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UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TEXAS 76011-8064

March 4, 1998

ML16113A392

W. Paul Goranson, Manager
Radiation Safety, Licensing,
and Regulatory Compliance
Quivira Mining Company
6305 Waterford Building, Suite 325
Oklahoma City, Oklahoma 73118

SUBJECT: NRC INSPECTION REPORT 40-8905/98-01

Dear Mr. Goranson:

On January 16, 1998, the NRC completed an onsite inspection at the Ambrosia Lake uranium mill in McKinley County, New Mexico. Further information was received during discussions with you on February 3, 1998, regarding mine water cleanup and uranium recovery operations. The enclosed report presents the results of the inspection. The inspection disclosed that activities at the site have been conducted in accordance with NRC regulations and the conditions of the license.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be placed in the NRC Public Document Room.

Should you have any questions concerning this inspection, please contact Mr. Louis C. Carson II at (817) 860-8221 or the undersigned at (817) 860-8186.

Sincerely,

/s/ Linda Howell

for Charles L. Cain, Chief
Nuclear Materials Safety Branch -1

Docket No.: 40-8905
License No.: SUA-1473

Enclosure: NRC Inspection Report
40-8905/98-01

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cc w/enclosure:

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ENCLOSURE

U. S. NUCLEAR REGULATORY COMMISSION

REGION IV

Docket No.:	40-8905
License No.:	SUA-1473
Report No.:	40-8905/98-01
Licensee:	Quivira Mining Company
Facility:	Ambrosia Lake Facility
Location:	McKinley County, New Mexico
Dates:	January 14-16, 1998
Inspector:	Louis C. Carson, Health Physicist Nuclear Materials Safety Branch -1 Division of Nuclear Materials Safety
Accompanied by:	Daniel S. Rom, Geotechnical Engineer Engineering and Geosciences Branch Division of Waste Management Office of Nuclear Material Safety and Safeguards
Approved By:	Charles L. Cain, Chief Nuclear Materials Safety Branch -1 Division of Nuclear Materials Safety
Attachment:	Supplemental Information

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EXECUTIVE SUMMARY

Ambrosia Lake Facility
NRC Inspection Report 40-8905/98-01

This inspection included a review of the site status and remediation, management organization and controls, radiation protection, waste management, and environmental protection.

Site Status and Decommissioning for Uranium Mill Sites

- Site remediation and standby activities were found to have been conducted in accordance with applicable regulatory requirements. No health or safety concern was identified during site tours (Section 1).

Management Organization and Controls

- The licensee's organization structure met license requirements. Adequate oversight had been provided for site activities. Procedures were reviewed and were deemed adequate for the work in progress (Section 2).

- The licensee had reviewed NRC Information Notice 96-70, "Year 2000 Effect on Computer System Software." The licensee was reviewing computer activities at the site to identify and resolve Year 2000 computer issues (Section 2).

Radiation Protection

- The licensee had implemented a radiation protection program that met the requirements established in 10 CFR Part 20 and the license. Records of occupational exposures at the site indicated that workers had received small fractions of the dose limits established in 10 CFR Part 20 (Section 3).

- The Annual ALARA report was submitted in compliance with License Condition 10 and 10 CFR 20.1101 (Section 3).

Radioactive Waste Management and Environmental Protection

- Reviews of the licensee's radioactive waste management, environmental protection, groundwater monitoring, and land use survey programs indicated that the licensee was in compliance with license requirements (Section 4).

- All reports related to the groundwater corrective action and environmental monitoring programs had been submitted to the NRC as required. A review of the reports and the laboratory data revealed that releases of licensed materials to the environment during 1997 were within regulatory limits (Section 4).

Report Details

1 Site Status and Decommissioning Inspection Procedure for Uranium Mill Sites (87654)

1.1 Inspection Scope

The site status and remediation activities were reviewed to determine if licensee activities were being conducted in accordance with the Quivira license.

1.2 Observations and Findings

a. Site Status

Quivira's Ambrosia Lake facility was the nation's largest uranium ore processing facility. The conventional mill ceased operation in 1985 and has remained in "standby" condition since then. During 1997, the licensee produced 18,000 pounds of yellowcake per month by extracting uranium from mine water. With the addition of two ion exchangers that were placed into service in late 1997, the yellowcake production rate will be more than 20,000 pounds per month. The licensee ships yellowcake slurry offsite for drying.

Since the last inspection, remediation activities were limited to mill tailings pile maintenance, the groundwater corrective action program, and surveys of equipment for release offsite. Two tailings piles remain onsite. Pile 1 contains 30 million tons of mill tailings spread over 260 acres, and tailings Pile 2 contains 3 million tons of tailings spread over 90 acres. At the time of this inspection, no active mill tailings reclamation work was being conducted. Reclamation activities since the last inspection included windblown soil cleanup, placement of protective soil and rock layers for erosion protection around both tailings ponds, and excavation of drainage channels and diversion ditches around the tailings piles. Both mill tailings Piles 1 and 2 were covered with the final radon barrier in 1995 and 1996, respectively. Radon flux measurements were performed on both impoundments in 1996.

b. Geotechnical Remediation

On January 14, 1998, an inspector from the Office of Nuclear Material Safety and Safeguards (NMSS) inspected the site. The purpose of this inspection was to review construction activities and records associated with the reclamation of mill tailings Piles 1 and 2 from a geotechnical perspective. Reclamation construction was last inspected by NMSS engineers on January 18, 1995. Between January of 1995 and January of 1998, construction work had been performed on Piles 1 and 2 and the diversion ditches. This work included the placement of a protective cover, radon barrier, and contour material on Piles 1 and 2. A licensee representative stated that the cleanup of windblown tailings south and east of Pile 1 was complete. However, verification tests in the windblown soil

cleanup area had not started. Additionally, the inspector determined that 55 pallets of crushed drums were buried in Pile 2 as allowed by License Condition 30.

The licensee and the inspector conducted a tour of the aggregate rock stockpile area and the reclaimed areas near tailings Piles 1 and 2. The rock that had been delivered from the nearby Mt. Taylor lava flows was generally found to be of high quality. This same rock source had been used at the Department of Energy (DOE) Ambrosia Lake Title-I site and at the Homestake and ARCO sites. Substantial rock quality test data had been accumulated by DOE and licensees that had used this rock source for cover material. The inspector observed that the upper surface of Pile 1 had been covered with rock but noticed substantial vegetation had covered the central portion of the rock cover. The side slopes were substantially rock covered, and the rock thickness appeared to be satisfactory. However, due to repeated grader travel, heavy longitudinal wheel ruts were present on the cover. The licensee acknowledged that the ruts were unacceptable and stated that the side slopes will be evened out by use of a harrow in the Spring of 1998. Thickness checks had been made by the licensee on all rock placed except for a 150-foot strip between the top of the cell and the side slopes.

Construction of a spillway on the southwest side of Pile 1 had begun, but adverse weather conditions had temporarily stopped work on the spillway. The spillway and diversion channel were expected to be completed with bedrock placed in 1998. The licensee reported that bedrock was likely to be encountered at some locations in the diversion channel. Therefore, design changes may be required in transition zones from earth to bedrock within the diversion channel.

Following the tour of construction activities at tailings Pile 1 and 2, a records review was made. The inspector's review of weekly construction reports and daily summaries for 1995, 1996, and 1997 revealed that materials had been tested at proper intervals. Furthermore, areas with failing tests were re-worked until satisfactory compaction was achieved. Thickness checks on rock cover indicated satisfactory depth of placement. The inspector was informed that thickness checks were made within the previously noted grader wheel ruts; therefore, measured depths should be conservative. The inspector did not find any lapses in testing and found the content of reports to be satisfactory .

The inspector toured the onsite geotechnical laboratory and determined that the licensee's technician was knowledgeable in its operation. The inspector noted that test procedure deficiencies that were identified during the 1995 inspection had been corrected. The inspector identified no anomalous results or questionable testing practices and concluded that the laboratory testing facility operations were satisfactory. Thickness checks for the aggregate rock placed on Pile 1 must still be presented to the NRC in final form. The licensee stated that correction of the "corduroy" wheel marks on the exterior of Pile 1 will be corrected as well as vegetative growth on top of Pond 1.

c. Site Tour

A facility tour was performed to verify that site activities were being conducted in accordance with applicable regulations and the conditions of the license to ensure that operational controls were adequate to protect the health and safety of workers and the public. During the plant tour, site buildings, fences, gates, and operating equipment were observed, and the inspector conducted radiation surveys using a microRoentgen meter. Although Quivira has no specific regulatory requirements for site security, the inspector observed security guards controlling access and traffic into the site. The licensee routinely kept the access gate closed to prevent unauthorized access to the property. Security guards were on duty at the site gate around-the-clock. The inspector noted all visitors and contract workers had to sign logbooks to gain access to the site. In addition, the restricted area was surrounded with a barbed wire fence. The inspector determined that licensed material was secure within the site property as required as by 10 CFR 20.1801. Additionally, fences were posted with radioactive material signs as required by 10 CFR 20.1902 and the license. No problem areas were identified, and no health or safety hazard was identified during the site tour.

1.3 Conclusions

Site remediation and standby activities were reviewed and found to have been conducted in accordance with applicable license and regulatory requirements. Site fences were in good condition and perimeter postings were appropriate. No health or safety hazards were identified. The licensee's site status and remediation activities were reviewed and found to be adequate.

2 Management Organization and Controls (88005)

2.1 Inspection Scope

The organization was reviewed to ensure that the licensee had established an structure with defined responsibilities and functions. The site standard operating procedures were reviewed to evaluate the effectiveness of the licensee's control of site activities. Additionally, the licensee's efforts to resolve Year 2000 computer software problems were reviewed.

2.2 Observations and Findings

a. Management Organization

The organization was reviewed to ensure that the licensee had maintained an organization structure that was consistent with requirements specified in the license. There were 32 employees on site, which included 7 personnel involved in uranium ion exchanger operations and other personnel involved in radiation protection, environmental monitoring, tailings reclamation work, and site maintenance. The senior company official

located at the site was the general manager who reported to the vice president. The radiation safety and environmental affairs supervisor, also the radiation safety officer (RSO), reported to the general manager. Two environmental technicians reported to the RSO. The licensee's Corporate Manager of Radiation Safety, Regulatory Compliance & Licensing was onsite during this inspection.

The inspector concluded that the licensee's staff and organization was appropriate and in accordance with license requirements.

b. Management Controls

The inspector reviewed the licensee's compliance with the license to determine the effectiveness of management controls. License Conditions 14 and 16 require that written procedures be established and reviewed by the RSO at least annually for non-operational and surveillance activities including environmental and radiation monitoring, instrument calibrations, and bioassays. The inspector reviewed each procedure in the RSO's controlled procedure manual and found that the RSO had performed the annual 1997 procedure review as validated by the RSO's signature and date of review. License Condition 20 requires that the licensee document the results of personnel monitoring, surveys, calibrations, sampling, audits, inspections, meetings, training sessions, investigations, and corrective actions. The inspector reviewed licensee records for 1997 and found that the licensee's program adequately met the requirements.

c. Year 2000 Computer Software Issue

The inspector reviewed whether the licensee had evaluated the effect that the Year 2000 computer software issue had on the site's licensed activities. A licensee representative stated that he had reviewed NRC Information Notice 96-70, "Year 2000 Effect on Computer System Software." The Corporate Manager of Radiation Safety, Regulatory Compliance & Licensing, had been assigned the task of identifying and resolving Year 2000 computer issues.

2.3 Conclusions

The licensee's organization structure was adequate, and adequate oversight had been provided for the current site status. Procedures established at the site had been sufficiently reviewed and were found to be appropriate for the site work in progress. The licensee had reviewed NRC Information Notice 96-70, and assigned resources to identify and resolve any issues affecting licensed activities.

3 Radiation Protection (83822)

3.1 Inspection Scope

This portion of the inspection effort was to determine if the licensee's radiation protection program was in compliance with the requirements established in the license and 10 CFR Part 20 regulations.

3.2 Observations and Findings

a. Occupational Exposure Monitoring Programs

License Condition 10 requires the licensee to perform an annual As Low As is Reasonably Achievable (ALARA) audit based on commitments contained in the licensee's Health Physics and Environmental Programs Manual. The inspector reviewed Quivira's 1997 annual ALARA audit that was submitted to the NRC on January 23, 1998, to determine if it represented a useful tool for Quivira's management to assess the health physics program. The licensee had an ALARA Committee, and its members consisted of corporate and site management and the RSO. The audit included appropriate topics regarding radiation protection activities on site and specific details, analyses, and trends of the personnel exposure data.

The inspector concluded that the ALARA audit met the intent of License Condition 10 and represented a useful management tool which thoroughly demonstrated the success of Quivira's ALARA program and policy based on analysis of 1997 radiological data.

The licensee's personnel monitoring program included use of thermoluminescent dosimeters (TLDs) to monitor for external exposures, and calculations were used to determine internal dose. During the 1997 calendar year, the highest TLD external exposure recorded for individual was 186 millirems.

Exposures to radon daughters were calculated using a time-weighted average format. During 1997, the highest annual radon daughter exposure for an individual was 0.3 working level months, or approximately 8 percent of the annual allowable occupational exposure limit. Internal exposures to uranium were determined by analyzing air samples for gross alpha activity and calculating average air concentrations for a particular area. Internal doses were calculated based on the individual's time in any given area of the facility. Based on 630 routine air samples taken in 1997, the calculated average exposure to uranium received by employees was less than one percent of the annual limit of intake.

Bioassays are required by License Condition 10. The inspector reviewed the 1997 bioassay records. The licensee's bioassay program required routine urine testing for natural uranium on employees working in the restricted area and on workers involved with the mill tailings reclamation project. Bioassay samples were analyzed by a vendor

laboratory. All sample shipments included blank and spiked samples for quality assurance. The licensee used an action level of 15 micrograms per liter (µg/l). During 1997, 82 urine samples were obtained. One sample result indicated a concentration of 41 µg/l of uranium, a value above an action level of 35 µg/l identified in the licensee's bioassay procedures. Actions taken by the licensee in response to the elevated level were appropriate. A followup sample indicated that the uranium content in the urine had dropped to below the lowest action level of 15 µg/l. The licensee's investigation did not reveal the cause of the elevated sample. The individual's internal exposure was calculated to be a fraction of the annual limit of intake for natural uranium.

During the 1997 calendar year, the highest total effective dose equivalent received by an individual was 390 millirems or 8 percent of the occupational dose limit. The inspector concluded that site doses were well below the occupational dose limits established in 10 CFR 20.1201.

c. Radiation Work Permits

License Condition 15 requires the licensee to use radiation work permits (RWPs) for all work where a potential for significant exposure to radioactive material exists. The inspector reviewed RWPs issued since the last inspection. RWPs were a combination of maintenance work orders and radiation safety instructions. The RWPs provided an adequate level of information about the scope of work to be performed and the corresponding radiological restrictions. The implementation of the RWP program was adequate.

d. Release of Equipment for Unrestricted Use

License Condition 25 establishes the requirements for the release of equipment from the site for unrestricted use. During 1997 some equipment was released for both restricted and unrestricted use, and nothing was identified with radioactive material that exceeded NRC's release limits.

e. Employee Training

The inspector reviewed the licensee's training program to determine if it met the requirements of 10 CFR 19.12 which requires that workers be provided radiation safety training. This training was required prior to beginning work at the site and annually thereafter. New employee training was provided to all new site workers in 1997, and refresher training was provided to all other site employees. All workers successfully completed written radiation safety training tests. The inspector also determined that the licensee's training met the requirements of the license and 10 CFR 19.12.

f. Equipment Calibrations

License Condition 20 requires, in part, that calibration of equipment be documented. The inspector reviewed the licensee's instrument calibration records. Equipment being calibrated by the licensee included a variety of air samplers and radiological survey instruments. The licensee had documented that all equipment had been properly calibrated at the respective frequencies and prior to use, if the calibration had expired.

3.3 Conclusions

The licensee had implemented a radiation protection program that met the requirements established in 10 CFR Part 20 and the conditions of the license. Records from the licensee's personnel monitoring program confirmed that occupational exposures were well below 10 percent of the 10 CFR Part 20 limits.

4 Radioactive Waste Management (88035) Environmental Monitoring (88045)

4.1 Scope

The inspector reviewed the licensee's environmental monitoring program to determine compliance with applicable regulations and requirements specified in the license. This portion of inspection included review of the implementation of the radiological environmental monitoring, groundwater corrective action, and radioactive waste management programs.

4.2 Observations and Findings

a. Radioactive Waste Management

License Condition 21 requires that daily inspections of the tailings piles be performed on regularly scheduled work days. Based on interviews of the staff and reviews of records, the inspector determined that daily inspections were being performed and documented.

b. Semiannual Effluent Report and Environmental Monitoring

License Condition 19 requires the licensee to submit the results of environmental and effluent samples to the NRC on a semiannual basis. Additional environmental monitoring requirements are identified in License Condition 34. The inspector reviewed the semiannual reports for the second half of 1996 and the first half of 1997, which were submitted to the NRC on February 28, 1997, and August 25, 1997. The licensee's environmental monitoring program included sampling of airborne particulate, radon gas, direct radiation, groundwater, surface water, soil, and vegetation. The licensee had obtained the required number of samples at the specified intervals. The licensee had reported the sample results to the NRC in a timely manner.

Five sample locations were used by the licensee, including one station located near a public residence and one background control location. Each sample location included an air particulate monitor, a radon gas canister, and a TLD. Air particulate samples were analyzed quarterly for natural uranium, thorium-230, radium-226, and lead-210. The inspector observed an operational sample location during the site tour.

Air particulate results in both semiannual reports indicated that the radionuclide concentrations were less than the effluent concentration limits (ECLs) established in 10 CFR Part 20, Appendix B. Thorium-230 air monitoring results for the first half of 1997 were found to be 67 percent of the 10 CFR Part 20 ECL on the north side of the site. According to the licensee, they were continuing to investigate this matter with their contract laboratory. However, the results were comparable with previous sample results.

Radon gas measurements were taken at 40 locations using the track-etch method. The sample canisters were changed out quarterly and analyzed for radon-222. Radon-222 gas concentrations onsite and offsite (background locations) were found to be above the 10 CFR Part 20 ECL, generally. The highest concentration of radon was located in the northeastern section of the site which was consistent with previous semiannual reports. The inspector determined that radon concentrations in the latest semiannual reports showed no increasing trend when compared to previous reports.

TLDs were used to measure the ambient gamma radiation levels at five sample locations. During the two semiannual report periods, the highest measurement, 92 millirems, was located at an onsite location near the Puertocito Creek. This ambient gamma radiation level at the onsite location was 55 millirems above the background location and the location nearest to a public residence for the same periods. The inspector determined that potential exposure to any member of the public from licensed material appeared to be below the annual 10 CFR Part 20 limit of 100 millirems.

Surface water samples were collected at offsite locations and were analyzed for dissolved and suspended natural uranium and radium-226 concentrations. The sample results indicated that the natural uranium concentrations along the Puertocito Creek were usually in excess of the 10 CFR Part 20 ECLs. However, it was determined that the radioactivity was naturally occurring and not licensed material.

Soil and sediment sampling were required on an annual basis. Soil samples were taken at the five sample stations, and sediment samples were taken at various creek locations. The samples were analyzed for natural uranium, radium-226, thorium-230, and lead-210. In 1997, the highest radioactivity concentration measured was 200 picocuries per gram (pCi/g) of thorium-230 in sediment along the Puertocito Creek. In comparison to the three previous years (700 pCi/g), the 1997 sediment results indicated a possible downward trend.

Vegetation samples were required to be taken twice a year near the five sample stations. The samples were analyzed for natural uranium, thorium-230, radium-226, lead-210 and polonium-210. No limits for vegetative samples are incorporated in the license, although the inspector did not identify any trends in the vegetation results.

c. Groundwater Compliance Monitoring Program

License Condition 34 requires the licensee to implement a groundwater Corrective Action Plan (CAP) and to annually submit a report on the CAP progress. Quivira submitted the annual CAP report on July 30, 1997, which covered the period from July 1996 through June 1997. The inspector toured some of the CAP groundwater compliance monitoring wells and reviewed the results of the licensee's groundwater remediation efforts. The report adequately provided information related to the site's progress towards meeting the groundwater protection standards.

The licensee showed the inspector trending data and charts that indicated the progress in groundwater remediation. For example, the amount of contaminated groundwater removed from most of the alluviums continued to decrease. During this reporting period, the total amount of uranium removed from these alluviums also decreased beyond the consideration that the volume of groundwater processed decreased. Only the interceptor trench alluvial unit had a substantial increase in volume of removed. However, the total amount of uranium removed during this reporting period decreased for the ninth consecutive year. The inspector attributed the volumetric increase to the mine water cleanup operations.

Groundwater sample results for the second half of 1996 and first half of 1997 were submitted to the NRC in the semiannual environmental monitoring reports dated February 28, 1997, and August 25, 1997. Groundwater sample results from selected wells indicated that the natural uranium, lead, thorium, radium, and gross alpha radioactivity remained above the limits specified in 10 CFR Part 40, Appendix A, and the license during 1997. The inspector concluded that the licensee was in compliance with License Condition 34.

d. Annual Land Use Survey

License Condition 39 requires that a land use survey be performed annually. An annual land use survey report was submitted to the NRC on June 17, 1997. The licensee's report did not identify any significant changes that had occurred for uses of residential and nonresidential properties, grazing lands, and water supplies.

4.3 Conclusions

A review of the annual land use survey, groundwater, and environmental monitoring programs indicated that the licensee was in compliance with license and regulatory requirements. All reports related to the groundwater and environmental monitoring

programs had been submitted to the NRC as required, and releases of licensed materials to the environment during 1997 were within regulatory limits.

6 Exit Meeting Summary

An exit meeting was conducted onsite on January 16, 1998. During this meeting, the inspectors reviewed the scope findings of the inspection. On February 3, 1998, discussions were held regarding mine water cleanup and uranium recovery operations. The licensee did not identify as proprietary any information provided to or reviewed by the inspector.

ATTACHMENT

SUPPLEMENTAL INSPECTION INFORMATION

PARTIAL LIST OF PERSONS CONTACTED

Licensee

T. Fletcher, General Manager
P. Goranson, Manager Radiation Safety, Regulatory Compliance & Licensing
P. Luthiger, Supervisor, Radiation Safety and Environmental Affairs

INSPECTION PROCEDURES USED

IP 83822	Radiation Protection
IP 87654	Decommissioning Inspection Procedure for Uranium Mill Sites
IP 88005	Management Controls and Controls
IP 88035	Radioactive Waste Management
IP 88045	Environmental Protection

ITEMS OPENED, CLOSED AND DISCUSSED

Opened

None

Closed

None

Discussed

None

LIST OF ACRONYMS USED

ALARA	as low as is reasonably achievable
CAP	Corrective Action Program
DOE	Department of Energy
ECLs	effluent concentration limits
gpm	gallons per minute
µg/l	micrograms per liter
µR/hr	microRoentgens per hour
NMSS	Office of Nuclear Material Safety and Safeguards
pCi/g	picocuries per gram
RSO	radiation safety officer
TLD	thermoluminescent dosimeter