan* (Plan) for its Ambrosia Lake uranium mill tailings facility. In a followup to the proposed Plan, Rio Algom submitted, under letters dated June 15, July 15, and September 27, 2005, a response to a Request for Additional Information and a revised Plan.

The Plan addresses the methods and procedures to be implemented to ensure that soil remediation is performed in a manner that is protective of human health and the environment. The Uranium Mill Tailings Radiation Control Act, as amended, and regulations in Title 10 of the Code of Federal Regulations, 10 CFR Part 40, require that material at uranium mill tailings sites be disposed of in a manner that protects human health and the environment.

The Ambrosia Lake site is in the Ambrosia Lake mining district of New Mexico, 25 miles north of Grants, New Mexico. It began processing ore in 1958, and processed approximately 33 million tons of ore through 1985. At that time, the facility was placed in a deferred production status, pending more favorable market conditions. The facility continued to be an active uranium production facility through December 2002. Reclamation of the tailings management facilities commenced in 1989 with the initiation of consolidating the top surface of the largest tailings impoundment. Reclamation activities have at times included excavation and disposal of unlined evaporation pond residues, contaminated soil cleanup, reclamation of the tailings impoundments, construction of surface water erosion protection features, and demolition of the mill buildings.

The original tailings disposal area was constructed in 1958, and originally consisted of eight ponding areas. Tailings Impoundments ponds 1 and 2 were used for solids disposal, pond 3 was a decant and seepage collection pond, and ponds 4 through 8 were used for evaporation of liquids decanted from ponds 1 and 2. Ponds 4 through 8 were unlined. Starter dike and retention dikes were constructed from clayey natural soils that were present on the site. Tailing disposal operations utilized the upstream spigoting method. By the end of 1984, nearly 33 million tons of tailing solids had been deposited at the site, and no failures allowing discharge of radioactive material outside the restricted area haved occurred.

Utilization of the acid leach process at the Ambrosia Lake mill required the sandstone ores to be ground to the natural grain size of approximately 28 mesh (0.60 mm or 0.024 in). This coarser grain size along with crust formation on the deposited tailings provided greater protection from possible wind dispersion.

All unlined evaporation ponds (pond 4 through 8) were taken out of service in 1984. Following solution transfer from these unlined ponds to lined evaporation cells, consolidation and removal of accumulated pond sediments in ponds 4-8 were transported to pond 2 for final disposal.

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Lined ponds 9 and 10 were constructed in 1976, and were also used for evaporation of liquids decanted from ponds 1 and 2. Pond 10 was removed from service in 1984, and allowed to dry out. The accumulated sediments, liner material, and contaminated soils beneath the liner from pond 10 were relocated to pond 2. The area was cleaned down to bedrock (shale and sandstone), and then backfilled with 0.91 meter (3 feet) of fill material. Pond 9, which remains in service to facilitate ongoing evaporation needs, is scheduled to be reclaimed in later 2006 – early 2007.

Ponds 11 through 15 were constructed in 1976, and ponds 16 through 21 were constructed in 1979. These synthetically lined ponds are referred to as the "Section 4 ponds." They are located along the southeastern portion of the site, and were used to evaporate liquid wastes generated from Rio Algom's uranium ore processing mill. These ponds have an overall evaporative area of 256 acres with a total holding capacity of 1570 acre-feet. Additional wastewater streams evaporated at the Section 4 ponds included wastewater from the ion exchange plant consisting of backwash solutions, and resin regeneration solutions. Ground water collected as part of the alluvial and bedrock ground water remediation plan, and other mill process solutions, were also disposed via evaporation at the Section 4 ponds. The ponds remained in active service through April 2005. Closure of all lined ponds will be performed pursuant to the Lined Pond Relocation Plan approved by the NRC in June 2005.

The applicant stated that the *Plan* is one component of the overall site decommissioning plan. The licensee has previously addressed, and the NRC has approved the remaining site-wide decommissioning plan elements through separate licensing actions including closure of tailings ponds 1 and 2, mill demolition, relocation of lined evaporation pond sediments, and ground water remediation.

The Plan addresses the soil decommissioning of the entire site associated with the facility license. The Plan also addresses areas of deeper soil contamination, including ponds 4 through 8, and pond 10. The applicant is requesting to close these areas through the application of alternate release criteria (ARC) by comparison of the site-specific dose assessment with the "benchmark dose." Construction methods used for the unlined ponds resulted in creating contaminated soils at depths beneath and in the vicinity of the unlined ponds that can exceed 12 feet from current surface elevation. Site conditions make excavation of these soils that are impacted at depth technologically and economically infeasible to remediate and create unnecessary safety and health concerns to employees.

Some other onsite areas of possible deeper soil contamination that lack adequate characterization data as a result of ongoing licensed activities. These areas include the mill area and the lined evaporation ponds (pond 9 and "Section 4 ponds"). Other areas addressed in this Plan are the saturated area immediately north of the treatment pond resulting from mine water seepage, the former saturated zones adjacent to pond 9 that existed prior to the installation, operation of the dewatering trench, and pipelines that contained process solutions.

2.0 NEED FOR THE PROPOSED ACTION

The proposed action of approval of the Plan is required by 10 CFR Part 40. The purpose of the Plan is to remediate the windblown tailings, effluent contaminated soils, and soils contaminated originating from the milling operation and disposal area and to demonstrate that the cleanup

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plan was successful in remediating the contaminated soils to comply with the proposed release criteria. For areas of deeper contamination attributed to licensed activities, Rio Algom will utilize ARC to allow these soils to be left in place with an engineered erosion protection cover.

3.0 THE PROPOSED ACTION

The proposed action is modification to a license condition of Source Materials License SUA-1473, to approve Rio Algom's proposal to implement the *Plan* to remediate soil impacts attributable to licensed activities. Following approval of the *Plan*, Rio Algom will develop and implement operational procedures to verify that the area meets the approved cleanup criteria. Following approval by NRC of successful remediation of the area pursuant to the *Plan, t*he area will be stabilized and the site will eventually be transferred to the U.S. Department of Energy (DOE).

4.0 ALTERNATIVES TO THE PROPOSED PLAN

The alternative to in-place stabilization is the no-action alternative. The no-action alternative would not provide an adequate long-term solution for the uranium byproduct material. However, it would require active maintenance for the life of the waste site.

In-place stabilization will provide a reasonable assurance of containing the radiological hazards for 1000 years. Further, to the extent practical in-place stabilization will limit the release of radon-222 from uranium byproduct and radon-220 from thorium by-product materials to the atmosphere so as not to exceed an average of 20pCi/m^2/sec, and the direct gamma exposure from the reclaimed tailings cells will be reduced to background levels.

5.0 DESCRIPTION OF AFFECTED ENVIRONMENT

5.1 Land Use

The site is located approximately 24 miles due north of Grants, New Mexico, in the Ambrosia Lake valley. Uranium mining started in this area in mid-1950s, and 17 mines are located within approximately 3 miles of the site (Rio Algom, 2005a). Land uses within 2 miles of the site are grazing, utilities, and mine reclamation activities, according to the 2005 land use survey (Rio Algom, 2005b).

5.2 Geology

5.2.1 Regional Geology

Rio Algom's mill and tailings facility is located north of the Zuni Uplift portion of the San Juan Basin. The basin is characterized by broad areas of relatively flat-lying sedimentary rocks, dipping to the northeast; portions of the basin are covered with alluvium and basalt flows. The site is within the Ambrosia Lake valley, which is formed by the Mesa Montanosa to the west and the San Mateo Mesa to the east. The stratigraphic sequence of hydrologic significance at the site consists of, in descending order, the Arroyo del Puerto alluvium (alluvial aquifer), the Mancos Formation and Tres Hermanos A and B (TRA and TRB) sandstones, the Dakota Sandstone, the Brushy Basin and the Westwater Canyon members of the Morrison Formation. The ore-bearing unit in the vicinity is the Westwater Canyon. Bedrock formations above the

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Westwater Canyon Member of the Morrison Formation have essentially been dewatered by ventilation holes and mine shafts located to the north and east of Rio Algom's mill and tailings facility. Units that have been affected by milling activities are the alluvium, the TRB sandstone, and the Dakota Sandstone.

5.2.2 Site Geology

The mill site and Tailings Impoundments 1 and 2 are located on the weathered Mancos Formation (saprolite) or on alluvium overlying the Mancos section. The alluvium consists of clay and clayey sand derived from reworked shales of the Mancos Formation. Bedrock units impacted by tailings seepage are the Dakota Sandstone that underlies ponds 7 and 8, and the TRB that underlies the saprolite throughout most of Tailings Impoundments 1 and 2. Most of the seepage from Tailings Impoundments 1 and 2 migrates laterally through the alluvium, and shallow saprolite in the direction of the surface slope to the alluvial aquifer, where it enters the interception trench. Seepage that enters the unweathered bedrock beneath Tailings Impoundments 1 and 2 slowly migrates through the TRB to the north and northeast of the Facility in the general direction of the dip. The dewatering trench located between pond 7 and pond 2 has minimized any tailings seepage to the TRA that underlies the saprolite, and alluvium in the general vicinity of pond 7.

5.3 Water Resources

5.3.1 Surface Water

Prior to mining activity, the Arroyo del Puerto was an ephemeral drainage as flow in the arroyo occurred only in response to large rainfall or snowmelt events. When mine dewatering was occurring, the arroyo was dry until it reached the discharge point for treated mine water. Mine discharges are permitted under a National Pollutant Discharge Elimination System (NPDES) permit issued by the Environmental Protection Agency. As an example, during 1999 an average of 337,000 ft^3/d of treated mine water was discharged to the Arroyo del Puerto channel. Some water was then diverted from the creek for mine injection. Since January 2000, when mine injection ceased, an average of 125,000 ft^3/d of treated mine water has been released to the Arroyo del Puerto channel. Water flowing in the arroyo infiltrates into the alluvium to facilitate the ground water corrective action plan implemented at the site for the alluvial unit. Other than minimal precipitation recharge, this infiltration is the only source of recharge to the alluvial ground water system. As of December 2005, no water has been discharged into the Arroyo del Puerto

5.3.2 Ground Water

5.3.2.1 Bedrock Aquifers

The principal near-surface bedrock hydrogeologic units beneath the site are the TRA, the TRB, and the Dakota Sandstone. The Mancos Formation serves as an aquitard that separates each of these water-bearing units. Ground water flow within bedrock units is generally down-dip, toward the north-northeast. An exception is a small portion of TRB in the southeast portion of the study area. Interception trenches IT-2 and IT-3 intercept water flowing in the TRB to the east from beneath Tailings Impoundment 1.

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A regional cone of depression has formed within bedrock units beneath the site as a result from the dewatering of mines through vent holes and mine shafts. Bedrock units are recharged where they crop out or where they are covered by alluvium. Transmissivity values for TRB, and Dakota of 4.7 square feet per day (ft^2/d) and 13 ft^2/d, respectively (Rio Algom, 2000b).

5.3.2.2 Alluvial Aquifers

Prior to mining in the area, natural sources of recharge to the alluvial system were insufficient to establish saturated conditions within the alluvium. Therefore, natural sources of recharge such as infiltrating overland flow and drainage are insignificant. Two principal sources of recharge to the system are currently maintaining the localized saturated condition: 1) infiltration of water from the Arroyo del Puerto bypass channel, and 2) leakage from Tailings Impoundment 1.

Current ground water flow in the alluvial system is generally to the southeast with a gradient of approximately 0.006. A ground water mound has formed in the northern portion of the study area, caused by infiltration from the Arroyo del Puerto bypass channel. North of this mound, ground water flows north toward mine shafts and vent holes located in Section 30. South of the mound ground water flows toward the northern half of trench IT-l, creating the ground water sweep. Ground water seeping from Tailings Impoundment 1 flows east toward trench IT-1.

Ground water exits the alluvial system at the northern and eastern margins of the study area where vent holes and mine shafts intersect the water table. Alluvial ground water also exits the southern end of study area as underflow beneath the Arroyo del Puerto through a narrow gap in the bedrock. Hydraulic gradients between the alluvial system and subcropping Tres Hermanos units are generally downward, indicating that some ground water is probably moving from the alluvial system into subjacent sandstone units.

5.3.3 Background Water Quality

Background values for the site were determined by the calculation of an upper tolerance limit (UTL) for constituent data sets that were either normally or lognormally distributed. In data sets that were not normally or lognormally distributed, the highest observed value was assigned as the UTL.

Rio Algom discussed the computation of background water quality data because sources unrelated to site activities have impacted offsite water quality. Such sources include seepage from the DOE facility, mine pumping and discharge, and the runoff and erosion from mine spoils and ore piles. As a result, widespread ambient ground water contamination has occurred that is unrelated to but inseparable from impacts related to milling at the site. Consequently, calculated background values may not be representative of ground water in other parts of the Ambrosia Lake valley outside of mined areas.

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Table 1
Background Ground Water Concentrations

Parameter	Background Concentration (UTL)
Gross Alpha (pCi/l)	16,726
Lead-210 (pCi/l)	36
Molybdenum (mg/l)	83
Nickel (mg/l)	0.14
Radium-226 & -228 (pCi/l)	196.1
Selenium (mg/l)	3.1
Thorium-230 (pCi/l)	5
Uranium (natural) (mg/l)	11.1

Source: Rio Algom, 2001

5.3.4 Current and Future Water Uses

Ground water in the Ambrosia Lake area is used for irrigation and livestock watering. There are no irrigation or livestock watering wells in the alluvial aquifer in the vicinity of the tailings impoundments. The alluvial aquifer is not saturated anywhere except near the site and the DOE tailings impoundment and cannot provide sufficient water for use. Therefore, the DOE obtained ground water corrective action compliance and license termination at its facility through the application of supplemental standards. Rio Algom obtained alternate concentration limits (ACL) for the site within the bedrock and alluvial units in February 2006. The land area where these ACL apply will be transferred to the DOE for long term stewardship upon license termination, thereby protecting both the public and the environment.

A list provided by the U.S. Geological Survey shows approximately 65 ground water wells within a 25-mile radius of the facility. The closest ground water supply well is completed in the Westwater Canyon Sandstone member of the Morrison Formation approximately 1.5 miles west of the site. A large reduction in water use and ground water withdrawals has occurred in the Ambrosia Lake area over the past 10 to 15 years as a result of the decline of the uranium industry because of poor economic conditions . The current economic base in the Ambrosia Lake area is reclamation at the site and ranching. With facility reclamation nearing completion, this area is unlikely to experience an increase in ground water use in the foreseeable future.

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5.4 Ecology (Flora and Fauna)

By letter dated September 20, 2004, the U.S. Fish and Wildlife Service (FWS) transmitted the Federal list of threatened and endangered species for McKinley County, New Mexico, to the NRC staff (FWS, 2004). According to this list, the following threatened and endangered species are found in McKinley County: bald eagle (*Haliaeetus leucocephalus*), black-footed ferret (*Mustela nigripes*), Mexican spotted owl (*Strix occidentalis lucida*) with critical habitat, southwestern willow flycatcher (*Empidonax traillii extimus*), and the Zuni fleabane (*Erigeron rhizomatus*). No habitat for these species has been identified at the site.

5.5 Meteorology, Climatology, and Air Quality

New Mexico has a mild, arid or semiarid, continental climate characterized by light precipitation totals, abundant sunshine, low relative humidity, and a relatively large annual and diurnal temperature range. Table 3 presents monthly average data from the Grants Airport except for pan evaporation data, which is from the Gallup ranger station.

Table 2

Climatic Data

Month	Avg. Temp (°F)	Avg Max. Temp. (°F)	Avg. Min. Temp. (°F)	Precip. (in)	Snowfall (in)	Wind Speed (mph)	Prevailing Direction	Pan Evaporation (in)
Jan	30.2	46.2	14.3	0.50	2.5	7.7	NW	0
Feb	34.9	51.3	18.5	0.42	22	9.2	NW	0
Mar	41.1	58.2	23.9	0.53	1.6	9.8	NW	0
Apr	48.8	67.4	30.1	0.47	0.3	11	W	6.61
May	57.5	76.3	38.8	0.54	0	10.3	W	9.31
Jun	66.9	86.3	47.5	0.57	0	9.9	W	12.12
Jul	71.6	88.2	55.0	1.71	0	8.0	SE	10.50
Aug	69.0	85.1	53.0	1.99	0	7.3	SE	8.70
Sep	62.2	79.7	44.6	1.32	0	7.8	NW	7.95
Oct	51.0	69.4	32.7	1.10	0.4	8.6	NW	5.07
Nov	39.1	56.1	22.1	0.59	0.9	7.7	NW	2.20
Dec	30.8	47.2	14.5	0.63	4.0	7.5	NW	0
Avg/ Total	50.3	67.6	32.9	10.37	11.9	8.7	NW	62.46

Source: Western Regional Climatic Center, 2005

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5.6 Socioeconomic

According to the 2000 Census data, the closest population center to the site is Milan, which is 20 miles south of the site, and immediately north of Grants (24 miles south of the site). As of the 2000 Census, Milan had a total population of 1,891 people (down from 1,911 people in 1990) with a median age of 29.8 years. Approximately 22 percent of the population is under 18 years old. Approximately 59 percent of the population 16 years old or older is in the workforce, and the median household income is $24,635. Approximately 29 percent of the population is below the poverty level.

As of the 2000 Census, Grants had a total population of 8,806 people (up from 8,626 people in 1990) with a median age of 34.4 years. Approximately 17 percent of the population is under 18 years old. Approximately 58 percent of the population 16 years old or older is in the workforce, and the median household income is $30,652. Approximately 22 percent of the population is below the poverty level (Census Bureau, 2005).

5.7 Historical and Cultural Resources

Implementation of the Plan may have an effect on two identified archaeological sites resulting from ground disturbing activities that will occur at both archaeological sites. Rio Algom has submitted a Data Recovery Plan to the New Mexico State Historic Preservation Office (SHPO) that addresses how the identified archaeological sites will be managed as part of the Plan. The Data Recovery plan consists of ten elements: (1) research context; (2) resource description/current knowledge of the sites; (3) specific research questions; (4) specific procedures to excavate the sites; (5) procedures to implement the plan; (6) backfill; (7) analytical procedures; (8) schedule; (9) personnel; and (10) curation. Archaeological activities will be in consultation with SHPO and will be conducted by qualified cultural resource specialists.

5.8 Public and Occupational Health

The site Health, Safety and Environment Management System provides adequate assurances to protect employees, the public and the environment. Health and safety programs implemented at the site address all facets of occupation safety including health physics monitoring. These comprehensive programs have continually demonstrated that employee exposures have been maintained as low as reasonably achievable.

The project has been designed to maximize protection of the public. Interaction with traffic from the general public is minimized through the construction of an overpass across the public highway. Fugitive dust from heavy equipment operation will be mitigated through the use of dust suppression methods on haul roads. The area will eventually be revegetated following work activities.

The NRC license requires the site to maintain comprehensive environmental monitoring programs that encompass air, soil, sediment, surface water, ground water, vegetation, radon, and direct gamma radiation. The facility air monitoring network was expanded as two additional ambient air monitoring stations have been installed to collect data to demonstrate that control measures are implemented and effective.

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The NRC staff is requiring quarterly monitoring of ground water for the first 2 years followed by semiannual monitoring until license termination. Specifics of the Ground Water Monitoring Network are presented in detail within the Environmental Assessment for the Alternative Concentration Limits that was published January 21, 2006 (ML060130091).

The purpose of this monitoring is to ensure that Rio Algom remains in compliance with the ground water standards in the license. Sampling data also allows monitoring of ground water plume movement over time and distance, and assures that ground water contamination will not present an unacceptable risk to human health or the environment in the future. If future data suggests that pollutant concentrations in ground water exceed acceptable levels, Rio Algom will be required to do frequent monitoring or corrective actions.

The DOE will propose a ground water monitoring plan as part of the long-term surveillance plan to be approved by the NRC. As custodian of the tailings after termination of the site's license, the DOE will be responsible for continued monitoring and any needed corrective action under the NRC general license.

5.9 Transportation

This action will result in increased traffic to and from the project site. However, increased traffic levels resulting from site employees will be below the traffic levels observed during the full operation of the facility. Dedicated haul roads to maintain segregation of traffic minimize the potential for traffic accidents occurring among project personnel. Interaction with traffic from the general public is minimized through the construction of an overpass across the public highway.

6.0 CONSULTATION WITH AFFECTED FEDERAL AND STATE AGENCIES

As required by the NRC guidance, the FWS and the State of New Mexico were asked to provide input regarding the impacts of this action. The New Mexico Historic Preservation Division (NMHPD) was also contacted. In addition, the NMHPD Web site was reviewed to identify any potential sites in the Ambrosia Lake area. No such historic sites were noted (NMHPD, 2005).

The NRC staff has reviewed the Plan, as amended, and examined the impacts of the request. The potential impacts of the proposed action are limited to the land surface, and are temporary due to construction activities.

The direct impacts to the surface will primarily be dust generation due to the removal, and hauling of the material to the disposal area. Fugitive dust from heavy equipment operation will be mitigated through the use of dust suppression methods on haul roads. The site Health, Safety and Environment Management System provides adequate assurances to control impacts to the environment. Additional ambient air monitoring stations have been installed to collect data to demonstrate that control measures are implemented and effective.

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7.0 CONCLUSION

The NRC staff is considering a request to approve the Soil Decommissioning Plan. The alternatives available to the NRC are to:

1. approve the license amendment request as submitted; or

2. amend the license with such additional conditions as are considered necessary or appropriate to protect public health and safety and the environment; or

3. deny the request.

Based on its review, the NRC staff has concluded that the environmental impacts of the proposed action are not significant and, therefore, do not warrant denial of the license amendment request. Additionally, in the technical evaluation report (TER) being prepared for this action, the staff documents its review of the licensee's proposed action with respect to the criteria for soil remediation, specified in 10 CFR Part 40, Appendix A, and has no basis for denial of the proposed action.

The NRC staff is considering preparation of a finding of no significant impact (FONSI). The following statements support a FONSI and summarize the conclusions of the draft EA.

> The Plan, which will utilize surface remediation and in-place stabilization, provides a reasonable assurance that its measures will contain the radiological hazards for 1000 years. This Plan is one component of the overall site decommissioning plan. The purpose is to provide a road map for the remediation of the windblown tailings, effluent contaminated soils, and soils contaminated by license activities that originated from the milling operation and disposal area, and to demonstrate that the cleanup plan was successful in remediating the contaminated soils to comply with the proposed release criteria. The staff finds reasonable assurance that the applicant has met its responsibilities under the provisions of 10 CFR Part 40 and will recommend approval of the plan.

The NRC has prepared this EA in support of the proposed licensing action for Rio Algom's uranium mill facility at Ambrosia Lake, New Mexico. On the basis of this draft EA, NRC has concluded that there will be no significant environmental impacts from the proposed action. Accordingly, the staff has determined that there is no need to prepare an Environmental Impact Statement for the proposed action.

LIST OF PREPARERS

This EA was prepared by Michael Raddatz, Project Manager, Uranium Processing Section, Fuel Cycle Facilities Branch, Division of Fuel Cycle Safety and Safeguards, Office of Nuclear Material Safety and Safeguards, and reviewed by Bill VonTill , Section Chief, Uranium Processing Section, Fuel Cycle Facilities Branch, Division of Fuel Cycle Safety and Safeguards, Office of Nuclear Material Safety and Safeguards.

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REFERENCES

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[ADAMS Accession No. ML031000403]

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[ADAMS Accession No. ML053000439

U.S. Fish and Wildlife Service. Letter to M. Raddatz dated 10/31/2005.
[ADAMS Accession No. ML052910059

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