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January 14, 1991

Jack Hornor
U.S. Nuclear Regulatory Commission
Region V
1450 Maria Lane, Suite 210
Walnut Creek, California 94596

Dear ~~Mr. Hornor~~ JACK:

This letter is written to summarize the closure, decontamination and reclamation activities conducted by the Washington State Department of Health for the Joy Mining Company experimental uranium extraction facility located in Stevens County, Washington. The closure of this facility is unique when compared to conventional uranium mills in, that bog residue material from the experimental extraction process was returned to the Flodelle Creek bog area; buildings and equipment were not disposed of onsite; sludge material from the chemical solution impoundment area was transferred to an approved low-level waste disposal site; the synthetic liner and pad for the chemical solution retention impoundment were decontaminated and salvaged or transferred offsite for disposal at an approved waste site; the uranium-bearing bog material is a young deposit and is absent of equilibrium quantities of daughter products; and the Washington State Department of Natural Resources is requesting authorization to maintain ownership of the site. The Department of Health feels the closure plan followed at the Joy Mining Company adequately protects human health and the environment and minimizes the need for future maintenance, and requests that the U.S. Nuclear Regulatory Commission concur in order that the Joy Mining Company radioactive materials license WN-I0220-1 may be terminated, and ownership revert back to the Washington State Department of Natural Resources. The following justification for the state's unique approach in the closure of the Joy uranium millsite is provided to assist the NRC in its determination that all applicable standards and requirements have been met in accordance with 10 CFR Part 150.15a:

1. The closure plan followed by the Department of Health was in accordance with criteria specified in the Final Environmental Impact Statement for the Joy Mining Company uranium mine/mill, issued in 1983.

2. The residue from the Joy extraction process is essentially the same, as far as radioactivity is concerned, as the surrounding surface soils found in the bog. In fact, the Joy extraction process removed a small percentage of the radioactivity from the bog material. Therefore, the return of residue bog material to the Flodelle bog was considered appropriate and in compliance with 10 CFR Part 40, Criterion 6 requirements for surface cover materials.

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3. The concentration of radium in the processed bog material (byproduct material) in no case exceeds background. Therefore, the exemption from design requirements for longevity and radon found in Criterion 6 apply.

4. Due to the unique nature of uranium bog deposits used as process material at the Joy Mining Company, certain radionuclides and release models which are of concern at conventional uranium mills, are not applicable at Joy Mining Company. For example, the Flodelle Creek uranium bog material contains only young post-glacieral uranium deposits which have not had the time for decay products to ingrow to any substantial degree. Laboratory analysis indicates that these deposits have approximately a 5% ingrowth of daughter products. Radium 226 concentrations in the bog material range from 10-12 pCi/gram, whereas Radium 226 concentrations in conventional hardrock uranium deposits generally contain several hundred pCi/gram.

5. Spectrographic chemical analysis of samples of ore and tailings residue show no qualitative difference. The tailings residue contains approximately a 1% increase in ferric and sulfate ions. These ions are found naturally in the Flodelle Creek area, and a 1% increase in ferric sulfate does not present an adverse impact to the Flodelle Creek environment.

6. All waste waters and liquids used in the milling process were either recycled or discharged to the lined chemical impoundment, and no liquids were allowed to be discharged to the surface or groundwaters during or after the operational phase of the site.

7. Although the milling process was designed to increase the solubility of radionuclides, this action was mitigated by returning the material back to the bog. In addition, the excess sulfate anions in the material will complex with any remaining soluble radium to produce very insoluble $RaSO_4$. This complexing action, coupled with the natural acidity of the bog, lowers the solubility of the radium further. It is our conclusion that the natural slight acidity of the bog prevents the radium from solubilizing and migrating into the ground of the surface waters.

8. Processed and unprocessed bog material was returned to the mined out areas of the Flodelle bog, leveled to contours similar to the original meadow, reseeded, and reclaimed in accordance with the Department of Natural Resources reclamation plan and the Final Environmental Impact Statement issued in 1983.

9. Direct gamma exposure measurements were taken in the bog area following the return of processed material. These measurements indicate that gamma exposure measurements in the fill areas was no greater than the background measurements taken in the surrounding areas.

10. The conventional method of tailings disposal is placement below grade in a lined pit with enough cover or overburden to reduce radon emanation rates to levels less than or equal to 20 pCi/meter^2/second, and gamma exposure rates to no more than background. The tailings at the Flodelle Creek project do not contain conventional quantities of radium, and consequently do not emit radon in excess of twice background values.

11. Three standards for Radium 226 were evaluated for their applicability in determining whether the processed bog material could safely be returned to the Flodelle bog. They include:

    A. The U.S. Environmental Protection Agency standards for cleanup of inactive uranium mill tailings; 5 pCi/gram averaged over the top 15 centimeters of surface material, and 15 pCi/gram averaged over any 15 centimeters subsurface.

    B. The National Radiological Protection Board (NRPB) of the U.S. Environmental Protection Agency recommended the unrestricted use of phosphogypsum in construction materials, provided sources of the raw material do not give rise to concentrations of radium in the finished product in excess of 25 pCi/gram.

    C. 10 CFR Part 40 states "Direct gamma exposure from the tailings should be reduced to background levels." This regulation does not conflict with the return of processed bog material to the Flodelle Creek bog. The 6 pCi/gram average radium concentration of processed bog material which was returned to the Flodelle Creek bog does not present a public health threat to the population downstream.

12. During the reclamation phase of the Joy millsite, all buildings, equipment, and solution retention pond liners and sludge were removed for salvage or disposal offsite (rather than being disposed onsite).

13. Normal contamination problems associated with conventional mills did not occur at the Joy millsite because the uranium bog material did not require grinding or crushing, and yellowcake drying was not implemented.

14. The mill circuit utilized ferric sulfate leach rather than acid leach.

15. During operational and closure phases at the millsite, no seepage leaks were detected from either the concrete leach tanks or the chemical solution impoundment.

The Department of Health intends to continue conducting annual inspections of the mill and the bog and to collect annual water samples from Junction Station #2 for trend analysis.

The enclosed material is submitted in support of our plan to terminate the Joy Mining Company radioactive materials license. If you have any questions, please feel free to contact me at (206) 753-3459.

Sincerely,

Gary Robertson, Head
Waste Management Section

GR:krf

Enclosures

cc: Ramon E. Hall

JOY MINING COMPANY CLOSURE

History and Reclamation Information

Radioactive Materials License WN-I0220-1 was issued to Joy Mining Company (JMC) on April 26, 1983. Amendment No. 1, dated November 18, 1983, amended the license in its entirety, by adding new operational and environmental conditions. The license authorized the processing of bog material for the purpose of extracting uranium deposited through a natural phenomenon in the organic material.

The Joy mine and millsite are located in a remote mountainous area at an elevation of approximately 3900 feet above sea level, on property owned by the Washington State Department of Natural Resources (DNR). The mill was constructed on a site approximately two acres in size, and 100 yards from the uranium-enriched bog, on the north fork of Flodelle Creek, approximately 20 miles east of Colville, Washington (see Attachment A for location map and licensing history). The mill was nonconventional because the uranium-bearing material contained no significant concentrations of the long-lived or more hazardous radioactive decay products which are normally associated with conventional uranium milling. The material from the bog was soft and sand like, with no grinding or pulverizing required. The JMC mill was the only one of its kind in the United States built to process yellowcake from bog material.

In 1979, the Joy Mining Company applied to the Department of Natural Resources (DNR) for permission to operate the uranium mill on state land. Under the provisions of the State Environmental Policy Act (SEPA) (RCW 43.21C or WAC 197-11), DNR issued for comment (on June 28, 1982) a proposed declaration of environmental non-significance for the Joy Mining Company to produce uranium oxide (yellowcake). The issuance of the negative declaration brought the proposal to the attention of the Division of Radiation Protection, and on July 9, 1982, the department assumed lead agency status per WAC 197-11-948 over the uranium milling project.

The department issued a final Environmental Impact Statement on April 18, 1983, and the radioactive materials license was issued on April 26, 1983. JMC began the construction phase of its operation immediately. Following mill construction, all operation activities were directed towards producing yellowcake on a commercial scale. However, the pilot process perfected in the laboratory did not work efficiently on a commercial scale. JMC produced approximately 500 pounds of ore concentrate before going bankrupt in 1985. The bonding company, Union Indemnity Insurance Company of New York (holding a $93,000 site reclamation bond), went bankrupt before the state could collect on the surety bond.

In 1988, after it became obvious that reclamation money would not be available from JMC or the bonding company, the department made the decision to begin site closure activities. On May 20, 1988, requests for proposals were mailed to companies licensed to conduct decontamination and decommissioning. On July 13, 1988, Allied Nuclear, Inc. (ANI) of Fremont, California, was selected as the successful bidder. Reclamation activities were begun on August 1, 1988, and completed on October 31, 1989.

Because the mill was in operation for less than one year, and yellowcake was not dried onsite, only minor contamination was found. Mill components were either free of contamination or else easily cleaned to releasable limits, and then either sold or salvaged. The mill building was decontaminated, dismantled, and also sold. Process tanks located within the building were transferred to the Dawn Mining Company in Ford, Washington.

All non-contaminated, valueless and flammable material from the mill and mill area was burned. All radioactive wastes were placed in 55-gallon drums and transferred to ANI's Richland, Washington facility for final disposal at a commercial low-level radioactive waste disposal site.

Return of the Ore Material to the Bog

In December of 1986, the Department of Health's Environmental Radiation Laboratory analyzed and compared partially processed bog material with unprocessed bog material, to determine if it could be safely returned to the bog. The processed and unprocessed samples, analyzed for chemical and radiological content, showed no measurable differences; based on this analysis, the department determined that the partially processed bog material could be safely returned to the bog (see Attachment B). In August of 1988, the raw and partially processed bog material was returned to the bog. The bog was contoured to its natural condition, and a flow direction gate was constructed at the head of the bog, thus allowing water from Flodelle Creek to flow over and through the bog as it had done before JMC diverted the main channel to the western edge of the bog.

Spray Evaporation

Liquids in the solution retention pond were removed by spray evaporation. To enhance evaporation, an amphitheater-style solar evaporation system was fabricated from black plastic and materials from the disassembled leach pit building (see Attachment C for details). A sprinkler system was installed, which was constantly monitored and adjusted to prevent mist from drifting out of the confines of the evaporation enclosure. The department required trained ANI personnel to be onsite at all times during the spray evaporation operation. The department performed unannounced inspections at approximately two-week intervals during the entire reclamation phase.

Environmental Soil Samples

Environmental samples were taken upon the completion of decontamination activities by ANI. Soil samples were taken from the soil-filled solution pond, the road to the bog, and the mill area (less than two acres). The soil sample area was gridded in 30-foot square sections (see Attachment D), with five samples taken from each grid (total of 900 samples). Each set of five samples was composited into one sample, making a total of 180 samples.

A Canberra Model 2001 (MCA) and a liquid nitrogen cooled Ge detector were used to analyze samples for radium 226 levels. Each of the 180 samples were weighed and placed in a lead-shielded counting chamber and received a ten minute count. The analysis showed activity levels of <5 pCi/gm of Ra-226. The count from each composited sample was entered in an appropriate grid, as shown by Attachment D. The five samples from the ore

stockpile area were sent to the State Laboratory for analysis and determination of radium 226 concentrations. Results from the laboratory indicated radium 226 concentrations did not exceed 4.5 pCi/g (see memos in Attachment D).

Radiation Measurements

Micro R measurements were taken in each of the 30-foot square sample areas, at approximately 30 inches above the ground surface, using a Ludlum Model 19 uR meter. These readings are shown in Attachment E and ranged between 26-30 micro-R/hr in the millsite area, 38-48 micro-R/hr in the stockpiled ore area, and 40-58 micro-R/hr in the bog area. Background readings varied between 18-20 micro-R/hr for the millsite. The micro-R readings recorded in Attachment E were taken after the stockpiled bog material was returned to the bog. The micro-R readings recorded are the highest readings recorded in the east/west survey of the grid. It should be noted that returning the stockpiled material to the bog did not result in an increase in radiation levels.

Groundwater

Potential impact on groundwater quality was routinely monitored by the Department of Health at a drinking water well in the Flodelle Creek Campground (see Attachment F), which is approximately 1.5 miles downstream from the JMC millsite. JMC began routine sampling at the campground in 1982, followed by the Department of Health from 1983-1986, and begun again in 1989. A review of this data reveals no impact to groundwater.

An attempt to monitor groundwater seeps down gradient from the mill building accounts for the samples noted as "seep", "seep well", and "Station 5" on Attachment F. Groundwater seeps occur at certain times of the year along the bank below the mill, but seep samples were difficult to obtain, due to the small amount of water available, and the change in seep locations from year to year. In 1982, JMC was ordered by the state to install a groundwater monitoring well to more accurately monitor the seeps. This well was located downgradient from the mill area and was infiltrated by the bog, preventing representative sampling. Seep monitoring was abandoned.

Because there was very little likelihood that extraction solutions would ever affect groundwater quality at the millsite, when considering the uranium levels existing naturally in the creek and bog area, no additional monitoring wells were installed. Other factors supporting this conclusion are the size of the mill, short operational period, and location of the mill.

Surface Water

During the wet seasons, the headwaters of the North Fork of Flodelle Creek form surface water pools and drain slowly southward in small interfingered channels, which in turn give way to a defined channel of about 1 to 2 feet wide and 1 to 2 feet deep. During the dry season, the headwater pools tend to dry up, and the flow in the downstream channel is reduced to a few inches in depth to no flow at all.

During periods of flooding, Flodelle Creek would overflow its narrow, shallow stream bed and spread out over the flat bog area. It was through the many floodings of the bog area with the uranium-enriched sediments scoured from the upstream (headwater) channels and carried by turbulent water that lead to the buildup of minable quantities of uranium in the bog. The bog surface is covered with a thick, tall layer of grass that acts as a filter or trap for the uranium-enriched sediments that wash downstream. Over a period of thousands of years, a significant quantity of uranium was deposited in the bog, layer by layer, to a depth of approximately 16 feet.

The concentrations of uranium in Flodelle Creek vary, according to the seasonal water levels. During the dry season, sampling locations are limited to areas where water is available, which may account for the variations in uranium values.

The uranium values for surface waters, which were obtained during the exploration and preoperational phases, indicate that uranium is in part dissolved in the water, and in part attached to the suspended solids carried by the water.

In May of 1982, the department initiated the sampling of surface water for uranium and radium 226, at the Joy Mining site. Analytical results from the headwaters of Flodelle Creek show that the surface water quality was generally higher in uranium than would normally be expected (see Attachment G). The downstream sampling station is located approximately one mile downhill from the Joy Uranium Mill site at the junction station 2.

Preoperational data collected by JMC has also been included in Attachment G. This data shows a wide fluctuation in uranium and radium concentrations sampled at the headwaters of Flodelle Creek.

Downstream sample data has been collected during all phases of mill activities; a review of this data indicates the surface water quality has not been affected.

Solution Transfer Line

An above-ground, two-inch PVC transfer line was used to move solutions from the mill building to the solution retention pond. The transfer line was installed above ground so that any disconnects or line breakage would be easily detected. Radiation measurements were taken at ground level along the line (approximately 100 feet long) and showed areas of slight contaminated of the soil. All contaminated soil was removed and transferred to ANI as radioactive waste. The transfer line was disassembled and placed in drums and also transferred to ANI as radioactive waste.

Leach Pit Solutions

The uranium milling process at JMC incorporated the use of four concrete leach pits. Pit #1 was located inside the mill building, with pits #2-4 located at the north end of the building. Each pit was lined with a heavy plastic coating material which was impervious to mill leaching solutions. Leach pit solutions were pumped from the pits to the process tanks inside the building for uranium extraction. In 1985, solutions from leach pits 2, 3, and 4 were pumped back into the mill process tanks, leaving only bog material, which was

subsequently removed during decommissioning. After the bog material was removed, an inspection of empty leach pits 2, 3, and 4 was conducted by the department, and no signs of damage to the plastic coating of the pits were observed. Leach pits 2, 3, and 4 were then decontaminated and filled with clean onsite borrow material.

Leach Pit #1

Leach pit #1 contained approximately 10,000 gallons of waste solution which had been drained from the process tanks and transfer lines. During decommissioning, the solution was pumped to the solution retention pond for evaporation. After leach pit #1 was emptied, waste resins, metal containers, timbers, and miscellaneous pieces of scrap were found in the bottom. This material was air dried, packaged into 85 55-gallon drums, and transferred to ANI for disposal as radioactive waste. Leach pit #1 was surveyed, and all areas greater than 1000 cpm were decontaminated, using a scabbling tool, which reduced readings to background. A final closeout survey was conducted of the pit, with the highest non-smearable reading after decontamination being 800 cpm.

After pit #1 was decontaminated to acceptable levels, the opening was filled with clean borrow and capped with approximately eight inches of concrete, bringing the pit to the same level as the building foundation. The concrete building foundation was left in place, as requested by the state Department of Natural Resources (the property owners).

Solution Retention Pond

A solution retention pond was constructed so that waste waters generated during mill operation could be stored, reused, or evaporated. The NPDES permit issued to JMC did not allow discharges of any liquids to the ground or surface waters. During compliance inspections and frequent decommissioning inspections, the department never observed any unauthorized discharges of liquids.

A French drain leak detection system was installed below the solution retention pond. This leak detection system was inspected as a part of the department's routine mill inspections; during the decommissioning phase, the leak detection system was inspected as frequently as five times monthly. The department also required ANI to check the system for leakage (at least weekly during the spray evaporation phase). The department and ANI conducted a final inspection upon completion of solution removal. At no time during decommissioning were liquids detected in the leak detection system.

The amount of liquid in the solution retention pond was determined to be approximately 151,300 gallons. Of this total, 116,502 gallons were original pond liquid, and 34,798 gallons were solution taken from the mill process system.

Sludge collected from the bottom of the pond was surveyed with a TBM-3, with readings ranging from 1000 to 1200 cpm. Sludge material was placed in 55-gallon drums (a total of 31 drums were used) and transferred to the ANI facility in Richland, Washington for final processing and disposal as radioactive waste.

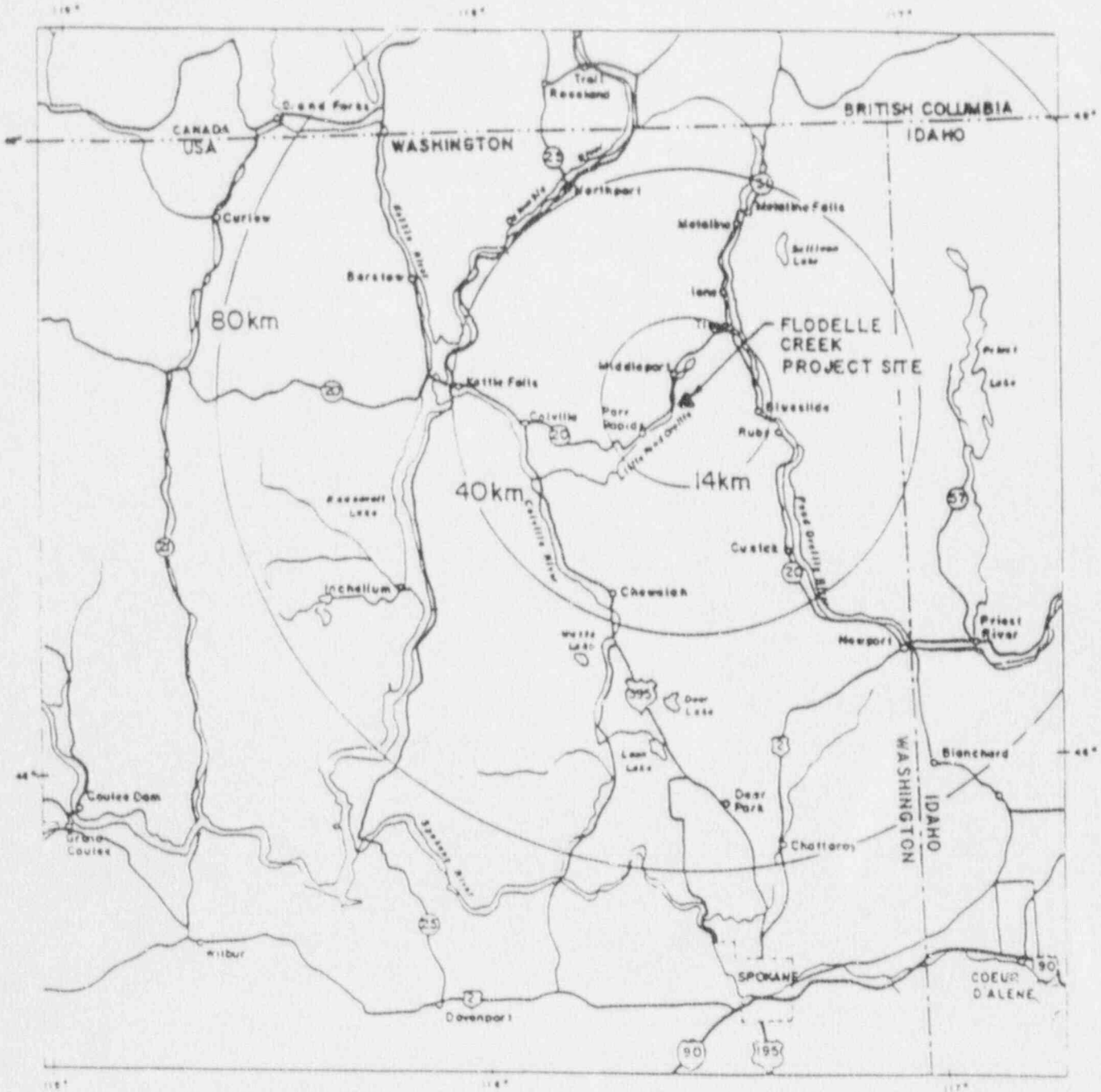
After the pond was empty, the uncontaminated portion of the hypalon liner was burned. The contaminated portion was cut into sections and placed in 55-gallon drums for disposal. The felt-like pad beneath the liner was white and clean, and contamination surveys showed no signs of leakage from the liner or the pond. Only background readings were measured on the white pad, thereby indicating no leakage from the hypalon liner. Before the white pad was removed, one small spot of contamination, reading 250 cpm, was detected on an area that was contaminated during the removal of the hypalon liner. This contaminated area was removed and disposed as contaminated waste. The liner pad was then cut into sections and salvaged.

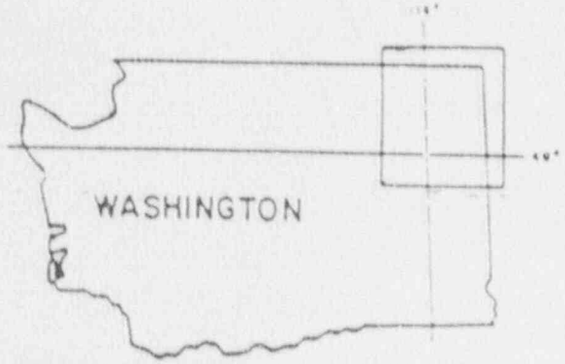
Following removal of the hypalon liner and pad, a complete radiation survey of the pond pit was conducted. The exposed ground area was surveyed with an alpha meter and a TBM-3, with no readings above background detected. ANI filled the pond with only clean onsite borrow while our staff observed the operation. ANI and department staff surveyed the surface of the filled-in pond area, and took soil samples. The surveys showed no readings above background, and the analyzed soil samples showed no radium 226 concentrations in excess of 5 pCi/g.

Future Use of Property

The property belongs to the Washington State Department of Natural Resources, which plans to revert its use back to light grazing and recreation (see attached letters from DOH and DNR).

ATTACHMENT A





INDEX MAP OF WASHINGTON SHOWING
LOCATION OF ENLARGED AREA

REGULATION OF A POST-GLACIAL URANIUM DEPOSIT IN THE STATE OF WASHINGTON

by

Joseph S. Stohr[1] and John L. Erickson[2]

Abstract

The state of Washington, in its role as an agreement state with the United States Regulatory Commission (USNRC), recently issued a radioactive materials license for the extraction of uranium from the ore of a surficial post-glacial deposit. The age of this deposit and differences in environmental chemistry result in low concentrations of uranium daughters. This project extracts uranium that is weakly bound to organic material in an anoxic environment, requiring an alternate extraction technique from that of a conventional mill. The process, being the first of its kind in the United States for the commercial production of yellowcake, has required extensive consideration of the applicability of existing regulations. Exemptions may be requested of the USNRC from specific requirements of the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA), involving the unrestricted use of byproduct material. Included in this paper are brief descriptions of the unique characteristics of this ore deposit, the differences between this type of mill and conventional mills and adaptations made to the existing regulations during the licensing process.

Introduction

The purpose of this paper is not to present an in-depth study of surficial uranium deposits but rather to offer a brief description of a particular and unique project with the regulatory problems associated with its licensing. For a more detailed description of this type of deposit, the reader is referred to the papers listed in Literature Cited.

1. Joseph S. Stohr, Radiation Health Physicist, Department of Social and Health Services, Radiation Control Section, MS/LF-13, Olympia, Washington 98504.

2. John L. Erickson, Radiation Health Physicist, Department of Social and Health Services, Radiation Control Section, MS/B17-9, Seattle, Washington 98104.

At the close of the last ice age, approximately 12,000 years ago, the glaciers that covered much of the northern United States receded, exposing mineralized uranium. This uranium is mobilized via surface and groundwaters and transported downstream. Drainage systems, where water flows into basins or lakes with no defined channels, cause the complexed uranium to be retained in the sediment by processes such as absorption, reduction, and chelation. These conditions have resulted in the gradual accumulation of uranium in the sediments and are called post-glacial uranium deposits (PGUD's).

These types of deposits have been noted throughout North America, including sites in British Columbia, Washington, California and Colorado. PGUD's vary widely in modes of accumulation and appearance but have to date the following similar characteristics.

1. They are surficial occurring at or within the first ten to fifteen feet of the surface.

2. They occur in soils and sediments rather than rock as in conventional deposits.

3. They occur in small hydrologically closed basins or flats where the water passes through the soils and sediment.

4. The uranium is loosely held chemically, giving rise to alternate extraction techniques involving smaller facilities.

5. Finally and perhaps most important since these deposits are less than 12,000 years old, they contain primarily uranium with less than 10 percent ingrowth of daughters. This lack of radioactive daughters permits a different approach to the long term storage of tailings and reduces the environmental impact.

These characteristics result in uranium deposits that appear attractive to the mining industry for reasons including ease of exploration, and low site development and production costs (see Appendix A for comparative analysis of a conventional with a PGUD mill).

Discussion

The deposit is located in a remote area in northeast Washington State. The site is at 3,500 feet elevation on the north fork of the Flodelle Creek drainage. This general area has been extensively mined for numerous minerals and contains two conventional uranium mines. The mine itself consists of an alpine bog of approximately 20 acres, on state owned land. The required conditions mentioned previously exist here, resulting in uranium concentrations of approximately 0.1 percent. In order to drain excess water prior to mining, diversion ditches are utilized around the bog perimeter. In addition, sumps are dug at the foot of the mine area, minimizing impacts to downstream waters.

The ore is removed by the open cut method to a depth of about 15 feet. It is trucked to claylined pads next to the mill located on two acres adjacent to the mine and stockpiled prior to processing. Each fall an attempt will be made to stockpile enough ore to allow processing to continue through the snow covered winter months. The rest of the year, the ore is removed and stockpiled as needed.

The mill circuit utilizes open filter bottom tanks (three outside the mill building and one inside). As mentioned previously, the uranium is loosely held in the ore, allowing the use of a ferric sulfate leach solution rather than the conventional acid leach. The pregnant liquor is stripped of uranium via ion exchange. From this point on in the mill process, standard techniques for concentration and precipitation of the uranium are used. The tailings will be rinsed to reclaim the ferric sulfate, stockpiled for monitoring of radium-226 concentrations and returned to the mined area. (See Appendix B for flow diagram of the milling process.)

The project is expected to last less than five years. As tailings are replaced, the area will be graded and replanted with species tolerant to local conditions. The Radioactive Materials License will remain in effect until the reclamation is completed satisfactorily to the concerned agencies.

State regulatory controls for this project are numerous. Four state and two local agencies require permits or approvals on 13 separate actions with the Department of Social and Health Services (DSHS) as lead agency, responsible for coordination of efforts. A list of these actions includes:

1. A Radioactive Materials License - Washington State Department of Social and Health Services.

2. A Mining Contract - Washington State Department of Natural Resources.

3. A Surface Mining Reclamation Plan - Washington State Department of Natural Resources.

4. A Forest Practices Permit - Washington State Department of Natural Resources.

5. A "Plan of Operation" approval - Washington State Department of Natural Resources.

6. An Appropriation of Surface Water - Washington State Department of Ecology.

7. A National Pollutant Discharge Elimination System Permit - Washington State Department of Ecology.

8. A Notice of Construction Air Quality Permit - Washington State Department of Ecology.

9. A Hydraulics Permit - Washington State Department of Game.

10. A Building Construction Permit - Stevens County Planning and Community Development Committee.

11. A Reclamation Plan approval - Stevens County Planning and Community Development Committee.

12. An On-Site Sewage Permit - Northeast Tri-County Health District.

13. A Waste Disposal Permit - Northeast Tri-County Health District.

All regulatory actions were completed prior to issuance of the Radioactive Materials License, April 27, 1983.

The regulatory emphasis placed on the uranium industry shifted during the 1960s from partial federal protection of uranium producers through fixed ore prices to protection of the public health, safety, and the environment. Prior to that time, virtually no regulatory controls existed for uranium mill tailings on either the federal or state level. According to the USNRC Final Task Force Report on the Agreement State Program, "Protection of public health and safety has traditionally been a function of the states. With the development of a private atomic energy industry, organizations which were subject to the laws of the state in other areas of public health became subject to the laws of the federal government in so far as radiation safety and the use of nuclear materials was concerned, but under the federal law, it was not at all clear what role, if any, was left to the states."

In 1978, Congress responded to the problems associated with inadequate regulatory authority and improperly decommissioned tailings sites. The Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978 was intended to provide a remedial action program for inactive sites and a regulatory program to ensure that no such sites would be generated in the future without adequate control. UMTRCA, however, did not always make a clear distinction between state and federal authority by binding agreement state standards to minimum federal standards for uranium milling and mill tailings management and by involving the USNRC directly in aspects of long term tailings management in agreement states.

Washington State became an agreement state in 1966, and amended the agreement with the USNRC to include UMTRCA requirements in early 1982. The intertwining of federal and state responsibilities and the unique characteristics of this project required extensive evaluation by all agencies as to whose authority regulated individual actions.

Section 83b of UMTRCA, Title II states, "...ownership of any byproduct material (i.e., uranium mill tailings)...which resulted from licensed activity shall be transferred" to the United States or a state upon license termination. However, 83b also states, the ownership by the state or federal government is mandatory "unless the commission determines prior to such termination that transfer of

title...is not necessary or desirable to protect the public health, safety, or welfare." To ensure the protection of public health from hazards of uranium daughters in byproduct material, UMTRCA has established requirements for restricted use of tailings areas. However, if low concentrations of uranium daughters are present, then minimal [illegible]ic hazards exist. With this established, the licensed PGUD in [illegible]ington State can be released for unrestricted use following reclamation. UMTRCA also designates federal authority on the adequacy of financial sureties for uranium mill projects and a concept of national minimum standards for tailings management.

The U.S. Environmental Protection Agency (USEPA) was directed by Congress through UMTRCA to set standards of general application providing protection from the hazards associated with uranium mill tailings. A major part of the standards for active sites includes requirements for control of releases from tailings during processing operations and prior to final disposal.

On October 1, 1983, the USEPA promulgated standards for active sites (40 CFR 192). Neither the uranium industry nor the environmental groups appear to be satisfied as to the appropriateness or adequacy of these standards. Individual evaluations of operating mills by the USNRC will determine how these new standards impact the existing sites and the time frames involved in implementation of the regulations.

The licensee, through the state of Washington, is in the process of applying for exemptions from requirements of UMTRCA. The application will address the following areas of concern:

1. The management and disposal strategies for the byproduct materials.

2. The requirements for unrestricted use of the tailings area after reclamation.

3. The requirements for ground water to be protected from uranium tailings.

4. The disposal of uranium tailings piles to be designed so radon emissions will be limited to 20 picocuries per square meter per second.

5. The disposal of uranium tailings piles to be designed to maintain their integrity for at least 1000 years.

6. The requirements for liners to be used for ground water protection.

The licensee may apply for exemptions to existing regulations through the USNRC with procedures established in 10 CFR 150, "Exemptions and Continued Regulatory Authority in Agreement States and Offshore Waters under Section 274."

In conclusion, the licensee began operations in the summer of 1983 and is presently stockpiling ore for processing through the winter. The authors anticipate that resolution of exemption requests for this project will be a time consuming process. We hope that by the time this paper is presented determinations will be made as to which of the existing requirements are applicable to the present situation.

Acknowledgements

The authors with to express their gratitude to the Radiation Control Section, State of Washington for their expertise and help in preparing for this document, and the licensee for project information.

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3. Public Law 95-604 "Uranium Mill Tailings Radiation Control Act of 1978", November 1978.

4. State of Washington, Department of Social and Health Services, "Final Environmental Impact Statement for the Proposed Joy Mining Company Uranium Mine/Mill", April 1983.

5. U.S. Atomic Energy Commission, DAO-3-TM-40, "Geology of Uraniferous Peat Beds at the Spring Claims, Jackson County, Colorado", February 1957.

6. U.S. Atomic Energy Commission, RME-2063(PT.1), "Geology of the Uraniferous Bog Deposit at Pettit Ranch, Kern County, California", October 1957.

7. U.S. Environmental Protection Agency, EPA 520/1-83-008, "Final Environmental Impact Statement for Standards for the Control of Byproduct Materials from Uranium Ore Processing", (40-CFR-192), October 1983.

8. U.S. Environmental Protection Agency, EPA 5201/1-82-023, "Regulatory Impact Analysis of Environmental Standards for Uranium Mill Tailings at Active Sites", March 1983.

9. U.S. Nuclear Regulatory Commission, Title 10 CFR Part 150, "Exemptions and Continued Regulatory Authority in Agreement States and in Offshore Waters under Section 274", August 1983.

Appendix A

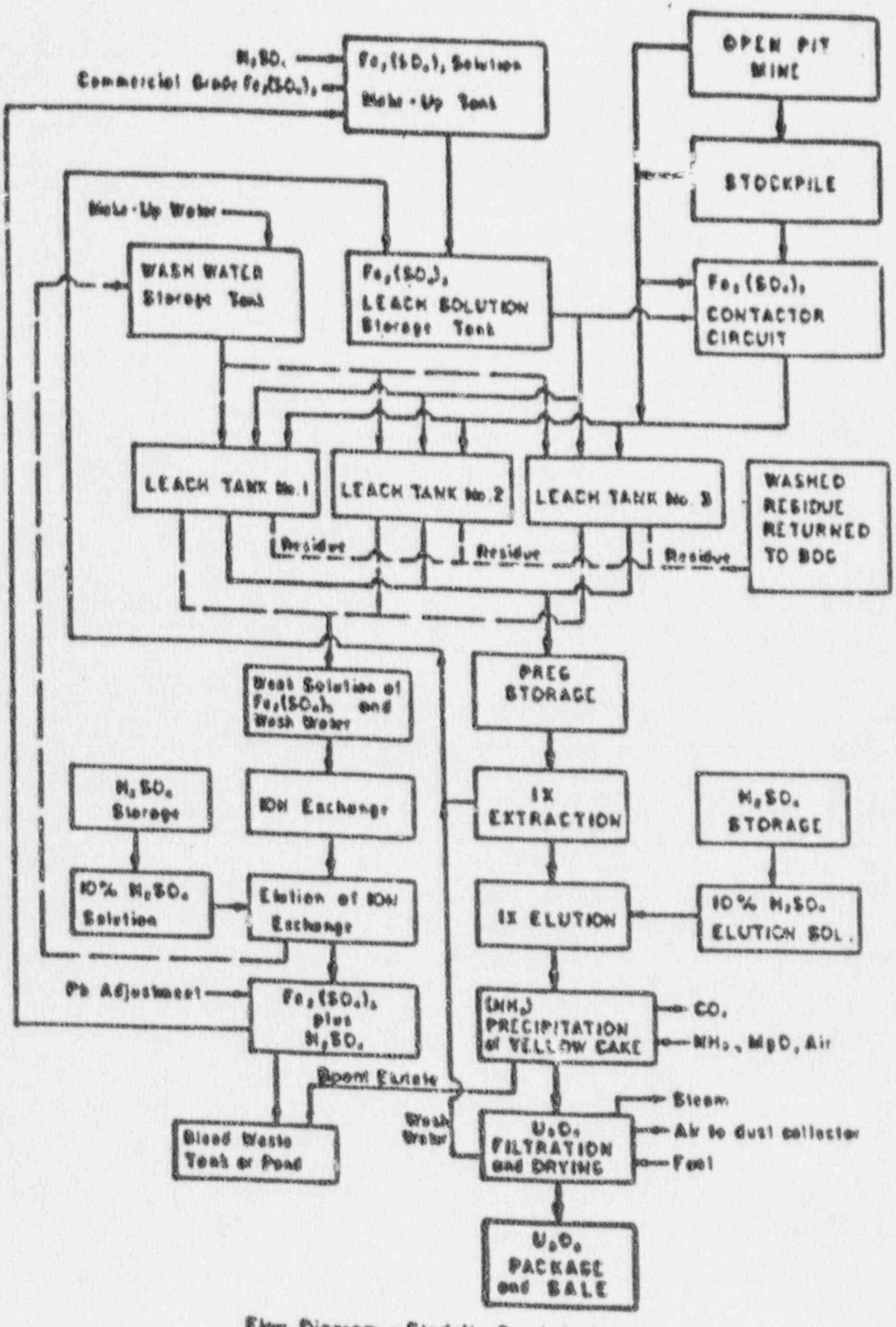
Comparative Analysis

Item	Model Mill	PGUD Mill
1. Mill Life	15 years	2.5 years
2. Average ore grade U_3O_8	0.10%	0.10%
3. Ore transport	truck	truck
4. Ore haul distance	50 km	3 km
5. Ore pad area	20 ac	1 ac
6. Grinding	2,000 stpd	None
7. Crushing	2,000 stpd	None
8. Radium-226	228 pCi/g	12 pCi/g
9. Annual operating days	310	310
10. Manpower	160	10
11. Avg. annual yellowcake product	580 mt	45.5 mt
12. Area of milling facility	125 ac	2 ac
13. Area of tailings impoundment	250 ac	20 ac (mine area)
14. Extra unused land	750 ac	5 ac
15. Waste disposal	tailings	commercial
16. Mill type	acid	ferric sulfate
17. Ore process rate	2,000 stpd	150 stpd

In comparing the Model Mill with the PGUD Mill, it is assumed that contamination of materials and equipment is either fixed or removable and that some material and equipment is not contaminated.

Comparisons are based on the seven subject headings listed in Table K-7-1 of Appendix K-7 NUREG-0706, Vol. III.

Appendix B



Flow Diagram - Rodelle Creek Project

ATTACHMENT B

J C3.

STATE OF WASHINGTON

DEPARTMENT OF SOCIAL AND HEALTH SERVICES

Olympia, Washington 98504-0093

December 24, 1986

TO: J C3

FROM: Steve Matthews SM
Radiation Health Physicist

SUBJECT: SOIL SAMPLING AT JOY MINING COMPANY

Environmental soil sampling at Joy Mining Company's Flodelle Creek Project was conducted on December 15, 1986 in order for the Nuclear Regulatory Commission to determine the feasibility of waving 10 CFR which disallows returning raw uranium ore to its open pit mining location.

Seven soil sampling stations were established, stations A through G. (See attachment one for diagram). Stations A, B and C are samples from stockpiled raw uranium ore. This material has not been processed in any way.

Stations D, E and F are samples from uranium ore which has been partially processed through the first loop of the mill circut. (See attachment two for the flow diagram). This material has been leached with a solution of sulfuric acid, iron sulfate, and wash water. It is being assumed that the residue has not been washed.

Station G is a control station located approximately 250 feet east of the mill (50 feet up hill and perpendicular to a southerly wind flow).

All soil stations were cleared of snow, ice and the first six inches of frozen soil. Soft material underneath was collected. Other than the control station (G) all samples were taken half way up the ore piles.

Approximately three kilograms of soil was collected at each station. The samples will be delivered to the DSHS Lab today for drying and sieving. The DSHS lab will then split the samples and send approximately one kilogram from each station to the U. S. Nuclear Regulatory Commission at the following address.

U. S. Nuclear Regulatory Commission
P.O. Box 25325
Denver, Colorado 80225
Attention: Kandice Jirree

or if shipping via UPS:

U. S. Nuclear Regulatory Commission
730 Simms Street
Suite 100
Golden, Colorado 80401
Attention: Kandice Jirree

The NRC has requested the samples to be double bagged.

We have requested the DSHS Lab to analyze the remaining 1-2 kilograms in the following priority:

Radium-226
Total Natural Uranium
Thorium-230 and 232 (alpha)
Iron content
pH

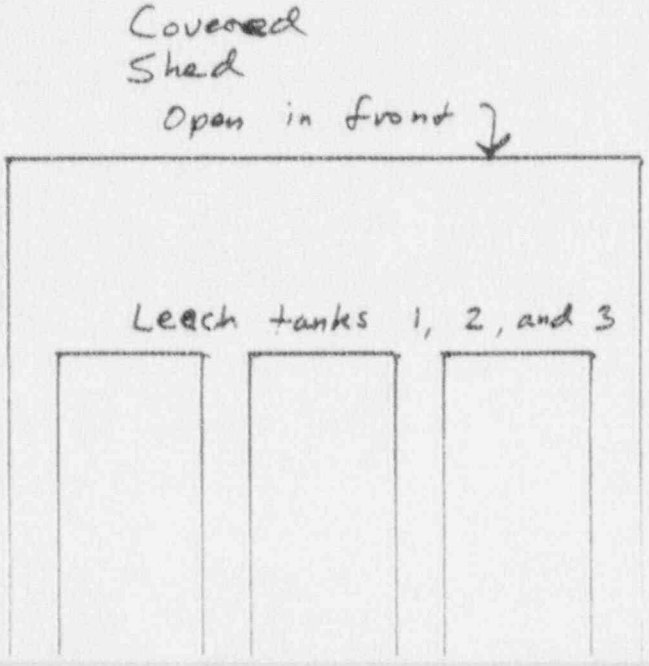
We have also requested the lab to prioritize these samples above all other U-Mill samples. We've requested sample results of Radium-226 by March 31, 1987 with the following four other parameters by April 30, 1987, if possible.

For all those concerned, please contact me at (206) 586-2996 or Scan-321-2996 for questions.

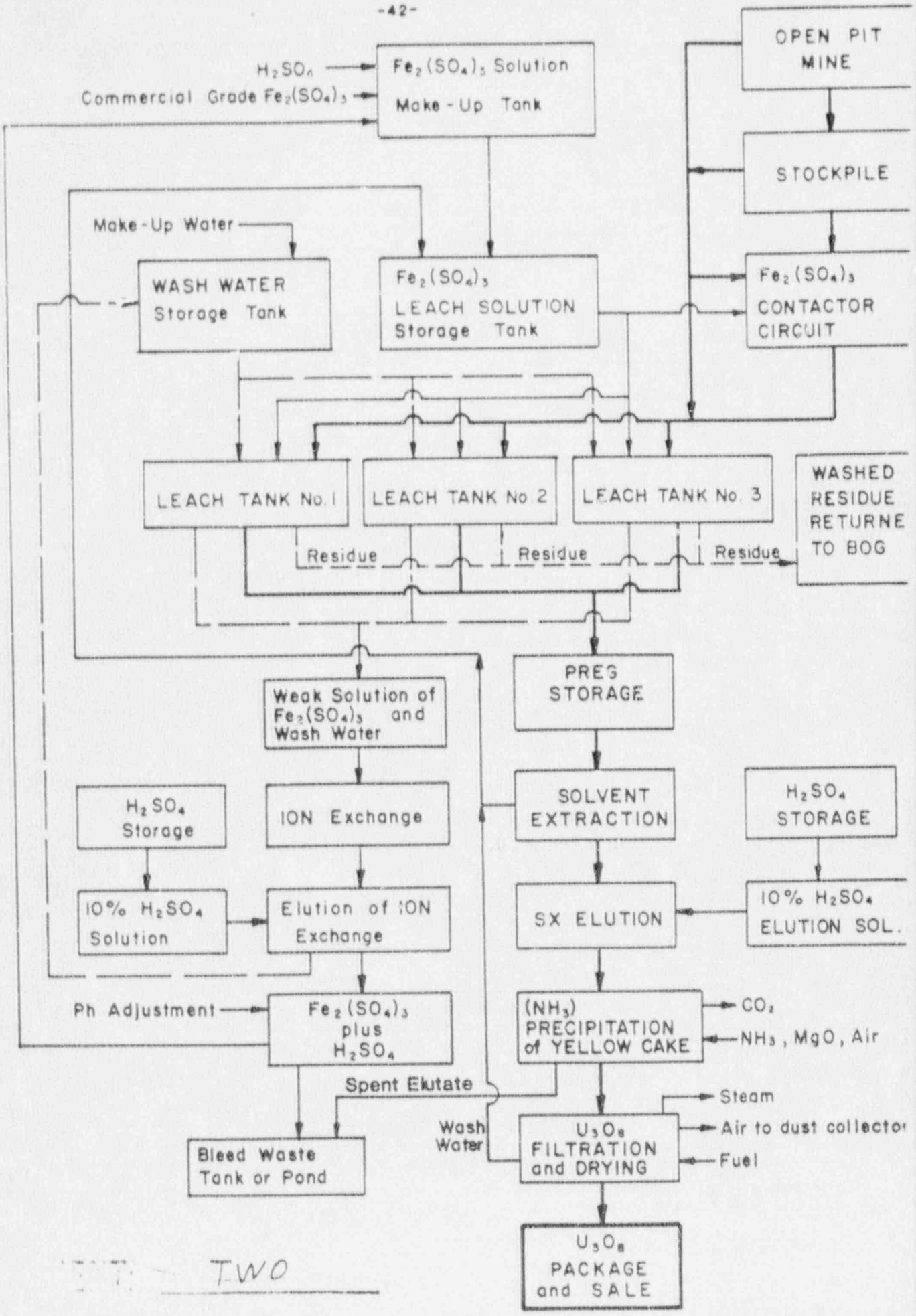
SM:pm

cc: Robert Mooney
Earl Ingersoll
John Erickson
Lee Gronemyer

...MENT: ONE



G



TWO

Flow Diagram - Flodelle Creek Project

Fig. No. 14

Environmental Radiation Laboratory
Laboratory Data Sheet

LABORATORIES

SAMPLE TYPE: S O I L

COLLECTION DATE: DAY 15 MONTH 12 YEAR 8

SAMPLE IDENTIFICATION: Project U Mill

LABORATORY NUMBER: 5920

COLLECTION AREA: Joy Mining Co.

COLLECTION SITE: Station E

TIME: 1215

COLL. BY: S. Matthews

TOTAL VOL. REC'D.(ml):

ADDED
ADDED

DATE RECEIVED: 12/23/86

DATE OF FINAL REPORT: 3/31/87

RADIOANALYSES RESULTS

ANALYSES	LESS THAN	RESULTS pCi/L	LOG NO.	CHEMIST INITIALS
		±		
		±		
Fe		10.35 E 02 ug/g	Chem Lab	CLW
pH		3.5 ±	"	CD
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		

Remarks

Final Report By Cheryl A. Hoole (Chemist (Name or initials)) Mar 3987 (Date) CQ Approved By Cindy Hart

ion Control Section
nmental Radiation Laboratory
atory Data Sheet

STATE OF WASHINGTON
DEPARTMENT OF SOCIAL AND HEALTH SERVICES
Health Services Division
LABORATORIES

SAMPLE TYPE: S O I L

COLLECTION DATE: DAY 15 MONTH 12 YEAR 86

LE IDENTIFICATION: Project U Mill

LABORATORY NUMBER: 5921

ECTION AREA: Joy Mining Co.

ECTION SITE: Station F

TIME: 1300

BY: S. Matthews

TOTAL VOL. REC'D.(ml):

ADDED
ADDED

RECEIVED: 12/23/86

DATE OF FINAL REPORT: 3/31/87

RADIOANALYSES RESULTS

ALYSES	LESS THAN	RESULTS ±2σ	LOG NO.	CHEMIST INITIALS
		±		
		±		
		±		
Fe		14.00 EQ2 ug/g ±	Chem Lab	CRW
PH		3.3 ±	"	CD
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		

marks

al Report By: Cynthia A Ford (Chemist (Name or initials)) Date: March 31, 87 Approved By: CD Carolyn Grant

...m Control Section
...mental Radiation Laboratory
...tory Data Sheet

STATE OF WASHINGTON
DEPARTMENT OF SOCIAL AND HEALTH SERVICES
Health Services Division
LABORATORIES

E IDENTIFICATION: Project U Mill

SAMPLE TYPE: SOIL

COLLECTION DATE: DAY 15 MONTH 12 YEAR 86

LABORATORY NUMBER 5922

ECTION AREA Jay Mining Co.

ECTION SITE Station G

TIME 1415

BY S. Matthews

TOTAL VOL. REC'D.(ml) _____

ADDED _____
ADDED _____

RECEIVED 12/23/86

DATE OF FINAL REPORT __/__/__

RADIOANALYSES RESULTS

...LYSES	LESS THAN	RESULTS pCi/L	LOG NO.	CHEMIST INITIALS
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		

...ARKS No Analysis required

...l Report By _____ (Chemist (Name or initials)) _____ (Date) Approved By _____

Environmental Radiation Laboratory
Laboratory Data Sheet

LABORATORIES

SAMPLE IDENTIFICATION: **Project** U Mill

SAMPLE TYPE: S O I L

COLLECTION DATE: DAY 15 MONTH 12 YEAR 8

COLLECTION AREA: Joy Mining Co.

LABORATORY NUMBER: 5 9 1

COLLECTION SITE: Station A

TIME: 1030

COLL. BY: S. Matthews

TOTAL VOL. REC'D.(ml): 10 lbs 10 oz wet

ADDED ____
ADDED ____

DATE RECEIVED: 12/23/86

DATE OF FINAL REPORT: 3/31/8_

RADIOANALYSES RESULTS

ANALYSES	LESS THAN	RESULTS pCi/g (dry)	Log No.	CHEMIST INITIALS
Th 232/230		1.0E01 ± 1E00	87049	CD
U 238/235/234		3.3 E02 ± 1E01	87049	CD
Ra-226		9.13E00 ± 6.8E-1	069.6	[illegible]
Fe		* 15.68E02	Chem Lab	CRW
F4		3.4	" "	CD

Remarks * ug/gm

Final Report By [signature] (Chemist Name or initials) March 31, 87 (Date) Approved By [signature] CG

Laboratory Data Sheet—

SAMPLE IDENTIFICATION: **Project** U Mill

SAMPLE TYPE: S O I L

COLLECTION DATE — DAY: 15 MONTH: 12 YR: 8

COLLECTION AREA: Joy Mining

LABORATORY NUMBER: 5 9 1

COLLECTION SITE: Station B

TIME: 1050

COLL. BY: S. Matthews

TOTAL VOL. REC'D.: 17lbs 10oz wet

ADDED ___

ADDED ___

DATE RECEIVED: 12/23/86

DATE OF FINAL REPORT: 3/31/18

RADIOANALYSES RESULTS

ANALYSES	LESS THAN	RESULTS pCi/l	Log No.	CHEMIST INITIALS
		±		
		±		
		±		
Th-232/230		6. E00 ± 2E00	87051	CO
U-238/235/234		2.7 E02 ± 1E01	87054*	Co
Ra-226		6.40E00 ± 4.8E-1	069.6	Nick
		±		
Fe		5.91E02 ug/g	Chem Lab	CRW
pH		4.4 ±	"	CD
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		

Remarks: *Sample was done in replicate, the higher value was reported. 160pCi/g. The ore may contain "hot spots" giving a non homogenized sample results w/ 1g analysis.

Final Report By: Cynthia A. O[illegible] (Chemist (Name or Initials)) Date: March 30, 87 Approved By: Cindy [illegible]

DSHS 13-448 (10-80)

Environmental Radiation Laboratory
Laboratory Data Sheet—

LABORATORIES

SAMPLE IDENTIFICATION: Project U Mill

SAMPLE TYPE: S O I L

COLLECTION DATE: DAY 1 5 MONTH 1 2 YEAR 8 6

LABORATORY NUMBER 5 9 1 8

COLLECTION AREA Joy Mining Co.

COLLECTION SITE Station C

TIME 1110

COLL. BY S. Matthews

TOTAL VOL. REC'D.(ml) 10 lbs 002 wt.

ADDED ____
ADDED ____

DATE RECEIVED 12/23/86

DATE OF FINAL REPORT 3/31/87

RADIOANALYSES RESULTS

ANALYSES	LESS THAN	RESULTS	Log No.	CHEMIST INITIALS
		±		
		±		
		±		
Th-232/230		8. E00 ± 1E00	87050	CO
U-238/235/234		1.5 E02 ± 1E01	87056	CO
Ra-226		7.13 E00 ± 5.2E-1	069.6	Nick
		±		
Fe		11.88 E02 µg/g	Chem Lab	CRW
pH		3.5 ±	"	CD
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		

Remarks

Final Report By [signature] Mar. 31, 87
Chemist (Name or initials) Date

Approved By Cindy Grant

Laboratory Data Sheet— LABORATORIES

SAMPLE IDENTIFICATION: **Project** U Mill

SAMPLE TYPE: S O I L

COLLECTION DATE — DAY: 15, MONTH: 12, YEAR: 8

LABORATORY NUMBER: 5 9 1

COLLECTION AREA: Joy Mining Co.

COLLECTION SITE: Station D

TIME: 1140

COLL. BY: S. Matthews

TOTAL VOL. REC'D.(ml) ______

ADDED ______

ADDED ______

DATE RECEIVED: 12/23/86

DATE OF FINAL REPORT: 3/30/87

RADIOANALYSES RESULTS

ANALYSES	LESS THAN	RESULTS pCi/l	Log No.	CHEMIST INITIALS
		±		
		±		
Fe		11.65 E02 ug/g	Chem Lab	CRW
pH		3.4 ±	"	CD
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		
		±		

Remarks ______

Final Report By [signature] Chemist (Name or initials) March 30, 87 Date Approved By Cindy Grant

Laboratory & Data Processing Copy — DSHS Billing Copy — Water Supplier Copy — District Engineer Copy — Local Health Dept. Copy

STATE OF WASHINGTON

DEPARTMENT OF SOCIAL AND HEALTH SERVICES

July 2, 1987

TO: Ron Teissere
Land Leasing
Department of Natural Resources

FROM: Steve Matthews SM
Office of Radiation Protection
Department of Social and Health Services

SUBJECT: TRANSFER OF ORE AND RESIDUE TO BOG

Attached are results of ore and residue samples collected at various times at the Flodelle Creek uranium mill site. All sample results indicate safe levels of hazardous constituents. Therefore, you have our permission to return all residue and raw ore materials to the bog.

Attachment One shows the raw ore and residue locations high-lighted in yellow.

Attachment Two is a memo from our environmental monitoring section to our uranium mill section indicating the logistics of returning raw ore and residue to the bog. Attachment 2A are the results of the soil samples collected on December 15, 1987.

Attachment Three are the results of residue core samples collected on March 12, 1987.

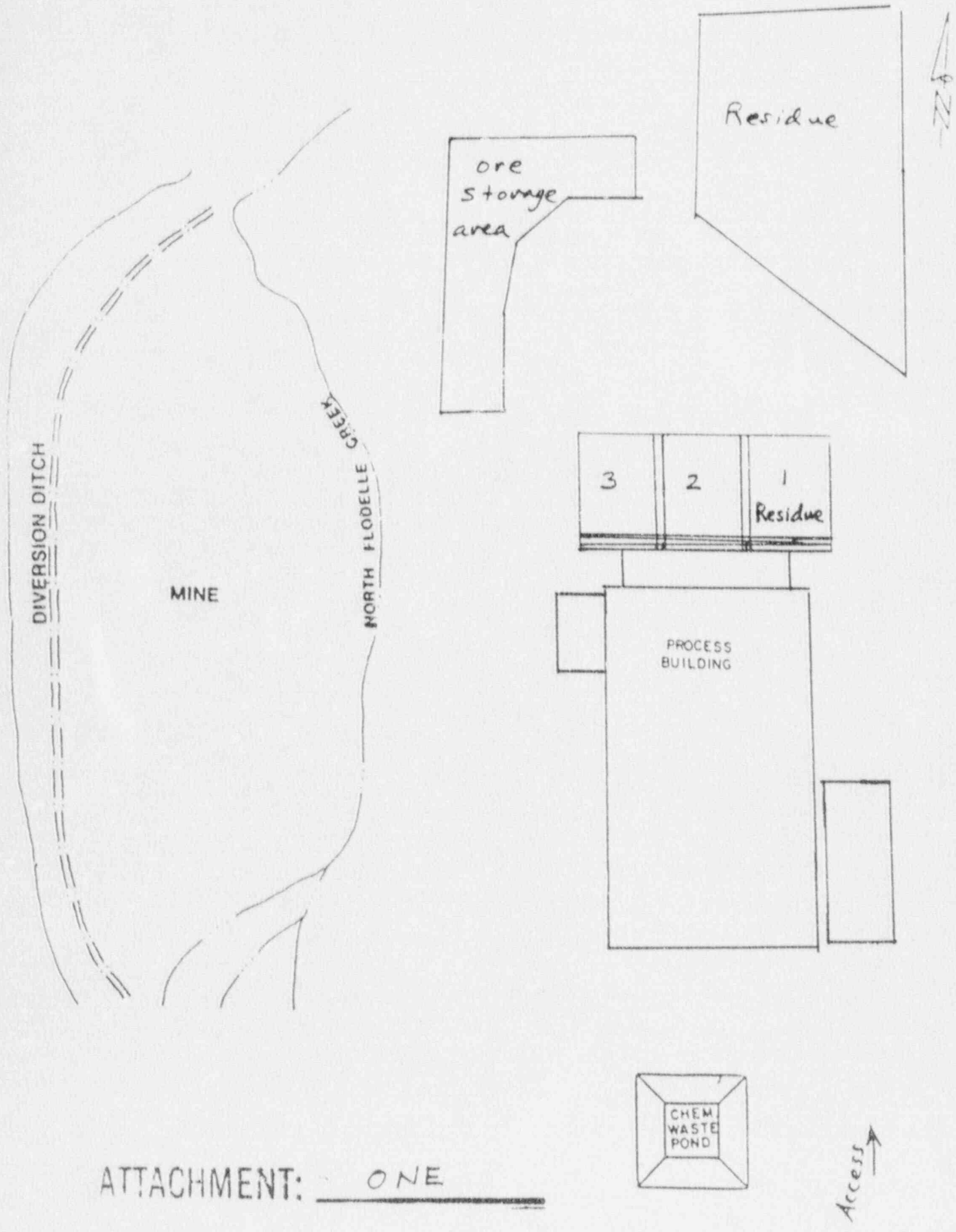
Attachment Four are results of split samples taken from January through December of 1984.

If you need further explanation of sample results, please contact me at (206) 586-2996.

SM:sm

Attachments

cc: Richard McCartan, AAG
Lee Gronemyer
JC3



ATTACHMENT: ONE

EDI M. NAKASSIAN
Secretary

STATE OF WASHINGTON

EPS-87-123

DEPARTMENT OF SOCIAL AND HEALTH SERVICES

Olympia, Washington 98504

May 4, 1987

TO: Lee Gronemyer

FROM: Don Peterson DP

SUBJECT: **ANALYSIS OF JMC'S ORE/RESIDUE SAMPLES**

Enclosed is the data for the ore and residue samples collected by Steve Matthews last December. A statistical test indicated the residue samples do not contain measurably higher levels of iron. This is however the soluble fraction. Insoluble iron is also present, bound to the organics. However, according to Doug Hildebrand, Joy spectroscopic analysis revealed total Fe in the residue, after being washed, was only increased by 1-2% over levels of Fe in the raw ore. The radionuclide analyses reveal levels typical of previous residue data. The data also confirms that the level of thorium is low, comparable to Ra-226. While there will be a more complete analysis for radionuclides, it would appear that the parameters of concern in the residue are not measurably higher than in the raw ore. Therefore, it appears reasonable to return the residue to the bog and not to treat it as radioactive or chemical waste.

DP:jr

cc: Bob Mooney
Earl Ingersoll
M 3-13 (new file)

ATTACHMENT: TWO

EPS-87-123

RESULTS

Joy Mining Company
Special Ore Samples

Collected December 15, 1986

		Iron†	pH	U-234/235/238	Th-232/230	Ra-226
Units		ppm		pCi/g	pCi/g	pCi/g
Ore	Station A	1,570	3.4	340 ± 10	10 ± 1	9.1 ± 0.6
	Station B	590	4.4	* 270 ± 10	6 ± 2	6.4 ± 0.5
	Station C	1,190	3.5	150 ± 10	8 ± 1	7.1 ± 0.5
Residue	Station D	1,170	3.4	**** NO ANALYSIS REQUIRED ****		
	Station E	1,030	3.5	**** NO ANALYSIS REQUIRED ****		
	Station F	1,400	3.3	**** NO ANALYSIS REQUIRED ****		
Background	Station G	********** NO ANALYSIS REQUIRED **********				

† Soluble fraction only.

---

* The sample was done in replicate with the higher value reported - vs- 160 pCi/g. The ore contains "hot spots" resulting in nonhomogeneous sample aliquots in a 1 gram analysis. The sample size was limited due to the high level of activity, this affected the yields of the environmental method used in analysis.

ATTACHMENT: 2A

Dale M. Sugerman
Secretary

STATE OF WASHINGTON
DEPARTMENT OF SOCIAL AND HEALTH SERVICES
9030 NE 150th Street (OT-4) • Seattle, Washington 98155-7224

R E S U L T S

Joy Mining Company
Special Samples
Residue Pile

Collected March 12, 1987
By S. Matthews

Lab No.	Site	pH	% Total Solids	Soluble Fe (ug/g)	Soluble $SO_4^=$ (ug/g)
6118	1 - 3/4	3.4	60	1,560	13,000
6119	1 - 5/6	3.5	65	1,240	18,000
6120	1 - 4/5	3.8	78	1,320	8,000
6121	2 - 6/7	3.5	76	1,540	10,000
6122	3 - 4/5	3.5	74	1,240	5,000
6123	3 - 6/7	3.6	75	1,120	3,700

90% of the pulverized sample passed through a #30 sieve.

ATTACHMENT: THREE

TABLE 23 (Continued)

JOY MINING COMPANY
SOIL, SEDIMENT, AND ORE RESIDUE ANALYSES
(pCi/gram ± 2 sigma)

Results of Split Samples Analyzed by the
State of Washington Department of Social and Health Services
and the Joy Mining Company

January 1984 through December 1984

Date	Location+	Isotope	DSHS	JMC
	Residue - Surface			
12 Oct. 84	#1	Nat. Uranium	210 ± 5	
		Ra-226	8.6 ± 0.3	
		Th-230/232	24 ± 1	
12 Oct. 84	#2	Nat. Uranium	140 ± 3	
		Ra-226	8.8 ± 0.6	
		Th-230/232	26 ± 1	
	Residue - Core			
12 Oct. 84	#3	Nat. Uranium	146 ± 3	
		Ra-226	6.7 ± 0.6	
		Th-230/232	3.5 ± 0.2	
12 Oct. 84	#4	Nat. Uranium	180 ± 3	
		Ra-226	8.3 ± 0.7	
		Th-230/232	5.1 ± 0.2	
12 Oct. 84	#5	Nat. Uranium	90 ± 2	
		Ra-226	5.4 ± 0.6	
		Th-230/232	3.7 ± 0.1	
12 Oct. 84	#6	Nat. Uranium	168 ± 3	
		Ra-226	6.4 ± 0.6	
		Th-230/232	4.6 ± 0.1	

+Surface and core sampling are from an ore residue pile adjacent to the mill.

ATTACHMENT C

Not included

ATTACHMENT D

STATE OF WASHINGTON

DEPARTMENT OF HEALTH

Olympia, Washington 98504

January 7, 1990

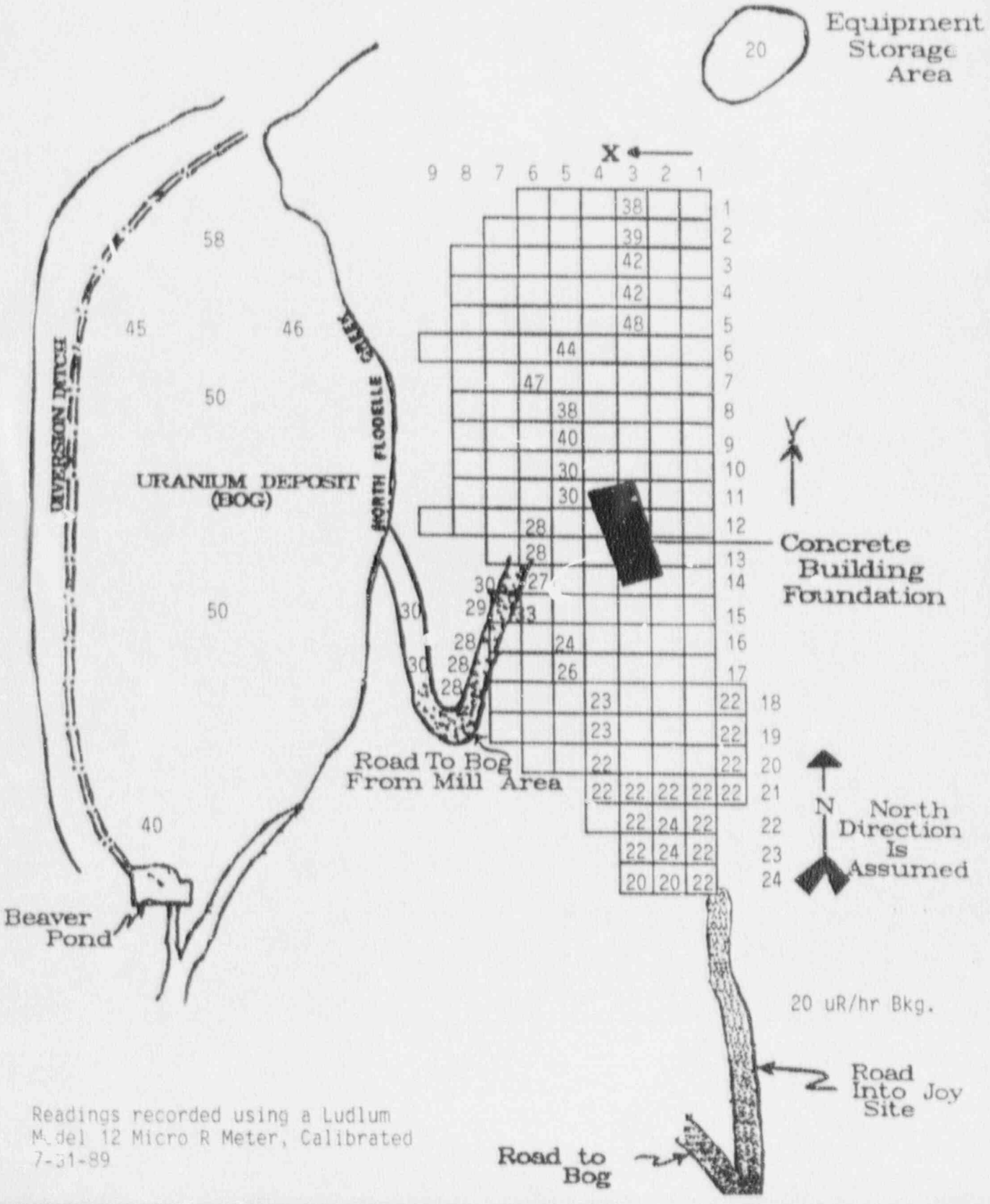
Analytical Results for Joy Minning Company
Collected October 4, 1989 by Gary Robertson

pCi/g, wet

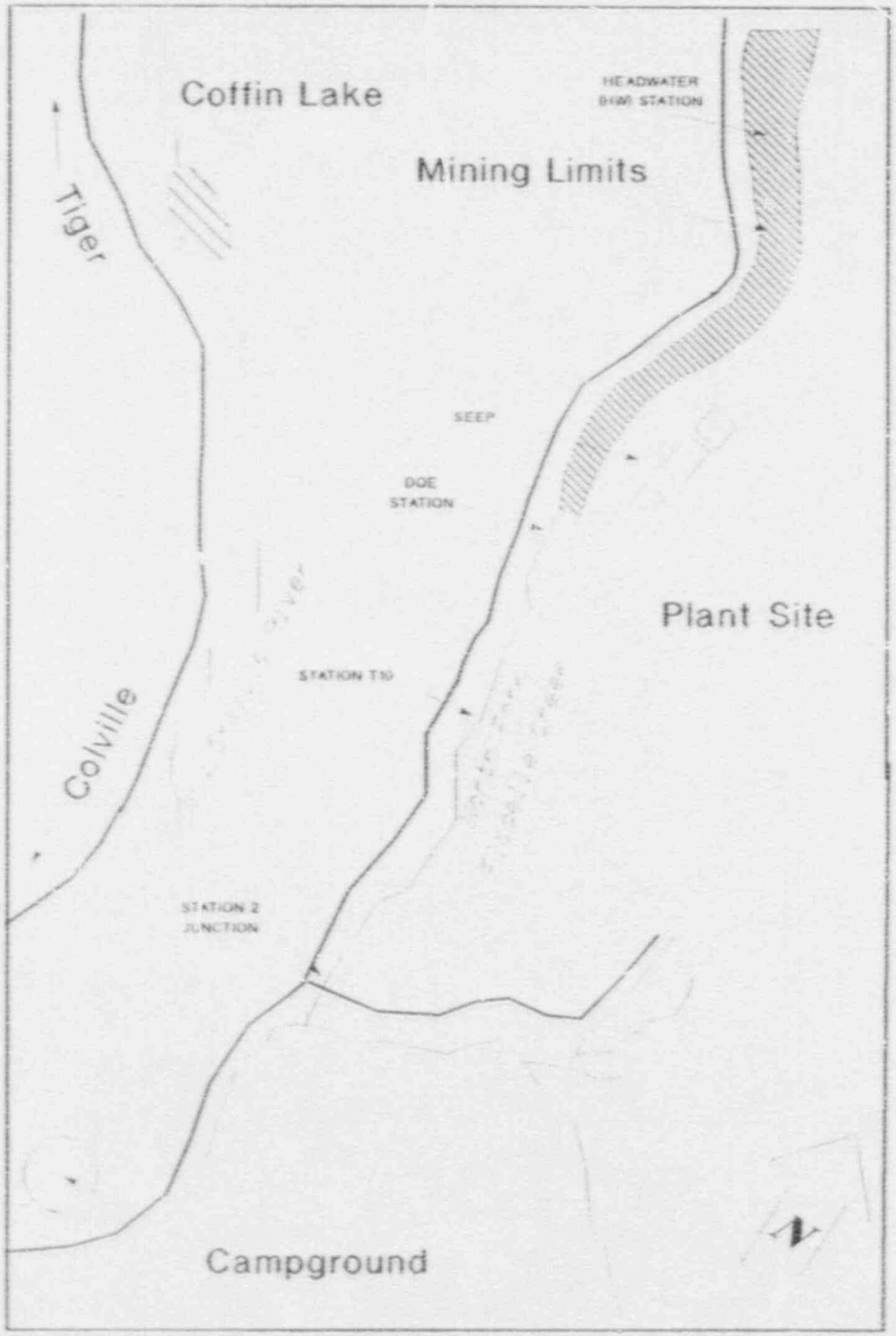
Lab#	Location	T.S.	URANIUM ANALYSIS Gamma	Wet	RADIUM ANALYSIS Gamma	Wet
9290	1-6	96%	50 ± 3	*	2.7 ± 0.2	1.8 ± 0.2
9291	4-2	92%	90 ± 4		4.0 ± 0.2	3.1 ± 0.3
9292	6-4	91%	163 ± 5	*	3.6 ± 0.2	4.0 ± 0.3
9293	6-6	90%	123 ± 1	138 ± 2	4.5 ± 0.1	4.5 ± 0.3
9294	9-5	89%	74 ± 3	*	3.2 ± 0.2	3.6 ± 0.3

GAMMA RESULTS WERE REPORTED

ATTACHMENT E


Equipment Storage Area
20
X
9 8 7 6 5 4 3 2 1
38 1
39 2
42 3
42 4
48 5
44 6
47 7
38 8
40 9
30 10
30 11
28 12
28 13
30 27 14
29 33 15
28 24 16
30 28 26 17
28 23 22 18
23 22 19
22 22 20
22 22 22 22 22 21
22 24 22 22
22 24 22 23
20 20 22 24
Concrete Building Foundation
N
North Direction Is Assumed
20 uR/hr Bkg.
Road Into Joy Site
Road to Bog
Road To Bog From Mill Area
URANIUM DEPOSIT (BOG)
DIVERSION DITCH
NORTH FLODELLE CREEK
58
45
46
50
50
40
Beaver Pond
Readings recorded using a Ludlum Model 12 Micro R Meter, Calibrated 7-31-89

ATTACHMENT F



JOY MINING COMPANY SITE LOCATION MAP

JOY MINING COMPANY
FLODELLE CREEK PROJECT

PREOPERATIONAL DATA
GROUND WATER
(pCi/L)

Table 12
1 of 2
28

LOCATION	DATE	RADIONUCLIDES				
		TOTAL U	DISSOLVED U	SUSPENDED U	DISSOLVED Ra-226	DISSOLVED Th-230
JMC-Campground	8-25-82	–	.84799	–	–	–
	4-29-83	–	4.596	–	–	0.0
	5-9-83	–	4.596	–	–	1.7
	5-21-83	< 0.574	< 0.574	< 0.574	.1 ± .5	–
	6-29-83	1.148	< 0.574	1.148	0.0 ± 0.3	0.0 ± .5
	7-26-83	0.517	< .006	0.517	< 0.2 ± 0.3	9.1 ± 2.5
	9-28-83	< 0.057	< .057	< 0.057	–	–

JOY MINING COMPANY
FLODELLE CREEK PROJECT

PREOPERATIONAL DATA
GROUND WATER
(mg/L)

LOCATION	DATE	PERTINENT WATER QUALITY PARAMETERS						
		pH	TDS	Fe	Pb	So_4	Cl	Cu
JMC-Camp-ground	8-25-83	6.8	76	-	-	-	-	-
	4-29-83	6.8	75.5	.32	< .025	< 10	< 10	< .025
	5-9-83	5	84.5	2.9	< .025	< 10	< 10	< .025
	5-21-83	7.5	97.1	1.8	< .025	< 10	< 10	< .025
	6-29-83	6.8	94	.84	< .025	< 10	< 10	< .025
	7-26-83	6.8	89.5	1.7	< .025	10	< 10	< .025
	9-28-83	6.8	155.5	0.93	< .025	< 10	< 10	< .025

Table 12
2 of 2
29

= groundwater

JOY MINING CO. PREOPERATIONAL DATA
SPLIT SAMPLE ANALYSIS BY DSHS AND JMC
COLLECTED OCT. 21, 1982

LOCATION	ANALYSIS	RESULT		UNITS
		DSHS	JMC	
JMC-Campground Well	Nat. Uranium	1.1±0.6	<1	pCi/l
	Radium 226	0.1±0.02	0.1±0.2	pCi/l
JMC-HW (dissolved)	Nat. Uranium	10.2±1.2	12.0	pCi/l
	Radium 226	0.3±0.1	0.0±0.3	pCi/l
JMC-HW (suspended)	Nat. Uranium	1.8±0.5	5.5 *	pCi/l
	Radium 226	<0.1	0.1±0.4 *	pCi/l
JMC-JCT (dissolved)	Nat. Uranium	2.9±0.8	3.0	pCi/l
	Radium 226	0.2±0.1	0.0±0.3	pCi/l
JMC-JCT (suspended)	Nat. Uranium	0.5±0.3	2.0 *	pCi/l
	Radium 226	<0.1	0.0±0.4 *	pCi/l
JMC-Millsite Soil	Nat. Uranium	6.8±0.5	<5	pCi/gm
	Radium 226	0.9±0.01	0.3±0.7	pCi/gm
JMC-HW Sediment	Nat. Uranium	1,043±7.6	994	pCi/gm
	Radium 226	2.1±0.03	0.3±0.5	pCi/gm
JMC-JCT Sediment	Nat. Uranium	40.3±0.7	54	pCi/gm
	Radium 226	8.2±1.4	4.5±1.6	pCi/gm

* Reported units pCi/composite.

JOY MINING CO. PREOPERATIONAL DATA
GENE WEHMEYER*
DRINKING WATER ANALYSIS
February 8, 1983 **

ANALYSIS	RESULTS pCi/l
Nat. uranium suspended	4
Nat. uranium dissolved	<1
Radium 226 suspended	0.3±0.4
Radium 226 dissolved	0.1±0.2
Thorium 230 suspended	0.0±0.4
Thorium 230 dissolved	0.4±0.7

* Just downstream from the junction of Amazon Creek and the Little Pend Oreille River (closest downstream resident?)

** Date to Hazen Lab, collection date unknown.

JOY MINING CO. PREOPERATIONAL DATA
SPLIT SAMPLE ANALYSIS BY DSHS AND JMC
COLLECTED May 9, 1983

LOCATION	ANALYSIS	RESULT		UNITS
		DSHS	JMC	
JMC-Campground Well	Nat. Uranium	2.2±0.6	...	pCi/l
	Radium 226	<0.1	0.0	pCi/l
JMC-HW (dissolved)	Nat. Uranium	3.8±1.1	8.124	pCi/l
	Radium 226	<0.1	0.0	pCi/l
JMC-HW (suspended)	Nat. Uranium	1.2±0.2	...	pCi/l
	Radium 226	<0.1	0.3	pCi/l
JMC-JCT (dissolved)	Nat. Uranium	10.6±1.3	...*	pCi/l
	Radium 226	0.1±0.1	0.0	pCi/l
JMC-JCT (suspended)	Nat. Uranium	0.9±0.4	...	pCi/l
	Radium 226	<0.2	0.8	pCi/l
JMC-Millsite Soil	Nat. Uranium	2.4±0.3	<3.389	pCi/gm
	Radium 226	1.7±0.2	0.0	pCi/gm
JMC-HW Sediment	Nat. Uranium	957±13	1,103.51	pCi/gm
	Radium 226	13.2±0.6	10.	pCi/gm
JMC-JCT Sediment	Nat. Uranium	132.±3	270.8	pCi/gm
	Radium 226	6.2±0.4	7.3	pCi/gm
JMC-millsite Vegetation	Radium 226	$4.0 \times 10^{-2} \pm .002$	4.1×10^{-2}	pCi/gm

* One table listed no data (see A-3), and one table listed 2.708 pCi/gm (See A-4)
... No data as of Nov. 10, 1983

JOY MINING CO. PREOPERATIONAL DATA
GROUND WATER 1983

Location	Date Collected	Total Ra-226 pCi/l	Total Nat. Uranium pCi/l
Campground well	April 29	0.0	...
"	May 9	0.0	...
"	May 31	0.2±0.3	<0.677
"	June 29	...	1.354
Seep well *	May 15	...	2.708
"	June 20	...	6.093
"	June 29	...	8.124

* Seepwell sampling started May 1983.
... No data as of Oct. 10, 1983

JOY MINING COMPANY
SURFACE AND GROUND WATER ANALYSES
(pCi/liter ± 2 sigma)

Results of Split Samples Analyzed by the
State of Washington Department of Social and Health Services
and the Joy Mining Company

July 1982 through December 1983

DATE	LOCATION	ISOTOPE	DSHS	JMC
	Surface Water			
May 9, 1983	Station 2 (Junction)	Nat. Uranium	10.6 ± 1.3	2.3
		Ra-226	0.1 ± 0.1	0.1 ± 0.3
May 9, 1983	Station 3	Nat. Uranium	6.8 ± 1.1	6.89
		Ra-226	<0.1	0.1 ± 0.4
July 30, 1983	Station 2 (Junction)	Nat. Uranium		
		Dissolved	6.3 ± 0.9	0.006
		Suspended	1.4 ± 0.5	0.006
		Ra-226		
		Dissolved	0.6 ± 0.4	0.1 ± 0.4
		Suspended	<0.1	0.18 ± 0.12
Oct. 11, 1983	Station 2 (Junction)	Nat. Uranium		
		Dissolved	4.0 ± 0.8	<0.0001
		Suspended	0.2 ± 0.1	
		Ra-226		
		Dissolved	<0.1	0.2 ± 0.2
		Suspended	<0.1	0.1 ± 0.3
	Ground Water			
May 9, 1983	Station 5	Nat. Uranium	2.2 ± 0.6	4.6
		Ra-226	<0.1	----
Oct. 11, 1983	Campground	Nat. Uranium	0.7 ± 0.4	<0.677
		Ra-226	<0.1	0.2 ± 0.3
Oct. 11, 1983	Seep	Nat. Uranium	4.5 ± 0.8	0.27
		Ra-226	<0.2	0.4 ± 0.5

JOY MINING COMPANY
SURFACE AND GROUND WATER ANALYSES
(pCi/liter ± 2 sigma)

Results of Split Samples Analyzed by the
State of Washington Department of Social and Health Services
and Joy Mining Company

January 1984 through December 1984

Date	Location	Isotope	DSHS	JMC
	Surface Water			
08 May 84	Junction	Nat. Uranium		
		Dissolved	6.0 ± 1.0	1.4
		Suspended	<0.2	
		Ra-226		
		Dissolved	0.3 ± 0.1	0.4 ± 0.5
		Suspended	<0.2	5.4 ± 1.3
30 July 84	Junction	Nat. Uranium		
		Dissolved	6.3 ± 0.9	
		Suspended	1.4 ± 0.5	
		Ra-226		
		Dissolved	0.6 ± 0.4	
		Suspended	<0.1	
	Ground Water			
08 May 84	Campground	Nat. Uranium	0.5 ± 0.1	1.4
		Ra-226	<0.2	0.3 ± 0.6
08 May 84	Seep	Nat. Uranium	0.7 ± 0.3	5.2
		Ra-226	0.2 ± 0.1	0.5 ± 0.6

JOY MINING COMPANY
SURFACE AND GROUND WATER ANALYSES
(pCi/liter ± 2 sigma)

Results of Split Samples Analyzed by the
State of Washington Department of Social and Health Services
and Joy Mining Company

January 1985 through December 1985

Date	Location	Isotope	DSHS	JMC
Surface Water				
13 June 85	Junction	Nat. Uranium		
		Dissolved	6.8 ± 0.5	
		Suspended	0.5 ± 0.1	
		Ra-226		
		Dissolved	<0.2	
		Suspended	<0.2	
24 Sept.85	Junction	Nat. Uranium	2.8 ± 0.2	
		Dissolved	1.1 ± 0.1	
		Suspended		
		Ra-226		
		Dissolved	<0.2	
		Suspended	<0.2	
Ground Water				
13 June 85	Campground	Nat. Uranium	0.8 ± 0.1	
		Ra-226	<0.2	
24 Sept.85		Nat. Uranium	1.7 ± 0.2	
		Ra-226	<0.2	

JOY MINING COMPANY
SURFACE AND GROUND WATER ANALYSES
(pCi/liter ± 2 sigma)

Results of Samples Analyzed by the
State of Washington Department of Social and Health Services

January 1986 through December 1986

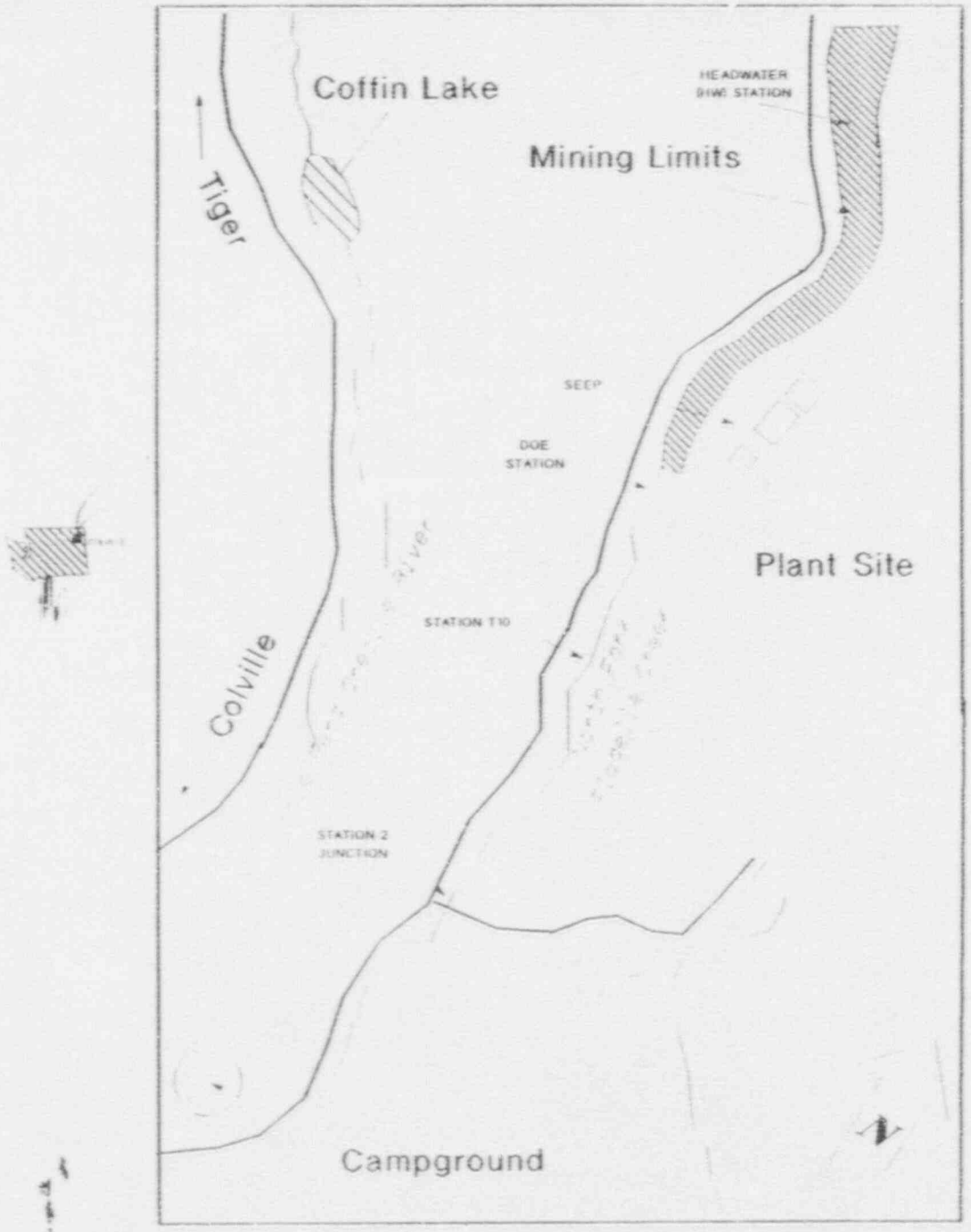
Date	Location	Isotope	DSHS
Surface Water			
8 May 86	Junction (Station-2)	Nat. Uranium	
		Dissolved	6.7 ± 0.6
		Suspended	0.5 ± 0.1
		Ra-226	
		Dissolved	0.3 ± 0.1
		Suspended	<0.2
24 Sept. 86	Junction (Station-2)	Nat. Uranium	
		Dissolved	1.7 ± 0.2
		Suspended	0.8 ± 0.1
		Ra-226	
		Dissolved	0.3 ± 0.1
		Suspended	<0.2
Ground Water			
8 May 86	Campground	Nat. Uranium	0.5 ± 0.1
		Ra-226	0.3 ± 0.1
24 Sept. 86	Campground	Nat. Uranium	0.5 ± 0.1
		Ra-226	0.2 ± 0.1

Analyses of samples collected at Joy Mining Company. These samples were collected by John Martelli and Randy Acselrod on September 27th, 1989.

NUMBER	SAMPLE INFORMATION	ISOTOPE	RESULT		RANDOM UNCERTAINTY (95%)	UNITS
9162	Joy Mining Company Station 2 Surface Water D i s s o l v e d	Uranium (234,235,238)	3.2	±	0.3	pCi/L
		Radium (226)	-0.1	±	0.1	pCi/L
		Conductivity	90	±	10	µmhos/cm
		TDS	70	±	7	mg/L
9163	Joy Mining Company Station 2, Water Filter uspended	Uranium (234,235,238)	2.1	±	0.3	pCi/L
		Radium (226)	0.1	±	0.2	pCi/L
9164	Joy Mining Company Campgrounds Ground Water	Uranium (234,235,238)	1.3	±	0.2	pCi/L
		Radium (226)	0.0	±	0.1	pCi/L
		Conductivity	100	±	10	µmhos/cm
		TDS	60	±	6	mg/L

Approved by: Whitmore Date 03 / 30 / 90

ATTACHMENT G



JOY MINING COMPANY SITE LOCATION MAP

JOY MINING CO. PREOPERATIONAL DATA
SURFACE WATER 1983

Location	Date Collected	Radium 226 PCi/l Total	Radium 226 PCi/l Dissolved	Uranium PCi/l Total	Uranium PCi/l Dissolved
JMC-HW	Jan 27	12.3	0.3	13.54	9.48
"	Jan 27	...	...	1,004	14
"	Mar 1	...	...	16.925	0
"	Mar 2	26	0.3	2,504.9	12.13
"	Mar 30	...	...	1,954.49	18.27
"	April 29	38.9	0.9	10.83	5.41
"	May 9	0.3	0.0	...	8.124
"	May 31	290±10	0.4±0.7	105,767.71	20.31
"	June 29	...	...	13,073.547	7.447
SEC 5 *	Jan 27	0.2	0.2	...	10.155
"	Mar 1	...	...	13.54	6.84
"	Mar 30	...	...	...	...
DOE Station	Jan 27	0.8	0.1	25.0	10.0
"	Jan 27	...	...	33.35	23.19
"	Mar 1	...	...	20.31	6.77
"	Mar 2	1.5	0.2	48.06	10.0
"	Mar 30	...	...	13.54	0
"	April 29	...	...	5.42	0
"	May 6	...	...	4.06	0.88
JMC-Jct	Jan 27	0.4	0.0	18	9
"	Mar 2	0.1	0.0	14.21	6.77
"	April 29	0.1	0.0	...	...
"	May 9	0.8	0.0	...	...
"	May 31	0.1±0.4	0.1±0.3	...	...
"	June 29	...	...	...	...
"	July 30	0.28±0.4	0.1±0.4	...	...
"	Aug. 1	0.22±0.4	0.2±0.4	...	...
"	Aug. 3	<0.35±0.3	<0.3±0.3	...	...
"	Aug. 5	0.59±0.4	0.4±0.4	...	...
"	Aug. 10	<0.14±0.3	0.1±0.3	...	...

* Location of Section 5 station unknown.
... No Data as of October 10, 1983.

JOY MINING CO. PREOPERATIONAL DATA
JUNCTION STATION
SURFACE WATER 1983

Date Collected	Nat. Uranium PCi/l	
	Total	Dissolved
Jan 8	...	<67.7
Jan 10	...	<67.7
Jan 18*	...	253.875
Jan 27	26.267	3.927
Feb 14	10.155	<.677
Feb 22	6.77	<6.77
Mar 1	13.54	6.77
Mar 7	6.77	<6.77
Mar 15	13.54	2.708
Mar 22	11.509	no detection
Mar 30	33.85	13.54
Apr 12	29.111	10.832
Apr 21	54.16	<6.77
Apr 29	85,911.3	85,897.8
May 4	<6.77	<6.77
May 6	4.062	<.677
May 9	...	2.708
May 16	4.062	<.677
May 23	<.677	<.677
May 31	4.062	2.031
Jun 6	<.677	<.677
Jun 15	<.677	<.677
Jun 20	14.894	4.739
Jun 29	2.031	.677

* Changed procedures - lowered detection limits.
... No data as of Oct. 10, 1983.

JOY MINING CO. PREOPERATIONAL DATA
SPLIT SAMPLE ANALYSIS BY DSHS AND JMC
COLLECTED OCT. 21, 1982

LOCATION	ANALYSIS	RESULT		UNITS
		DSHS	JMC	
JMC-Campground well	Nat. Uranium	1.1±0.6	1	pCi/l
	Radium 226	0.1±0.02	0.1±0.2	pCi/l
JMC-HW (dissolved)	Nat. Uranium	10.2±1.2	12.0	pCi/l
	Radium 226	0.3±0.1	0.0±0.3	pCi/l
JMC-HW (suspended)	Nat. Uranium	1.8±0.6	6.6 *	pCi/l
	Radium 226	0.1	0.1±0.4 *	pCi/l
JMC-JCT (dissolved)	Nat. Uranium	2.9±0.8	3.0	pCi/l
	Radium 226	0.2±0.1	0.0±0.3	pCi/l
JMC-JCT (suspended)	Nat. Uranium	0.5±0.3	2.0 *	pCi/l
	Radium 226	<0.1	0.0±0.4 *	pCi/l
JMC-Millsite Soil	Nat. Uranium	6.8±0.5	<5	pCi/gm
	Radium 226	0.9±0.01	0.3±0.7	pCi/gm
JMC-HW Sediment	Nat. Uranium	1,043±7.6	994	pCi/gm
	Radium 226	2.1±0.03	0.3±0.5	pCi/gm
JMC-JCT Sediment	Nat. Uranium	40.3±0.7	54	pCi/gm
	Radium 226	8.2±1.4	4.5±1.6	pCi/gm

* Reported units pCi/composite.

JOY MINING CO. PREOPERATIONAL DATA
SPLIT SAMPLE ANALYSIS BY DSHS AND JMC
COLLECTED May 9, 1983

LOCATION	ANALYSIS	RESULT		UNITS
		DSHS	JMC	
JMC-Campground well	Nat. Uranium	2.2±0.6	...	pCi/l
	Radium 226	<0.1	0.0	pCi/l
JMC-HW (dissolved)	Nat. Uranium	6.8±1.1	8.124	pCi
	Radium 226	<0.1	0.0	p
JMC-HW (suspended)	Nat. Uranium	1.3±0.2	...	
	Radium 226	<0.1	0.3	
JMC-JCT (dissolved)	Nat. Uranium	10.6±1.3	...*	pCi/l
	Radium 226	0.1±0.1	0.0	pCi/l
JMC-JCT (suspended)	Nat. Uranium	0.9±0.4	...	pCi/
	Radium 226	<0.2	0.8	pCi/
JMC-Millsite Soil	Nat. Uranium	2.4±0.3	<3.3	pCi/gm
	Radium 226	1.7±0.2	0.0	pCi/gm
JMC-HW Sediment	Nat. Uranium	957±13	1,103.51	pCi/gm
	Radium 226	13.2±0.6	10.	pCi/gm
JMC-JCT Sediment	Nat. Uranium	132.±3	270.3	pCi/gm
	Radium 226	6.2±0.4	7.3	pCi/gm
JMC-millsite Vegetation	Radium 226	$4.0 \times 10^{-2} \pm .002$	4.1×10^{-2}	pCi/gm

* One table listed no data (see A-3), and one table listed 2.708 pCi/gm (See A-4)
... No data as of Nov. 10, 1983

JOY MINING COMPANY
SURFACE AND GROUND WATER ANALYSES
(pCi/liter ± 2 sigma)

Results of Split Samples Analyzed by the
State of Washington Department of Social and Health Services
and the Joy Mining Company

July 1982 through December 198_

DATE	LOCATION	ISOTOPE	DSHS	JMC
	Surface water			
May 9, 1983	Station 2 (Junction)	Nat. Uranium Ra-226	10.6 ± 1.8 0.1 ± 0.1	9.6 0.2 ± 0.3
May 9, 1983	Station 3	Nat. Uranium Ra-226	6.8 ± 1.1 <0.1	6.89 0.1 ± 0.4
July 30, 1983	Station 2 (Junction)	Nat. Uranium Dissolved Suspended Ra-226 Dissolved Suspended	 6.3 ± 0.9 1.4 ± 0.5 0.6 ± 0.4 <0.1	 0.006 0.006 0.1 ± 0.4 0.18 ± 0.12
Oct. 11, 1983	Station 2 (Junction)	Nat. Uranium Dissolved Suspended Ra-226 Dissolved Suspended	 4.0 ± 0.8 0.2 ± 0.1 <0.1 <0.1	 <0.0001 0.2 ± 0.2 0.1 ± 0.3
	Ground Water			
May 9, 1983	Station 5	Nat. Uranium Ra-226	2.2 ± 0.6 <0.1	4.6 ----
Oct. 11, 1983	Campground	Nat. Uranium Ra-226	0.7 ± 0.4 <0.1	<0.677 0.2 ± 0.3
Oct. 11, 1983	Seep	Nat. Uranium Ra-226	4.5 ± 0.8 <0.2	0.27 0.4 ± 0.5

JOY MINING COMPANY
SURFACE AND GROUND WATER ANALYSES
(pCi/liter ± 2 sigma)

Results of Split Samples Analyzed by the
State of Washington Department of Social and Health Services
and Joy Mining Company

January 1984 through December 1984

Date	Location	Isotope	DSHS	JMC
	Surface Water			
08 May 84	Junction	Nat. Uranium		
		Dissolved	6.0 ± 1.0	1.4
		Suspended	<0.2	
		Ra-226		
		Dissolved	0.3 ± 0.1	0.4 ± 0.5
		Suspended	<0.2	5.4 ± 1.3
30 July 84	Junction	Nat. Uranium		
		Dissolved	6.3 ± 0.5	
		Suspended	1.4 ± 0.5	
		Ra-226		
		Dissolved	0.6 ± 0.4	
		Suspended	<0.1	
	Ground Water			
08 May 84	Campground	Nat. Uranium	0.5 ± 0.1	1.4
		Ra-226	<0.2	0.3 ± 0.6
08 May 84	Seep	Nat. Uranium	0.7 ± 0.3	5.2
		Ra-226	0.2 ± 0.1	0.5 ± 0.6

JOY MINING COMPANY
SURFACE AND GROUND WATER ANALYSES
(pCi/liter ± 2 sigma)

Results of Split Samples Analyzed by the
State of Washington Department of Social and Health Services
and Joy Mining Company

January 1985 through December 1985

Date	Location	Isotope	DSHS	JMC
Surface Water				
13 June 85	Junction	Nat. Uranium		
		Dissolved	6.8 ± 0.5	
		Suspended	0.5 ± 0.1	
		Ra-226		
		Dissolved	<0.2	
		Suspended	<0.2	
24 Sept.85	Junction	Nat. Uranium	2.8 ± 0.2	
		Dissolved	1.1 ± 0.1	
		Suspended		
		Ra-226		
		Dissolved	<0.2	
		Suspended	<0.2	
Ground Water				
13 June 85	Campground	Nat. Uranium	0.8 ± 0.1	
		Ra-226	<0.2	
24 Sept.85		Nat. Uranium	1.7 ± 0.2	
		Ra-226	<0.2	

'OY MINING COMPANY
SURFACE AND GROUND WATER ANALYSES
(pCi/liter ± 2 sigma)

Results of Samples Analyzed by the
State of Washington Department of Social and Health Services

January 1986 through December 1986

Date	Location	Isotope	DSHS
Surface Water			
8 May 86	Junction (Station-2)	Nat. Uranium	
		Dissolved	6.7 ± 0.6
		Suspended	0.5 ± 0.1
		Ra-226	
		Dissolved	0.3 ± 0.1
		Suspended	<0.2
24 Sept. 86	Junction (Station-2)	Nat. Uranium	
		Dissolved	1.7 ± 0.2
		Suspended	0.8 ± 0.1
		Ra-226	
		Dissolved	0.3 ± 0.1
		Suspended	<0.2
Ground Water			
8 May 86	Campground	Nat. Uranium	0.5 ± 0.1
		Ra-226	0.3 ± 0.1
24 Sept. 86	Campground	Nat. Uranium	0.5 ± 0.1
		Ra-226	0.2 ± 0.1

STATE OF WASHINGTON
Department of Social & Health Services
Division of Health
Office of Public Health Laboratories
Radiation & Environmental Chemistry Laboratory
1610 N. E. 150th St., Seattle, Washington 98155-7224

Analyses of samples collected at Joy Mining Company. These samples were collected by Leo Wainhouse on May 26th, 1988.

NUMBER	SAMPLE INFORMATION	ISOTOPE	RESULT		RANDOM UNCERTAINTY (95%)	UNITS
7146	Joy Mining Company Station 2 Surface Water	Uranium (234,235,238)	11.4	±	0.5	pCi/L
		Radium (226)	0.1	±	0.2	pCi/L
		Conductivity	110	±	10	µmhos/cm
		TDS	100	±	10	mg/L
7147	Joy Mining Company Station 2 Sediment	Uranium (234,235,238)	97	±	1	pCi/g
		Radium (226)	7.4	±	0.1	pCi/g
7148	Joy Mining Company Station 2, Water Filter	Uranium (234,235,238)	-----	±	-----	pCi/L
		Radium (226)	-----	±	-----	pCi/L

Approved by: Cynthia A. Ostrom Date 10/12/88

STATE OF WASHINGTON
Department of Social & Health Services
Division of Health
Office of Public Health Laboratories
Radiation & Environmental Chemistry Laboratory
1610 N. E. 150th St., Seattle, Washington 98155-7224

Analyses of samples collected at Joy Mining Company. These samples were collected by Leo Wainhouse on September 26th, 1988.

NUMBER	SAMPLE INFORMATION	ISOTOPE	RESULT		RANDOM UNCERTAINTY (95%)	UNITS
4909	Joy Mining Company Station 2 Surface Water	Uranium (234,235,238)	3.0	±	0.3	pCi/L
		Radium (226)	0.1	±	0.1	pCi/L
		Conductivity	80	±	10	µmhos/cm
		TD	70	±	7	mg/L
4910	Joy Mining Company Station 2, Water Filter	NO ANALYSIS REQUIRED				

Approved by: Cynthia Ebaugh

Date 04/03/89

STATE OF WASHINGTON
Department of Health
Division of Laboratories
Radiation Laboratory
1610 N. E. 150th St., Seattle, Washington 98155-7224

Analysis of samples collected at Joy Mining Company. These samples were collected by J. Martelli and L. Gronemyer on May 23, 1989.

NUMBER	SAMPLE INFORMATION	ISOTOPE	RESULT		RANDOM UNCERTAINTY (95%)	UNITS
8247	Joy Mining Company Station 2 Surface Water Dissolved	Uranium (234,235,238)	7.6	±	0.3	pCi/L
		Radium (226)	0.1	±	0.1	pCi/L
		Conductivity	70	±	7	µmhos/cm
		TDS	80	±	8	mg/L
8248	Joy Mining Company Station 2, Sediment (DRY WEIGHT)	Uranium (234,235,238)	119	±	3	pCi/g
		Radium (226-da)	3.8	±	0.1	pCi/g
8249	Joy Mining Company Station 2 Surface Water Suspended	Uranium (234,235,238)	2.0	±	0.2	pCi/L
		Radium (226)	0.1	±	0.1	pCi/L

Approved by: [signature] Date 10/10/89

Analyses of samples collected at Joy Mining Company. These samples were collected by John Martelli and Randy Ac[illegible]rod on September 27th, 1989.

NUMBER	SAMPLE INFORMATION	ISOTOPE	RESULT	RANDOM UNCERTAINTY (95%)	UNITS
9162	Joy Mining Company Station 2 Surface Water D i s s o l v e d	Uranium (234,235,238)	3.2 ±	0.3	pCi/L
		Radium (226)	-0.1 ±	0.	pCi/L
		Conductivity	90 ±	10	µmnos/c
		TDS	70 ±	7	mg/L
9163	Joy Mining Company Station 2, Water Filter Suspended	Uranium (234,235,238)	2.1 ±	0.3	pCi/L
		Radium (226)	0.1 ±	0.2	pCi/L
9164	Joy Mining Company Campgrounds Ground Water	Uranium (234,235,238)	1.3 ±	0.2	pCi/L
		Radium (226)	0.0 ±	0.1	pCi/L
		Conductivity	100 ±	10	µmhos/c
		TDS	60 ±	6	mg/L

Approved by: [signature] Date 03/30/90

JOY MINING CO. PREOPERATIONAL DATA
SURFACE WATER 1983

Location	Date Collected	Radium 226 PCi/l Total	Radium 226 PCi/l Dissolved	Uranium PCi/l Total	Uranium PCi/l Dissolve
JMC-HW	Jan 27	12.3	0.3	13.54	9.48
"	Jan 27	...	...	1,004	14
"	Mar 1	...	...	16.925	0
"	Mar 2	26	0.3	2,504.9	12.18
"	Mar 30	...	...	1,954.49	18.27
"	April 29	38.9	0.9	10.83	5.41
"	May 9	0.3	0.0	...	8.124
"	May 31	290±10	0.4±0.7	105,767.71	20.31
"	June 29	...	...	13,073.547	7.447
SEC 5 *	Jan 27	0.2	0.2	...	10.155
"	Mar 1	...	...	13.54	6.84
"	Mar 30	...	...	...	...
DOE Station	Jan 27	0.8	0.1	25.0	10.0
"	Jan 27	...	...	33.35	23.19
"	Mar 1	...	...	20.31	6.77
"	Mar 2	1.5	0.2	48.06	10.0
"	Mar 30	...	...	13.54	0
"	April 29	...	...	5.42	0
"	May 6	...	...	4.06	0.88
JMC-Jct	Jan 27	0.4	0.0	18	9
"	Mar 2	0.1	0.0	14.21	6.77
"	April 29	0.1	0.0	...	...
"	May 9	0.8	0.0	...	...
"	May 31	0.1±0.4	0.1±0.3	...	...
"	June 29	...	...	...	...
"	July 30	0.28±0.4	0.1±0.4	...	...
"	Aug. 1	0.22±0.4	0.2±0.4	...	...
"	Aug. 3	<0.35±0.3	<0.3±0.3	...	...
"	Aug. 5	0.59±0.4	0.4±0.4	...	...
"	Aug. 10	<0.14±0.3	0.1±0.3	...	...

* Location of Section 5 station unknown.
... No Data as of October 10, 1983.

JOY MINING CO. PREOPERATIONAL DATA
JUNCTION STATION
SURFACE WATER 1983

Date Collected	Nat. Uranium PCi/l Total	Dissolved
Jan 8	...	<67.7
Jan 10	...	<67.7
Jan 18*	...	253.875
Jan 27	26.267	3.927
Feb 14	10.155	<.677
Feb 22	<6.77	<6.77
Mar 1	13.54	6.77
Mar 7	6.77	<6.77
Mar 15	13.54	2.708
Mar 22	11.509	no detection
Mar 30	33.85	13.54
Apr 12	29.111	10.832
Apr 21	54.16	<6.77
Apr 29	85,911.3	85,897.8
May 4	<6.77	<6.77
May 6	4.062	<.677
May 9	...	2.708
May 16	4.062	<.677
May 23	<.677	<.677
May 31	4.062	2.031
Jun 6	<.677	<.677
Jun 15	<.677	<.677
Jun 20	14.894	4.739
Jun 29	2.031	.677

* Changed procedures - lowered detection limits.
... No data as of Oct. 10, 1983.

JOY MINING COMPANY
FLODELLE CREEK PROJECT

PREOPERATIONAL DATA
SURFACE WATER
(pCi/L)

STATION	DATE	RADIONUCLIDE		
		TOTAL U	SUSPENDED U	DISSOLVED U
JMC-HW	1-27-83	11.48	3.44	8.04
	2-28-83	14.35	14.35	9.76
	3-30-83	1657.39	1641.90	15.50
	4-29-83	72851.92	72840.44	6.89
	5-9-83	-	-	6.89
	5-31-83	89689.96	89672.74	17.22
	6-29-83	11086.24	11079.92	6.314
	7-26-83	2815333.58	2807870.42	0.7463
	8-31-83	3759199.45	3759193.69	5.74
	9-30-83	6602.37	6602.03	0.344

JOY MINING COMPANY
FLODELLE CREEK PROJECT

PREOPERATIONAL DATA
SURFACE WATER
(pCi/L)

STATION	DATE	RADIONUCLIDE		
		TOTAL U	SUSPENDED U	DISSOLVED U
JMC-JCT	1-8-83	-	-	< 57.41
	1-10-83	-	-	< 57.41
	1-18-83	-	-	215.28
	1-27-83	22.27	18.94	3.33
	2-14-83	8.61	8.61	< 0.57
	2-22-83	< 5.74	< 5.74	< 5.74
	2-28-83	11.48	5.74	5.74
	3-7-83	5.74	5.74	< 5.74
	3-15-83	11.48	9.19	2.30
	3-22-83	9.76	9.76	-
	3-30-83	28.70	17.22	11.48
	4-12-83	24.69	15.50	9.19
	4-21-83	45.93	45.93	5.74
	4-29-83	9.19	4.59	4.59
	5-4-83	< 5.74	< 5.74	< 5.74
	5-6-83	3.44	3.44	< 0.57
	5-9-83	-	-	2.30
	5-16-83	3.44	3.44	< 0.57
	5-23-83	< 0.57	< 0.57	< 0.57
	5-31-83	3.44	1.72	1.72
	6-6-83	< 0.57	< 0.57	< 0.57
	6-15-83	< 0.57	< 0.57	< 0.57
	6-20-83	12.63	8.61	4.02
	6-29-83	1.72	1.15	0.57
	7-5-83	4.59	1.72	2.87
	7-11-83	3.04	1.32	1.72
	7-17-83	1.43	1.43	< 0.06
	7-26-83	1.72	0.57	1.15
	7-30-83	.006	.006	.006
	8-1-83	.006	.006	.006
	8-3-83	2.12	0.63	1.49
	8-10-83	0.86	0.17	0.69
	8-20-83	0.52	0.34	0.17
	8-29-83	0.92	0.23	0.69
	9-6-83	9.19	9.19	< 0.06
	9-12-83	6.60	6.60	< 0.06
	9-20-83	< 0.06	< 0.06	< 0.06
	9-28-83	< 0.06	< 0.06	< 0.06

JOY MINING COMPANY
FLODELLE CREEK PROJECT

PREOPERATIONAL DATA
SURFACE WATER
(pCi/L)

LOCATION	DATE	RADIONUCLIDES			
		TOTAL Ra-226	DISSOLVED Ra-226	TOTAL Th-230	DISSOLVED Th-230
JMC-HW	1-27-83	12.3	.3	9.6	0.0
	3-2-83	26	.3	–	.2
	4-29-83	38.9	.9	48.0	0.0
	5-9-83	.3	0.0	0.0	0.0
	5-31-83	290.0 ± 10	.4 ± 0.7	270.0 ± 20	0.0 ± 0.5
	6-29-83	23.3 ± 2.4	0.3 ± 0.4	13.4 ± 6.7	0.4 ± .7
	7-26-83	24.0 ± 3	0.7 ± 0.6	22.0 ± 4	1.5 ± 1.5
JMC-JCT	1-27-83	.4	0.0	.9	.1
	3-2-83	.1	0.0	–	.1
	4-29-83	.1	0.0	.1	0.0
	5-9-83	.8	0.0	.1	0.0
	5-31-83	.1 ± .4	.1 ± .3	0.0 ± .5	.4 ± .6
	6-29-83	0.0 ± 0.4	0.0 ± 0.2	29.3 ± 5.5	0.3 ± 0.5
	7-26-83	0.5 ± 0.4	0.2 ± 0.2	1.3 ± 1.6	0.0 ± 2.4
	7-30-83	0.28 ± 0.52	0.1 ± 0.4	–	–
	8-1-83	0.22 ± 0.45	0.2 ± 0.4	–	–
	8-3-83	0.35 ± 0.37	0.3 ± 0.3	–	–
	8-5-83	0.59 ± 0.50	0.4 ± 0.4	–	–
	8-10-83	0.14 ± 0.34	0.1 ± 0.3	–	–

Table 10
4 of 8
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WASHINGTON STATE DEPARTMENT OF
Natural Resources

BRIAN BOYLE
Commissioner of Public Lands

NORTHEAST REGION
225 S. Silke Rd.
P.O. Box 190
Colville, WA 99114

(509) 684-5201
1-800-527-3305

January 29, 1990

E.Lee Gronemyer
Dept. of Health
Airdustrial Center, Bldg 5
Mail Stop LE-13
Olympia WA 98504

RE: Joy Mining Site

Dear Mr. Gronemyer:

1. I am in receipt of your letter dated January 23, 1990. Your "observations and evaluations indicate that the site is radiologically safe and that the Department of Natural Resources has unrestricted use of the previous millsite land."

2. Intended future use of this site will include tree planting to reforest the millsite. Continued present use similar to adjacent forest and wet meadow will include grazing and occasional recreation use; i.e., hunting, hiking, etc. There are no plans for any intensive use; however, we maintain all options on state trust lands.

If you have any further questions, or if I can be of assistance feel free to call me.

Sincerely,

L.R. (Dick) Dunton
North Columbia District Manager

LRD:rn

cc: Ryder Chronic, Regional Manager
Al Hedin, Assistant Manager, State Lands
Ron King, Land Manager
File
WP

0409
GRONEMYE.LTR

KRISTINE GEBBE
Secretary

STATE OF WASHINGTON

DEPARTMENT OF HEALTH

Airdustrial Center, Bldg. 5 • Mail Stop LE-13 • Olympia, Washington 98504

January 23, 1990

Ryder W. Chronic
DNR - Regional Manager
P.O. Box 190
Colville, Washington 99114

Dear Mr. Chronic:

The purpose for this letter is to inform you that the reclamation of the Joy Mining Company (JMC) site is completed. The last of the contract work required by Allied Nuclear, Inc. was completed on or before October 31, 1989. The Department of Health (DOH) has released Allied Nuclear from any further obligations at the site, and the final payment to their contract has been made. The soil samples and radiation measurements taken by DOH, following site reclamation, have also been analyzed and evaluated. Our observations and evaluations indicate that the site is radiologically safe and that DNR has unrestricted use of the previous millsite land.

A second purpose for this letter requests an answer from you concerning future use of the JMC millsite. Through previous discussions with DNR personnel, we believe the site is going to revert back to nature through tree planting and natural vegetation growth. It is further believed that DNR will not encourage the use of the millsite for camping or other recreational purposes. We also understand that DNR will not make any additional changes to the bog area. Any further changes in the bog area will be due to Flodelle Creek water flow and/or other natural causes.

Information concerning future use of the millsite is important to us (DOH), since the data will be used as part of our license termination request to the U. S. Nuclear Regulatory Commission. License termination procedures require concurrence from the Commission before DOH can be totally relieved of regulatory and radiological responsibilities at the site. Following license termination, DOH will probably continue with stream sampling and/or other environmental studies over the next year or two.

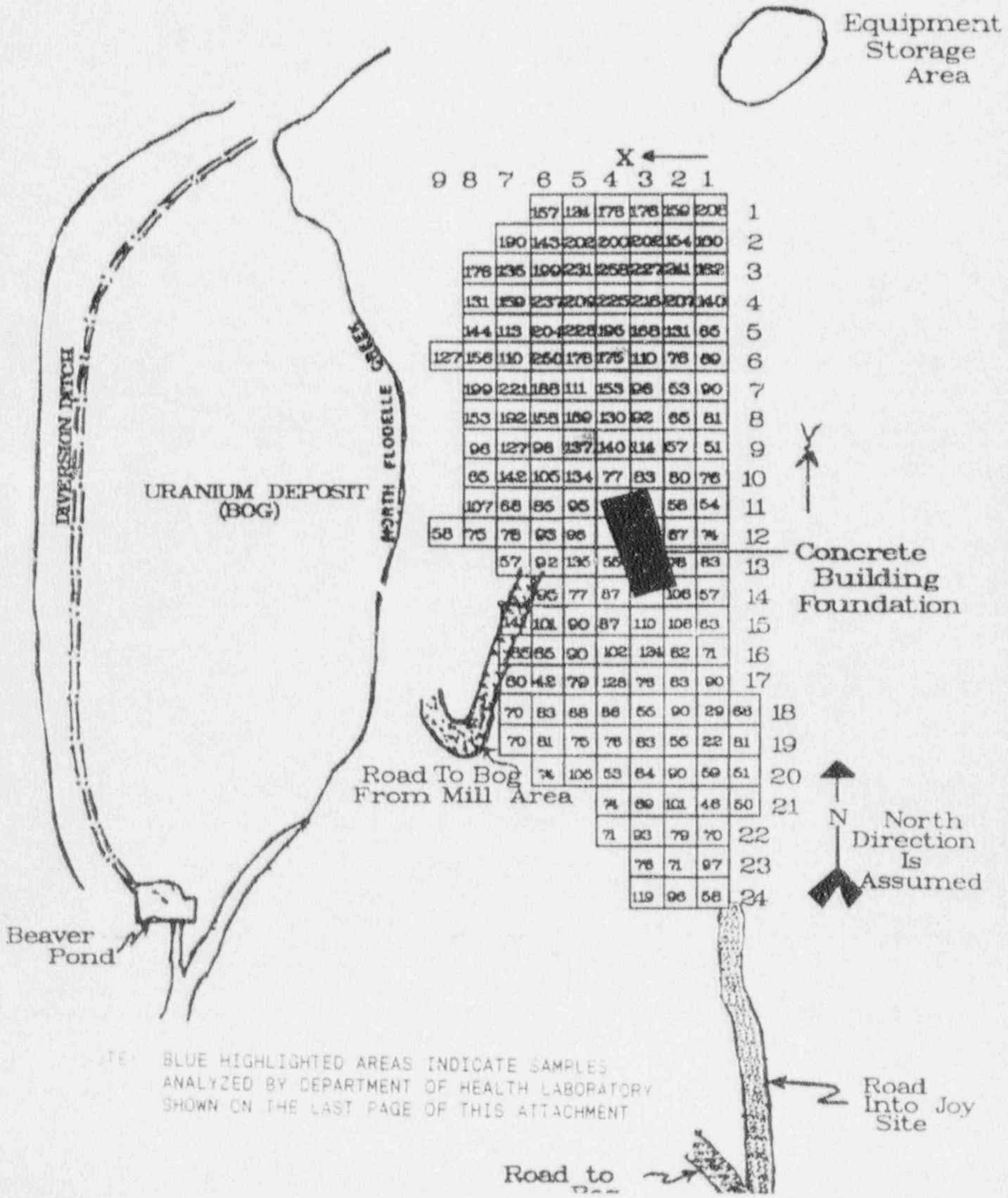
Thank you in advance for forwarding information concerning future use or plans for the JMC millsite.

Sincerely,

E. Lee Gronemyer
Radiation Health Physicist

ELG:krf

cc: Ron King



BLUE HIGHLIGHTED AREAS INDICATE SAMPLES ANALYZED BY DEPARTMENT OF HEALTH LABORATORY SHOWN ON THE LAST PAGE OF THIS ATTACHMENT