



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION IV  
611 RYAN PLAZA DRIVE, SUITE 400  
ARLINGTON, TEXAS 76011-4005**

January 20, 2004

Orval and Antonia Baird  
P.O. Box 87  
Tendoy, Idaho 83468

**SUBJECT: RADIOLOGICAL SURVEY OF FORMER SALMON RIVER URANIUM  
DEVELOPMENT MILL SITE**

Dear Mr. and Ms. Baird:

On May 22, 2001, the U.S. Nuclear Regulatory Commission (NRC) visited your property in Salmon, Idaho. The NRC previously licensed this site as the Salmon River Uranium Development, Inc (SRUD). During the visit, the NRC conducted a radiological scoping survey. The scoping survey provided a preliminary assessment of site conditions which revealed that residual radioactive material is still present at the site.

As a result of the May 22, 2001, radiological scoping survey, the NRC determined that a detailed site scoping survey was warranted to more precisely define the extent and magnitude of the radioactive contamination remaining at the site. As discussed in our July 29, 2003, letter to you, the NRC conducted a site visit from October 6-8, 2003, and during that visit, conducted an expanded survey with the assistance of representatives from the Oak Ridge Institute for Science and Education (ORISE). Following the completion of the onsite visit, the State of Idaho collected a water sample from the stored jugs of processed thorium which are currently located offsite in your root cellar. Enclosure 1 provides NRC's summary of the visit and an analysis of the survey. Enclosure 2 is a copy of ORISE's radiological scoping survey report based on their work at the SRUD site in October 2003. Enclosure 3 is a copy of water sample results obtained from the State of Idaho.

In summary, the expanded scoping survey determined that fixed radioactive contamination is present in two site structures; loose contaminated soil is present in two structures; and, the soils around the mill site are contaminated with processed source material, byproduct material, and natural ores. Localized contamination was also identified on the access road and in the former tailings pond. The site may also contain mixed wastes, i.e., a combination of dried sulfuric acid and radioactive material. Finally, a sample of the processed liquid thorium product indicated that the jugs contain small quantities of radioactive material.

The results of the October 2003 scoping survey confirm NRC's assumption, as stated in our April 4, 2002 letter to you, that the SRUD site would probably require remediation in order to comply with the decommissioning requirements in Subpart E of 10 CFR Part 20 for unrestricted release. However, a more thorough analysis will need to be performed to determine the extent of the remediation that may be required. This remediation includes the jugs of processed thorium material which must be appropriately disposed of as radioactive material only after express NRC approval to do so.

The NRC will continue to work with you to ensure timely and effective remediation of the SRUD site. The NRC project manager for this site, Eric Pogue at (301) 415-6064, will be in contact with you in the near future to discuss the next steps to be taken in this regard. In the meantime, please note that the materials discussed in the attached reports, including the jugs of processed thorium, are radiologically contaminated and are subject to NRC jurisdiction. These materials could pose a health and safety risk to individuals and the environment; therefore, these materials shall not be disturbed, nor, shall they be disposed of, prior to your receiving written approval from the NRC.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and your response (if any) will be made available electronically for public inspection in the NRC's Public Document Room (PDR) 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 any questions concerning this letter, please contact Mr. Robert Evans, Senior Health Physicist, at (817) 860-8234 or myself, at (817) 860-8191.

Sincerely,

*/RA/*

D. Blair Spitzberg, Ph.D., Chief  
Fuel Cycle & Decommissioning Branch

Docket No.: 040-03400  
License No.: R-00230 (expired)  
P-04001 (expired)

Enclosures:

1. NRC Site Summary Report No. 040-03400/2003-01
2. Radiological Scoping Survey of the Salmon River Uranium Development, Inc. Processing Mill, North Fork, Idaho
3. Water Sample Results from Paragon Analytics, Inc.

Orval and Antonia Baird

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cc w/enclosures:

Mr. Ray Henderson  
Minerals Program Manager  
U.S. Forest Service  
50 Highway 93 South  
Salmon, ID 83467

Mr. Timothy J. Vitkus  
Survey Projects Manager  
Environmental Survey and  
Site Assessment Program  
Oak Ridge Institute for Science  
and Education  
P.O. Box 117  
Oak Ridge, TN 37831-0117

Idaho Radiation Control Program Director



**ENCLOSURE 1**

U.S. NUCLEAR REGULATORY COMMISSION  
REGION IV

Docket No. 040-03400

License No. R-00230 (Expired), P-04001 (Expired)

Report No. 040-03400/2003-01

Licensee: Salmon River Uranium Development, Inc.

Facility: Salmon River Uranium Mill

Location: 5 Miles West of North Fork, Idaho

Dates: October 6-8, 2003

Inspector: Robert Evans, P.E., C.H.P., Senior Health Physicist  
Fuel Cycle and Decommissioning Branch

Accompanied By: Timothy J. Vitkus, Survey Projects Manager  
Environmental Survey and Site Assessment Program  
Oak Ridge Institute for Science and Education

Teresa L. Brown, Health Physics Technician  
Environmental Survey and Site Assessment Program  
Oak Ridge Institute for Science and Education

J. Ray Morton, Health Physics Technician  
Environmental Survey and Site Assessment Program  
Oak Ridge Institute for Science and Education

Approved By: D. Blair Spitzberg, Ph.D., Chief  
Fuel Cycle and Decommissioning Branch

Attachments: Supplemental Information  
Photographs Taken at Former Salmon River Uranium Mill Site

## **EXECUTIVE SUMMARY**

Former Salmon River Uranium Development Mill  
NRC Site Summary Report 040-03400/2003-01

This purpose of the site visit was to conduct an expanded scoping survey of the former Salmon River Uranium Development (SRUD) mill site.

### **Decommissioning Inspection Procedure for Materials Licensees**

- An expanded scoping survey was conducted at the former SRUD site. The radiological sample results and field observations indicate that the mill site contained a mixture of unrefined and unprocessed ore, processed ore, and byproduct material. Fixed contamination was identified in two buildings, and loose material was identified on floors. Contamination was identified in a number of outdoor soil samples. Localized contamination was identified in areas outside of the mill, including the access road and the tailings pond (Section 1.2).
- A limited dose assessment indicated that the site contamination exceeds the NRC's radiological criteria for license termination and will likely require remediation (Section 1.2).
- One area of the site may contain mixed wastes. A berm, constructed around two former sulfuric acid storage tanks, appeared to contain a mixture of dried sulfuric acid and radioactive material (Section 1.2).
- The property owners had jugs of processed liquid thorium product stored in a root cellar. A sample of the material indicated elevated concentrations of radioactive material. The quantities of radioactive material in the jugs were determined to not be significant health and safety hazards; however, the material will need to be disposed of as radioactive material, following express NRC approval (Section 1.2).

## Report Details

### **Summary of Facility Status**

The U.S. Atomic Energy Commission (AEC) issued Source Material License P-04001 to SRUD on October 10, 1958. This license allowed the company to transfer and deliver possession of and title to raw source material. The AEC issued a second license, Source Material License R-00230, to SRUD on March 30, 1959. This license allowed SRUD to process source material. This second license was valid for only three months to give the licensee time to respond to the AEC's request for additional information. The licensee failed to respond to the AEC's request, and Source Material License R-00230 expired on June 30, 1959, without being renewed. Source Material License P-04001 subsequently expired on October 31, 1959.

On May 22, 2001, the NRC visited the former SRUD site. This site visit was documented in the July 3, 2001, letter to you from Dwight Chamberlain of the U.S. Nuclear Regulatory Commission (NRC). Soil samples were collected during the 2001 site visit. Based on these analytical results and field observations, NRC staff believed that the site contained a mixture of processed source material, tailings material, and natural ore.

During October 2003, the NRC conducted a second site visit. The purpose of the second visit was to conduct additional radiological sampling to further quantify the amount of radioactive material that was present at the site. During the site visit, the property owners were interviewed about the mill's operating history.

According to the property owners, operations using source material occurred during two distinct eras, the late 1950's and the late 1970's. During the late 1950's, a portable ball mill or a portable crusher was used to crush the ore. The crushed ore slurry was dewatered using a drying filter. The product was then stored in cloth sacks behind the plant. The ore processing did not include use of the permanently installed ball mill or rod mill because the amount of ore processed per batch was less than the minimum required capacity of the ball and rod mills.

The property owners estimated that original milling operations produced about 2000 pounds of product. At the time of this site visit, the amount of remaining material was estimated to be about 1000 pounds. According to the property owners, some of the original product was used offsite during the late-1960's and early-1970's by site workers as a substitute for sand for road and vehicle traction during wintertime. NRC has determined that it will not pursue the material that left the site in the late-1960's and early-1970's, as it represents a very minimal risk and would be difficult if not impossible to locate.

During the 1960's, the mill was supposedly used to process gold ore. Gold ore processing included the use of the original ball mill, rod mill, and float tanks/tables. Arsenic was apparently used in the process circuit.

As noted in the docket file, during 1967, the AEC considered enforcement action against Minerals Refining Company (the owner at that time) for possession of source material without a valid AEC license. There was no documentation in the docket file indicating what, if any, action had been taken by the AEC. The NRC inspector was unable to confirm through documentation

reviews and interviews if source material processing occurred during the 1960's or early 1970's; although, based on a description of mill history by the property owners, 1000-2000 pounds of processed source material was present at the site during this time frame.

During 1978-1979, source material was processed a second time at the mill. The material was processed in batch modes using pilot plant equipment. A jaw crusher was used to crush the ore into smaller rocks. The crushed rocks were then fed into a portable ball mill. A screen was used to filter out the ore fines. The pea rock material was then transferred into a water tank. The output from this tank was transferred into the leach tank where sulfuric acid and steam were added to the solution. Steam was added to raise the temperature of the solution to promote a chemical reaction. The process required equal amounts of water, pea rock material, and sulfuric acid. A vacuum separator was then used to separate the solid waste material from the source material that was in liquid solution. The source material solution was transferred into the heavy water storage tank, while the waste material was disposed just outside the mill. The processed source material product was stored in plastic jugs. The property owners estimated that less than 50 gallons of product was produced during the late-1970's.

The property owners stated that the first batch of ore processed in 1978 was a truckload of uranium ore obtained from a source in Wyoming. The uranium byproduct material was apparently stored onsite in a barrel for a period of time. The byproduct material was dumped onto the ground adjacent to the mill during the early 1990's when the barrel was stolen. The property owners stated that the remainder of the material processed through the pilot plant was thorium ore.

At the time of the October 2003 site visit, the mill was a series of dilapidated structures that consisted of one main processing building, several attached and unattached storage sheds and trailers, two above-ground storage tanks, an ore inlet chute structure, and a dry tailings pond. Abandoned mill components were located inside and outside of the buildings. The remaining mill components included several storage and processing tanks, two boilers/dryers (one located inside and one outside the main building), and an ore hopper. Missing equipment included the original ball mill, rod mill, and float tanks/tables. These components were apparently never used to process source material at any time and were recently transferred to an individual in Montana.

The inspector observed several piles of material on the site property. The property owners provided an assessment and origin of each pile of material:

- The first pile located south/west of the main processing building consisted of miscellaneous trash, dirt, crushed ore, and byproduct material.
- The second pile west of the main processing building consisted of several truckloads of unprocessed ore.
- The third pile west of the main processing building was a small pile of unprocessed ore in the form of rocks.
- Several ore piles were located on the bluff above the plant and near the entrance to the ore shoot. This material was unprocessed ore and rocks from local mines.

With regard to site security, the inspector noted that the mill access road was controlled by a locked gate; although, the property owner stated that the site was occasionally accessed by trespassers. There were no residences in the immediate vicinity of the mill, as the SRUD property is bounded by property owned by the U.S. Forest Service.

## **1 Decommissioning Inspection Procedure for Materials Licenses (87104)**

### **1.1 Inspection Scope**

The purpose of the inspection was to conduct an expanded scoping survey of the former SRUD mill site.

### **1.2 Observations and Findings**

The NRC conducted a detailed site scoping survey to further quantify the amount of radioactive material on the site property. Representatives from the Oak Ridge Institute for Science and Education (ORISE) conducted the radiological survey on behalf of the NRC. Details of the ORISE survey are provided in Enclosure 2. In summary, the survey identified fixed surface contamination in Building 1 (main mill processing building) and Building 3 (add-on building located north/east of main processing building). Loose residual thorium and uranium contamination was found on the floors of Building 1 and Building 2 (building located just west/south of main processing building). Soils outside the buildings were contaminated with varying amounts of thorium, uranium, and progeny products. Localized contamination was identified in the perimeter areas including the access road and tailings pond.

Following the site visit, the NRC inspector conducted a limited dose assessment using computer modeling. The assessment was conducted to evaluate whether the site met the decommissioning requirements specified in 10 CFR Part 20, Subpart E, "Radiological Criteria for License Termination." In particular, the assessment attempted to determine whether the site, in its current condition, met or exceeded the 25-millirem radiological criteria for unrestricted use. The inspector used version 6.21 of the computer model RESRAD with most pathways suppressed and using default parameters. Using the average of 42 soil sample results with background values subtracted, the assessment demonstrated that the radiological criteria (25-millirems) would be exceeded. This limited assessment suggested that the site will likely require remediation to meet the radiological criteria.

One portion of the site may contain mixed wastes, a combination of non-radiological hazardous wastes and radioactive wastes. A berm was constructed around the former sulfuric acid storage tanks. The storage tanks had holes in them which allowed the sulfuric acid to drain from the tanks. The berm appeared to consist of dirt, crushed ore, and byproduct material. In selected locations, the berm material also contained a white, crusty material that appeared to be dried sulfuric acid that had leached from the storage tanks. Depending on the concentrations of the radioactive material and sulfuric acid in the soil, the berm material may have to be disposed as radioactive mixed waste.

During the site visit, the property owners were storing five jugs of liquid thorium material in a locked root cellar near Baker, Idaho. The inspector conducted radiological surveys of these jugs. The jugs consisted of recycled 5-gallon sulfuric acid containers. Liquid thorium product was apparently placed into these jugs during the 1978-1979 time frame. The owner transferred the jugs from the mill to the root cellar during the late 1990's, in part, to protect the material from vandalism. The jugs were not labeled as radioactive material.

The NRC inspector selected the jug that contained the most residual material for radiological surveying. The jug was surveyed with a microRoentgen meter and a count rate meter. With a background of 10-15 microRoentgens per hour ( $\mu\text{R/hr}$ ), the sides of the jug measured 30-35  $\mu\text{R/hr}$  while the bottom of the jug (where the residuals were located) measured 60  $\mu\text{R/hr}$ . Using a count rate meter with a background of 80-90 counts per minute (cpm), the jug measured up to 800 cpm on contact with the bottom of the jug.

After the conclusion of the onsite visit, representatives from the Idaho Department of Environmental Quality collected a sample of the liquid thorium product. Results of the sample are provided in Enclosure 3. Provided below are the laboratory sample results and an estimate of the total amount of radioactive material in the possession of the property owners:

Radionuclide	Laboratory Sample Result	Converted Sample Result	Annual Eff. Conc. Limit	Est. Total Quantity	Part 20 App. C
Thorium	110,000 $\mu\text{g/l}$	2.42 E-5 $\mu\text{Ci/ml}$	3 E-8 $\mu\text{Ci/ml}$	2.2 $\mu\text{Ci}$	100 $\mu\text{Ci}$
Radium-228	8200 $\pm$ 2400 $\text{pCi/l}$	8.20 E-6 $\mu\text{Ci/ml}$	6 E-8 $\mu\text{Ci/ml}$	0.74 $\mu\text{Ci}$	0.1 $\mu\text{Ci}$
Uranium	2,000 $\mu\text{g/l}$	3.40 E-6 $\mu\text{Ci/ml}$	3 E-7 $\mu\text{Ci/ml}$	0.31 $\mu\text{Ci}$	100 $\mu\text{Ci}$
Radium-226	240 $\pm$ 59 $\text{pCi/l}$	2.40 E-7 $\mu\text{Ci/ml}$	6 E-8 $\mu\text{Ci/ml}$	0.02 $\mu\text{Ci}$	0.1 $\mu\text{Ci}$

The converted sample results are the original sample result, in units of micrograms per liter ( $\mu\text{g/l}$ ) or picocuries per liter ( $\text{pCi/l}$ ), as converted to microcuries per milliliter ( $\mu\text{Ci/ml}$ ) for direct comparison to the NRC's annual average effluent concentration limits. The annual effluent concentration limits were obtained from 10 CFR Part 20, Appendix B, Table 2, Column 2, and represent the concentrations that are allowed in liquid effluents being released into the environment. The estimated total quantity of radioactive material was calculated assuming that each of the jugs contained 18 liters of liquid and the contents in all jugs were similar since only one sample was collected. Finally, the quantities of licensed materials requiring labeling (last column of table) was obtained from 10 CFR Part 20, Appendix C, for comparison to the estimated total quantities of radioactive material.

In summary, the estimated total quantities of radioactive material were less than the Appendix C limits except for radium-228, suggesting that the jugs should have been labeled as radioactive material. However, the estimated total quantities of radioactive

material were considered low, suggesting that the quantities were not safety significant. The property owners' storage of unlabeled radioactive material in a root cellar was not a significant radiological health and safety hazard; however, the material will need to be disposed of as radioactive material, following express NRC approval.

The NRC inspector conducted a limited public dose assessment to ensure that the estimated doses resulting from the property owner's possession of processed source material would remain below 10 CFR 20.1301(a)(1) requirements. This regulation stipulates an annual dose limit of 100 millirems per year for the radiation dose received by any member of the public. The inspector used the guidance provided in Appendix O, Public Dose, from NUREG-1556, Volume 7, "Consolidated Guidance About Materials Licensees: Program Specific Guidance About Academic, Research and Development, and Other Licenses of Limited Scope." Assuming a constant 0.06 millirems per hour dose rate (same dose rate as 60  $\mu$ R/hr), an occupancy factor of one-sixteenth for outside areas, and the maximum time of 8760 hours per year, the annual dose to any member of the public was conservatively calculated to be 33 millirems per year. Therefore, the property owners' storage of processed thorium in the root cellar was determined to not be a significant health and safety hazard from external doses.

### 1.3 Conclusions

An expanded scoping survey was conducted at the former SRUD site. The radiological sample results and field observations indicate that the mill site contained a mixture of unrefined and unprocessed ore, processed ore, and byproduct material. Fixed contamination was identified in two buildings, and loose material was identified on floors. Contamination was identified in a number of outdoor soil samples. Localized contamination was identified in areas outside of the mill, including the access road and the tailings pond. A limited dose assessment indicated that the site contamination exceeds the radiological criteria for license termination and will likely require remediation. One area of the site may contain mixed wastes. A berm, constructed around two former sulfuric acid storage tanks, appeared to contain a mixture of dried sulfuric acid and radioactive material. The property owners had jugs of processed liquid thorium product stored in a root cellar. A sample of the material indicated elevated concentrations of radioactive material. The quantities of radioactive material in the jugs were determined to not be significant health and safety hazards; however, the material will need to be disposed of as radioactive material, following express NRC approval.

## **2 Exit Meeting Summary**

The inspection results were presented to the property owners at the conclusion of the onsite inspection on October 8, 2003. The property owners acknowledged the findings as presented. The owners did not identify any information reviewed by the NRC inspector as being proprietary information.

## ATTACHMENT 1

### SUPPLEMENTAL INFORMATION

#### PARTIAL LIST OF PERSONS CONTACTED

##### Salmon River Uranium Development Site Representatives

A. Baird, Property Owner  
O. Baird, Property Owner  
M. Barrett, Colleague of Property Owners

##### State of Idaho

D. Walker, Senior Health Physicist, INEEL Oversight Program  
D. Fredericks, Environmental Scientist, Idaho Department of Environmental Quality

#### ITEMS OPENED, CLOSED AND DISCUSSED

##### Opened

None.

##### Closed

None.

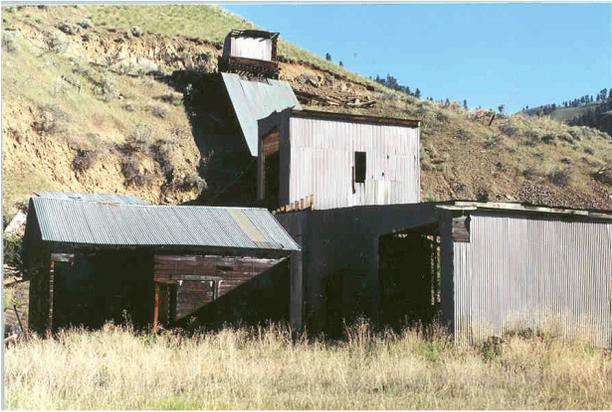
##### Discussed

None.

#### LIST OF ACRONYMS USED

AEC	U.S. Atomic Energy Commission
CFR	Code of Federal Regulations
cpm	counts per minute
µg/l	micrograms per liter
µR/hr	microRoentgens per hour
NRC	U.S. Nuclear Regulatory Commission
ORISE	Oak Ridge Institute for Science and Education
pCi/g	picocuries per gram
pCi/l	picocuries per liter
SRUD	Salmon River Uranium Development, Inc.

**ATTACHMENT 2**



Former Salmon River Uranium Develop. Mill



Former SRUD Mill, Side View



Former Tailings Pond



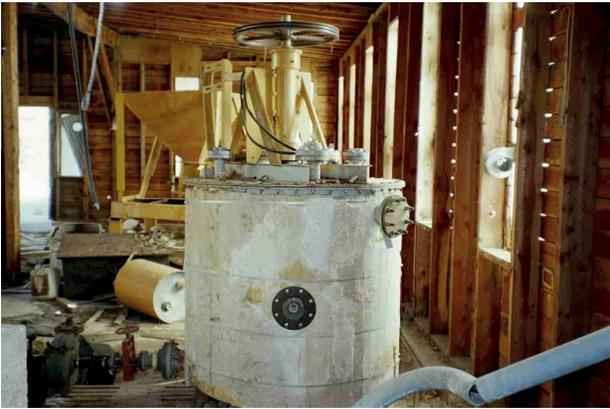
Former Jaw Crusher Building



Trailer with Source Material Dumped in Front



Representative Jug of Liquid Thorium Product



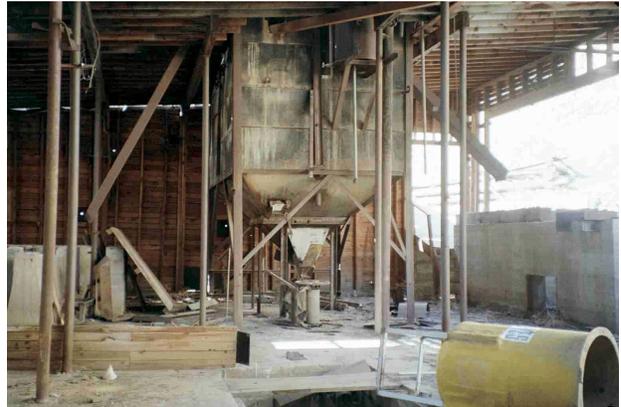
Leach Tank



Process Tank



Portable Ore Crusher



Ore Hopper



Scan Sampling



Soil Sampling