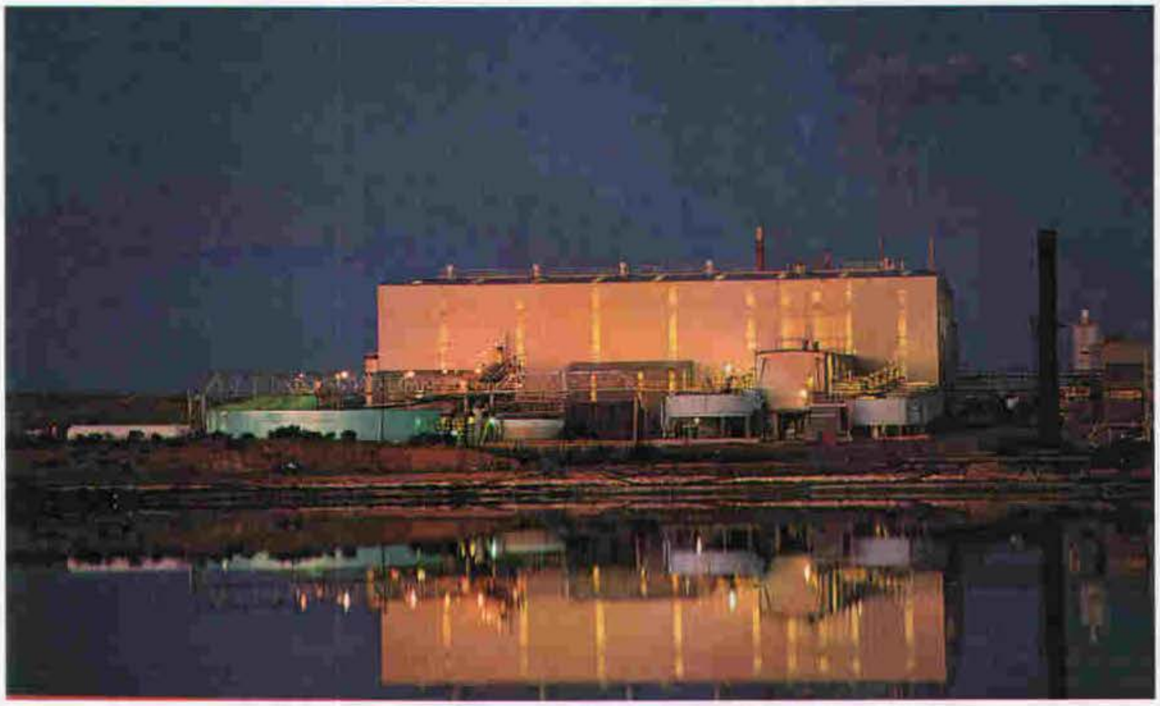

WHITE MESA URANIUM MILL

LICENSE RENEWAL APPLICATION

STATE OF UTAH RADIOACTIVE MATERIALS LICENSE No. UT1900479

February 28, 2007

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Volume 2 of 5
(License Renewal Application)
(Appendices A-I)

DENISON MINES (USA) CORP.

BOOK #11

ENVIRONMENTAL PROTECTION MANUAL

AIR MONITORING – PARTICULATE RADIONUCLIDES

PART I AIR MONITORING PLAN

1.0 PARTICULATE RADIONUCLIDE AIR MONITORING

Air samples for monitoring particulate radionuclides are taken at the following four locations: (See Attachment A)

BHV-1	Northeast of the Mill at the meteorological station.
BHV-2	Approximately 2.5 miles north of the Mill.
BHV-4	Approximately 400 yards south of Cell No. 4.
BHV-5	Approximately 100 yards south of the intersection of State Highway 191 and the Mill access road.
BHV-6	Approximately 0.5 miles south of BHV-5 along Highway 191.

Air samples are collected on a weekly basis. A composite of 13 weekly samples from each of the above locations is prepared to form a quarterly sample for each location.

2.0 QUALITY ASSURANCE

Quality assurance of the samples is met by collecting samples in accordance with the conditions and guidelines set forth in this SOP (Section 6.0).

Quality assurance of the analytical results is based on the contract laboratory's quality controls such as blanks, duplicates, and standard percent recovery. The laboratory will also follow U.S. NRC Regulatory Guides 4.14 and 4.15 when analyzing the air filter samples. The laboratory is committed to meet the LLD values for radionuclides listed in these guidance documents, and will perform re-runs on all samples not meeting these limits.

3.0 ANALYTICAL REQUIREMENTS

Each quarterly sample will be analyzed for U-nat, Ra-226, Th-230 and Pb-210. Results will be expressed in picocuries per milliliter (pCi/mL).

PART II STANDARD OPERATING PROCEDURES

1.0 EQUIPMENT

The equipment used in monitoring levels of particulate radionuclides consists of high volume air samplers equipped with mass flow controllers and vacuum switch controlled timers. The samplers are capable of collecting air through the sample filter at a volumetric flow rate of approximately 40 standard cubic feet per minute (scfm). The mass flow controller varies the actual air flow rate as dictated by changing temperature, filter loading, and barometric pressure to maintain a constant standard air flow rate. The actual rate is read directly from the analog gauge located on the front panel. The timer is turned off when no vacuum exists in the system, i.e., when the motor/blower assembly is disconnected or otherwise malfunctions.

Particulates are trapped on an 8 x 10-inch glass microfiber filter such as one of the following, or equivalent:

1. Whatman EPM 1000
2. Whatman EPM 2000
3. Schliecher & Schuell #1 HV.

2.0 MONITORING METHODOLOGY

The air samplers are mounted on towers approximately 2 meters above ground plane. The samplers run continuously except for calibration, mechanical or electrical failure, and maintenance down time. Target flow rate will be 32 scfm.

Air filters are replaced weekly due to particulate loadings. Maximum filter use duration will be weekly unless weather conditions prohibit safe access to one or more of the air monitoring station locations.

Each filter is stamped by the manufacturer with a unique number. The blank filters are weighed to the nearest 0.0001 gram using a Sartorius Model 2432 analytical balance or equivalent. The filters are kept in manila folders for support during transportation. The weights are then recorded on the filter folders along with the location, filter number, start date, and start time. When the filters are collected in the field, the stop date and time are entered on the folder. On return from the field, the filters are again weighed and the gross weights are recorded on the folders. Filters and folders are kept in resealable plastic bags.

Samples are collected continuously for approximately one week. The "loaded" filters are removed from the shut down samplers, folded, and placed in the folders in the plastic bags. If any part of the filter remains on the seal gasket, it is removed and added to the folder. The new filters are removed from their folders and placed on the vacuum head with the filter holder frame tightened enough to seal, but not tight enough to rupture the filters. The samplers are then turned on.

Each station's filters are composited on a quarterly basis (13 weeks) by the environmental staff. The samples are forwarded, along with an analytical sheet and Chain of Custody (COC) form (provided by the contract laboratory), to the contract laboratory in sealed plastic bags.

3.0 CALIBRATION

3.1 Orifice Plate

The orifice plates shall be calibrated every year as recommended by the EPA. A certified calibration laboratory that will use the EPA or an EPA-approved method will do the calibration. Calibration records are kept in the environmental files.

3.2 Sampler

Sampler airflow rates are checked weekly by visual observation of the analog meter, graduated in standard cubic feet per minute.

Calibration of the equipment occurs during the first Monday of each month. If a non-scheduled motor replacement is necessary, the sampler is re-calibrated.

An orifice plate assembly and U-tube manometer are used for monthly calibrations.

The sampler flow rate is regulated to a standard air volume that is recorded on the field calibration sheet using 20°C. (298 K) and 29.2 inches (760 mm) of mercury as standard conditions. A monthly calibration worksheet (Attachment C) is completed for each air sampling station and retained in the files.

The monthly calibration task involves the following:

1. Before visiting each monitoring location, the air temperature and barometric pressure are recorded.
2. The motors are replaced as required. The replacement motors are prepared at the Mill office.
3. The new filter is placed on the vacuum head, and the orifice plate is secured on top of the filter.
4. The orifice plate is connected to the U-tube manometer and the initial inches H_2O is recorded.
5. The control screw is adjusted as necessary to advance or slow the vacuum motor to reach the desired flow rate. The final flow rate must be at least 32 scfm on the analog meter and reach 75% on-stream time for the quarter to meet the required LLD for the radionuclide parameters.
6. The U-tube manometer level, in inches, is then recorded and a flow rate calculated.

4.0 CALCULATIONS

Using inches of water from the U-tube, refer to the following subsections to perform the calculation of flow rate. Section 4.1 provides the equation used to compute the flow rate at field conditions, and the "actual" flow rate, in cubic meters per minute. Actual flow rate must be corrected to standard flow rate using the flow rate equation in Section 4.2. The standard flow rate is then converted to standard cubic feet with the conversion equation in Section 4.3.

4.1 Orifice Equation

Using the inches of water determined from the U-tube, the following equation is used to calculated the flow rate at field conditions using:

$$Qa = a \times (\text{inches of water})^{b}$$

Where
Qa = flow rate at field conditions, in cubic meters per minute (m^3 / min).
a = orifice constant
b = orifice constant.

The constants a and b in the above equation are provided by the calibration laboratory for each specific calibrated orifice (Attachment D). Each orifice will have unique performance properties which relate to design and those measured performance properties are incorporated into the flow equation as specific constants. The flow equation demonstrates the relationship between measured vacuum pressure in inches of water to actual flow rate utilizing this device.

4.2 Standard Conditions Flow Rate Equation

The flow rate at standard conditions is calculated by adjusting the field condition flow rate, calculated above, by the following equation:

$$Qs = Qa \times \frac{[Pa \times Ts]}{[Ps \times Ta]}$$

where

Ts = Absolute temperature at orifice calibration (298 K)
Ta = Absolute temperature at air sampler calibration (273°C + measured °C)
Ps = Atmospheric pressure at orifice calibration (760 mm Hg)
Pa = Atmospheric pressure at air sampler calibration (measured mm Hg)
Qs = Flow rate at standard conditions in cubic meters per minute (m^3 / min).
Qa = Flow rate at field conditions in cubic meters per minute(m^3 / min).

4.3 Correction Equation

To convert the standard flowrate, Qs, from cubic meters per minute to standard cubic feet per minute, use the following equation:

$$Q_{\text{Standard Cubic Feet per Minute}} = 35.341 \times Qs$$

5.0 RECORD KEEPING

The records are kept on the filter folders, which are retained in the environmental files in the environmental office, and are also into the computer files, after the data have been reviewed. The following information will be entered in computer files (see Attachment E):

- Filter number
- Start date
- Start time
- End date
- Stop time
- Total time
- Total liters
- Loading in mg/cubic meter
- Percent on-stream
- Weekly average flow rate in cubic feet per minute

6.0 QUALITY ASSURANCE

6.1 Installation and Removal of Filters

Field methods to assure quality of air sample collection include the following:

1. Inspection of all new filters for aberrations and discarding damaged ones.
2. Maintaining seals on equipment connections.
3. Careful installation and removal of filters, retaining all abraded filter media.
4. Proper sequential handling of all filters.
5. Filters are inspected for fingerprint contamination by visual observation.

6.2 Sample Duration

Maintenance of sample duration is assured by:

1. Installation of a vacuum-actuated timer which operates the timer only when the motor is running and pulling the minimum allowable vacuum.

2. Weekly monitoring of stations and inspecting wear on the motors and proper change-out at appropriate intervals (monthly).

6.3 Sample Flow Rate

Quality assurance of sample flow rate is accomplished by weekly visual checks of the analog read-out. Monthly checks of flow controller operation and documentation thereof also provide quality assurance. Samplers are checked for calibration at motor rotation intervals (monthly).

6.4 Calculations

Calculations are checked on a random basis for inconsistencies, and such checks are documented.

Upon retrieval of the data analytical sheet from the contract laboratory, the date of receipt is noted, along with the date of transcribing to the sample station log sheet and the transcriber's initials. The transcription of data is reviewed by another person in the Environmental Department to minimize transposition of numerical values. Calculation and data storage is by computer program.

6.5 Sampler Performance

A record of sampler operation time versus total possible duration time is maintained as a flag against excessive equipment downtime. Sampler performance is reviewed monthly.

6.6 Quality Control Methodology

Blanks are weighed each week and submitted alongside the actual filters. The filters and blanks are recorded on an analytical sheet which is sent to the vendor, and this sheet is returned with the results.

AIR MONITORING -- RADON

1. RADON MONITORING PLAN

1.1 Locations and Frequency of Samples

Radon samples are taken at the following locations:

BHV-1
BHV-2
BHV-3
BHV-4
BHV-5
BHV-6

See Attachment A to Section 1.1 of this Environmental Protection Manual for the locations of these monitoring stations.

Samples are collected on a quarterly basis

1.2 Quality Assurance

Quality assurance of the samples is met by collecting samples in accordance with the conditions and guidelines set forth in Section 2 of this procedure. In addition, the following steps will be followed:

a) Detector locations will be monitored periodically to ensure the detectors have not been lost;

b) Detector shipments will be inspected to ensure that all detectors are present when receiving or shipping detectors; and

c) Monitoring data will be reviewed for consistency and data transportation.

1.3 Analytical Requirements

Each quarterly sample will be analyzed for Radon-222.

2. STANDARD OPERATING PROCEDURES

2.1 Equipment

Samples will be collected using the Radtrak® (Trac-Etch) Outdoor Air Radon Detector, or equivalent.

2.2 Monitoring Methodology

The following monitoring procedures will be followed:

a) Remove detector from package – The Radtrak® radon detectors are supplied in aluminum bags which prevent radon exposure. Open the aluminum bag and remove the clear plastic cup which has a Radtrak® detector fastened to the bottom. Detectors, before, during or after exposure should not be in locations which exceed a temperature of 160°F (70°C). There is no low temperature.

b) Fill in the enclosed Detector Log Sheet with the serial number on the detector label. Also fill in the date installed and the location information in the location/comments area.

c) Attach a field canister to a post or other location using the metal bracket with the open mouth of the canister facing down. The canister may be placed at any desired height (typically 3-6 feet) and preferably in a location minimizing animal damage or tampering. Remove the clear acrylic retaining ring from the canister by removing the wing nuts. Install the assembled cup inside the canister and replace the retaining ring and wing nuts in order to hold the cup in place.

d) Leave the detector undisturbed for the duration of the three month monitoring period.

e) At the end of the monitoring period, remove the Radtrak® detector from the plastic cup. Peel off the gold seal provided with the shipment and cover all the holes on the top of the detector. This stops the monitoring period. Record the ending date on the Detector Log Sheet.

f) Return the detector(s) along with a copy of the Detector Log Sheet using the enclosed label for shipment back to supplying organization.

3. RECORD KEEPING

Data maintained in record form for environmental radon is:

a) Sample period;
b) Sample location; and
c) Radon levels.

METEOROLOGICAL DATA MONITORING PLAN

AND STANDARD OPERATING PROCEDURES

1. MONITORING METHODOLOGY

1.1 Monitoring Equipment

The collection of meteorological data is accomplished on a daily basis through the use of a Campbell Scientific Data Logger Model #SM 192, or equivalent. The meteorological station retrieves the data continuously and the information is downloaded into the aforementioned data logger.

1.2 Weekly Function Check

On a weekly basis, a function check of the system is performed. The function check includes checking of the data logging process, amount of data points being stored, wind direction, wind speed, and battery voltage. This information is tabulated on the form "A" attached.

1.3 Weekly Downloading of Data

See form "B" for specifications on the downloading and data retrieval.

1.4 Monthly Exchange of Data Module

On the first Monday of each month, after the downloading and data retrieval, exchange the data module with another data module and send the older module in for downloading and data verification by the independent meteorological contractor.

After the contractor has downloaded all data and verification of the data has been established, the contractor will then return the data module for exchanging the next month.

1.5 Record Keeping

All paperwork generated through the downloading and verification process will be maintained in the Environmental Department.

FORM A

WEEKLY METEOROLOGICAL STATION CHECK - WHITE MESA MILL

HARDWARE | COMMENTS

SOLAR PANEL: ______________________________

BATTERY CHARGE: ______________________________

STATION CONDITION: ______________________________

SENSORS

WIND VANE: ______________________________

WIND SPEED: ______________________________

TOWER CABLES: ______________________________

DATA MODULE: ________________ Bytes: ______

DATA RETREIVAL

DATE:

STORAGE LOCATION START: __________

STORAGE LOCATION END: __________

DATA TRANSFER OK (TECH INITIALS): ____________________

TIME OF DAY (MST): ________________

Total dump of data from datalogger to storage module:

Key	Display	Explanation
*8	08:00	Manual dump
71	08:71	7 for storage module 1 for modules address
AA	03:xxxx	advance to location three, write this number down and add 1 to it. Backup to location 02:
B	02:xxxx	using the b key and enter this new number in location 02:
AA 1A	04:00	After entering the number, advance to location 4 and enter a '1' and then 'A' to begin the dump. The display should increment rather quickly while the dump proceeds.
*0		Exit and return to normal logging mode.

Procedure to check on the number of data points stored in a storage module:

Key	Display	Explanation
*9	09:01	Enter storage module command mode
1	09:1	1 is the storage module address
A	91:00	ready to accept command
7	91:7	Enter command#7 (DISPLAY DATA)
A	07:00	Dump pointer to SRP
A	07:xxxxx	This is the number of data points stored in the storage module. If this number is > 2, then the logger is storing data correctly to the storage module.
*0		Exit and return to normal logging mode.

*6 COMMAND SUMMARY

Push	Display	Comment
*6	06:0000	Enter display mode
A	01:xxxx	displays wind direction
A	02:xxxx	displays wind speed (m/s)
A	03:xxxx	displays battery voltage
*0	:LOG1	Exits program

STACK EMISSION MONITORING PROCEDURES

WHITE MESA GAS STACK EMISSIONS

1.0 INTRODUCTION

White Mesa uses scientifically approved reference methods to determine gas stack emissions release concentration for radionuclide particulates. These methods conform to principles that apply to obtaining valid samples of airborne radioactive materials, using prescribed acceptable methods and materials for gas and particulate sampling. See American Standard Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities ANSI N13.1-1969. These sampling methods are also consistent with guidance contained in the U.S. Nuclear Regulatory Commission's Regulatory Guide 4.14, "Radiological Effluent and Environmental Monitoring at Uranium Mills."

2.0 SAMPLING METHODOLOGIES

The sampling methods for airborne radionuclide particulates, from the yellowcake dryer and other mill effluent control stacks, are identical to methods published in the EPA's manual, Gas Stream Sampling Reference Methods for New Source Performance Standards; they are found in the EPA Manual in Appendix No. 5, "Determination of Particulate Emissions from Stationary Sources" ("EPA Method #5") and Appendix No. 17, "Determination of Particulate Emissions from Stationary Sources (In-Stack Filtration Method)" ("EPA Method #17). Copies of EPA Method #5 and #17 are attached to this SOP. Sampling is performed as per the methods, to ensure that the sampling and results are: (1) isokinetic; (2) representative; and (3) adequate for determination of the release rates and concentrations of U-Nat, Th-230, Ra-226 and Pb-210.

2.1 Sampling Equipment

Sampling equipment used to collect airborne radionuclide particulates from point source emission stacks at the Mill consists of equipment manufactured by Research Appliance Company (RAC), (or other equivalent apparatuses), as follows:

1. RAC Model 201009 Model 2414 stack sampler.
2. Two each, RAC Model 201044 modular sample cases. One heater box and one glassware box.
3. One each, RAC Model 201019 umbilical cord.

4. Three each, RAC Model 201013 – 100mm diameter filter holders.
5. One each, RAC Model 201005 standard pilot tube, three feet length, stainless steel/S-type probe.
6. Barometer.
7. Psychrometer.
8. Satorius Model 2432 balance or equivalent.
9. Triple beam balance.

Equipment instruction and operating manual(s) provided by the manufacturer(s) are retained at the Mill and used for specific guidance and reference.

2.2 Sample Collection

Gas stack samples are collected from emission control systems used in Uranium Recovery Operations at the Mill. These samples are collected from process stacks when the emission control systems are operating. They are sampled for radionuclide particulate concentrations at a frequency in accordance with Table 5-1. Sample collection methods are described in detail in EPA Method #5 and EPA Method #17, Determination of Particulate Matter Emissions From Stationary Sources. It is necessary to read and understand all procedures described in the methods and in the equipment manual. The operation of the equipment requires "hands-on" instruction from the Radiation Departmental Staff from individuals who are experienced in using sample collection equipment and applying sample collection methods. The following steps are described for stack sample collection.

1. Check equipment listed in Section 2.1 of this SOP. Consult the manufacturers equipment operations manual for details.
2. Assemble equipment as described in the operations manual for sample collection EPA Method #17.
3. Follow the calibration procedure listed in the manual. If the calibration measurements are not obtained, consult the trouble shooting section of the manual for corrective instruction. Once the collection apparatus is calibrated, proceed to the next step.
4. Weigh a new glass fiber filter, record the weight, and place in the filter holder assembly.
5. Check the sample collection system for leaks.
6. Cap ends of sample probes to prevent contamination and transport sample unit to the sample location.
7. Uncap sample end and insert 3/8-diameter sample probe into the stack in the midsection of the exhaust stream.
8. Turn sample apparatus on and observe unit operation to insure a sample is being collected and the apparatus is functioning properly.

9. Collect the stack sample for at least one hour during periods of routine process operation. Note the collection time.
10. Record the information described in the manufacture's operations manual. This information is also described in the EPA Methods #5 and #17 for point source particulate emissions.
11. After sample collection is complete, turn off unit. Obtain sample filter from filter housing and place in a new plastic petri dish. Send to outside laboratory for radionuclide analysis in accordance with Table 5-1.

2.3 Sample Handling and Shipping

1. During preparation and assembly on the sampling train, keep all openings where contamination can occur covered until just prior to assembly or until sampling is about to begin.
2. Using a tweezer or clean disposable surgical gloves, place a labeled (identified) and weighed filter in the filter holder. Be sure that the filter is properly centered and the gasket properly placed so as to prevent the sample gas stream from circumventing the filter. Check the filter for tears after assembly is completed.
3. Before moving the sampling train to the cleanup site, remove the probe from the sample train, wipe off the silicone grease, and cap the open outlet of the probe. Be careful not to lose any condensate that might be present. Wipe off the silicone grease from the filter inlet where the probe was fastened, and cap it. Remove the umbilical cord from the last impinger, and cap the impinger. If a flexible line is used between the first impinger or condenser and the filter holder, disconnect the line at the filter holder, and let any condensed water or liquid drain into the impingers or condenser. After wiping off the silicone grease, cap off the filter holder outlet and impinger inlet. Either ground-glass stoppers, plastic caps, or serum caps may be used to close these openings.
4. Transfer the probe and filter-impinger assembly to the cleanup area. This area should be clean and protected from the wind so that the chances of contaminating or losing the sample will be minimized.
5. Save a portion of the acetone used for cleanup as a blank. Take 200 ml of this acetone directly from the wash bottle being used, and place it in a glass sample container labeled "acetone blank."
6. Carefully remove the filter from the filter holder, and place it in its identified petri dish container. Use a pair of tweezers and/or clean disposable surgical gloves to handle the filter. If it is necessary to fold the filter, do so such that the PM cake is inside the fold. Using a dry Nylon bristle brush and/or a sharp-edged blade, carefully transfer to

the petri dish and PM and/or filter fibers that adhere to the filter holder gasket. Seal the container.

7. Send to the laboratory for radionuclide analysis.

3.0 RECORD KEEPING

Records of gas stack effluent sampling events and results of analysis are retained at the Mill. The following information is recorded:

1. Stack and Run ID
2. Date and Sampler
3. Sampled Air Volume at standard conditions
4. Sampled Water Volume at standard conditions
5. Moisture Content (volume basis)
6. Stack Gas Molecular Weight (wet basis)
7. Stack Gas Velocity
8. Stack Gas Volumetric Flow Rate (dry basis, at standard conditions)
9. Particulate Concentration
10. Percent Isokinetics
11. Emission Rates for Particulates U-Nat, Th-230, Ra-226, and Pb-210.

The data are used to calculate emission rates in pounds and pico curies per hour for radionuclide particulate concentrations.

4.0 MONITORING LOCATION AND FREQUENCY

Stack sampling must be performed during any quarter or semi-annual period that the stacks operate in accordance with the schedule in Table 5-1. During non-operational periods, stack sampling is not performed.

4.1 YELLOWCAKE STACKS

The exhaust stack for the drying and packaging equipment associated with the yellowcake calciner is sampled on a quarterly basis during operations. The sample ports are located on the roof of the main Mill building.

4.2 Feed Stacks

The grizzly feed stack is located on the north end of the grizzly structure. This stack is accessible from a stack platform and is sampled on a semi-annual basis if this system is operating.

5.0 ANALYSIS REQUIREMENTS

All gas stack samples are collected at the Mill according to the calendar year schedule shown below in Table 5-1. The samples will be sent to an off-site laboratory for the analysis detailed below.

TABLE 5-1
Sampling Frequency and Analysis

Feed Stack		Stack for Y.C. Dryer and Packaging	
Quarterly:	None	Quarterly:	If operating, U-nat
Semi-Annual:	If operating, U-nat, Th-230	Semi-Annual:	If operating, U-nat-Th-230, Ra-226, Pb-210

6.0 QUALITY ASSURANCE METHODOLOGY

6.1 Equipment Operation

Prior to performing an emission point sampling run, the sampling equipment is subjected to a dry run test to determine leakages or equipment malfunction. Calibration of equipment is checked on a periodic basis. Probe tips are protected by a protective cap while not in use to protect accuracy determinations. During transport of equipment, all openings are sealed to prevent contamination. Calculations utilized during runs to maintain isokinetic conditions are reviewed and dry run tested prior to the actual run. All containers and probes are washed prior to each usage.

Malfunction of sampling equipment, excessive malfunctions of normal operations being monitored, or percent isokinetic sampling rates greater than ± 10% error, indicate mandatory voiding of the run or data involved.

6.2 Operations

If samples are collected from the operation of any unit which appears, in the judgment of the sampler, to be functioning in a manner not consistent with normal operations, then the sample will be voided and the system will be resampled.

6.3 Chemical Sample Control

Analyses on each period's sample shall include blanks for the filters, impinger solutions, and the rinse solutions. A field logbook shall be maintained listing data generated, determinations of volumes measured, and net gain weights of filters to provide a back up to summary data records. Filters are transmitted within plastic enclosed petri dishes. Handling of filters is only done using tweezers.

6.4 Calculations

All calculations will be retained at the Mill in both a hard copy and computer files.

The gas stack effluent concentrations (C) are calculated as follows:

Lab Result μCi (A) / Volume Sampled (V) = Effluent Concentration (C)

where

Volume Sampled (V) = Flow rate (Q) * Time of sample collection in minutes (t)

and

Lab Result μCi (A) = Radioisotopic activity, in μCi on air filter

SURFACE WATER MONITORING PLAN

AND STANDARD OPERATING PROCEDURES

PART I SURFACE WATER MONITORING PLAN

1.0 MONITORING METHODOLOGY

1.1 Flow Measurement

No flow measurements are taken at the two drainage creeks sample locations: Westwater Canyon and Cottonwood Creek.

1.2 Water Quality

Westwater Canyon and Cottonwood Creek are monitored at two locations west of and adjacent to the White Mesa Mill facility (See Figure 1). Samples are obtained annually from Westwater and quarterly from Cottonwood using grab sampling and analyzed in accordance with Table 1.

2.0 QUALITY ASSURANCE

Quality assurance for surface water monitoring includes an annual review of procedures used to measure field parameters; review of procedures for sample preservation; precautions applied to use of sample containers and equipment; and semi-annual submittal of one site split sample for analysis as a blind duplicate.

PART II SURFACE WATER STANDARD OPERATING PROCEDURES

1.0 EQUIPMENT

Equipment used for monitoring surface water quality includes:

1. Hydrolab Surveyor 4 meter and probe, or equivalent;

2. 2 one gallon sample containers

2.0 SAMPLING PROCEDURE

Two one gallon samples using clean unused sample containers that are provided by the analytical laboratory, are obtained. Specific conductivity, temperature and pH data are obtained in the field as an in-stream measurement, and recorded on the field water analysis data form (Attachment A). One of the samples is sent off to the laboratory and the other remains on site in the environmental sample refrigerator as a backup sample for the analytical laboratory. Suspended samples are not filtered.

Samples are submitted to the analytical laboratory on a quarterly basis. See Table 1 for analytical data to be requested on the surface samples.

2.1 Sample Labeling

Sample containers are labeled with:

1. Project/facility
2. Date and time of sample
3. Filtered or unfiltered
4. Preservation method
5. Sampler's initials
6. Sample location

3.0 CALIBRATION

Equipment used to measure field parameters will be calibrated in accordance with SOP PBL-EP-12.

4.0 RECORD KEEPING

Radiological and chemical quality data is maintained in the Mill files in the Environmental Office. Records will include field and laboratory data as follows:

1. Sample location
2. Sample date
3. Field pH
4. Field temperature
5. Field conductivity
6. Total Suspended Solids Concentration
7. Total Suspended Radionuclide Concentrations
8. Dissolved Radionuclide Concentrations for U-nat, Th-230, Ra-226

5.0 MONITORING LOCATIONS AND FREQUENCY

As shown on Table 1, surface water samples are collected from two locations west of the Mill property:

1. Lower Cottonwood Creek;

2. Lower Westwater Creek.

Samples are obtained four times a year on Cottonwood Creek with the semi-annual list of parameters analyzed twice, and the quarterly list analyzed twice per year. Westwater is sampled once on an annual basis and analyzed for the list of semi-annual parameters shown on Table 1.

6.0 ANALYSIS PROCEDURE

The contract laboratory analytical procedures are in accordance with their respective established quality assurance and quality control programs.

Field sampling procedures are discussed in Section 2.0. Measurement of field parameters is performed using instruments which have been calibrated in accordance with SOP PBL-EP-12.

7.0 QUALITY ASSURANCE METHODOLOGY

7.1 Field Quality

Review of pH, temperature, and conductivity procedures performed in accordance with SOP PRL-EP-12 is done each year. Review of procedures involved with sample preservation is checked each sampling period. Sample collection bottles are not re-used and sample contents are maintained in a cooler.

7.2 Water Quality

On a semi-annual basis, one site sample is split in the field and submitted as a blind duplicate for analytical and sample collection quality assurance. Deviations greater than ten percent result in review of procedures.

Data is reviewed and graphed on a semiannual basis to observe abnormalities.

Table 1

Operational Phase Surface Water Monitoring Program

Monitoring Sites
Westwater and Cottonwood Creeks

Field Requirements

1. Temperature °C
2. Specific Conductivity, µmhos at 25 °C
3. pH at 25 °C
4. Sample date
5. Sample ID

Vendor Laboratory Requirements

Semiannual*

One gallon Unfiltered and raw
One gallon Unfiltered and preserved to pH <2 with HNO_3
Total dissolved solids
Total suspended solids
Gross Alpha
Suspended U-nat
Dissolved U-nat
Suspended Ra-226
Dissolved Ra-226
Suspended Th-230
Dissolved Th-230

Quarterly

One gallon Unfiltered and Raw
One gallon Unfiltered and preserved to pH <2 with HNO_3

Total dissolved solids
Total suspended solids

*Semiannual sample must be taken a minimum of four months apart.
**Annual Westwater Creek sample is analyzed for semi-annual parameters.
Radionuclides and LLDs reported in Ci/ml

Attachment A

FIELD WATER ANALYSIS SURFACE WATER
WHITE MESA MILL

LOCATION (Circle one): Cottonwood Creek   Westwater Canyon   Other (describe)__________

____

DATE:______________________   BY:______________________
(Sampler's initials)

pH BUFFER 7.0 ______________   pH BUFFER 4.0 ______________

SPECIFIC CONDUCTIVITY ____________________ μMHOs

STEAM DEPTH: ____________________

pH of WATER ________________________   TEMP ________________

____

COND μmhos ____________   COND μmhos ____________

pH Units ______________   pH units ______________

Temp °C ______________   Temp °C ______________

COND μmhos ____________   COND μmhos ____________

pH units ______________   pH units ______________

Temp °C ______________   Temp °C ______________

Comments:

____

____

____

WHITE MESA MILL TAILINGS MANAGEMENT SYSTEM AND DISCHARGE MINIMIZATION TECHNOLOGY (DMT) MONITORING PLAN

1. INTRODUCTION

This Tailings Management System and Discharge Minimization Technology Monitoring Plan (the "Plan") for the White Mesa Mill (the "Mill") provides procedures for monitoring of the tailings cell system as required under State of Utah Radioactive Materials License No. UT1900479 (the "Radioactive Materials License"), as well as procedures for operating and maintenance of monitoring equipment and reporting procedures that are adequate to demonstrate DMT compliance under State of Utah Ground Water Discharge Permit No. 370004 for the Mill (the "GWDP").

This Plan is designed as a systematic program for constant surveillance and documentation of the integrity of the tailings impoundment system including dike stability, liner integrity, and transport systems, as well as monitoring of water levels in Roberts Pond and feedstock storage areas at the Mill. The Plan requires daily, weekly, quarterly, monthly and annual inspections and evaluations and monthly reporting to Mill management.

2. DAILY TAILINGS INSPECTIONS

The following daily tailings inspections shall be performed:

2.1. Daily Comprehensive Tailings Inspection

On a daily basis, including weekends, all areas connected with the four tailings cells will be inspected. Observations will be made of the current condition of each cell, noting any corrective action that needs to be taken.

The Environmental or Radiation Technician is responsible for performing the daily tailings inspections, except on weekends when the Shift Foreman will perform the weekend tailings inspections. The Radiation Safety Officer may designate other individuals with training, as described in Section 2.4 below, to perform the daily tailings inspection.

Observations made by the inspector will be recorded on the *Daily Inspection Data* form (a copy of which is attached in Appendix A). The *Daily Inspection Data* form contains an inspection checklist, which includes a tailings cells map, and spaces to record observations, especially those of immediate concern and those requiring corrective action. The inspector will place a check by all inspection items that appear to be operating properly. Those items where conditions of potential concern are observed should be marked with an "X". A note should accompany the "X" specifying what the concern is and what corrective measures will resolve the problem. This observation of concern should be noted on the form until the problem has been remedied. The date that corrective action was taken should be noted as well.

Areas to be inspected include the following: Cell 1, 2, 3, and 4A, Dikes 1, 2, 3, 4A-S, and 4A-W, wind movement of tailings, effectiveness of dust minimization methods, spray evaporation, Cell 2 spillway, Cell 3 and 4A liquid pools and associated liquid return equipment, cell leak detection systems, and the wildlife ponds.

Operational features of the tailings area are checked for conditions of potential concern. The following items require visual inspection during the daily tailings inspection:

a) Tailings slurry and SX raffinate transport systems from the Mill to the active disposal cell(s), and pool return pipeline and pumps.

   Daily inspections of the tailings lines are required to be performed when the Mill is operating. The lines to be inspected include the: tailings slurry lines from CCD to the active tailings cell; SX raffinate lines that can discharge into Cell 1 or Cell 3; the pond return line from the tailings area to the Mill; and, lines transporting pond solutions from one cell to another.

b) Cell 1.

c) Cell 2.

d) Cell 3.

e) Cell 4A.

f) Dike structures including dikes 1, 2, 3, 4A-S, and 4A-W.

g) The Cell 2 spillway, Cell 3 and Cell 4A liquid pools and associated liquid return equipment.

h) Presence of wildlife and/or domesticated animals in the tailings area, including waterfowl and burrowing animal habitations.

i) Spray evaporation pumps and lines.

j) Wind movement of tailings and dust minimization.

Wind movement of tailings will be evaluated for conditions which may require initiation of preventative dust minimization measures for cells containing tailings sand. During tailings inspection, general surface conditions will be evaluated for the following: 1) areas of tailings subject to blowing and/or wind movement, 2) liquid pool size, 3) areas not subject to blowing and/or wind movement, expressed as a percentage of the total cell area. The evaluations will be reviewed on a weekly basis, or more frequently if warranted, and will be used to direct dust minimization activities.

k) Observation of flow and operational status of the dust control/spray evaporation system(s).

l) Observations of any abnormal variations in tailings pond elevations in Cells 1, 3, and 4A.

m) Locations of slurry and SX discharge within the active cells. Slurry and SX discharge points need to be indicated on the tailings cells map included in the *Daily Inspection Data* form.

n) An estimate of flow for active tailings slurry and SX line(s).

o) An estimate of flow in the solution return line(s).

p) Daily measurements in the leak detection system (LDS) sumps of the tailings cells will be made when warranted by changes in the solution level of the respective leak detection system.

The trigger for further action when evaluating the measurements in any of the leak detection systems is a gain of more than 12 inches in 24 hours. If this observation is made, the Mill Manager should be notified immediately and the leak detection system pump started.

Whenever the leak detection system pump is operating and the flow meter totalizer is recording, a notation of the date and the time will be recorded on the *Daily Inspection Data* form. This data will be used in accordance with License Condition 11.3.B through 11.3.E of the Mill's Radioactive Materials License, to determine whether or not the flow rate into the leak detection system is in excess of the License Conditions.

q) An estimate of the percentage of the tailings beach surface area and solution pool area is made, including estimates of solutions, cover areas, and tailings sands for Cells 3 and 4A.

Items (a), (m), (n), and (o) are to be done only when the Mill is operating. When the Mill is down, these items cannot be performed.

2.2. Daily Operations Inspection

During Mill operation, the Shift Foreman, or other person with the training specified in Section 2.4 below, designated by the Radiation Safety Officer, will perform an inspection of the tailings line and tailings area at least once per shift, paying close attention for potential leaks and to the discharges from the pipelines. Observations by the Inspector will be recorded on the appropriate line on the *Operating Foreman's Daily Inspection* form.

2.3. Daily Operations Patrol

In addition to the inspections described in Sections 2.1 and 2.2 above, a Mill employee will patrol the tailings area at least twice per shift during Mill operations to ensure that there are no obvious safety or operational issues, such as leaking pipes or unusual wildlife activity or incidences.

No record of these patrols need be made, but the inspectors will notify the Radiation Safety Officer and/or Mill management in the event that during their inspection they discover that an abnormal condition or tailings emergency has occurred.

2.4. Training

All individuals performing inspections described in Sections 2.1 and 2.2 above must have Tailings Management System training as set out in the Tailings Inspection Training procedure, which is attached as Appendix B. This training will include a training pack explaining the procedure for performing the inspection and addressing inspection items to be observed. In addition, each individual, after reviewing the training pack, will sign a certification form, indicating that training has been received relative to his/her duties as an inspector.

2.5. Tailings Emergencies

Inspectors will notify the Radiation Safety Officer and/or Mill management immediately if, during their inspection, they discover that an abnormal condition exists or an event has occurred that could cause a tailings emergency. Until relieved by the Environmental or Radiation Technician or Radiation Safety Officer, inspectors will have the authority to direct resources during tailings emergencies.

Any major catastrophic events or conditions pertaining to the tailings area should be reported immediately to the Mill Manager or the Radiation Safety Officer, one of whom will notify Corporate Management. If dam failure occurs, notify your supervisor and the Mill Manager immediately. The Mill Manager will then notify Corporate Management, MSHA (303-231-5465), and the State of Utah, Division of Dam Safety (801-538-7200).

3. WEEKLY TAILINGS AND DMT INSPECTION

3.1. Weekly Tailings Inspections

Weekly tailings inspections are to be conducted by the Radiation Safety Department and include the following:

a) *Leak Detection Systems*

Each tailings cell's leak detection system shall be checked weekly to determine whether it is wet or dry. If marked wet, the liquid levels need to be measured and reported. In Cell 1 and Cell 3 the leak detection system is measured by use of a pipe that is removed from the system which will indicate the presence of solutions in the LDS system. Cell 4A has a blow tube, which has been measured and marked. Once solutions have been identified by blowing air into the tube at a given depth, the tube is pulled from the tubing encasement and the measurements are extracted from the marked tubing.

If sufficient fluid is present in the leak detection system of any cell, the fluid shall be pumped from the LDS, to the extent reasonably possible, and record the volume of fluid recovered. Any fluid pumped from an LDA shall be returned to a disposal cell.

If fluid is pumped from an LDS, the flow rate shall be calculated by dividing the recorded volume of fluid recovered by the elapsed time since fluid was last pumped or increases in the LDS fluid levels were recorded, whichever is the more recent. This calculation shall be documented as part of the weekly inspection.

Upon the initial pumping of fluid from an LDS, a fluid sample shall be collected and analyzed in accordance with paragraph 11.3 C. of the Radioactive Materials License.

b) *Slimes Drain Water Level Monitoring*

(i) Cell 3 is an active tailings cell while Cell 2 is partially reclaimed with approximately

90% of the surface covered by platform fill. Each cell has a slimes drain system which aids in dewatering the slimes and sands placed in the cell;

(ii) Cell 2 has a pump placed inside of the slimes drain access pipe at the bottom of the slimes drain. As taken from actual measurements, the bottom of the slimes drain is 38 feet below a water level measuring point at the centerline of the slimes drain access pipe, at the ground surface level. This means that the bottom of the slimes drain pool and the location of the pump are one foot above the lowest point of the FML in Cell 2, which, based on construction reports, is at a depth of 39 feet below the water level measuring point on the slimes drain access pipe for Cell 2;

(iii)The slimes drain pump in Cell 2 is on a timed system, under which it pumps for 15 minutes each hour, thereby allowing the slimes wastewater to recharge for 45 minutes before being pumped again. Based on measurements taken in August 2006, the water level in the Cell 2 slimes drain recharges to a depth of about 28.50 feet before each pumping and is pumped to a depth of 38 feet after each pumping, in each case measured below the water level measuring point on the slimes drain access pipe. The average wastewater head in the Cell 2 slimes drain is therefore about 5 feet. The depth to water of about 28.50 feet after recharge is below the phreatic surface of tailings Cell 2, which is at a depth of about 20 feet below the water level measuring point on the slimes drain access pipe. As a result, there is a continuous flow of wastewater from Cell 2 into the slimes drain collection system. Mill management considers that the average allowable wastewater head in the Cell 2 slimes drain resulting from pumping at these intervals is satisfactory and is as low as reasonably achievable. Based on past experience, recycling the pump more than 15 minutes every hour can result in more replacement costs for pumps and more resulting system downtime;

(iv)The Cell 2 slimes drain pump is checked weekly to observe that it is operating and that the timer is set properly, which is noted on the Weekly Tailings Inspection Form. If at any time the pump is observed to be not working properly, it will be fixed or replaced within 15 days;

(v) Depth to wastewater in the Cell 2 slimes drain access pipe shall be monitored and recorded weekly to determine maximum and minimum fluid head before and after a pumping cycle, respectively. All head measurements must be made from the same measuring point (the notch at the north side of the access pipe), and made to the nearest 0.01 foot. The results will be recorded as depth-in-pipe measurements on the Weekly Tailings Inspection Form;

(vi)On a monthly basis, the slimes drain pump will be turned off and the wastewater in the slimes drain access pipe will be allowed to stabilize for at least 90 hours. Once the water level has stabilized (based on no change in water level for three (3) successive readings taken no less than one (1) hour apart) the water level of the wastewater will be measured and recorded as a depth-in-pipe measurement on the Monthly Inspection Data form, by measuring the depth to water below the water level measuring point on the slimes drain access pipe;

(vii) No process liquids shall be allowed to be discharged into Cell 2;

(viii) If at any time the most recent average annual head in the Cell 2 slimes drain is found to have increased above the average head for the previous calendar year, the Licensee will comply with the requirements of Part I.G.3 of the GWDP, including the requirement to provide notification to the Executive Secretary orally within 24 hours followed by written notification;

(ix)Because Cell 3 is currently active, no pumping from the Cell 3 slimes drain is authorized. Prior to initiation of tailings dewatering operations for Cell 3, a similar procedure will be developed for ensuring that average head elevations in the Cell 3 slimes drain are kept as low as reasonably achievable, and that the Cell 3 slimes drain is inspected and the results reported in accordance with the requirements of the permit."

c) Wind Movement of Tailings

An evaluation of wind movement of tailings or dusting and control measures shall be taken if needed.

d) Tailings Wastewater Pool Elevation Monitoring

Solution elevation measurements in Cells 1 and 3 and Roberts Pond are to be taken by survey on a weekly basis as follows:

(i) The survey will be performed by the Mill's Radiation Safety Officer or designee (the "Surveyor") with the assistance of another Mill worker (the "Assistant");

(ii) The survey will be performed using a survey instrument (the "Survey Instrument") accurate to 0.01 feet, such as a Sokkai No. B21, or equivalent, together with a survey rod (the "Survey Rod") having a visible scale in 0.01 foot increments;

(iii)The reference Points (the "Reference Points") for Cells 1 and 3 and Roberts Pond are known points established by professional survey. For Cell 1 and Roberts Pond, the Reference Point is a wooden stake with a metal disk on it located on the southeast corner of Cell 1. The elevation of the metal disk (the "Reference Point Elevation") for Cell 1 and Roberts Pond is at 5,623.14 feet above mean sea level ("FMSL"). For Cell 3, the Reference Point is a piece of metal rebar located on the south dike of Cell 3. The elevation at the top of this piece of rebar (the Reference Point Elevation for Cell 3) is at 5,607.83 FMSL;

(iv) The Surveyor will set up the Survey Instrument in a location where both the applicable Reference Point and pond surface are visible. For Cell 1 and Roberts Pond, this is typically on the road on the Cell 1 south dike between Cell 1 and Roberts Pond, approximately 100 feet east of the Cell 1/Roberts Pond Reference Point. For Cell 3, this is typically on the road on the Cell 3 dike approximately 100 feet east of the Cell 3 Reference Point;

(v) Once in location, the Surveyor will ensure that the Survey Instrument is level by centering the bubble in the level gauge on the Survey Instrument;

(vi)The Assistant will place the Survey Rod vertically on the Reference Point (on the metal disk on the Cell 1/Roberts Pond Reference Point and on the top of the rebar on the Cell 3 Reference Point. The Assistant will ensure that the Survey Rod is vertical by gently rocking the rod back and forth until the Surveyor has established a level reading;

(vii) The Surveyor will focus the cross hairs of the Survey Instrument on the scale on the Survey Rod, and record the number (the "Reference Point Reading"), which represents the number of feet the Survey Instrument is reading above the Reference Point;

(viii) The Assistant will then move to a designated location where the Survey Rod can be placed on the surface of the main solution pond in the Cell or Roberts Pond, as the case may be. These designated locations, and the methods to be used by the Assistant to consistently use the same locations are as follows:

A. Cell 3

A stake has been place in the central area of the south dike of Cell 3. The Assistant will walk perpendicular to the dike from the stake to the nearest point on the liquid surface of Cell 3 and place the Survey Rod at that location;

B. Cell 1

A mark has been painted on the north side of the ramp going to the pump platform in Cell 1. The Assistant will place the Survey Rod against that mark and hold the rod vertically, with one end just touching the liquid surface; and

C. Roberts Pond

A mark has been painted on the railing of the pump stand in Roberts Pond. The Assistant will place the Survey Rod against that mark and hold the rod vertically, with one end just touching the liquid surface.

Based on the foregoing methods, the approximate coordinate locations for the measuring points for Roberts Pond and the Cells are:

	Northing	Easting
Roberts Pond	323,041	2,579,697
Cell 1	322,196	2,579,277
Cell 3	320,508	2,577,760

These coordinate locations may vary somewhat depending on solution elevations in the Pond and Cells;

(ix)The Assistant will hold the Survey Rod vertically with one end of the Survey Rod just touching the pond surface. The Assistant will ensure that the Survey Rod is vertical by gently rocking the rod back and forth until the Surveyor has established a level reading;

(x) The Surveyor will focus the cross hairs of the Survey Instrument on the scale on the Survey Rod, and record the number (the "Pond Surface Reading"), which represents the number of feet the Survey Instrument is reading above the pond surface level.

The Surveyor will calculate the elevation of the pond surface as FSML by adding the Reference Point Reading for the Cell or Roberts Pond, as the case may be, to the Reference Point Elevation for the Cell or Roberts Pond and subtracting the Pond Surface Reading for the Cell or Roberts Pond, and will record the number accurate to 0.01 feet.

e) *Summary*

In addition, the weekly inspection should summarize all activities concerning the tailings area for that particular week.

Results of the weekly tailings inspection are recorded on the *Weekly Tailings and DMT Inspection* form. An example of the *Weekly Tailings and DMT Inspection* form is provided in Appendix A.

3.2. Weekly Inspection of Solution Levels in Roberts Pond

On a weekly basis, solution elevations are taken on Roberts Pond, in accordance with the procedures set out in Section 3.1 d) above. The Weekly solution level in Roberts Pond is recorded on the *Weekly Tailings and DMT Inspection* form. Based on historical observations, the FML at the Pond Surface Reading area for Roberts Pond, is approximately six inches above the lowest point on the pond's FML. If the pond solution elevation at the Pond Surface Reading area is at or below the FML for that area, the pond will be recorded as being dry.

3.3. Weekly Feedstock Storage Area Inspections

Weekly feedstock storage area inspections will be performed by the Radiation Safety Department, to confirm that:

a) the bulk feedstock materials are stored and maintained within the defined area described in the GWDP, as indicated on the map attached hereto as Appendix D; and

b) all alternate feedstock located outside the defined Feedstock Area are maintained within water tight containers.

The results of this inspection will be recorded on the *Ore Storage/Sample Plant Weekly Inspection Report*, a copy of which is contained in Appendix A. Any variance in stored materials from this requirement or observed leaking alternate feedstock drums or other containers will be brought to the attention of Mill Management and rectified within 15 days.

4. MONTHLY TAILINGS INSPECTION

Monthly tailings inspections will be performed by the Radiation Safety Officer or his designee from the Radiation Safety Department and recorded on the *Monthly Inspection Data* form, an example of which is contained in Appendix A. Monthly inspections are to be performed no sooner than 14 days since the last monthly tailings inspection and can be conducted concurrently with the quarterly tailings inspection when applicable. The following items are to be inspected:

a) Tailings Slurry Pipeline

When the Mill is operating, the slurry pipeline will be inspected at key locations to determine pipe wear. Pipe thickness will be measured using an ultrasonic device by either the radiation safety staff or other trained designees. The critical points of the pipe include bends, slope changes, valves, and junctions, which are critical to dike stability. These locations to be monitored will be determined by the Radiation Safety Officer or his designee from the Radiation Safety Department during the Mill run.

b) Diversion Ditches

Diversion ditches 1, 2 and 3 shall be monitored monthly for sloughing, erosion, undesirable vegetation, and obstruction of flow. Diversion berm 2 should be checked for stability and signs of distress.

c) Sedimentation Pond

Activities around the Mill and facilities area sedimentation pond shall be summarized for the month.

d) Overspray Dust Minimization

The inspection shall include an evaluation of overspray minimization, if applicable. This entails ensuring that the overspray system is functioning properly. In the event that overspray is carried more than 50 feet from the cell, the overspray system should be immediately shut-off.

e) *Remarks*

A section is included on the *Monthly Inspection Data* form for remarks in which recommendations can be made or observations of concern can be documented.

f) *Summary of Daily, Weekly and Quarterly Inspections*

The monthly inspection will also summarize the daily, weekly and, if applicable, quarterly tailings inspections for the specific month.

In addition, settlement monitors are typically surveyed monthly and the results reported on the *Monthly Inspection Data* form.

5. QUARTERLY TAILINGS INSPECTION

The quarterly tailings inspection is performed by the Radiation Safety Officer or his designee from the Radiation Safety Department, having the training specified in Section 2.4 above, once per calendar quarter. A quarterly inspection should be performed no sooner than 45 days since the previous quarterly inspection was performed.

Each quarterly inspection shall include an Embankment Inspection, an Operations/Maintenance Review, a Construction Review and a Summary, as follows:

a) *Embankment Inspection*

The Embankment inspection involves a visual inspection of the crest, slope and toe of each dike for movement, seepage, severe erosion, subsidence, shrinkage cracks, and exposed liner.

b) *Operations/Maintenance Review*

The Operations/Maintenance Review consists of reviewing Operations and Maintenance activities pertaining to the tailings area on a quarterly basis.

c) *Construction Review*

The Construction Review consists of reviewing any construction changes or modifications made to the tailings area on a quarterly basis.

d) *Summary*

The summary will include all major activities or observations noted around the tailings area on a quarterly basis.

If any of these conditions are noted, the conditions and corrective measures taken should be documented in the *Quarterly Inspection Data* form. An example of the *Quarterly Inspection Data* form is provided in Appendix A.

6. ANNUAL EVALUATIONS

The following annual evaluations shall be performed:

6.1. Annual Technical Evaluation

An annual technical evaluation of the tailings management system is performed by a registered professional engineer (PE), who has experience and training in the area of geotechnical aspects of retention structures. The technical evaluation includes an on-site inspection of the tailings management system and a thorough review of all tailings records for the past year. The Technical Evaluation also includes a review and summary of the annual movement monitor survey (see Section 5.2 below).

All tailings cells and corresponding dikes will be inspected for signs of erosion, subsidence, shrinkage, and seepage. The drainage ditches will be inspected to evaluate surface water control structures.

In the event tailings capacity evaluations (as per SOP PBL-3) were performed for the receipt of alternate feed material during the year, the capacity evaluation forms and associated calculation sheets will be reviewed to ensure that the maximum tailings capacity estimate is accurate. The amount of tailings added to the system since the last evaluation will also be calculated to determine the estimated capacity at the time of the evaluation.

Tailings inspection records will consist of daily, weekly, monthly, and quarterly tailings inspections. These inspection records will be evaluated to determine if any freeboard limits are being approached. Records will also be reviewed to summarize observations of potential concern. The evaluation also involves discussion with the Environmental and/or Radiation Technician and the Radiation Safety Officer regarding activities around the tailings area for the past year. During the annual inspection, photographs of the tailings area will be taken. The training of individuals will be reviewed as a part of the Annual Technical Evaluation.

The registered engineer will obtain copies of selected tailings inspections, along with the monthly and quarterly summaries of observations of concern and the corrective actions taken. These copies will then be included in the Annual Technical Evaluation Report.

The Annual Technical Evaluation Report must be submitted by September 1st of every year to:

Directing Dam Safety Engineer
State of Utah, Natural Resources
1636 West North Temple, Suite 220
Salt Lake City, Utah 84116-3156

6.2. Movement Monitors

A movement monitor survey is to be conducted by a licensed surveyor annually during the second quarter of each year. The movement monitor survey consists of surveying monitors along dikes 3-S, 4A-W, and 4A-S to detect any possible settlement or movement of the dikes. The data generated from this survey is reviewed and incorporated into the *Annual Technical Evaluation Report* of the tailings management system.

6.3. Freeboard Limits

a) Tailings Cells 1 and 4A

The freeboard limits are as per *January 10, 1990 Drainage Report for Cells 1 and 4A* and are stated below:

(i) A liquid maximum elevation of 5,615.4 feet mean sea level in Cell 1.

(ii) A liquid maximum elevation of 5,596.4 feet mean sea level in Cell 4A.

b) Tailings Cell 3

The freeboard limit for Cell 3 is determined annually using the following procedure:

(i) From a survey of Cell 3, the pool surface will be determined.

(ii) An estimate of the maximum tons of dry tailings to be generated during the next 12 months will be made. This estimate is multiplied by 1.5, a factor of safety, to yield the Maximum Mill Production.

(iii) The Maximum Mill Production is divided by the number of tons required to reduce the pool size by one acre and then subtracted from the pool surface (determined in Step i), yielding the Reduced Pool Area.

(iv) The PMP Flood Volume Requirement, as per the *January 10, 1990 Drainage Report*, is 123.4 acre feet. The PMP Flood Volume Requirement is divided by the Reduced Pool Area to determine the PMP Freeboard Level.

(v) The Wave Run Up of 0.78 feet (as specified in the *January 10, 1990 Drainage Report*) is added to the PMP Freeboard Level to determine the Total Required Freeboard.

The calculation of the Total Required Freeboard for Cell 3 will be calculated annually and the calculation sheet filed in the Mill Central File.

c) *Roberts Pond*

The freeboard limit for Roberts Pond is a liquid maximum elevation of 5,624.0 feet above mean sea level, as specified in the GWDP.

6.4. Annual Leak Detection Fluid Samples

In the event solution has been detected in a leak detection system, a sample will be collected on an annual basis. This sample will be analyzed according to the conditions set forth in License Condition 11.3.C. The results of the analysis will be reviewed to determine the origin of the solution.

7. OTHER INSPECTIONS

All daily, weekly, monthly, quarterly and annual inspections and evaluations should be performed as specified in Sections 2, 3, 4, 5 and 6 above. However, additional inspections should be conducted after any significant storm or significant natural or man-made event occurs.

8. REPORTING REQUIREMENTS

In addition to the *Daily Inspection Data*, *Weekly Tailings Inspection, Monthly Inspection Data* and *Quarterly Inspection Data* forms included as Appendix A and described in Sections 2, 3, 4 and 5 respectively, and the *Operating Foreman's Daily Inspection* and *Weekly Mill Inspection* forms described in Sections 2 and 3, respectively, the following additional reports shall also be prepared:

8.1. Monthly Tailings Reports

Monthly tailings reports are prepared every month and summarize the previous month's activities around the tailings area. If not prepared by the Radiation Safety Officer, the report shall be submitted to the Radiation Safety Officer for review. The Mill Manager will review the report as well before the report is filed in the Mill Central File. The report will contain a summary of observations of concern noted on the daily and weekly tailings inspections. Corrective measures taken during the month will be documented along with the observations where appropriate. All daily and weekly tailings inspection forms will be attached to the report. A monthly inspection form will also be attached. Quarterly inspection forms will accompany the report when applicable. The report will be signed and dated by the preparer in addition to the Radiation Safety Officer and the Mill Manager.

8.2. DMT Reports

Quarterly reports of DMT monitoring activities of all required information required by Part 1.F.2 of the GWDP relating to the inspections described in Section 3.1(b) (Slimes Drain Water Level Monitoring), 3.1(d) (Tailings Wastewater Pool Elevation Monitoring), 3.2 (Weekly Inspection of Solution Levels in Roberts Pond) and 3.3 (Weekly Feedstock Storage Area Inspections) will be provided to the Executive Secretary on the schedule provided in Table 5 of the GWDP. An annual summary and graph for each calendar year of the depth to wastewater in the Cell 2 slimes drain must be included in the fourth quarter report. After the first year, and beginning in 2008, quarterly reports shall include both the current year monthly values and a graphic comparison to the previous year.

APPENDIX A

FORMS

APPENDIX A (CONT.)
DAILY INSPECTION DATA

Inspector:_______________

Date;_________________

Accompanied by:________

Time:_________________

Any Item not "OK" must be documented. A check mark = OK, X = Action Required

I. TAILINGS SLURRY TRANSPORT SYSTEM					
Inspection Items	Conditions of Potential Concern	Cell 1	Cell 2	Cell 3	Cell 4A
Slurry Pipeline	Leaks, Damage, Blockage, Sharp Bends				
Pipeline Joints	Leaks, Loose Connections				
Pipeline Supports	Damage, Loss of Support				
Valves	Leaks, Blocked, Closed				
Point(s) of Discharge	Improper Location or Orientation				

II. OPERATIONAL SYSTEMS					
Inspection Items	Conditions of Potential Concern	Cell 1	Cell 2	Cell 3	Cell 4A
Water Level	Greater Than Operating Level, Large Change Since Previous Inspection				
Beach	Cracks, Severe Erosion, Subsidence				
Liner and Cover	Erosion of cover, Exposure of Liner				

III. DIKES AND EMBANKMENTS							
Inspection Items	Conditions of Potential Concern	Dike 1-I	Dike 1-1A	Dike 2	Dike 3	Dike 4A-S	Dike 4A-W
Slopes	Sloughs or Sliding Cracks, Bulges, Subsidence, Severe Erosion, Moist Areas, Areas of Seepage Outbreak						

Crest	Cracks, Subsidence, Severe Erosion						

IV. FLOW RATES				
	Slurry Line(s)	Pond Return	S-X Tails	Spray System
GPM				

V. PHYSICAL INSPECTION OF SLURRY LINES(S)

Walked to Discharge Point ____________Yes ____________No
Observed Entire Discharge Line ____________Yes ____________No

VI. DUST CONTROL			
	Cell 2	Cell 3	Cell 4A
Dusting			
Wind Movement of Tailings			
Precipitation: ____________________ inches liquid			
General Meteorological conditions:________________________ ____ ____			

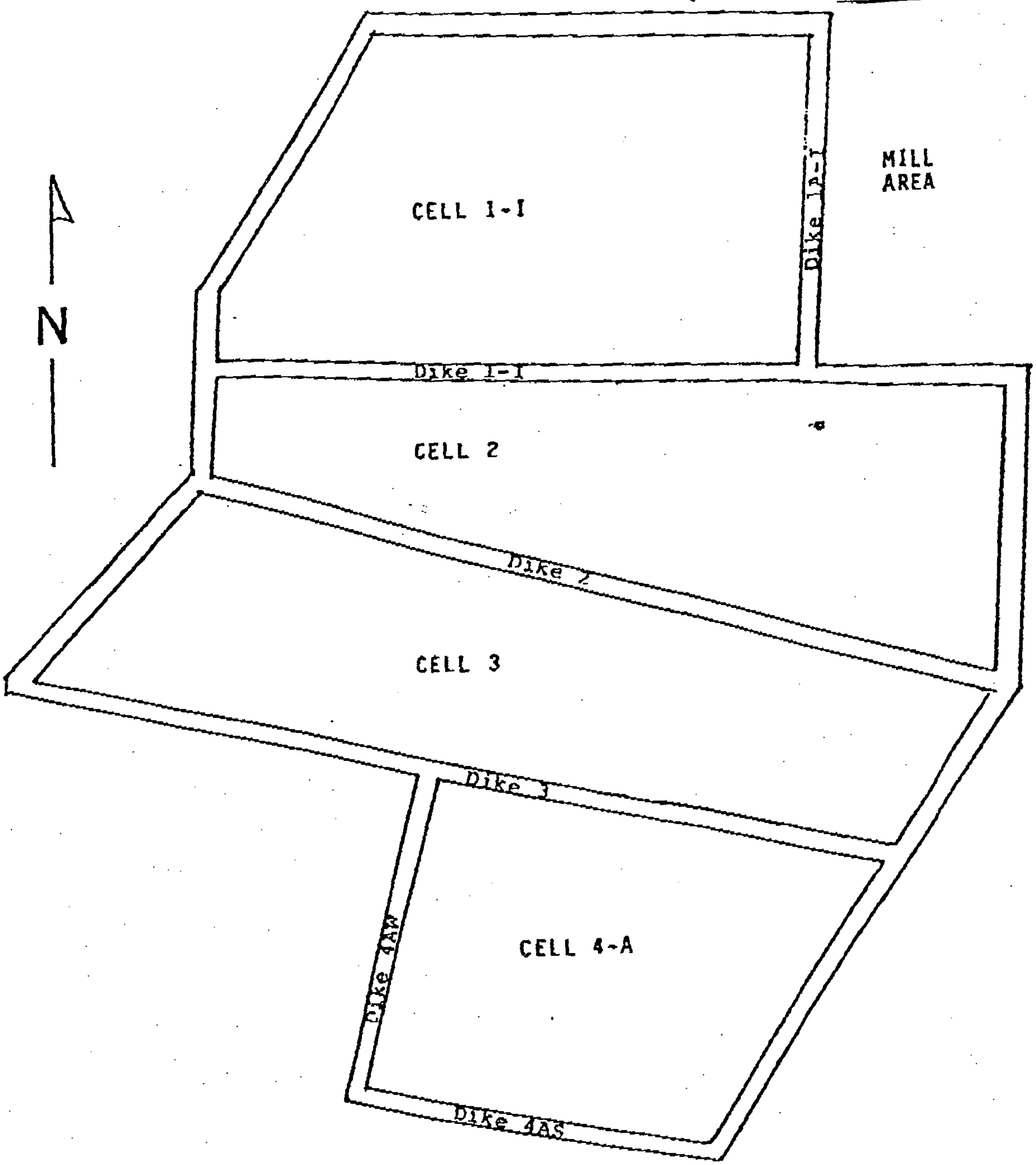
VII. DAILY LEAK DETECTION CHECK				
	Cell 1	Cell 2	Cell 3	Cell 4A
Leak Detection System Checked	________Checked ______Wet______Dry Initial level__________ Final level__________ Gal. pumped________	________Checked ______Wet______Dry Initial level__________ Final level__________ Gal. pumped________	________Checked ______Wet______Dry Initial level__________ Final level__________ Gal. pumped________	________Checked ______Wet______Dry Initial level__________ Final level__________ Gal. pumped________

VIII OBSERVATIONS OF POTENTIAL CONCERN	Action Required

DAILY INSPECTION REPORT
TAILINGS SLURRY DISCHARGE LOCATION

DATE: ____________________

INSPECTOR: ____________________



APPENDIX A (CONT)

DENISON MINES (USA) CORP.
WEEKLY TAILINGS INSPECTION

Date:________________ Inspectors: ______________________________

1. Pond elevations (msl,ft)

Cell 1: (a) Pond Solution Elevation ________________
(b) FML Bottom Elevation ______5597______
(c) Depth of Water above FML ((a)-(b)) _______________

Cell 3: (a)Pond Solution Elevation ________________
(b)FML Bottom Elevation ______5570______
(c)Depth of Water above FML ((a)-(b)) _______________

Roberts
Pond: (a)Pond Solution Elevation _______________
(b)FML Bottom Elevation ______5612.34___
(c)Depth of Water above FML ((a)-(b)) _______________

2. Slimes Drain Liquid Levels Cell 2

Pump functioning properly ________
Pump Timer set at 15min on 45 min off _______

________________Depth to Liquid pre-pump
________________Depth to Liquid Post-pump

(all measurements are depth-in-pipe)

Pre-pump head is 38'-Depth to Liquid Pre-pump = _______

Post-pump head is 38' –Depth to Liquid Post-pump = ______

3. Leak Detection Systems

Observation:				
	Cell 1	Cell 2	Cell 3	Cell 4A
Is LDS wet or dry?	_____wet____dry	_____wet____dry	_____wet____dry	_____wet____dry
If wet, Record liquid level:	_______Ft to Liquid	_______Ft to Liquid	_______Ft to Liquid	_______Ft to Liquid
If sufficient fluid is present, record volume of fluid pumped and flow rate:	Volume ______ Flow Rate______	Volume ______ Flow Rate______	Volume ______ Flow Rate______	Volume ______ Flow Rate______
Was fluid sample collected?	____yes____no	____yes____no	____yes____no	____yes____no

4. Tailings Area Inspection (Note dispersal of blowing tailings):
____
____

5. Control Methods Implemented:____
____
____

6. Remarks:____
____

7. Contaminated Waste Dump:____
____
____

APPENDIX A (CONT.)

MONTHLY INSPECTION DATA

Inspector: ____________________________

Date: ________________________________

1. Slurry Pipeline: ____
____
____
____
____

Pipe Thickness:___________(To be measured only during periods when the Mill is operating)

2. Diversion Ditches and Diversion Berm:

Observation:

	Diversion Ditch 1	Diversion Ditch 2	Diversion Ditch 3	Diversion Berm 2
Diversion Ditches:				
Sloughing	_____yes_____no	_____yes_____no	_____yes_____no	
Erosion	_____yes_____no	_____yes_____no	_____yes_____no	
Undesirable Vegetation	_____yes_____no	_____yes_____no	_____yes_____no	
Obstruction of Flow	_____yes_____no	_____yes_____no	_____yes_____no	
Diversion Berm:				
Stability Issues				_____yes_____no
Signs of Distress				_____yes_____no

Comments:____
____
____
____
____
____

3. Summary of Activities Around Sedimentation Pond: ________________________________
____
____
____
____
____

4. Overspray Dust Minimization:

Overspray system functioning properly: _______yes_______no

Overspray carried more than 50 feet from the cell: _____yes______no
If "yes", was system immediately shut off? _____yes_____no

Comments:____

5. Remarks: ____

6. Settlement Monitors

Cell 2 W1: ___________	Cell 2W3-S: ___________	Cell 3-1N: ___________
Cell 2 W2: ___________	Cell 2E1-N: ___________	Cell 3-1C: ___________
Cell 2 W3: ___________	Cell 2E1-1S: ___________	Cell 3-1S: ___________
Cell 2 W4: ___________	Cell 2E1-2S: ___________	Cell 3-2N: ___________
Cell 2W7-C: ___________	Cell 2 East: ___________	Cell 2W5-N: ___________
Cell 4A-Toe: ___________		

7. Summary of Daily, Weekly and Quarterly Inspections: ______________________________

8. Monthly Slimes Drain Static Head Measurement for Cell 2 (Depth-in-Pipe Water Level Reading): ________________

APPENDIX A (CONT.)

WHITE MESA MILL
TAILINGS MANAGEMENT SYSTEM

QUARTERLY INSPECTION DATA

Inspector: ______________________________

Date: ________________________________

1. Embankment Inspection: ____

____
____
____
____
____

2. Operations/Maintenance Review: ____

____
____
____
____
____

3. Construction Activites: ____

____
____
____
____
____

4. Summary: ____

____
____
____
____
____

APPENDIX A (CONT.)

ORE STORAGE/SAMPLE PLANT WEEKLY INSPECTION REPORT

Week of ________ through ________ Date of Inspection:________________

Inspector:________________________

Weather conditions for the week:

____
____
____

Blowing dust conditions for the week:

____
____
____
____

Corrective actions needed or taken for the week:

____
____
____
____

Are all bulk feedstock materials stored in the area indicated on the attached diagram:
yes:_______ no:________
comments:____
____

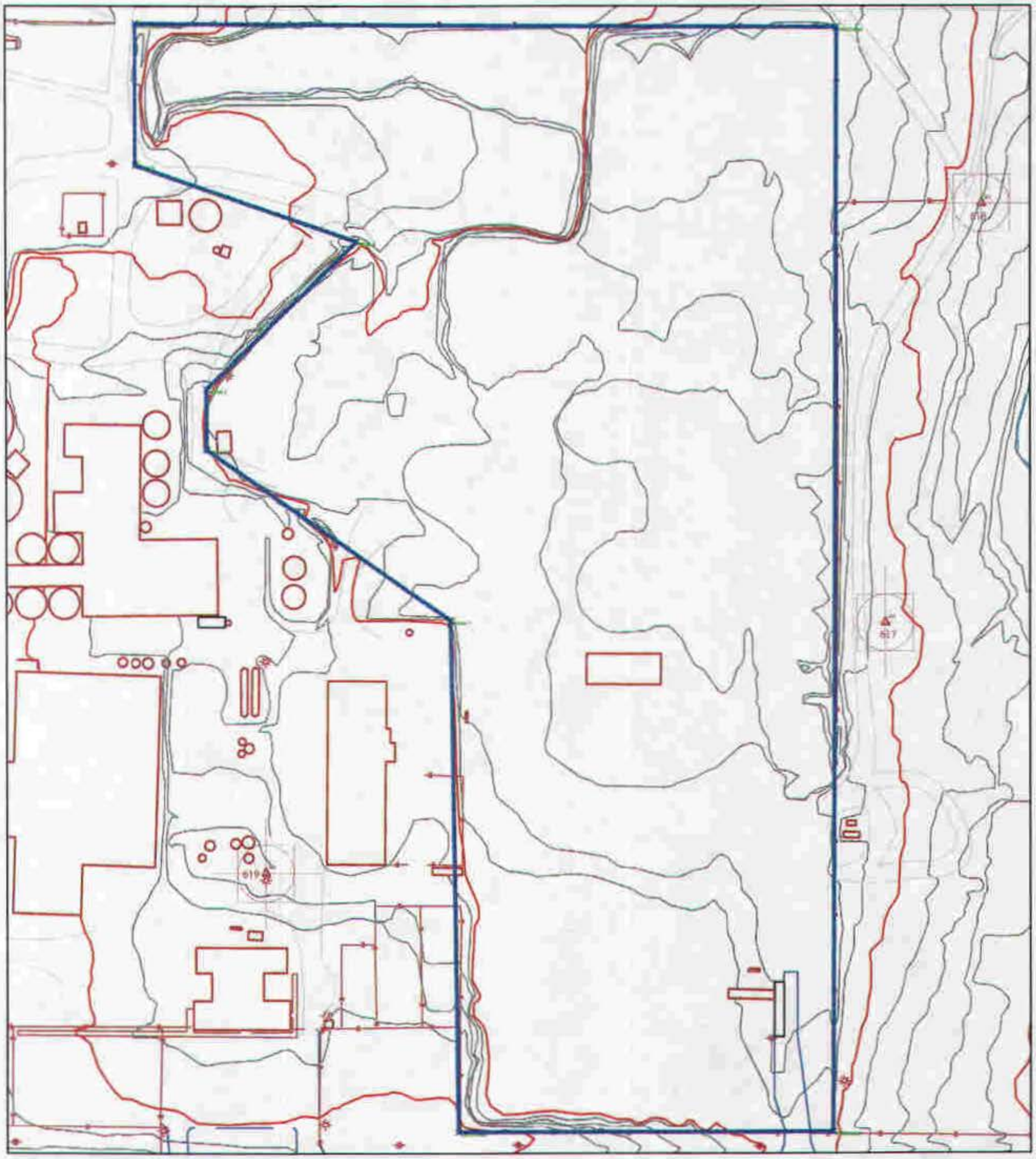
Are all alternate feedstock materials located outside the area indicated on the attached diagram maintained within water-tight containers:
yes:_______ no:_______
comments (e.g., conditions of containers):____________________________________
____
____

Conditions of storage areas for materials:

____
____
____
____

Other comments:

____
____



Denison Mines (USA) Corp.

Project: WHITE MESA MILL

REVISIONS			
Date	By	County:	State: UT
02/26/07	BM	Location:	

Appendix B

Feedstock Storage Area Map

Scale: N/A | Date: 08/03/2006 | wm_ore_pad.dwg

Author: bm | Drafted By: bm

APPENDIX C

WHITE MESA MILL TAILINGS MANAGEMENT SYSTEM

TAILINGS INSPECTION TRAINING

This document provides the training necessary for qualifying management-designated individuals for conducting daily tailings inspections. Training information is presented by the Radiation Safety Officer or designee from the Environmental Department. Daily tailings inspections are conducted in accordance with the White Mesa Mill Tailings Management System and Discharge Minimization Technology (DMT) Monitoring Plan. The Radiation Safety Officer or designee from the Radiation Safety Department is responsible for performing monthly and quarterly tailings inspections. Tailings inspection forms will be included in the monthly tailings inspection reports, which summarize the conditions, activities, and areas of concern regarding the tailings areas.

Notifications:

The inspector is required to record whether all inspection items are normal (satisfactory, requiring no action) or that conditions of potential concern exist (requiring action). A "check" mark indicates no action required. If conditions of potential concern exist the inspector should mark an "X" in the area the condition pertains to, note the condition, and specify the corrective action to be taken. If an observable concern is made, it should be noted on the tailings report until the corrective action is taken and the concern is remedied. The dates of all corrective actions should be noted on the reports as well.

Any major catastrophic events or conditions pertaining to the tailings area should be reported immediately to the Mill Manager or the Radiation Safety Officer, one of whom will notify Corporate Management. If dam failure occurs, notify your supervisor and the Mill Manager immediately. The Mill Manager will then notify Corporate Management, MSHA (303-231-5465), and the State of Utah, Division of Dam Safety (801-538-7200).

Inspections:

All areas of the tailings disposal system are routinely patrolled and visible observations are to be noted on a daily tailings inspection form. Refer to Appendix A for an example of the daily tailings inspection form. The inspection form consists of three pages and is summarized as follows:

1. Tailings Slurry Transport System:

The slurry pipeline is to be inspected for leaks, damage, and sharp bends. The pipeline joints are to be monitored for leaks, and loose connections. The pipeline supports are to be inspected for damage and loss of support. Valves are also to be inspected particularly for leaks, blocked valves, and closed valves. Points of discharge need to be inspected for improper location and orientation.

2. Operational Systems:

Operating systems including water levels, beach liners, and covered areas are items to be inspected and noted on the daily inspection forms. Sudden changes in water levels previously observed or water levels exceeding the operating level of a pond are potential areas of concern and should be noted. Beach areas that are observed as having cracks, severe erosion or cavities are also items that require investigation and notation on daily forms. Exposed liner or absence of cover from erosion are potential items of concern for ponds and covered areas. These should also be noted on the daily inspection form.

Cells 1, 3 and 4A solution levels are to be monitored closely for conditions nearing maximum operating level and for large changes in the water level since the last inspection. All pumping activities affecting the water level will be documented. In Cells 1 and 3, the PVC liner needs to be monitored closely for exposed liner, especially after storm events. It is important to cover exposed liner immediately as exposure to sunlight will cause degradation of the PVC liner. Small areas of exposed liner should be covered by hand. Large sections of exposed liner will require the use of heavy equipment

These conditions are considered serious and require immediate action. After these conditions have been noted to the Radiation Safety Officer, a work order will be written by the Radiation Safety Officer and turned into the Maintenance Department. All such repairs should be noted in the report and should contain the start and finish date of the repairs.

3. Dikes and Embankments:

Inspection items include the slopes and the crests of each dike. For slopes, areas of concern are sloughs or sliding cracks, bulges, subsidence, severe erosion, moist areas, and areas of seepage outbreak. For crests, areas of concern are cracks, subsidence, and severe erosion. When any of these conditions are noted, an "X" mark should be placed in the section marked for that dike.

In addition, the dikes, in particular dikes 3, 4A-S and 4A-W, should be inspected closely for mice holes and more importantly for prairie dog holes, as the prairie dogs are likely to burrow in deep, possibly to the liner. If any of these conditions exist, the inspection report should be marked accordingly.

4. **Flow Rates:**

Presence of all flows in and out of the cells should be noted. Flow rates are to be estimated in gallons per minute (GPM). Rates need to be determined for slurry lines, pond return, SX-tails, and the spray system. During non-operational modes, the flow rate column should be marked as "0". The same holds true when the spray system is not utilized.

5. **Physical Inspection of Slurry Line(s):**

A physical inspection of all slurry lines has to be made every 4 hours during operation of the mill. If possible, the inspection should include observation of the entire discharge line and discharge spill point into the cell. If "fill to elevation" flags are in place, the tailings and build-up is to be monitored and controlled so as to not cover the flags.

6. **Dust Control:**

Dusting and wind movement of tailings should be noted for Cells 2, 3, and 4A. Other observations to be noted include a brief description of present weather conditions, and a record of any precipitation received. Any dusting or wind movement of tailings should be documented. In addition, an estimate should be made for wind speed at the time of the observed dusting or wind movement of tailings.

The Radiation Safety Department measures precipitation on a daily basis. Daily measurements should be made as near to 8:00 a.m. as possible every day. Weekend measurements will be taken by the Shifter as close to 8:00 a.m. as possible. All snow or ice should be melted before a reading is taken.

7. **Observations of Potential Concern:**

All observations of concern during the inspection should be noted in this section. Corrective action should follow each area of concern noted. All work orders issued, contacts, or notifications made should be noted in this section as well. It is important to document all these items in order to assure that the tailings management system records are complete and accurate.

8. Map of Tailings Cells:

The last section of the inspection involves drawing, as accurately as possible, the following items where applicable.

1. Cover area
2. Beach/tailing sands area
3. Solution as it exists
4. Pump lines
5. Activities around tailings cell (i.e. hauling trash to the dump, liner repairs, etc.)
6. Slurry discharge when operating
7. Over spray system when operating

9. Safety Rules:

All safety rules applicable to the mill are applicable when in the tailings area. These rules meet the required MSHA regulations for the tailings area. Please pay particular notice to the following rules:

1. The posted speed limit for the tailings area is 15 mph and should not be exceeded.
2. No food or drink is permitted in the area.
3. All personnel entering the tailings area must have access to a two-way radio.
4. Horseplay is not permitted at any time.
5. Only those specifically authorized may operate motor vehicles in the restricted area.
6. When road conditions are muddy or slick, a four-wheel drive vehicle is required in the area.
7. Any work performed in which there is a danger of falling or slipping in the cell will require the use of a safety belt or harness with attended life line and an approved life jacket. A portable eyewash must be present on site as well.
8. Anytime the boat is used to perform any work; an approved life jacket and goggles must be worn at all times. There must also be an approved safety watch with a two-way hand-held radio on shore. A portable eyewash must be present on site as well.

10. Preservation of Wildlife:

Every effort should be made to prevent wildlife and domesticated animals from entering the tailings area. All wildlife observed should be reported on the Wildlife Report Worksheet during each shift. Waterfowl seen near the tailings cells should be discouraged from landing by the use of noisemakers.

11. Certification:

Following the review of this document and on-site instruction on the tailings system inspection program, designated individuals will be certified to perform daily tailings inspections. The Radiation Safety Officer authorizes certification. Refer to the Certification Form, Appendix C. This form should be signed and dated only after a thorough review of the tailings information previously presented. The form will then be signed by the Radiation Safety Officer and filed.

APPENDIX D

CERTIFICATION FORM

Date: ___________________________

Name: __________________________

I have read the document titled "Tailings Management System, White Mesa Mill Tailings Inspector Training" and have received on-site instruction at the tailings system. This instruction included documentation of daily tailings inspections, analysis of potential problems (dike failures, unusual flows), notification procedures and safety.

____
Signature

I certify that the above-named person is qualified to perform the daily inspection of the tailings system at the White Mesa Mill.

____
Radiation Safety Personnel/ Tailings System Supervisor

WHITE MESA MILL TAILINGS MANAGEMENT SYSTEM

DUST MINIMIZATION

1. Operational Procedure for Dust Minimization:

In an effort to keep wind movement of tailings sand to a minimum, the following dust minimization procedures will be utilized.

1.1. When blowing tailings sand or dusting is observed on Cell 3 beaches, the spray system should be operated until a crystal crust develops on the sands surface. The spray lines will be moved as necessary. As soon as the crystal surface develops, the spray system will be shut off. The Radiation Safety Officer along with the Mill Foreman and Shift Foreman will be responsible for the operational decisions regarding dust minimization. The spray lines require periodic cleaning because they tend to crystallize over a period of time. The spray system should be operated if there is evidence of excessive blowing sands indicating surface crust deformation or otherwise on an as needed basis.

1.2. During times of strong winds, the Radiation Safety Officer will ensure that no spray is being carried out of the cells. If spray is leaving the confines of the cell, all spraying will cease immediately.

1.3. Additional snow fencing and straw bales will be assembled to form windbreaks, as needed on Cell 3 beaches.

1.4. As 11e.(2) by product material is placed in Cell 3, interim cover can be advanced in an effort to minimize dusting on Cell 3.

The effectiveness of the above methods will be documented on the weekly tailings inspection form. Documentation will include observed wind movement of tailings sand, if any, and the steps taken the preceding week for dust control. Wind movement of tailings sand is noted on every daily inspection form along with an estimate of the percentage of dusting from Cells 2 and 3. The areas of blowing dust will be noted as well on Monday's daily inspection form.

2. Procedure: Tailings Dust Control System:

There are five methods of control of blowing tailings dust: Spraying raffinate solution, creating wind breaks with straw bales and snow fencing, flooding with slurry, using chemical stabilization agents and covering with interim cover. During operation of the mill, Cell 2 will not require any dust control measures since the cell consists of cover area and a slimes area. In addition to these areas, cover will be advancing along the slimes area as the disposal of waste at the Cell 2 dump expands. This advancement of cover will also reduce the amount of exposed tailings sand on Cell 2's surface; thereby eliminating the need for dust control measures. If dusting is observed on Cell 2, similar dust control measures to those implemented for Cell 3 will be taken. The entire control activities will be focused on Cell 3 beaches unless the above conditions are modified.

At present, there are four general areas in Cell 3:

1. The pond.

2. The 11e.(2) by product material disposal area.

3. The cover area.

4. The tailings beaches.

The area of concern regarding dusting is the tailings beaches. These beaches will need to be sprayed in order to minimize dusting. The sprays should continue until a crust develops on the tailings surface. Once a crust develops, the spray system can be shut down.

Another method of dust control for Cell 3 beaches is the use of straw bales and snow fencing, which are used as wind breaks. These breaks should extend at least three feet above the existing sands and should be extended in lines to form barriers. These windbreaks will be monitored daily and repaired or replaced as needed.

The use of interim cover as a means of dust control in Cell 3 beaches will be utilized only in the area in which the 11e.(2) by product materials are placed, or in areas of Cell 3 where the tailings sand is up to final grade and is dewatered sufficiently enough to support the use of equipment for placement of the interim cover. As the material is placed, the cover can be advanced; thus, reducing the amount of tailings sand subject to dusting.

Once the mill is operating and tailings are deposited in Cell 3, the area where tailings sand is deposited becomes inaccessible to equipment. After a period of two to three weeks, the sand surface will be stable enough to walk or work on. Tailings will be deposited through two lines until the sands are at the final deposition elevation. At this time, the lines will be moved to another area.

3. Procedure: Dust Minimization for Ore Stockpiles:

Dusting from the ore stockpiles have not been observed to be a problem as a hard crust has developed, which has inhibited dusting. The primary dust control techniques will utilize water application to the roadways on an as needed basis. If dusting is observed while transferring ore to the Grizzly from either roadways or stockpiles, water applications will be applied to minimize dusting. The number of applications, time of application, and location of application is documented and kept on file in the Radiation Office. Weekly inspections of the stockpile area are conducted to evaluate the effectiveness of dust control measures.

WHITE MESA MILL TAILINGS MANAGEMENT SYSTEM

TAILINGS LINE DETECTION

1. Procedure: Tailings Line Rupture Detection System

The following method detects line rupture of a tails line at the White Mesa Mill.

There are four major pipelines that transport solution and slurry from the Mill to the tailings Cells and from the tailings Cells back to the Mill. One six inch line and one eight inch line transport slurry from the Mill to impoundment Cell 3. One eight inch line transports tails solution from the solvent extraction process to impoundment Cell 1-I. Solution is returned back to the mill in a pond return line from either Cell 1-I or Cell 3.

Each of the above mentioned lines will have separate sensing systems that will be tied into a common alarm system. Each line will have a sensor at its discharge to determine the flow condition in the line. There will be a total of four (4) sensors.

The type of sensors will be a conductivity detection device, which will detect the presence or absence of material in the pipe. They will be positioned at high points in the line so that a "no flow" condition will not produce a high conductivity reading. If they were positioned at a low point in the line, the material would always present a false reading.

A time delay device will be incorporated in both tailings slurry lines that will activate the alarm after approximately 30 seconds of no flow condition, or a time determined by operational practice. This is necessary because of surges in the tailings slurry lines. It is not anticipated that delay devices will be necessary for the pond return line or SX tails line. The rupture detection alarm will be both optical and auditory, and will activate in the Central Control Room. An alarm indicator will be installed in the Central Control Room along with an "on-off" switch so that the Shift Foreman will have immediate control over the pond return pump.

The Central Control Room will have an alarm panel that will show lights corresponding to the different lines. The lines not in use will be shown as "no flow" conditions by the lights. When a line goes from a "flow" to a "no flow" condition, an alarm horn unique to the tailings system will sound and the corresponding light to the line will then blink intermittently. The Shift Foreman can then acknowledge the alarm. This will turn off the horn, but the light will remain on and cease to blink.

The Shift Foreman under the direction of the Mill Foreman will perform the daily test of the rupture detection system during the day shift. The Shift Foreman will shut down each running pump under his control and observe the alarm board in the Central Control Room. When the appropriate alarm sounds, he will acknowledge the alarm and restart the pump, making sure the alarm light goes out. This will be recorded in the daily Shift Foreman's report.

The Radiation Safety Officer will review these reports to ensure that the rupture detection system is functioning properly. In the event of a failure of the rupture detection alarm system or rupture of a line, the Mill Foreman will be notified immediately.

2. Operational Procedure for Tailings Rupture Detection System - Central Control Room

2.1. Every day on the day shift the Shift Foreman will test the rupture detection system. This test will show alarms at the rupture detection system panel board located in the Central Control Room.

2.2. Any alarm will suggest a line rupture and will be investigated and treated as such.

2.3. Line ruptures will be reported immediately to the Mill Manager and the Radiation Safety Officer. The Mill Manager will also inform corporate management immediately.

SURFACE SOIL MONITORING

PART I SOIL MONITORING PLAN

1.0 SOIL MONITORING

Surface soils are sampled at the five air monitoring sites. The sampling locations, shown in Figure 1, are as follows: BHV-1, BHV-2, BHV-3, BHV-4, BHV-5 and BHV-6. Soil samples are taken once per year during August or as soon as possible thereafter, but no later than September 30 of the year. In addition, a soil sample could be taken from Westwater Creek, in the place of a water sample. However, a sediment (soil) sample would only be taken at Westwater Creek if water was not available. In the event that a soil sample is collected in place of a water sample for Westwater Creek, the sample should be analyzed for the same parameters as those called for in this SOP (Radium-226 and U-nat). Refer to SOP No. PBL-EP-3 for details regarding collection of a water sample from Westwater Creek.

2.0 SAMPLING AND ANALYTICAL QUALITY ASSURANCE

The sample bags are marked for location identification and are submitted to the analytical laboratory accompanied by Chain-of-Custody forms. (Attachment A)

Analytical quality assurance for soil monitoring is based on the contract laboratory's quality controls such as blanks, duplicates, and standard percentage recovery. The laboratory is committed to meet the LLD values for radionuclides contained in U.S. NRC Regulatory Guides 4.14 and 4.15 and will perform re-runs on all samples not meeting these limits, as per EPA SW-846. Appropriate laboratory control and quality assurance data will be provided by the contract laboratory, or equivalent, including LLD information.

3.0 ANALYTICAL REQUIREMENTS

All soil samples will be analyzed, on a dry basis for the following radionuclides: Ra-226 and U-Nat. Analytical results will be reported in appropriate radiological units such as pico curies per gram or micro curies per kilogram.

PART II SOIL MONITORING STANDARD OPERATING PROCEDURES

1.0 SURFACE SOIL SAMPLING

1.1 Equipment

Equipment used for soil sampling is as follows:

1. Tape measure or measuring stick calibrated to 1 foot and to one centimeter.

2. Clean trowel or shovel.

3. Clean sample containers.

1.2 Soil Sampling Procedure

Soil samples are collected using a clean trowel or shovel to excavate a soil sample evenly across a one square foot area at a depth of one centimeter. The one centimeter excavation depth is maintained by using the tape measure or other suitable calibrated measuring stick. As the soil is being collected, it is placed directly into the sample container. The sample container is then identified with a label (see Section 2.1 below).

2.0 SAMPLING QUALITY ASSURANCE

2.1 Sample Labeling

Each sample must be labeled and all sample labels must be filled out in ink and numbered. The following information must be contained on the label:

1. Project and facility.

2. Company name

3. Date and time of sample collection.

4. Sampler's initials.

5. Sample location.

6. Requested Analytical Parameters

2.2 Sample Chain-of-Custody

During sampling activities, traceability of the sample must be maintained upon sample collection until the laboratory data is issued. Information on the custody, handling, transfer, and shipment of the samples will be recorded on a Chain-of-Custody form (COC). The sampler is responsible for filling out the COC form. The COC form will be signed by the sampler when the sampler relinquishes the samples to anyone else. A COC form is to be completed for each set of samples placed in a sample shipping container and is to include the following:

1. Sampler's name.

2. Date and time of collection.

3. Sample location.

4. Sample type.

5. Analysis requested.

6. Signatures of persons releasing custody.

7. Signatures of persons accepting custody, dates, and times.

Copies of the COC forms and all custody documentation when received will be retained in appropriate files at the Mill. The original COC form remains with the samples until disposal of the samples. The samples are kept at the laboratory for a period of three months after analyses are complete. After sample disposal, the COC form will be sent to the Environmental Department along with the analyses.

2.3 Sample Handling and Shipping

Samples will be placed in shipping containers and transported to the contract laboratory. COC forms will be placed inside a resealable bag and placed inside the sample shipping container.

2.4 Record Keeping

All soil sample data are retained in the files and when analytical results are available the results are entered into a computer file and retained in the files. Laboratory analytical data are stored in the soil files after the data has been entered on a computer file.

3.0 ANALYTICAL QUALITY ASSURANCE

3.1 Data Validation and Quality Control

Laboratory analyses will be reviewed by the technical staff and any identifiable anomalies in results noted and investigated. Appropriate measures to confirm or disaffirm results will be pursued, such as laboratory conversation, analytical sample rerun, or trend analysis.

3.2 Quality Assurance and Data Validation

The contract laboratory will prepare and retain a copy of all analytical and quality control documentation. The laboratory will provide hard copy information in each data package submitted in accordance with quality assurance objectives for the surface soil quality assurance project plan that is: COC forms, cover sheets with comments, narratives, samples analyzed, reporting limits and LLD values for analytes, and analytical results of quality control samples. The data reduction and laboratory review will be documented, signed, and dated by the analyst.

3.3 Corrective Action

Corrective action will be taken for any deficiencies or deviations noted in the procedures or anomalous results, such as but not limited to additional sample collection, sample re-run, laboratory inquires, or other actions as appropriate.

VEGETATION MONITORING

PART I VEGETATION MONITORING PLAN

1.0 VEGETATION MONITORING PLAN

Vegetation is sampled in early spring, late spring, and late fall at three locations around the Mill. These locations are: Northeast Area (near BHV-1), Northwest Area (½ mile west of BHV-1) and the Southwest Area (West of BHV-4 and south off Cell 3).

2.0 QUALITY ASSURANCE

Quality assurance for vegetation monitoring is based on the contract laboratory's quality controls such as duplicates, blanks, standard percent recovery, and spike percent recovery. The laboratory will also follow U.S. EPA Guide SW-846 and U.S. NRC Regulatory Guides 4.14 and 4.15 when analyzing the vegetation samples. The laboratory is committed to meet the LLD values for radionuclides addressed in these guidelines and will perform re-runs on all samples not meeting these limits.

3.0 ANALYTICAL REQUIREMENTS

Each vegetation sample will be analyzed for Ra-226 and Pb-210 radionuclide concentrations. Results will be expressed in units of picocuries per gram (pCi/g) or micro curies per kilogram (µci/kg), on a wet basis.

PART II VEGETATION MONITORING STANDARD OPERATING PROCEDURES

1.0 VEGETATION SAMPLING

1.1 Equipment

Equipment used for vegetation sampling is as follows:

1. Scissors

2. Large plastic sample bags

1.2 Vegetation Sampling Procedure

Vegetation samples are collected and removed at the surface with scissors at each sampling location. The vegetation sample is enclosed in a large plastic bag. Each sample will be weighed upon return to the office and must weigh at least three kilograms in order for the laboratory to meet the required LLD values outlined in U.S. NRC Regulatory Guide 4.14. In addition, as vegetation samples are collected efforts will be made to minimize the amount of soil in the samples. The sample bag is then labeled (see Section 2.1).

2.0 SAMPLING QUALITY ASSURANCE

2.1 Sample Labeling

All sample labels must be filled out in waterproof ink and numbered. The date, time, sampler's initials, and the sample location will be completed at the time the sample is collected. The following information will be included on the label:

1. Project and facility.
2. Sampler's company affiliation.
3. Date and time of sample collection.
4. Sampler's initials.
5. Sample location.
6. Weight of sample.
7. Requested analytical parameters.

2.2 Sample Chain-of-Custody

During sampling activities, traceability of the sample must be maintained upon sample collection until the laboratory data is issued. Information on the custody, handling, transfer, and shipment of the samples will be recorded on a Chain-of-Custody form (COC). The sampler is responsible for filling out the COC form. The COC form will be signed by the sampler when the sampler relinquishes the samples to anyone else. A COC form is to be completed for each set of samples placed in a shipping container and is to include the following:

1. Sampler's name.
2. Date and time of collection.
3. Sample location.
4. Sample type.
5. Analysis requested.

6. Signatures of persons releasing custody.

7. Signatures of persons accepting custody, dates, and times.

Copies of the COC forms and all custody documentation when received will be retained in appropriate files at the Mill. The original COC form remains with the samples until analysis of the samples. After sample analysis, the COC form will be sent to the Environmental Department along with the analyses.

2.3 Sample Handling and Shipping

Sample bags will be packaged in large shipping boxes and transported to the contract laboratory. COC forms will be placed inside a sealed bag and placed inside the shipping box.

2.4 Record Keeping

All vegetation sampling data will be retained in a file. When analytical data becomes available, the data is entered into a computer file and retained in the files. All laboratory analytical data is stored in the vegetation files after the data has been entered into the computer file.

3.0 ANALYTICAL QUALITY ASSURANCE

3.1 Data Validation and QC Review

Laboratory analyses will be reviewed by the technical staff and any identifiable anomalies in results noted and investigated. Appropriate measures to confirm or disaffirm results will be pursued, such as laboratory conversation, analytical sample rerun, or trend analysis.

3.2 Quality Assurance and Data Validation

The contract laboratory will prepare a copy of and retain all analytical and QC documentation. The laboratory will provide the Mill with paper copies of the following in each data package, in accordance with QA objectives for the Surface Soil QA Project Plan:

1. COC forms
2. Cover sheets with comments
3. Narrative
4. Samples analyzed
5. Reporting limits and LLD values for analytes
6. Analytical results of QC samples

The data reduction and laboratory review will be documented, signed, and dated by the contract laboratory analyst.

3.3 Corrective Action

Corrective action will be taken for any deficiencies or deviations noted in the procedures or anomalous results, such as but not limited to additional sample collection, sample re-run, laboratory inquires, or other actions as appropriate.

EXTERNAL GAMMA MONITORING PLAN

AND STANDARD OPERATING PROCEDURES

1. EXTERNAL GAMMA MONITORING PLAN

1.1 Locations and Frequency of Monitoring

External gamma measurements are taken over a quarterly interval for the twelve months of the year at all BHV locations and selected areas around the mill site (see Attachment #1 for those locations).

1.2 Quality Assurance

Quality assurance for external gamma measurements consists of:

a) Monitoring the container locations to ensure the TLDs have not been lost;

b) Ensuring that all containers are present when receiving or shipping to Landauer; and

c) Reviewing Landauer data for consistency and data transportation.

1.3 Analytical Requirements

Values reported are in millirems per week average for the monitor period (supplied by Landauer) along with a counting error term. The counting error term is calculated by:

[(sample 2 sigma) – (control mrem/week)] / (#weeks)

1.4 STANDARD OPERATING PROCEDURES

1.5 Equipment

External gamma is monitored at the ambient air sampling sites and other selected areas around the mill site, using the spherical container TLD badges from Landauer, Inc., or the equivalent.

1.6 Monitoring Methodology

a) The containers, each containing five TLD chips, are mounted approximately one meter above ground plane at each site with one container per site.

b) The containers loaded with TLDs are received the first of each quarter from Landauer and exchanged with those in the field.

c) A background TLD is stored in the Administration Vault as a transportation control.

d) The TLDs are returned to Landauer for processing.

1.7 Record Keeping

Data maintained in record form for external gamma is:

a) Sample period;

b) Sample location; and

c) External gamma levels for total radiation.

Attachment #1

Location of Spherical Environmental Monitors Fourth Quarter 2006

Badge Number	Location of Monitors
0	Front Gate
1	Vanadium Control Room - Located on South Wall
2	BHV-6
3	Ore Storage - Cameco Barrel Storage Area
4	Vanadium Precipitation - Located on Agitator Start Stop Button
5	Yellowcake Drying Area - Located on North Yellowcake Dryer Alarm
6	Leach Area - Located at #2 Leach Tank Eyewash Station
7	SAG Mill Control Room
8	Yellowcake Precip. - Located on S. Wall by Yellowcake Precip Redissolve Tank
9	Central Control Room - Located on Shifter's Bulletin Board
10	Ore Pad Trommel Screen - Located on Power Distribution Panel
11	Barrel Dump Station - Located at Operator's Panel
12	Metallurgical Laboratory - Hanging From Ceiling
13	Filter Press Room - Located on North Wall
14	BHV-1
15	BHV-2
16	BHV-3
17	BHV-4
18	BHV-5
19	SAG Mill - Located Outside SAG Mill Control Room Door (North Side)
20	Tails - Located on Cell 2 at the Power Distribution Center
21	CCD - Located Outside MCC On North Wall on Breaker Box
22	North SX - Located on Regen. Pump Start/Stop Switch
23	Administration Building - Located on Main Bulletin Board
24	In Tree By Picnic Bench Outside Administration Building
25	Yellowcake Packaging - Hung on Wall outside Door
26	North Yellowcake Dryer Area 2nd Level on N. Dryer Temp. Ctrl. Box
27	Bucking Room - Located on East Wall Behind Crusher
28	Mill Lunch Room - Located on Projection Screen on West Wall
29	South SX - Located on Column #10
30	Maintenance Supertintendent's Office - Located on North Wall
31	Ore Feed Grizzly - Located on North Wall at Power Distribution Boxes
32	Scalehouse - Located in Office at Northeast Corner
33	OBS (Sample Plant) - Located on South Side of Southwest Entrance Door
34	Administration Building - Vault (Control)

SPECIFIC CONDUCTIVITY, pH METER, AND TEMPERATURE FIELD INSTRUMENT CALIBRATION STANDARD OPERATING PROCEDURES

1.0 SPECIFIC CONDUCTIVITY, pH, AND TEMPERATURE FIELD INSTRUMENT CALIBRATION STANDARD OPERATING PROCEDURE

1.1 Introduction

A critical element in the White Mesa Mill's Groundwater and Surface Water Monitoring Program is the measurement of each Monitoring Location's field parameters (i.e., pH, temperature, and conductivity). The instrument utilized at the Mill to perform these measurements is the Hydrolab Surveyor 4 with multiple parameter probe called the Minisonde. It is important that all instruments used in these measurements be calibrated and inspected prior to each use, to ensure that they are functioning properly and have no obvious, visible damage or contamination present.

1.2 Equipment

1. Hydrolab Surveyor 4 with Minisonde or equivalent
2. NBS traceable thermometer.
3. pH 7.0 and 4.0 buffer solutions.
4. Ecologic Instrument Division of Industrial Municipal Equipment Inc. stock conductivity solution of 3000 mhos or equivalent
5. Deionized water.

2.0 CALIBRATION OF PROBES FOR CONDUCTANCE, pH, AND TEMPERATURE

2.1 pH Probe Calibration

The following describes the procedures for calibration of the Hydrolab Surveyor 4 / Minisonde pH probe.

1. Prior to calibration ensure that the Surveyor 4's battery is fully charged.

2. Inspect probes for visible damage and contamination.

3. Rinse the probes with distilled water prior to placing them in the sample container.

4. Fill the Minisonde's sample container with pH 7.0 buffer solution. If the Minisonde's sample container is not used and the probe is placed directly into a sample container place the probe protector over the probes prior to measurement.

5. From the Surveyor 4 main menu choose calibrate and press "Enter".

6. At the next prompt choose "Ions-1", and press "Enter".

7. Type "7" after "standard:<<".

8. Thoroughly rinse the probes and sample container with deionized water. Rinse sensors with a small amount of the pH 4.0 buffer. Fill the sample cup with the pH 4.0 buffer solution. Allow 1-3 minutes for the readings to stabilize.

9. In the Main Menu move the cursor to "Calibrate" and press "Enter."

10. Next move the cursor to "Ions" and press "Enter."

11. Place the cursor on "pH: units" and press "Enter."

12. Now type the 4.0 after "standard: <<, followed by "Enter."

13. The pH sensor is now calibrated. If further problems are encountered refer to the DataSonde4\MiniSonde manual or return instrument to the manufacturer for repair or calibration if required.

2.2 Temperature Probe Calibration

The following describes the procedures for calibration of the Hydrolab Surveyor 4 / Minisonde temperature probe:

1. The Hydrolab Surveyor 4 / Minisonde temperature probe is calibrated at the factory and typically does not require any calibration for temperature. However, a check to ensure that it the probe functioning properly should be performed prior to each use.

2. Place the probe in distilled water and allow the temperature reading to stabilize (1-3 minutes), record the reading.

3. Monitor the temperature of the solution with a NBS traceable thermometer, recording this reading.

4. Comparison of these two temperature readings should not vary more than 0.5 degrees Celsius between the two readings. No reference checks of temperature readings are retained.

5. At this point sample collection and monitoring of groundwater and surface water field temperature may proceed.

2.3 Specific Conductance Probe Calibration

The following describes the procedures for proper calibration of Surveyor 4 / Minisonde for specific conductance measurements:

1. Rinse probes with de-ionized water.

2. Fill sample container with conductivity standard solution.

3. Allow conductivity readings to stabilize (1-3 minutes).

4. Record reading on the Groundwater/Surface Water Field Sampling Sheet. Repeat previous steps monitoring deionized water (less than 10 mhos). If conductivity standard reading is within two-percent of the standard and the deionized water reading is less than 10 mhos, proceed to field measurements.

5. If the readings do not meet the conditions stated in the previous step, calibrate the instrument using the conductivity standard.

6. To calibrate choose "Calibrate".

7. From the menu choose "Specific Conductance" and press "Enter."

8. Enter the value of the standard solution in mhos/sq. cm and press "Enter."

9. The Surveyor 4 display will indicate whether or not the calibration was successful. If display indicates the calibration was successful proceed forward with field measurements. If display indicates that calibration was not successful repeat calibration procedures until indication that calibration was successful is given.

3.0 QUALITY ASSURANCE

Following the steps outlined in procedures above and using the prescribed equipment will produce accurate and repeatable results of groundwater and surface water field parameters. HS/EA Department Manager will review technician performance periodically.

No.: PBL-15 Rev. No.: R-1 Book No. 8 Date: February 25, 2007	DENISON MINES (USA) CORP. STANDARD OPERATING PROCEDURES Title: Release and Shipping of Vanadium Blackflake	Page 1 of 4

1. Purpose

The following procedure applies to the release and shipping of all vanadium in the form of blackflake from the restricted area of the White Mesa Mill (the "Mill"). Denison Mines (USA) Corp. ("DUSA") produces or has produced vanadium in three forms: blackflake, vanadium pregnant liquor ("VPL") and ammonium metavanadate ("AMV"). This procedure addresses release of vanadium blackflake only. Release of VPL or AMV may only be accomplished in accordance with separate procedures relating specifically to those forms of vanadium. The purpose of this procedure is to ensure that no lot of vanadium blackflake is released from the Mill's restricted area unless: a) it has an average source material content of less than 0.05%; and b) the applicable requirements of NRC Regulatory guide 1.86 and 10 CFR Part 20 are satisfied.

2. Form of Container

2.1. Vanadium blackflake shall be packaged in 55 gallon metal drums, each drum containing approximately 550 pounds of vanadium.

3. Sampling and Analysis for Source Material Content

3.1. Drums shall be assembled into lots for shipment.

3.2. A composite sample of all of the drums in each lot must be taken and analyzed as follows:

- a) Obtain an equal volume sample from each individual drum in the lot and composite them into a single sample;
- b) Submit the composite sample to the Mill laboratory for sample preparation;
- c) Perform a radiological analysis on the composite sample for total uranium and total thorium;
- d) Upon receipt of the analysis, record the combined percentage of uranium and thorium on the attached Source Material Assay and Radiological Survey of Vanadium Form; and
- e) Attach copies of the assay results to the attached Source Material Assay and Radiological Survey of Vanadium Form.

3.3. Under no circumstances may a lot of vanadium that has a composite sample with a combined weight percent uranium and thorium of 0.05% or greater be released from the Mill's restricted area, unless it is released to a facility that has an appropriate source material license and the material is being released to such licensee in accordance with that license.

4. Preparing Blackflake Drums and Shipping

4.1. Move all drums from stacked lots and place them on the ground so that the sides and tops can be easily inspected and prepared as necessary. The bottoms of the drums are to be inspected by lifting the drums with a barrel grab and visually checking for leaks and rust. Do not get under the drums when checking or cleaning and painting the bottoms.

4.2. After the drums are placed on the ground, check that lids and rings are properly secured and tightened.

4.3. Ensure strong, tight packaging – i.e., no holes in any of the containers. Notify your supervisor if there are any holes in the containers.

4.4. Paint drums if necessary.

4.5. Ensure that appropriate labeling is properly attached to each drum.

4.6. Check the drum number, date, lot number, gross weight, tare weight, and net weight on the tops and/or sides of each drum against the numbers on the drum list that will be attached to the Bill of Lading. If numbers do not match exactly, notify your supervisor.

5. Product Shipment Surveys

5.1. Prior to shipment release, the Radiation Safety Department will survey blackflake product shipments from the facility. No shipments will be released prior to the Radiation Safety Department's authorization.

5.2. Equipment, scanning procedures and equipment calibration used for blackflake product shipment surveys is detailed in the Radiation Protection Manual, Book 9.

5.3. Drums shall be cleaned prior to the radiation surveys.

5.4. Drums requiring repair shall be repaired prior to the radiation surveys.

5.5. The following surveys shall be performed:

5.5.1. Alpha Surveys:

a) Perform a fixed alpha survey of each drum. The release limits for fixed alpha radiation contamination is an average of 5,000 dpm/100 cm^2 and a maximum of 15,000 dpm/100 cm^2. Any drum that exceeds 1,000 dpm/100cm^2 fixed alpha contamination requires a removable alpha smear/wipe test to be performed;

b) Perform a removable alpha survey on any barrel exceeding 1,000 dpm/100 cm^2 fixed alpha contamination. The release limit for removable alpha contamination is 1,000 dpm/100 cm^2. Perform a smear/wipe test and analyze filters for removable alpha on 25% of the barrels at a minimum, and perform a smear/wipe test and analyze the filters for removable alpha on any barrels that exceed 1,000 dpm/100 cm^2 fixed contamination;
c) Record the results of the foregoing alpha surveys on the attached Source Material Assay and Radiological Survey of Vanadium Form; and
d) Any drums with visible contamination are to be cleaned prior to release.

5.5.2. Gamma Surveys:

a) Perform a gamma survey of each drum on contact with the surface of the drum and record the results on the appropriate spaces on the attached Source Material Assay and Radiological Survey of Vanadium Form. No drum that has an average contact gamma radiation exposure rate in excess of 2 mrad/hr shall be released from the restricted area of the Mill;
b) Calculate the average contact gamma dose rate for the lot by summing the value calculated for each drum in the lot under paragraph 5.5.2 a) above and by dividing the sum by the number of drums in the lot. Record this average contact gamma dose rate for the lot on the appropriate space on the attached Source Material Assay and Radiological Survey of Vanadium Form; and
c) No lot of sixty-six 55 gallon blackflake drums will be permitted to be released from the Mill's restricted area unless the average contact gamma dose rate for the lot, calculated over all drums in the lot pursuant to paragraph 5.5.2 b), does not exceed 0.907 mrad/hr. If a lot size is different than sixty-six 55 gallon drums of blackflake, then the RSO will determine an equivalent calculation, based on the analysis used to determine the 0.907 mrad/hr, to be used as the permitted average contact gamma dose rate for such lot.

5.6. If any lot is shipped in more than one shipment, the RSO shall ensure that the average contact gamma dose rate for the drums in each shipment is comparable to the average contact gamma dose rate for the lot.

6. Loading Drums Onto the Truck

6.1. After the drums have been surveyed, load the drums into the transport vehicle using appropriate Mill mobile equipment.

6.2. Brace the load of drums as may be required for transport.

6.3. If the transport vehicle has entered the Mill's restricted area, then prior to the truck leaving the restricted area, the truck will be scanned as per PBL-2, Intermodal Container Acceptance, Handling & Release.

6.4. Ensure that the shipment has been properly placarded.

6.5. Fill out the appropriate transportation paperwork for the shipment. Provide a copy of the shipping packet to the driver and maintain a copy for the Mill. The paperwork to be provided to the driver shall not include the Source Material Assay and Radiological Survey of Vanadium Form.

7. Hazard Identification and Safety

7.1. All safety precautions for material loading operations must be observed, including: securing the loading ramp, and using mobile equipment, and drum stacking precautions.

8. Paperwork Tracking

8.1. The attached Source Material Assay and Radiological Survey of Vanadium Form shall be completed for each lot that is shipped, and shall be maintained in the Mill's central files for inspection. Do not permit any vanadium to leave the restricted area unless:

a) the attached Source Material Assay and Radiological Survey of Vanadium Form has been completed, with assay results attached;
b) the Source Material weight percent, as indicated on the Form, is less than 0.05%;
c) the Average Dose Rate/Lot, as indicated on the Form, does not exceed 0.907 mrad/hr, or such other value as may be determined by the RSO under Section 5.5.2 c) above;
d) the Maximum Dose Rate/Lot, as indicated on the Form, does not exceed 2 mrad/hr; and
e) the alpha survey results indicated on the Form comply with the release standards described in Section 5.5.1 above.

Source Material Assay
&
Radiological Survey of Vanadium

DUSA Lot #:

Date: ___________
Surveyed By: ___________

Source Material Assay
Total Weight % U: ___________
Total Weight % Th: ___________
Total Source Material: ___________

Total
Alpha

Instrument:
SN ESP-1 / AC-3
02299 / 1
Cal. Date: 02286 / 2
Function Check (5 x 1 min.)
Th 230 @ 30300 dpm
Bkg Average: ___________
Dpm Average: ___________

Removable
Alpha

Model: ___________
SN: ___________
Cal. Date: ___________
Alpha Bkg Ave: ___________
Alpha eff: ___________
Alpha Factor: ___________

Total
Dose

Model #: ___________
SN: ___________
Cal. Date: ___________
Source: ___________
Efficiency: ___________

Total
Gamma

Model #: ___________
SN: ___________
Cal. Date: ___________
Source: ___________
Efficiency: ___________

Note:
Laboratory assay results for this lot of vanadium product are attached.

DATE ______________ LOT NO. ____________________________

BACKGROUND __________ EFFICIENCY FACTOR ______________

Drum Number	Total Alpha dpm/100cm²	Removable Alpha dpm/100cm²	Dose Rate mr/hr Tops	Dose Rate mr/hr Sides
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
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26				
27				
28				
29				
30				
31				
32				
33				

Average Gamma Dose Rate/Lot______________

Maximum Gamma Dose Rate/Lot______________

DATE ______________ LOT NO. ______________

BACKGROUND __________ EFFICIENCY FACTOR ______________

Drum Number	Total Alpha dpm/100cm²	Removable Alpha dpm/100cm²	Dose Rate mr/hr Tops	Dose Rate mr/hr Sides
34				
35				
36				
37				
38				
39				
40				
41				
42				
43				
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66				

STORMWATER
BEST MANAGEMENT PRACTICES PLAN

for

White Mesa Uranium Mill
6425 South Highway 191
P.O. Box 809
Blanding, Utah

February 2007

Prepared by:
Denison Mines (USA) Corp.
1050 17th Street, Suite 950
Denver, CO 80265

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TABLE OF CONTENTS

1.0 INTRODUCTION/PURPOSE

Denison Mines (USA) Corp. ("DUSA") operates the White Mesa Uranium Mill ("the Mill) in Blanding, Utah. The Mill is a net water consumer, and is a zero-discharge facility with respect to water effluents. That is, no water leaves the Mill site because the Mill has:

- no outfalls to public stormwater systems,
- no surface runoff to public stormwater systems,
- no discharges to publicly owned treatment works ("POTWs"), and
- no discharges to surface water bodies.

The State of Utah issued Groundwater Discharge Permit No. UGW370004 to DUSA on March 8, 2005. As a part of compliance with the Permit, DUSA is required to submit a Stormwater Best Management Practices Plan ("BMPP") to the Executive Secretary of the Division of Radiation Control, Utah Department of Environmental Quality. This BMPP presents operational and management practices to minimize or prevent spills of chemicals or hazardous materials, which could result in contaminated surface water effluents potentially impacting surface waters or ground waters through runoff or discharge connections to stormwater or surface water drainage routes. Although the Mill, by design, cannot directly impact stormwater, surface water, or groundwater, the Mill implements these practices in a good faith effort to minimize all sources of pollution at the site.

2.0 SCOPE

This BMPP identifies practices to prevent spills of chemicals and hazardous materials used in process operations, laboratory operations, and maintenance activities, and minimize spread of particulates from stockpiles and tailings management areas at the Mill. Storage of ores and alternate feeds on the ore pad, and containment of tailings in the Mill tailings impoundment system are not considered "spills" for the purposes of this BMPP.

The Mill site was constructed with an overall grade and diversion ditch system designed to channel all surface runoff, including precipitation equivalent to a Probable Maximum Precipitation/Probable Maximum Flood ("PMP/PMF") storm event, to the tailings management system. In addition, Mill tailings, all other process effluents, all solid waste and debris (except used oil and recyclable materials), and spilled materials that cannot be recovered for reuse are transferred to one or more of the tailings cells in accordance with the Mill's NRC license conditions. All of the process and laboratory building sinks, sumps, and floor drains are tied to the transfer lines to the tailings impoundments. A site map of the Mill is provided in Figure 1. A sketch of the site drainage basins is provided in Figure 2.

As a result, unlike other industrial facilities, whose spill management programs focus on minimizing the introduction of chemical and solid waste and wastewater into the process sewers and storm drains, the Mill is permitted by NRC license to manage some spills via draining or washdown to the process sewers, and ultimately the tailings system. However, as good environmental management practice, the Mill attempts to minimize:

1) the number and size of material spills, and
2) the amount of unrecovered spilled material and washwater that enters the process sewers after a spill cleanup.

Section 4.0 itemizes the practices in place at the Mill to meet these objectives.

Requirements and methods for management, recordkeeping, and documentation of hazardous material spills are addressed in the DUSA White Mesa Mill Spill Prevention, Control and Countermeasures ("SPCC") Plan Revised February, 2007, the Emergency Response Plan ("ERP"), also revised in February, 2007, and the housekeeping procedures incorporated in the White Mesa Mill Standard Operating Procedures ("SOPs"). The SPCC plan and the ERP are provided in their entirety in Appendices 1 and 2, respectively.

3.0 RESPONSIBILITY

All Mill personnel are responsible for implementation of the practices in this BMPP. DUSA White Mesa Mill management is responsible for providing the facilities or equipment necessary to implement the practices in this BMPP.

The Mill Management Organization is presented in Figure 3. The DUSA Corporate Management Organization is presented in Figure 4.

An updated spill prevention and control notification list is provided in Table 1.

4.0 BEST MANAGEMENT PRACTICES

A summary list and inventory of all liquid and solid materials managed at the Mill is provided in Tables 2 through 5.

4.1 General Management Practices Applicable to All Areas

4.1.1 Keep Potential Pollutants from Contact with Soil, and Surface Water:

- Store hazardous materials and other potential pollutants in appropriate containers.
- Label the containers.
- Keep the containers covered when not in use.

4.1.2 Keep Potential Pollutants from Contact with Precipitation

- Store bulk materials in covered tanks or drums.
- Store jars, bottle, or similar small containers in buildings or under covered areas.
- Replace or repair broken dumpsters and bins.
- Keep dumpster lids and large container covers closed when not in use (to keep precipitation out).

4.1.3 Keep Paved Areas from Becoming Pollutant Sources

- Sweep paved areas regularly, and dispose of debris in the solid waste dumpsters or tailings area as appropriate.

4.1.4 Inspection and Maintenance of Diversion Ditches and Drainage Channels within the Process and Reagent Storage Area

- Diversion ditches and drainage channels will be inspected during the regularly scheduled inspections required by Groundwater Discharge Permit No. UGW370004, and Byproduct Materials License #UT1900479. Areas requiring maintenance or repair will be report to site management and maintenance departments for necessary action. Status of maintenance or repairs will be documented during follow up inspections.

4.1.5 Recycle Fluids Whenever Possible:

- When possible, select automotive fluids, solvents, and cleaners that can be recycled or reclaimed.
- When possible, select consumable materials from suppliers who will reclaim empty containers.
- Keep spent fluids in properly labeled, covered containers until they are picked up for recycle or transferred to the tailings area for disposal.

4.2 Management Practices for Process and Laboratory Areas

4.2.1 Clean Up Spills Properly

- Clean up spills with dry cleanup methods (absorbents, sweeping, collection drums) instead of water whenever possible.
- Clean spills of stored reagents or other chemicals immediately after discovery. (Groundwater Discharge Permit No. UGW370004, Section I.D.8.c.)
- Recover and re-use spilled material whenever possible.
- Keep supplies of rags, sorbent materials (such as cat litter), spill collection drums, and personnel protective equipment ("PPE") near the areas where they may be needed for spill response.
- If spills must be washed down, use the minimum amount of water needed for effective cleanup.

4.2.2 Protect Materials Stored Outdoors

- If drummed feeds or products must be stored outdoors, store them in covered or diked areas when possible.
- If drummed chemicals must be stored outdoors, store them in covered or diked areas when possible.
- Make sure drums and containers stored outdoors are in good condition and secured against wind or leakage. Place any damaged containers into an overpack drum or second container.

4.2.3 Water Management

- When possible, recycle and reuse water from flushing and pressure testing equipment.
- When possible, wipe down the outsides of containers instead of rinsing them off in the sink.
- When possible, wipe down counters and work surfaces instead of hosing or rinsing them off to sinks and drains.

4.2.4 Materials Management

- Purchase and inventory the smallest amount of laboratory reagent necessary.
- Do not stock more of a reagent than will be used up before its expiration date.
- All new construction of reagent storage facilities will include secondary containment which shall control and prevent any contact of spilled reagents, or otherwise released reagent or product, with the ground surface. (Groundwater Discharge Permit No. UGW370004, Section I.D.3.e.)

4.3 Management Practices for Maintenance Activities

4.3.1 Keep a Clean Dry Shop

- Sweep or vacuum shop floors regularly.
- Designate specific areas indoors for parts cleaning, and use cleaners and solvents only in those areas.
- Clean up spills promptly. Don't let minor spills spread.
- Keep supplies of rags, collection containers, and sorbent material near each work area where they are needed.
- Store bulk fluids, waste fluids, and batteries in an area with secondary containment (double drum, drip pan) to capture leakage and contain spills.

4.3.2 Manage Vehicle Fluids

- Drain fluids from leaking or wrecked/damaged vehicles and equipment as soon as possible. Use drip pans or plastic tarps to prevent spillage and spread of fluids.
- Promptly contain and transfer drained fluids to appropriate storage area for reuse, recycle, or disposal.
- Recycle automotive fluids, if possible, when their useful life is finished.

4.3.3 Use Controls During Paint Removal

- Use drop cloths and sheeting to prevent windborne contamination from paint chips and sandblasting dust.
- Collect, contain, and transfer, as soon as possible, accumulated dusts and paint chips to a disposal location in the tailings area authorized to accept waste materials from maintenance or construction activities.

4.3.4 Use Controls During Paint Application and Cleanup

- Mix and use the right amount of paint for the job. Use up one container before opening a second one.
- Recycle or reuse leftover paint whenever possible.
- Never clean brushes or rinse or drain paint containers on the ground (paved or unpaved). Clean brushes and containers only at sinks and stations that drain to the process sewer to the tailings system.
- Paint out brushes to the extent possible before water washing (water-based paint) or solvent rinsing (oil-based paint).
- Filter and reuse thinners and solvent whenever possible). Contain solids and unusable excess liquids for transfer to the tailings area.

4.4 Management Practices for Ore Pad, Tailings Area, and Heavy Equipment

Detailed instructions for ore unloading, dust suppression, and tailings management are provided in the Mill SOPs.

4.4.1 Wash Down Vehicles and Equipment in Proper Areas

- Wash down trucks, trailers, and other heavy equipment only in areas designated for this purpose (such as washdown pad areas and the truck wash station).
- At the truck wash station, make sure the water collection and recycling system is working before turning on water sprays.

4.4.2 Manage Stockpiles to Prevent Windborne Contamination

- Water spray the ore pad and unpaved areas at appropriate frequency in accordance with Mill SOPs.
- Water spray stockpiles as required by opacity standards or weather conditions.
- Don't over-water. Keep surfaces moist but minimize runoff water.

4.4.3 Keep Earthmoving Activities from Becoming Pollutant Sources

- Schedule excavation, grading, and other earthmoving activities when extreme dryness and high winds will not be a factor (to prevent the need for excessive dust suppression).
- Remove existing vegetation only when absolutely necessary.
- Seed or plant temporary vegetation for erosion control on slopes.

TABLES

Table 1
White Mesa Mill Management Personnel
Responsible for Implementing This BMPP

Mill Staff

Personnel	Title	Work Phone	Home Phone/ Other Contact Number
Rich E. Bartlett	Interim Mill Manager	435-678-2221 Ext. 105	435 678-2495
Wade Hancock	Maintenance Foreman	435-678-2221 Ext.166	435 678-2753
Scot Christensen	Mill Foreman	435-678-2221	435 678-2015
David E. Turk	Radiation Safety Officer	435-678-2221 Ext. 113	435 678-7802
Wally Brice	Environmental Technician	435-678-2221 Ext. 122	435 678-2309

Corporate Management Staff

Personnel	Title	Work Phone	Home Phone/ Other Contact Number
Ron F. Hochstein	President/ Chief Operating Officer	604 806-3589	Cell: 604 377-1167
David C. Frydenlund	Vice President and General Counsel	303 389-4130	303 221-0098 Cell: 303 808-6648

TABLE 2
REAGENT YARD LIST

REAGENT	QUANTITY (LBS)	NUMBER OF STORAGE TANKS	CAPACITY (GALLONS)
ADOGEN 2382	6,120	---	
ADVANTAGE 101M	2,475	---	
AMERSITE 2	0	---	
AMINE 2384	19,440	---	
AMMONIUM SULFATE (BULK)	54,000	---	
AMMONIUM SULFATE (BAGS)	4,300	---	
ANHYDROUS AMMONIA	107,920	2	31,409
CHEMFAC 100	12,800	---	
CLARIFLOC N-101P	3,000	---	
DECYLALCOHOL	45,430	---	
DIESEL FUEL		2	250
		1	6,000
FLOCCULENT M1011N	30,550	---	
FLOCCULENT M1302C	3,550	---	
GRINDING BALLS	48,290	---	
ISODECANOL	45,430	---	
KEROSENE	1,344	3	10,152
MACKANATE	3,150	---	
MILLSPERSE 802	1,410	---	
NALCO 2458	0	---	
NALCO 8815	0	---	
PERCOL 351	1,500	---	
PERCOL 406	13,950	---	
PERCOL 745	0	---	
POLOX	10,360	---	
POLYHALL YCF	0	---	
PROPANE		1	30,000
SALT (BAGS)	39,280	---	
SALT (BULK)	0	---	
SODA ASH (BAGS)	39,280	---	
SODA ASH (BULK)	84,100	1	16,921
		1	8,530
SODIUM CHLORATE	101,128	1	17,700
		1	10,500
SODIUM HYDROXIDE	0	1	19,904
SULFURIC ACID	4,801,440	1	1,600,000
		2	269,160
UNLEADED GASOLINE		1	3,000
USED OIL		1	5,000

TABLE 3.0
LABORATORY CHEMICAL INVENTORY LIST[1]

Chemical in Lab	RQ[2]	Quantity In Stock
Aluminum nitrate	2,270 kg	1.8 kg
Ammonium bifluoride	45.4 kg	2.27 kg
Ammonium chloride	2,270 kg	2.27 kg
Ammonium oxalate	2,270 kg	6.8 kg
Ammonium thiocyanate	2,270 kg	7.8 kg
Antimony potassium tartrate	45.4 kg	0.454 kg
n-Butyl acetate	2,270 kg	4 L
Carbon tetrachloride	4.54 kg	1.0 L
Cyclohexane	454 kg	24 L
Ferric chloride	454 kg	6.810 kg
Ferrous ammonium sulfate	454 kg	0.57 kg
Potassium chromate	4.54 kg	0.114 kg
Sodium nitrite	45.4 kg	2.5 kg
Sodium phosphate tribasic	2,270 kg	1.4 kg
Zinc acetate	454 kg	0.91 kg

Chemical in Volatiles and Flammables Lockers (A,B,C)	RQ[2]	Quantity In Stock
Chloroform	4.54 kg	8 L
Formaldehyde	45.4 kg	<1L of 37% solution
Nitrobenzene	454 kg	12 L
Toluene	454 kg	12 L

Chemical in Acid Shed	RQ[2]	Quantity In Stock
Chloroform	4.54 kg	55 gal
Hydrochloric acid	2,270 kg	58 gal
Nitric acid	454 kg	5 L
Phosphoric acid	2,270 kg	10 L
Sulfuric acid	454 kg	25 L
Hydrofluoric Acid	45.4 kg	1 L
Ammonium hydroxide	454 kg	18 L

1. This list identifies chemicals which are regulated as hazardous substances under the Federal Water Pollution Control Act 40 CFR Part 117. The lab also stores small quantities of other materials that are not hazardous substances per the above regulation.

2. Reportable Quantities are those identified in 40 CFR Part 117 Table 117.3: "Reportable Quantities of Hazardous Substances Designated Pursuant to Section 311 of the Clean Water Act."

TABLE 4.0
REAGENT YARD/SMALL QUANTITY CHEMICALS LIST [1]

CHEMICAL	RQ[2]	QUANTITY IN STORAGE COMPOUND
Acetic Acid, Glacial	1,000 lbs	4 gal
Ammonium Hydroxide	1,000 lbs	5L
Carbon Disulfide	100 lbs	0 lbs
Calcium Hypochlorite	10 lbs	2 kg (4.4 lbs)
Chlorine	10 lbs	0 lbs
Ferrous Sulfate Heptahydrate	1,000 lbs	5 kg (11lbs)
Hydrochloric Acid	5,000 lbs	60 gal of 40% solution
Nitric Acid	1,000 lbs	10 L
Potassium Permanganate 0.1 N	32 gal	5 kg (11 lbs)
Sodium Hypochlorite 5.5%	100 lbs	2 kg (11 lbs) of 5.5% solution
Silver Nitrate	1 lb	0 lbs
Trichloroethylene	100 lb	2 L
Xylene (Mixed Isomers)	100 lbs	0 lbs

1. This list identifies chemicals which are regulated as hazardous substances under the Federal Water Pollution Control Act 40 CFR Part 117. Materials in this list are stored in a locked storage compound near the bulk storage tank area. The Mill also stores small quantities of other materials that are not hazardous substances per the above regulation.

2. Reportable Quantities are those identified in 40 CFR Part 117 Table 117.3: "Reportable Quantities of Hazardous Substances Designated Pursuant to Section 311 of the Clean Water Act."

TABLE 5.0
REAGENT YARD/BULK CHEMICALS LIST[1]

REAGENT	RQ[2]	QUANTITY IN REAGENT YARD
Sulfuric Acid	1,000 lbs	9,000,000 lbs
Floc #301	None	1,200 lbs
Hyperfloc 102	None	1,500 lbs
Ammonia – East Tank	100 lbs	0 lbs
Ammonia – West Tank	100 lbs	105,000 lbs
Kerosene	100 gal	500 gal
Salt (Bags)	None	2,000 lbs
Ammonium Hydrogendifluoride	None	20,450 lbs
Soda Ash Dense (Bag)	None	0 lbs
Phosphoric Acid	5,000 lbs	6,300 lbs
Polyox	None	490 lbs
Millsperse	None	1,410 lbs
Nalco TX760	None	9 barrels
Nalco 7200	None	1,590 lbs
Tributyl phosphate	None	9,450 lbs
Distillates	None	100 gal
Diesel	100 gal	Approx. 3300 gal
Gasoline	100 gal	Approx. 6000 gal
Alamine 336 drums	None	0 lbs
Floc 109	None	0 lbs
Floc 208	None	0 lbs
Floc 904	None	0 lbs
Hyperfloc 624	None	0 lbs
Salt (Bulk solids)	None	0 lbs
Salt (Bulk solutions)	None	0 lbs
Caustic Soda	1,000 lbs	0 lbs
Ammonium Sulfate	None	0 lbs
Sodium Chlorate	None	20,000 lbs
Alamine 335 Bulk	None	0 lbs
Alamine 310 Bulk	None	0 lbs
Isodecanol	None	0 lbs
Vanadium Pentoxide[3]	1000 lbs	30,000 lbs
Yellowcake[3]	None	< 100,000 lbs
Ammonia Meta Vanadate	1000 lbs	0 lbs

1. This list identifies all chemicals in the reagent yard whether or not they are regulated as hazardous substances under the Federal Water Pollution Control Act 40 CFR Part 117.

2. Reportable Quantities are those identified in 40 CFR Part 117 Table 117.3: "Reportable Quantities of Hazardous Substances Designated Pursuant to Section 311 of the Clean Water Act."

3. Vanadium Pentoxide and Yellowcake, the Mill's products, are not stored in the Reagent Yard itself, but are present in closed containers in the Mill Building and/or Mill Yard.

TABLE 6.0
PETROLEUM PRODUCTS AND SOLVENTS LIST[1]

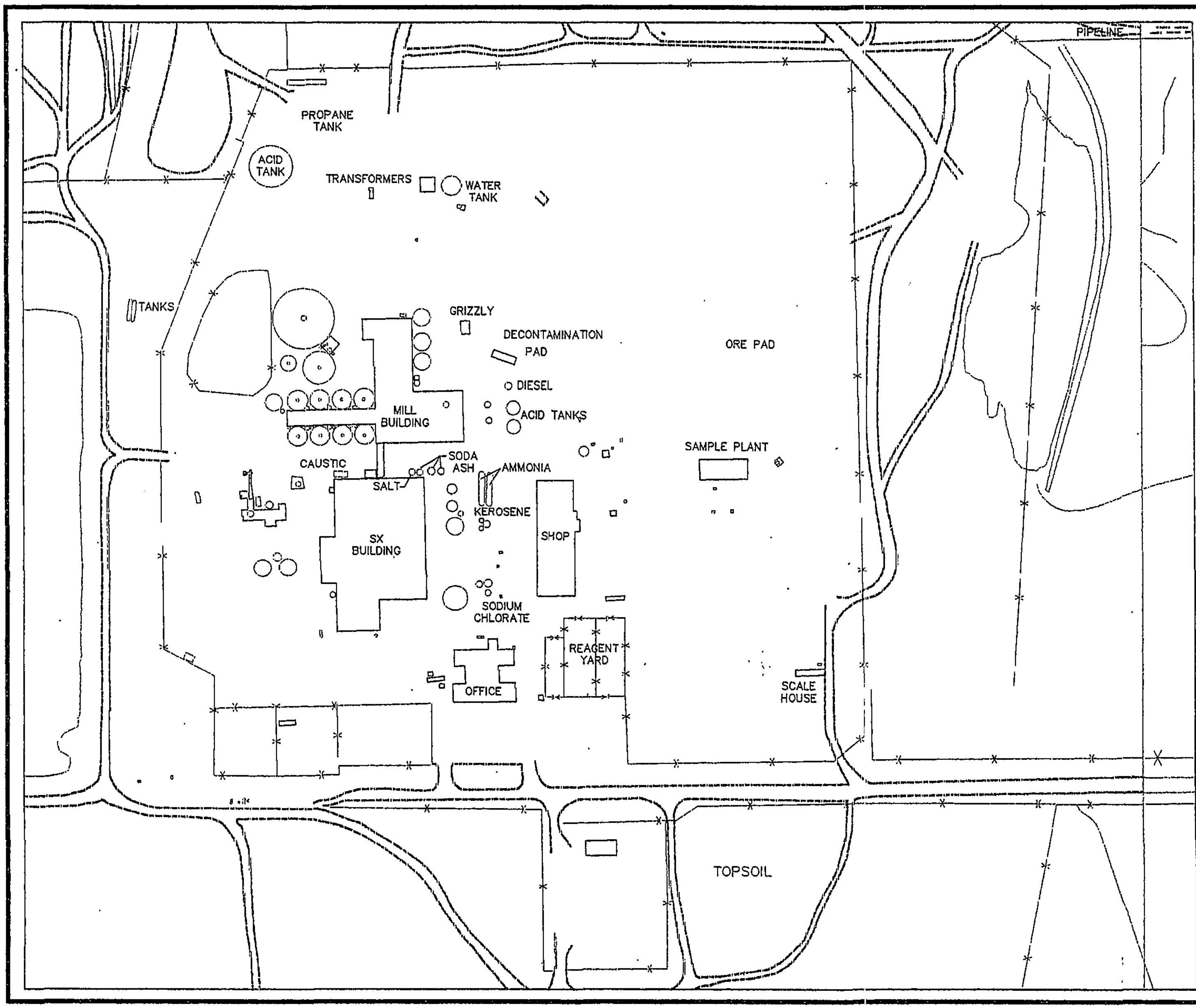
PRODUCT	RQ	QUANTITY IN WAREHOUSE
Lubricating Oils in 55 gallon drums	100 gal	1,540 gallons
Transmission Oils	100 gal	0 gallons
Water Soluble Oils	100 gal	30 gallons
Xylene (mixed isomers)	100 lbs	0 gallons
Toluene	1000 lbs	0 gallons
Varsol Solvent (2% trimethyl benzene in petroleum distillates)	100 gal	0 gallons

1. This list includes all solvents and petroleum-based products in the Mill warehouse petroleum and chemical storage aisles.

2. Reportable Quantities are those identified in 40 CFR Part 117 Table 117.3: "Reportable Quantities of Hazardous Substances Designated Pursuant to Section 311 of the Clean Water Act."

FIGURES

Figure 1
White Mesa Mill
Mill Site Layout



International Uranium (USA) Corporation

Project: WHITE MESA MILL

REVISIONS | County: San Juan | State: Utah

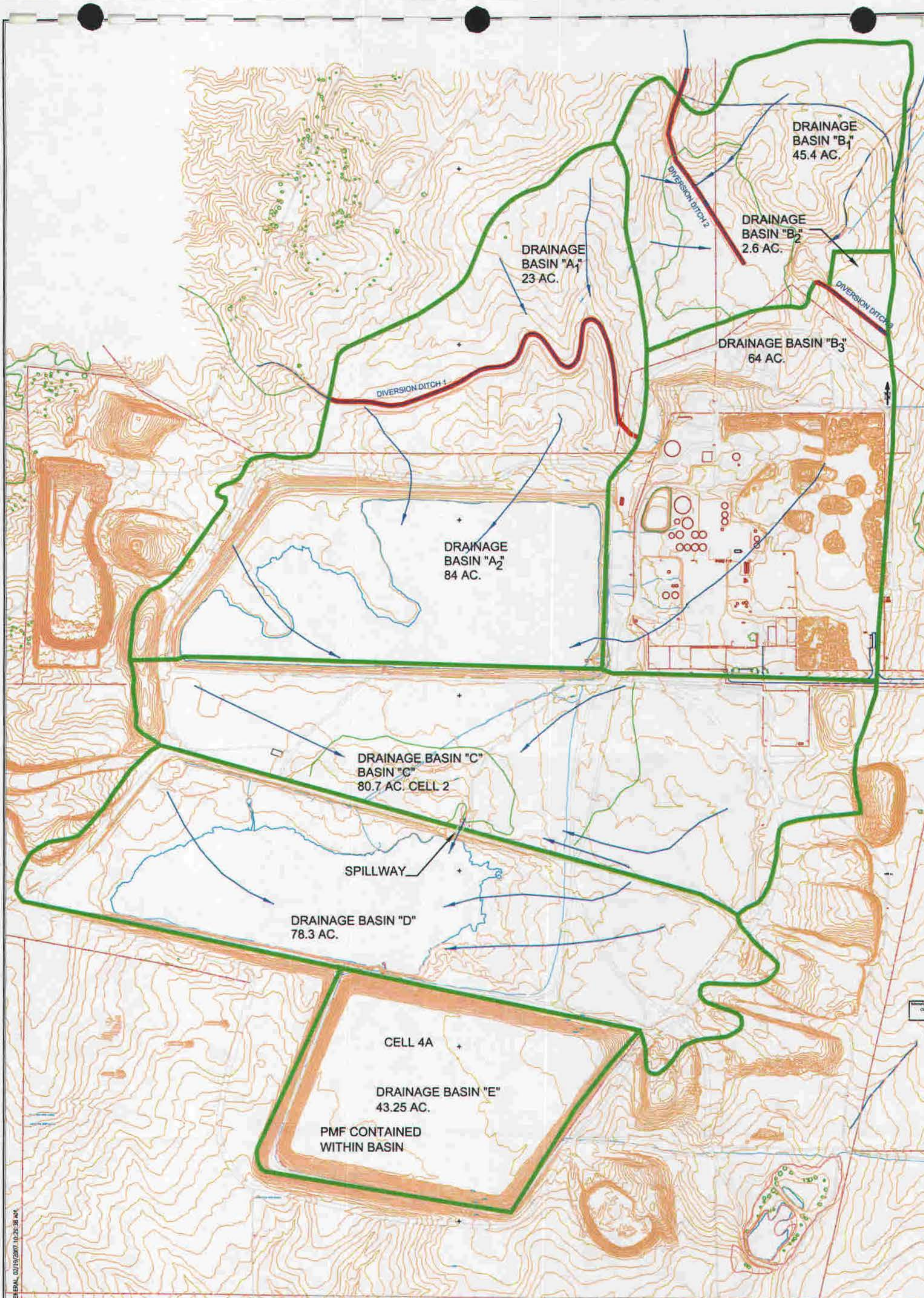
Date | By | Location:

Figure 1
MILL SITE LAYOUT

Scale: 1"=200' | Date: Nov. 14, 2002 | traffic-pat

Author: unknown | Drafted By: SleddCad

Figure 2
White Mesa Mill
Mill Site Drainage Basins



Sufrace Water Flow
Drainage Basins
Diversion Ditches

1000 0 1000 2000

International Uranium (USA) Corporation

Project	WHITE MESSA MILL
County: San Juan	State: Utah
Location:	
REVISIONS: Date 2/15/07, By BM	Figure 2 — Mill Site Drainage Basins
Scale: 1"=2000'	Date: 2005 — figure2-091205
Author: HRR	Drafted By: Battumur M

Figure 3
White Mesa Mill
Mill Management Organization Chart

White Mesa Mill
Organizational Structure

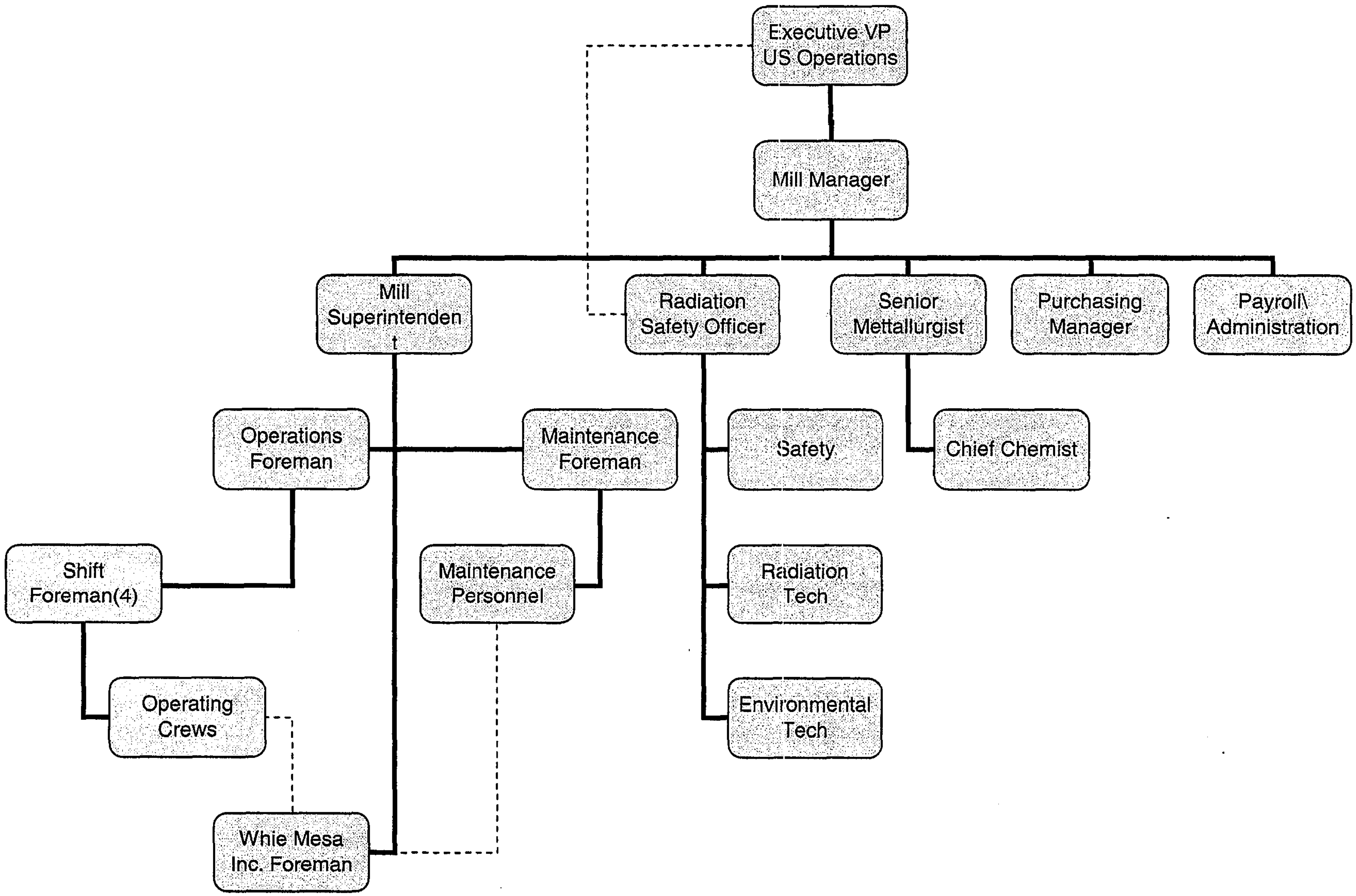
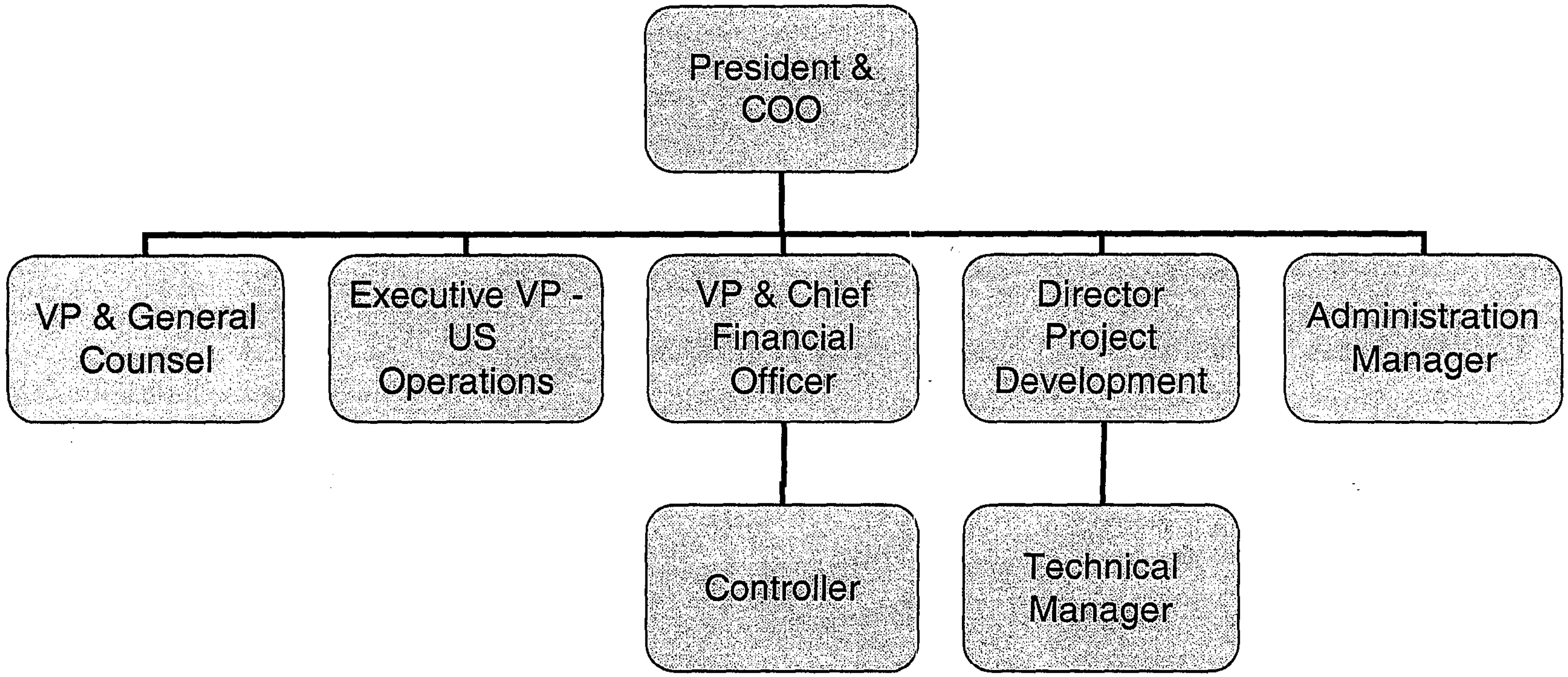


Figure 4

Corporate Management Organization Chart

Denison Mines (USA) Corp.
Organizational Structure



APPENDICES

APPENDIX 1

WHITE MESA MILL
SPILL PREVENTION, CONTROL, AND COUNTERMEASURES PLAN

SPILL PREVENTION, CONTROL, AND COUNTERMEASURES PLAN

FOR CHEMICALS AND PETROLEUM PRODUCTS

for

White Mesa Uranium Mill
6425 South Highway 191
P. O. Box 809
Blanding, Utah 84511

February 2007

Prepared by:
Denison Mines (USA) Corp.
1050 17th Street, Suite 950
Denver, Colorado 80265

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WHITE MESA MILL

SPILL PREVENTION, CONTROL, AND COUNTERMEASURES PLAN FOR CHEMICALS AND PETROLEUM PRODUCTS

1.1 OBJECTIVE:

The objective of the Spill Prevention, Control, and Countermeasures (SPCC) Plan is to serve as a site-specific guideline for the prevention of and response to chemical and petroleum spills, and as a guidance document for compliance with Groundwater Discharge Permit No. UGW370004. The plan outlines spill potentials, containment areas, and drainage characteristics of the White Mesa Mill site. The plan addresses chemical spill prevention, spill potentials, spill discovery, and spill notification procedures. The Oil Pollution Prevention Sections of the Clean Water Act (40 CFR 112 to 117), also referred to as the Spill Prevention, Control, and Countermeasures ("SPCC") rules, establish requirements that apply to facilities which could reasonably be expected to discharge oil in quantities that may be harmful, as described in that Act, into or upon the navigable waters of the United States or that may affect natural resources of the United States. Section 112 states that the Act is not applicable to facilities that are not subject to the authority of the U. S. Environmental Protection Agency ("EPA") for one of the following reasons:

1. Due to its location, the facility could not reasonably be expected to discharge oil into navigable waters of, or impact natural resources of, the U.S. or

2. The facility is subject to authority of the Department of Transportation as defined in a Memorandum of Understanding ("MOU") between the Secretary of Transportation and the EPA Administrator, or

3. The facility does not exceed either the underground or the above ground storage capacity (42,000 gallons and 1,320 gallons, respectively) prescribed in the rules.

The Mill could not reasonably be expected, as described in the SPCC regulation, to discharge oil into the navigable waters, or impact natural resources, of the U.S. The Mill site was constructed with an overall grade and diversion ditch system designed to channel the non-recovered portion of any material spill to the tailings management system. Hence, it is not reasonable to expect that surface spills will ever reach navigable waters or natural resources of the U.S. or Utah.

Therefore, the SPCC reporting requirements in the Clean Water Act are not applicable to the Mill. However, as good environmental management practice, the Mill has implemented the spill management program, described in this document, which is consistent with the intent of the Clean Water Act to the extent practicable. Although the Mill, by design, cannot directly impact navigable waters of the U.S., and as a result, spills that may occur but are retained within the site would not be "reportable", the Mill implements these practices in a good faith effort to minimize all potential sources of pollution at the site.

Storage of ores and alternate feeds on the ore pad, and containment of tailings in the Mill tailings impoundment system are not considered "spills" for the purposes of this SPCC.

Ammonia is the only chemical that has the potential to leave the site, and would do so as a vapor.

Figure 1, Site Layout Map shows a map of the mill site including the locations of the chemical tanks on-site. Figure 2 shows the basins and drainage ditch areas for the mill site. Table 1.0 is an organization chart for Mill operations. Table 2.0 lists the reagent tanks and their respective capacities. Table 3.0 lists the laboratory chemicals, their amounts, and their reportable quantities. Table 4.0 lists the operations chemicals. Table 5.0 lists the chemicals in the reagent yard, their amounts, and their reportable quantities. Table 6.0 lists the petroleum products and solvents on site.

1.2 RESPONSIBILITIES:

Person in charge of facility responsible for spill prevention:

Mr. Richard E. Bartlett, Interim Mill Manager
6425 South Highway 191
Blanding, UT 84511
(435) 678-2221 (work)
(435) 459-2495 (home)

Person in charge of follow-up spill record keeping and/or reporting:

Mr. David E. Turk, Department Head, Health , Safety, and Environmental
6425 South Highway 191
Blanding, UT 84511
(435) 678-2221 (work)
(435) 678-7802 (home)

Refer to *Section 1.9 Spill Incident Notification* for a list of company personnel to be notified in case of a spill. In addition, an organizational chart is provided in Table 1.0.

1.3 DRAINAGE BASINS, PATHWAYS, AND DIVERSIONS:

The main drainage pathways are illustrated in Figure 2. The map shows drainage basin boundaries, flow paths, constructed diversion ditches, tailings cells, the spillway between Cell 2 and 3, dikes, berms, and other relevant features. The White Mesa Mill is a "zero" discharge facility for process liquid wastes. The mill area has been designed to ensure that all spills or leaks from tanks will drain toward the lined tailings cells.

The tailings cells, in turn, are operated with sufficient freeboard (minimum of three feet) to withstand 100% of the PMP (Probable Maximum Precipitation). This allows for a maximum of 10 inches of rain at any given time.

1.4 DESCRIPTION OF BASINS:

Precipitation and unexpected spills on the mill property are contained within their respective drainage basins. Runoff would ultimately drain into one of the three (3) lined tailings cells.

1.4.1 Basin A1

Basin A1 is north of Cell 1-I and Diversion Ditch No. 1. The basin contains 23 acres, all of which drain into Westwater Creek. This area is not affected by mill operations.

1.4.2 Basin A2

Basin A2 contains all of Cell 1-I including an area south of the Diversion Ditch No. 1. The basin covers 84 acres. Any runoff from this basin would be contained within Cell 1-I.

1.4.3 Basin B1

Basin B1 is north of the mill property and is not affected by mill operations. The basin contains 45.4 tributary acres. Runoff from this basin drains into a flood retention area by flowing through Diversion Ditch No. 2. Diversion Ditch No. 2 drains into Westwater Creek.

1.4.4 Basin B2

Basin B2 is northeast of the mill and contains only 2.6 acres. Runoff from this basin would drain into Diversion Ditch No. 3. Diversion Ditch No. 3 ultimately drains into Diversion Ditch No. 2. This basin is not affected by mill operations.

1.4.5 Basin B3

Basin B3 contains most of the mill area, buildings, ore stockpiles, process storage tanks, retention ponds, spill containment structures, pipelines, and roadways. The normal direction of flow in this basin is from the northwest to the southwest. Any runoff from this basin would drain into Cell 1-I. The basin contains 64 acres. This basin has sufficient freeboard to withstand 100% of the PMP (Probable Maximum Precipitation). This allows 10 inches of rain for any given storm event.

1.4.6 Basin C

Basin C contains all of Cell 2. The basin consists of 80.7 acres. This basin contains earth stockpiles and the heavy equipment shop. The direction of flow in this basin is to the southwest. All runoff in this basin would be channeled along the southern edge of the basin. Runoff would then flow into Cell 3 via the spillway from Cell 2 to Cell 3.

1.4.7 Basin D

Basin D contains all of Cell 3. This basin consists of 78.3 acres including a portion of the slopes of the topsoil stockpile and random stockpile. The basin contains all flows, including those caused by the PMF.

1.4.8 Basin E

Basin E contains Cell 4A and consists of 43.3 acres. All anticipated flows including those caused by the PMF will be contained within the basin and will flow directly into Cell 4A.

1.5 POTENTIAL CHEMICAL SPILL SOURCES AND SPILL CONTAINMENT

This section details potential sources of chemical spills and "reportable quantities". For purposes of this SPCC, a "reportable quantity" will be defined as quantities listed below which could be expected to reach navigable waters of the United States. Reportable Quantities are those identified in 40 CFR Part 117 Table 117.3: "Reportable Quantities of Hazardous Substances Designated Pursuant to Section 311 of the Clean Water Act." It is not expected that any spill would reach navigable waters of the United States. However, if a spill of a volume listed below occurs, and remains on the mill site, which is the more likely scenario, then management is to be notified so that proper internal evaluations of the spill are made.

1.5.1 Reagent Tanks (Tank list included in Table 2.0)

1.5.2 Ammonia

The ammonia storage tanks consist of two tanks with a capacity of 31,409 gallons each. The tanks are located southeast of the Mill building.

Daily monitoring of the tanks for leaks and routine integrity inspections will be conducted to minimize the hazard associated with ammonia. The reportable quantity for an ammonia spill is 7 gallons.

Ammonia spills should be treated as gaseous. Ammonia vapors will be monitored closely to minimize the hazard associated with inhalation. If vapors are detected, efforts will be made to stop or repair the leak expeditiously. Ammonia is the only chemical (as vapor) that has the potential to leave the site.

1.5.3 Ammonia Meta Vanadate

Ammonia meta vanadate is present in the SX building as the process solutions move through the circuit to produce the vanadium end product. But, the primary focus will be on the transportation of this chemical. The reportable quantity for an ammonia meta vanadate spill is 1,000 pounds.

1.5.4 Caustic Storage (Sodium Hydroxide)

The caustic storage tank is located on a splash pad on the northwest corner of the SX building. The tank has a capacity of 19,904 gallons. The tank supports are mounted on a concrete curbed catchment pad that directs spills into the sand filter sump in the northwest corner of the SX building. The reportable quantity for a sodium hydroxide spill is 85 gallons.

1.5.5 Sodium Carbonate (Soda Ash)

The soda ash solution tank has a capacity of 16,921 gallons and is located in the northeast corner of the SX building. The smaller soda ash shift tank has a capacity of 8,530 gallons and is located in the SX building. Spills will be diverted into the boiler area, and would ultimately drain into Cell 1-I. There is no reportable quantity associated with a sodium carbonate spill.

1.5.6 Sodium Chlorate

Sodium chlorate tanks consist of two fiberglass tanks located within a dike east of the SX building. The larger tank is used for dilution purposes and has a maximum capacity of 17,700 gallons. The smaller tank serves as a storage tank and has a capacity of 10,500 gallons. Daily monitoring of the tanks for leaks and integrity inspections will be conducted to minimize the hazard associated with sodium chlorate.

Sodium chlorate that has dried and solidified becomes even more of a safety hazard due to its extremely flammable nature. The reportable quantity for a sodium chlorate spill is 400 gallons.

1.5.7 Sulfuric Acid

The sulfuric acid storage tanks consist of one large tank with the capacity of 1,6000,000 gallons and two smaller tanks with capacities of 269,160 gallons each.

The large tank is located in the northwest corner of mill area basin B3 and is primarily used for acid storage and unloading. The tank support for the large tank is on a mound above a depression which would contain a significant spill. All flows resulting would be channeled to Cell 1-I. The tank is equipped with a high level audible alarm which sounds prior to tank overflows. A concrete spill catchment with a sump in the back provides added containment around the base of the tank. However, the catchment basin would not be able to handle a major tank failure such as a tank rupture. The resulting overflow would flow towards Cell 1-I.

The two smaller storage tanks are located within an equal volume spill containment dike east of the mill building. The tanks are not presently in use, but are equipped with high level audible alarms.

The reportable quantity for a sulfuric acid spill is 65 gallons (1,000 pounds).

1.5.8 Vanadium Pentoxide

Vanadium pentoxide is produced when vanadium is processed through the drying and fusing circuits and is not present in the vanadium circuit until after the deammoniator. Efforts will be made to minimize leaks or line breaks that may occur in processes in the circuit that contain vanadium pentoxide. Special care will be taken in the transportation of this chemical. The reportable quantity for a vanadium pentoxide spill is 1,000 pounds.

1.5.9 Kerosene (Organic)

The kerosene storage area is located in the central mill yard and has a combined capacity of 10,152 gallons in three tanks. Any overflow from these three tanks would flow around the south side of the SX building and then into Cell 1-I. These tanks have drain valves which remain locked unless personnel are supervising draining operations. The reportable quantity for a kerosene spill is 100 gallons.

1.6.0 Used/ Waste Oil

Used/ Waste oil for parts washing is located north of the maintenance shop in a tank and has a capacity of 5,000 gallons. The tank is contained within a concrete containment system. Ultimate disposal of the used oil is to an EPA permitted oil recycler. Any oil escaping the concrete containment system will be cleaned up. Soil contaminated with used oil will be excavated and disposed of in Cell 2.

1.6.1 Propane

The propane tank is located in the northwest corner of the mill yard and has a capacity of 30,000 gallons. Daily monitoring of the tank for leaks and integrity inspections will be conducted to minimize potential hazards associated with propane leaks. Propane leaks will be reported immediately. There is no reportable quantity associated with a propane spill.

1.7 POTENTIAL PETROLEUM SPILL SOURCES AND CONTAINMENT

This section details potential sources of petroleum spills and "reportable quantities". For purposes of this SPCC, a "reportable quantity" will be defined as quantities listed below which could be expected to reach navigable waters of the United States. It is not expected that any spill would reach navigable waters of the United States. However, if a spill of a volume listed below occurs, and remains on the mill site, which is the more likely scenario, then management is to be notified so that proper internal evaluations of the spill are made.

1.7.1 Petroleum Tanks

1.7.1.1 Diesel

Two diesel storage tanks are located north of the mill building. The tanks have capacities of 250 gallons each. One of the diesel tanks is for the emergency generator. The other tank is located in the pumphouse on an elevated stand. Spillage from either tank would ultimately flow into Cell 1-I. The reportable quantity for a diesel spill is 100 gallons.

1.7.2 Aboveground Fuel Pump Tanks

1.7.2.1 Diesel

The diesel tank is located on the east boundary of Basin B3 and has a capacity of 6,000 gallons. The tank is contained within a concrete catchment pad. The reportable quantity for a diesel spill is 100 gallons.

1.7.2.2 Unleaded Gasoline

The unleaded gasoline tank is located next to the diesel tank. The unleaded gasoline tank has a capacity of 3,000 gallons and is contained within the same containment system as the diesel tank. The reportable quantity for an unleaded gasoline spill is 100 gallons.

1.7.2.3 Pump Station

Both the diesel and the unleaded gasoline tanks will be used for refueling company vehicles used around the mill site. The pump station is equipped with an emergency shut-off device in case of overflow during fueling. In addition, the station is also equipped with a piston leak detector and emergency vent. Check valves are present along with a tank monitor console with a leak detection system. The catchment is able to handle a complete failure of one tank. However, if both tanks failed the concrete catchment pad would not be able to contain the spill. In this case, a temporary berm would need to be constructed. Absorbent diapers or floor sweep would be used in an effort to limit and contain the spill. The soil would be cleaned up and placed in the authorized disposal area in Cell 2.

1.7. 2.4 Truck Unloading

In the event of a truck accident resulting in an overturned vehicle in the mill area, proper reporting and containment procedures will be followed when warranted, such as when oil or diesel fuel is spilled. Proper clean-up procedures will be followed to minimize or limit the spill. The spill may be temporarily bermed or localized with absorbent compounds. Any soils contaminated with diesel fuel or oil will be cleaned up and placed in the authorized disposal area in Cell 2.

1.8 SPILL DISCOVERY AND REMEDIAL ACTION

Once a chemical or petroleum spill has been detected, it is important to take measures to limit additional spillage and contain the spill that has already occurred. Chemical or petroleum spills will be handled as follows:

The Shift Foreman will direct efforts to shut down systems, if possible, to limit further release.

The Shift Foreman will also secure help if operators are requiring additional assistance to contain the spill.

The Shift Foreman is also obligated to initiate reporting procedures.

Once control measures have begun and personal danger is minimized, the Shift Foreman will notify the Production Superintendent, Maintenance Superintendent, or Mill Manager.

The Production or Maintenance Superintendent will notify the Mill Manager, who in turn will notify the Environmental Health and Safety Manager.

The Mill Manager will assess the spill and related damage and direct remedial actions. The corrective actions may include repairs, clean-up, disposal, and company notifications. Government notifications may be necessary in some cases.

If a major spill continues uncontrolled, these alternatives will be considered.:

1. Construct soil dikes or a pit using heavy equipment.
2. Construct a diversion channel into an existing pond.
3. Start pumping the spill into an existing tank or pond.
4. Plan further clean-up and decontamination measures.

1.9 SPILL INCIDENT NOTIFICATION

1.9.1 External Notification

As stated in Section 1.1, spills are not expected to reach navigable waters of the United States. If a spill of a "reportable quantity" occurs, then mill and corporate management must be notified and they will evaluate whether or not the following agencies must be notified:

1. EPA National Response Center	1-800-424-8802
2. State of Utah, Department of Environmental	
Quality, Division of Radiation Control	801/536-4250
3. State of Utah	801/538-7200
Water Quality Division	801/538-6146

In case of a tailings dam failure, contact the following agencies:

1. State of Utah, Department of Environmental	
Quality, Division of Radiation Control	801/536-4250
2. State of Utah, Natural Resources	801/538-7200

1.9.2 Internal Notification

Internal reporting requirements for incidents, spills, and significant spills are as follows:

Report Immediately

Event Criteria:

1. Release of toxic or hazardous substances
2. Fire, explosions, and accidents
3. Government investigations, information requests, or enforcement actions
4. Private actions or claims (corporate or employee)
5. Deviations from corporate policies or government requirements by management

Which have or could result in the following:

1. Death, serious injury, or adverse health effects
2. Property damage exceeding $1,000,000

3. Government investigation or enforcement action which limits operations or assesses penalties of $100,000 or more
4. Publicity resulted or anticipated
5. Substantial media coverage

Report At The Beginning Of The Next Day

Event Criteria:

1. Was reported to a government agency as required by law
2. Worker (employee or contractor) recordable injury or illness associated with a release
3. Community impact-reported or awareness
4. Publicity resulted or anticipated
5. Release exceeding the reportable quantities listed in Section 1.5, for each specific process material, waste, or by-product

In the event of a spill of a reportable quantity, the Mill Manager is required to call the Corporate Environmental Manager or the President and Chief Executive Officer. The individual first discovering the spill will report it to the Shift Foreman, Production Superintendent or Maintenance Superintendent, who will in turn ensure that the Mill Manager is notified. The Environmental Health and Safety Manager will also be contacted by the Mill Manager.

Name	Title	Home Phone
Mill Personnel:		
Richard E. Bartlett	Interim Mill Manager	(435) 678-2495
Wade Hancock	Maintenance Foreman	(435) 678-2753
David E. Turk	Environmental Health and Safety Manager	(435) 678-7802
N/A	Production Superintendent	
N/A	Maintenance Foreman	
Scot Christensen	Mill Shift Foreman	(435) 678-2015
Corporate Personnel:		
Ronald F. Hochstein	President and Chief Operating Officer	(604) 377-1167
David C. Frydenlund	Vice President and General Counsel	(303) 221-0098

In the event the next person in the chain-of-command cannot be reached, then proceed up the chain-of-command to the next level. Table 1.0 shows the organizational chart for the mill site.

1.10 RECORDS AND REPORTS

The following reports and records are to be maintained in Central Files by the Environmental Health and Safety Manager for inspection and review for a minimum of three years:

1. Record of site monitoring inspections
   a. Daily Tailings Inspection Data
   b. Weekly Tailings Inspection and Survey
   c. Monthly Tailings Inspection, Pipeline thickness
   d. Quarterly Tailings Inspection
2. Tank to soil potential measurements
3. Annual bulk oil and fuel tank visual inspections
4. Tank and pipeline thickness tests
5. Quarterly and annual PCB transformer inspections (if transformer contains PCBs)
6. Tank supports and foundation inspections
7. Spill Incident Reports
8. Latest revision of SPCC plan

1.11 PERSONNEL TRAINING AND SPILL PREVENTION PROCEDURES

All new employees are instructed on spills at the time they are employed and trained. They are briefed on chemical and petroleum spill prevention and control. They are informed that leaks in piping, valves, and sudden discharges from tanks should be reported immediately. Abnormal flows from ditches or impoundments are of immediate concern. In addition, a safety meeting is presented annually by the Environmental Health and Safety Manager to review the SPCC plan.

1.11.1 Training Records

Employee training records on chemical and petroleum spill prevention are maintained in the general safety training files.

1.11.2 Monitoring Reports

Shift logs shall provide a checklist for inspection items.

1.12 REVISION

This procedure is to be reviewed by the mill staff and a registered professional engineer at least once every three years, and updated when circumstances warrant a revision.

1.13 Summary

Below is a table listing the specific reportable quantities associated with the major chemical and petroleum products on-site.

CHEMICAL	REPORTABLE QUANTITY (RQ)
AMMONIA	100 POUNDS
AMV	1,000 POUNDS
SODIUM HYDROXIDE	1,000 POUNDS
SODA ASH	No Reportable Quantity
SODIUM CHLORATE	400 GALLONS
SULFURIC ACID	1,000 POUNDS
VANADIUM PENTOXIDE	1,000 POUNDS
KEROSENE	100 GALLONS
OIL	No Reportable Quantity
PROPANE	No Reportable Quantity
DIESEL & UNLEADED FUEL	100 GALLONS

1.14 MILL MANAGER APPROVAL

I hereby certify that I have reviewed the foregoing chemical and petroleum product SPCC plan, that I am familiar with the International Uranium (USA) Corporation White Mesa Mill facilities, and attest that this SPCC plan has been prepared in accordance with the Standard Operating Procedures currently in effect.

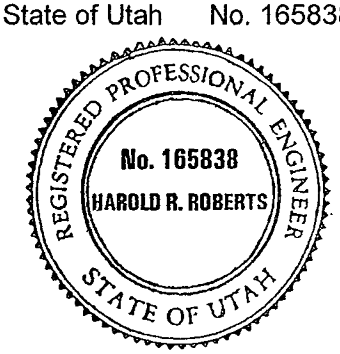
Richard E. Bartlett
Interim Mill Manager

1.15 CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER

I hereby certify that I have reviewed the foregoing chemical and petroleum product SPCC plan, that I am familiar with the International Uranium (USA) Corporation White Mesa Mill facilities, and attest that this SPCC plan has been prepared in accordance with good engineering practices.

Harold R. Roberts

Registered Professional Engineer
State of Utah No. 165838



TABLES

Table 1
White Mesa Mill Management Personnel
Responsible for Implementing This BMPP

Mill Staff

Personnel	Title	Work Phone	Home Phone/ Other Contact Number
Rich E. Bartlett	Interim Mill Manager	435-678-2221 Ext. 105	435 678-2495
Wade Hancock	Maintenance Foreman	435-678-2221 Ext.166	435 678-2753
Scot Christensen	Mill Foreman	435-678-2221	435 678-2015
David E. Turk	Radiation Safety Officer	435-678-2221 Ext. 113	435 678-7802
Wally Brice	Environmental Technician	435-678-2221 Ext. 122	435 678-2309

Corporate Management Staff

Personnel	Title	Work Phone	Home Phone/ Other Contact Number
Ron F. Hochstein	President/ Chief Operating Officer	604 806-3589	Cell: 604 377-1167
David C. Frydenlund	Vice President and General Counsel	303 389-4130	303 221-0098 Cell: 303 808-6648

TABLE 2.0
REAGENT TANK LIST

QUANTITY	REAGENT	CAPACITY (GAL)
2	DIESEL	250
3	KEROSENE	10,152
1	USED/WASTE OIL	5,000
1	DIESEL	6,000
1	UNLEADED	3,000
1	PROPANE	30,000
2	AMMONIA	31,409
1	SODIUM HYDROXIDE	19,904
1	SODA ASH SOLUTION	16,921
1	SODA ASH SHIFT	8,530
1	SODIUM CHLORATE	17,700
1	SODIUM CHLORATE	10,500
1	SULFURIC ACID	1,600,000
2	SULFURIC ACID	269,160

TABLE 3.0
LABORATORY CHEMICAL INVENTORY LIST[1]

Chemical in Lab	RQ[2]	Quantity In Stock
Aluminum nitrate	2,270 kg	1.8 kg
Ammonium bifluoride	45.4 kg	2.27 kg
Ammonium chloride	2,270 kg	2.27 kg
Ammonium oxalate	2,270 kg	6.8 kg
Ammonium thiocyanate	2,270 kg	7.8 kg
Antimony potassium tartrate	45.4 kg	0.454 kg
n-Butyl acetate	2,270 kg	4 L
Carbon tetrachloride	4.54 kg	1.0 L
Cyclohexane	454 kg	24 L
Ferric chloride	454 kg	6.810 kg
Ferrous ammonium sulfate	454 kg	0.57 kg
Potassium chromate	4.54 kg	0.114 kg
Sodium nitrite	45.4 kg	2.5 kg
Sodium phosphate tribasic	2,270 kg	1.4 kg
Zinc acetate	454 kg	0.91 kg

Chemical in Volatiles and Flammables Lockers (A,B,C)	RQ[2]	Quantity In Stock
Chloroform	4.54 kg	8 L
Formaldehyde	45.4 kg	<1L of 37% solution
Nitrobenzene	454 kg	12 L
Toluene	454 kg	12 L

Chemical in Acid Shed	RQ[2]	Quantity In Stock
Chloroform	4.54 kg	55 gal
Hydrochloric acid	2,270 kg	58 gal
Nitric acid	454 kg	5 L
Phosphoric acid	2,270 kg	10 L
Sulfuric acid	454 kg	25 L
Hydrofluoric Acid	45.4 kg	1 L
Ammonium hydroxide	454 kg	18 L

1. This list identifies chemicals which are regulated as hazardous substances under the Federal Water Pollution Control Act 40 CFR Part 117. The lab also stores small quantities of other materials that are not hazardous substances per the above regulation.

2. Reportable Quantities are those identified in 40 CFR Part 117 Table 117.3: "Reportable Quantities of Hazardous Substances Designated Pursuant to Section 311 of the Clean Water Act."

TABLE 4.0
REAGENT YARD/SMALL QUANTITY CHEMICALS LIST [1]

CHEMICAL	RQ[2]	QUANTITY IN STORAGE COMPOUND
Acetic Acid, Glacial	1,000 lbs	4 gal
Ammonium Hydroxide	1,000 lbs	5L
Carbon Disulfide	100 lbs	0 lbs
Calcium Hypochlorite	10 lbs	2 kg (4.4 lbs)
Chlorine	10 lbs	0 lbs
Ferrous Sulfate Heptahydrate	1,000 lbs	5 kg (11lbs)
Hydrochloric Acid	5,000 lbs	60 gal of 40% solution
Nitric Acid	1,000 lbs	10 L
Potassium Permanganate 0.1 N	32 gal	5 kg (11 lbs)
Sodium Hypochlorite 5.5%	100 lbs	2 kg (11 lbs) of 5.5% solution
Silver Nitrate	1 lb	0 lbs
Trichloroethylene	100 lb	2 L
Xylene (Mixed Isomers)	100 lbs	0 lbs

1. This list identifies chemicals which are regulated as hazardous substances under the Federal Water Pollution Control Act 40 CFR Part 117. Materials in this list are stored in a locked storage compound near the bulk storage tank area. The Mill also stores small quantities of other materials that are not hazardous substances per the above regulation.

2. Reportable Quantities are those identified in 40 CFR Part 117 Table 117.3: "Reportable Quantities of Hazardous Substances Designated Pursuant to Section 311 of the Clean Water Act."

TABLE 5.0
REAGENT YARD/BULK CHEMICALS LIST[1]

REAGENT	RQ[2]	QUANTITY IN REAGENT YARD
Sulfuric Acid	1,000 lbs	9,000,000 lbs
Floc #301	None	1,200 lbs
Hyperfloc 102	None	1,500 lbs
Ammonia – East Tank	100 lbs	0 lbs
Ammonia – West Tank	100 lbs	105,000 lbs
Kerosene	100 gal	500 gal
Salt (Bags)	None	2,000 lbs
Ammonium Hydrogendifluoride	None	20,450 lbs
Soda Ash Dense (Bag)	None	0 lbs
Phosphoric Acid	5,000 lbs	6,300 lbs
Polyox	None	490 lbs
Millsperse	None	1,410 lbs
Nalco TX760	None	9 barrels
Nalco 7200	None	1,590 lbs
Tributyl phosphate	None	9,450 lbs
Distillates	None	100 gal
Diesel	100 gal	Approx. 3300 gal
Gasoline	100 gal	Approx. 6000 gal
~~Alamine 336 drums~~	~~None~~	~~0 lbs~~
Floc 109	None	0 lbs
Floc 208	None	0 lbs
Floc 904	None	0 lbs
Hyperfloc 624	None	0 lbs
Salt (Bulk solids)	None	0 lbs
Salt (Bulk solutions)	None	0 lbs
Caustic Soda	1,000 lbs	0 lbs
Ammonium Sulfate	None	0 lbs
Sodium Chlorate	None	20,000 lbs
Alamine 335 Bulk	None	0 lbs
Alamine 310 Bulk	None	0 lbs
Isodecanol	None	0 lbs
Vanadium Pentoxide[3]	1000 lbs	30,000 lbs
Yellowcake[3]	None	< 100,000 lbs
Ammonia Meta Vanadate	1000 lbs	0 lbs

1. This list identifies all chemicals in the reagent yard whether or not they are regulated as hazardous substances under the Federal Water Pollution Control Act 40 CFR Part 117.

2. Reportable Quantities are those identified in 40 CFR Part 117 Table 117.3: "Reportable Quantities of Hazardous Substances Designated Pursuant to Section 311 of the Clean Water Act."

3. Vanadium Pentoxide and Yellowcake, the Mill's products, are not stored in the Reagent Yard itself, but are present in closed containers in the Mill Building and/or Mill Yard.

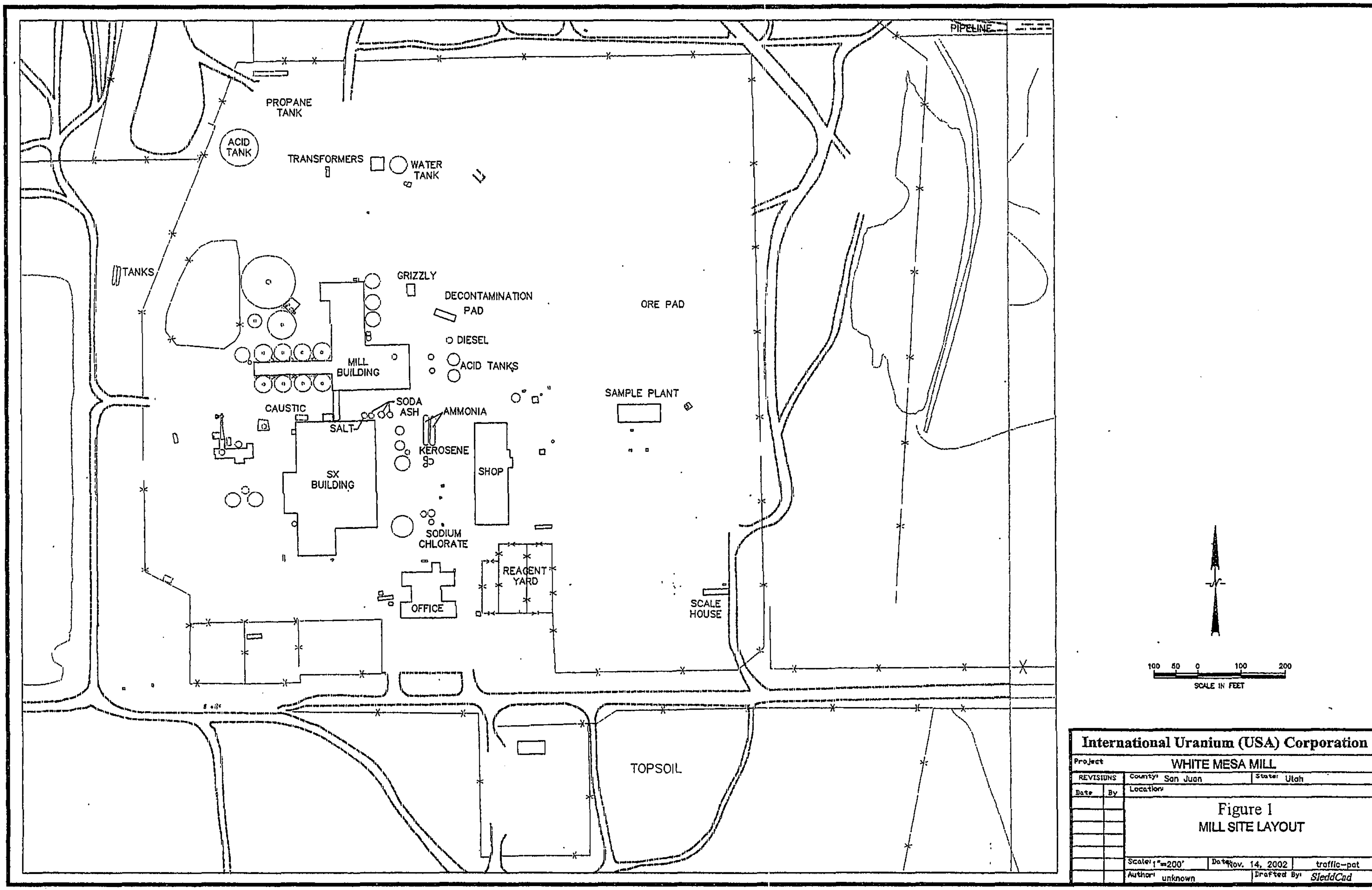
TABLE 6.0
PETROLEUM PRODUCTS AND SOLVENTS LIST[1]

PRODUCT	RQ	QUANTITY IN WAREHOUSE
Lubricating Oils in 55 gallon drums	100 gal	1,540 gallons
Transmission Oils	100 gal	0 gallons
Water Soluble Oils	100 gal	30 gallons
Xylene (mixed isomers)	100 lbs	0 gallons
Toluene	1000 lbs	0 gallons
Varsol Solvent (2% trimethyl benzene in petroleum distillates)	100 gal	0 gallons

1. This list includes all solvents and petroleum-based products in the Mill warehouse petroleum and chemical storage aisles.
2. Reportable Quantities are those identified in 40 CFR Part 117 Table 117.3: "Reportable Quantities of Hazardous Substances Designated Pursuant to Section 311 of the Clean Water Act."

FIGURES

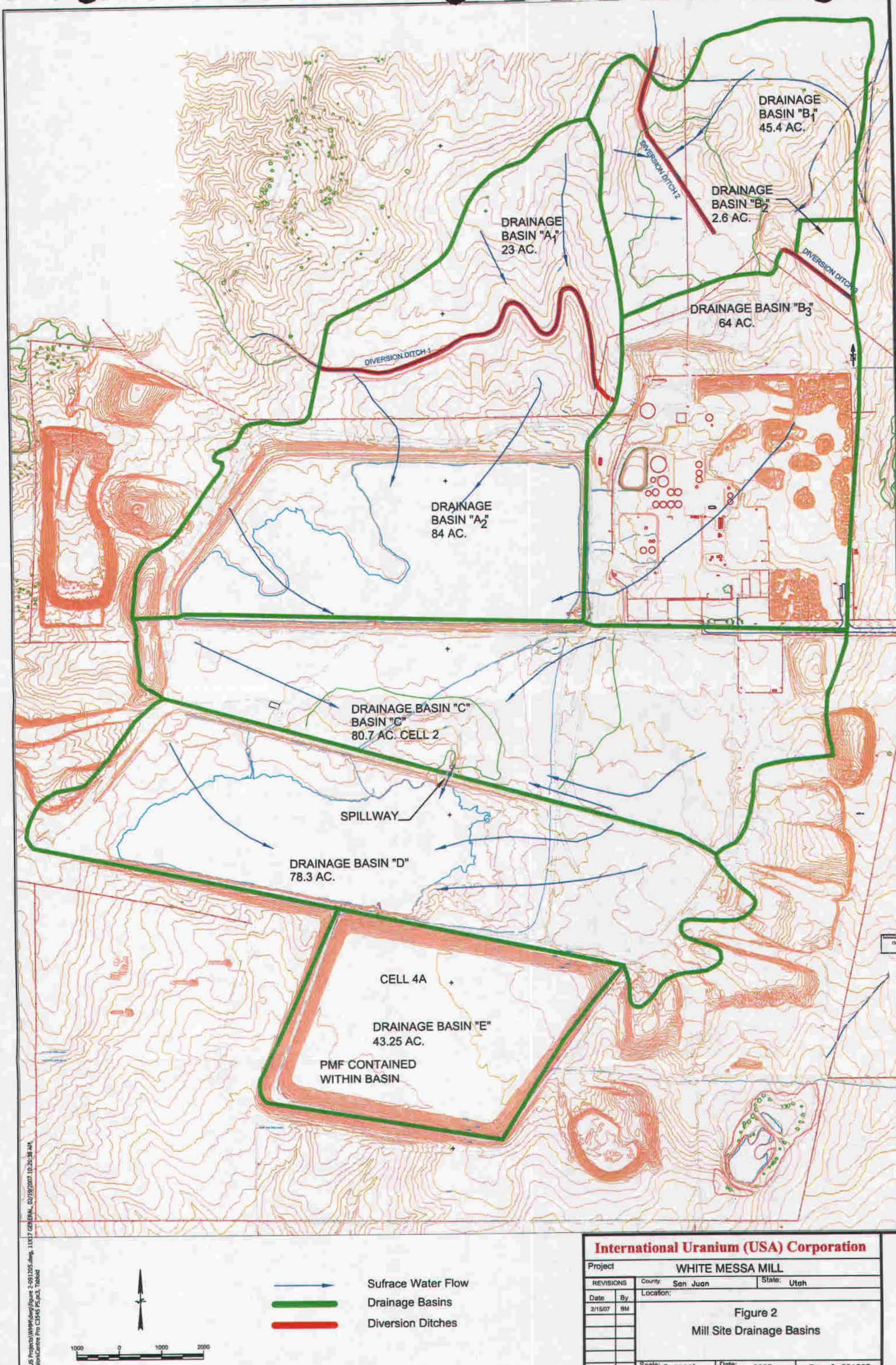
Figure 1
White Mesa Mill
Mill Site Layout



International Uranium (USA) Corporation

Project	WHITE MESA MILL		
REVISIONS	County: San Juan	State: Utah	
Date / By	Location:		
	Figure 1 MILL SITE LAYOUT		
	Scale: 1"=200'	Date: Nov. 14, 2002	traffic-pat
	Author: unknown	Drafted By: SleddCad	

Figure 2
White Mesa Mill
Mill Site Drainage Basins



International Uranium (USA) Corporation

Project	WHITE MESSA MILL
County: San Juan	State: Utah
Location:	
Figure 2	Mill Site Drainage Basins
Scale: 1"=2000'	Date: 2005
figure2-091205	
Author: HRR	Drafted By: Batturnur M

REVISIONS	
Date	By
2/15/07	BM

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APPENDIX 2

WHITE MESA MILL
EMERGENCY RESPONSE PLAN

EMERGENCY RESPONSE PLAN
REVISION 1.1

Denison Mines (USA) Corp.
White Mesa Mill
Blanding, Utah

April 14, 1986

REVISED
February 16, 2007

Distribution List:

1. Ron F. Hochstein
2. Rich E. Bartlett
3. David Turk
4. Michael Spillman
5. Mill Shift Foremen
6. Blanding Fire Department
7. San Juan County EMS Coordinator
8. State of Utah, Department of Radiation Control

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FIGURES:

1. INTRODUCTION

This Emergency Response Plan is written not only to comply with Federal, State and local regulations, but even more importantly to reduce the risk to our employees and that of the community in regards to Health, Safety and Environmental Emergencies.

This plan includes the following:

- evaluation of the potential risks for fire, explosions, gas releases, chemical spills and floods (including tailings dam failure);
- specific emergency programs for each potential event;
- definition of administrative response actions; and,
- definition of the emergency response contacts - both internal and external.

The White Mesa Mill (the "Mill") operates under the following regulatory agencies:

- Utah State Department of Environmental Quality, Division of Radiation Control;
- Mine Safety and Health Administration;
- Environmental Protection Agency;
- Utah State Department of Environmental Quality, Division of Air Quality; and,
- Utah State Division of Natural Resources Bureau of Dam Safety.

2. WHITE MESA MILL OVERVIEW

The Mill processes conventional uranium or uranium/vanadium ores to recover uranium and vanadium. In addition to the processing of conventional ores, the Mill also processes alternate feed materials using similar process steps and chemicals. The conventional ore is stored on the Ore Pad (shown in Exhibit 3). Alternate feed materials are also stored on the Ore Pad and may be stored in bulk form, lined burrito bags, liners or drums. The descriptions of each alternate feed material are maintained by the Mill's Radiation Safety Officer.

The Mill utilizes a semi-autogenous grind circuit followed by a hot sulfuric acid leach and a solvent extraction process to extract uranium and vanadium from ores, using large amounts of sulfuric acid, sodium chlorate, kerosene, amines, ammonia and caustic soda in the process The reagent storage tank locations are described in further detail in Section 4.6.

Emissions from the Mill process are in the form of air emissions from exhaust stacks and solid/liquid tailings which are stored in the Mill's tailings cells located west/southwest of the main Mill building. The major exhaust stack parameters are shown in the following table.

Description	Height (ft from surface)	Diameter (inches)	Estimated Flow Rate (cfm)
Leach Exhaust	~100	36	13,700
Yellow Cake Drying (3 stacks)	~85	18	4,000 per stack
Vanadium Roasting & Fusion	~85	38	4100

There are also smaller exhaust stacks associated with the Laboratory in the Mill Administration building and the boiler exhaust stack.

The Mill's tailings cells are comprised of four below grade engineered cells, Cell 1-I, 2, 3 and 4A. Liquids are stored in Cell 1-I and Cell 3, the active tailings cell. The liquid in the tailings cells is very acidic. In addition to the tailings cells, there is also an emergency lined catchment basin west of the Mill building. Solutions in this basin or the tailings cells should not be used to fight fires in the Mill facility.

The products of the Mill include ammonium metavanadate (AMV), vanadium pregnant liquor (VPL), vanadium pentoxide (V_2O_5), and yellowcake, or uranium concentrate (U_3O_8). The V_2O_5 and U_3O_8 products are packaged in steel drums for shipment. The AMV is packaged in either steel drums or super-saks while the VPL is sold in liquid form in bulk.

Master files containing Material Safety Data Sheets for all materials in use at the Mill are maintained at the Safety Office, Mill Maintenance Office, Mill Laboratory and Mill Central Control Room. Copies are also on file at the Blanding Clinic, Doctor's Offices, Blanding Fire House and Office of the San Juan County Emergency Medical Coordinator.

The nearest residence to the Mill is approximately one mile to the north of the Mill, the next is a residence approximately two miles north of the Mill, followed by the community of White Mesa, about 3.5 miles to the south. The City of Blanding is located approximately 6 miles to the northeast.

The Mill site is near Utah State Highway 191 and can be accessed by a paved access road from the highway to the Mill facilities.

3. PLAN OBJECTIVES

The primary objectives of this plan are:

1. To **save lives, prevent injuries**, prevent panic, and minimize property/environmental damage to the lowest possible level.

2. To evacuate and account for all people in the area including visitors, truck drivers, contractors, etc.

3. To provide assembly areas that are as safe as possible and which can be reached without traveling through a hazardous area. Assembly areas will be properly manned to deal with sick or injured persons, and provisions will be made to evacuate those persons to proper shelter.

4. To make adequately trained personnel available to cope with rescue and recovery operations as directed by the Incident Commander.

4. DESCRIPTION OF FACILITIES

The Mill facilities are shown on the Site Layout Map included as Exhibit 3.

4.1 Fire Water Supply and Alarm Systems

4.1.1 Fire Water Supply

The fire water supply facilities include:

- 400,000 gallon Storage Tank of which 250,000 gallons are reserved for fire emergencies
- Centrifugal diesel driven pump rated at 2,000 gpm at 100 psi. This pump starts automatically when the pressure in the fire main drops below 100 psi (See Figure 1, Fire System Schematic).

When more water is needed for an emergency an additional source is the Recapture Reservoir supply pipeline, which can be utilized in emergencies at a rate of about 1,200 gpm.

4.1.2 Alarm System

The alarm systems include the following:

- public address system
- hand held radios
- siren.

4.2 Office Building and Laboratory

4.2.1 Office Building

The office building (approximately 10,000 square feet) contains the administration offices, radiation health and safety offices and the Mill laboratory. The central file vault and the main computer system are also in this building. The ambulance is kept on the west side of the office building near the safety office entrance.

4.2.2 Laboratory

The laboratory facilities contain the following:

- three flammable cabinets (keys required)
- chemical storage room south of main lab
- six fume hoods - hoods 1,2, 3 and 4 are in the center of the laboratory and hoods 5 and 6 are along the west wall. Hoods 1 and 2 are no longer in service. Hoods 3 and 4 are on the west side, 1 and 2 are on the east side of the center cluster of hoods with 2 being in front. Only hoods 5 and 6 may be used for perchloric acid.
- outside laboratory chemical storage north of office building (key required)
- perchloric acid storage vault located underground west of office building (key required)

A wide variety of chemicals in small quantities are located in the laboratory. These chemicals range from acids to bases along with flammable metal compounds and peroxide forming compounds. Oxidizers and organic chemicals, which have a strong potential of producing harmful vapors if the containers are damaged to the point that the chemicals are exposed are stored in a storage room in the laboratory. There are no acids stored in this storage room. The acids (including but not limited to sulfuric, nitric, acetic, perchloric, phosphoric and hydrochloric acids) are stored in the main laboratory area in 2.5 liter or 500-ml bottles. MSDS books for all chemicals in the laboratory are located in the Laboratory, Safety Department, Mill Maintenance office and Mill Central Control room.

4.2.3 Electrical

Electrical transformers and electrical switches are located in the laboratory at the east end of the chemical storage room.

4.2.4 Fire Protection System

The fire protection systems in the office building and laboratory include:

- a fire hose station located on the east end of the office building. The station includes two sets of turnout gear, two SCBA units and Incident Commander materials.
- automatic "wet" sprinkler system which is actuated at 212° F
- portable dry chemical extinguishers strategically located throughout the building.

4.3 Solvent Extraction Building

The solvent extraction (SX) building (approximately 21,000 square feet) houses the uranium and vanadium solvent extraction circuits and the ELUEX circuit. The SX circuits may contain up to 200,000 gallons kerosene (757,000 liters) which has a flash point of 185° F.

Associated equipment in the SX building includes a temporary boiler located at the southwest end of the SX building which maintains the temperature for the fire system.

Chemicals which may be encountered in the SX building include:

- Kerosene
- Caustic Soda
- Anhydrous Ammonia
- Sulfuric Acid
- Salt (Brine)
- Soda Ash
- Ammonium Sulfate
- Amines
- Alcohol
- Sodium Chlorate
- Sodium Vanadate
- Propane

The VPL product is stored in the SX building.

4.3.1 Electrical

All electrical switches are located outside in the MCC room north of the SX building. The main control panel for all of the equipment is located in the Central Control Room in the main Mill building.

4.3.2 Fire Protection System

The SX building fire protection systems include:

- a "wet" AFFF foam sprinkler system with heat actuated sprinkler heads that release at 212°F.
- portable dry chemical extinguishers strategically located throughout the building.

For fire hydrant and hose cabinet locations in the SX building refer to the Fire System Schematic included as Figure 1 in this Plan.

4.4 Mill Building

The mill building (approximately 22,000 square feet) contains process equipment related to grind, leach, counter current decantation, precipitation, drying and packaging of uranium and vanadium products.

Chemicals which may be encountered in the mill building include:

- Caustic Soda
- Anhydrous Ammonia
- Sulfuric Acid
- Soda Ash
- Ammonium Sulfate
- Sodium Chlorate
- Sodium Vanadate
- Propane

The finished products which are contained in the mill building include AMV, V_2O_5 and U_3O_8 (or yellowcake).

4.4.1 Electrical

The main electrical switch gear is located west of the SAG mill on the ground floor in the north west corner of the mill building. Circuit control panels are located in the SAG mill control room, the central control room, the vanadium roaster control room and the AMV area.

4.4.2 Fire Protection System

The main mill building fire protection systems include:

- portable dry chemical extinguishers strategically located throughout the building.
- water hoses throughout the building.

For fire hydrant and hose cabinet locations in the Mill building refer to the Fire System Schematic included as Figure 1 of this Plan.

4.5 Maintenance Shop/Warehouse/Change Room Building

This building (approximately 20,000 square feet) contains the main maintenance shop area (located on the north end of the building), the main warehouse (located on the south end of the building) and the personnel change rooms and lunch/training room (located on the extreme south end of the building on the ground and second floors).

Within the maintenance shop area are the following work area and specialty shops:

- the main maintenance shop area contains welding and cutting equipment, lathes, presses, and drill presses.
- a carpenter shop which contains various saws and planes. Fiberglass work is also done within this shop area and it is located at the northwest end of the maintenance shop area.
- an electrical shop which is located south of the carpenter shop.
- a heavy equipment maintenance shop area is located at the north end of the maintenance shop in the center of the building.
- a rubber room for rubber lining of equipment is located east of the equipment shop area.
- the maintenance shop office, instrument shop and tool room are located at the south end of the maintenance shop area.

The warehouse area contains primarily dry good storage for repair parts and consumables for the operation of the Mill. There is an electrical water heater for the change room which is located in the warehouse area at the south end.

Within the warehouse and maintenance shops there are some oils and chemicals stored in the following locations:

- small quantities of flammable material such as starting fluid and spray paint are kept in the warehouse.
- drums of new oil and anti-freeze are stored along the east wall of the equipment maintenance area and on the east side of the warehouse on oil storage racks.
- used oil is stored in a tank located northeast of the equipment shop. The tank has a capacity of approximately 5,800 gallons.
- in the main maintenance shop area and the rubber room there are flammable storage cabinets and east of the warehouse there is a trailer which is used to store flammable items such as rubber cements, paints and fiberglass resins.
- compressed gas cylinder storage, both empty and full is located outside, east of the maintenance shop.

4.5.1 Electrical

The main electrical circuit breaker for the maintenance shop and warehouse building is located on the east wall inside the Maintenance shop. Auxiliary electrical panels for the change room and warehouse are located in the southwest corner of the warehouse area.

4.5.2 Fire Protection System

The fire protection system within the maintenance shop/warehouse/change room building includes:

- "wet" automatic sprinkler system that releases at 212° F.
- portable dry chemical extinguishers strategically located throughout the maintenance area, warehouse area and the change room and lunch room.

For fire hydrant and hose cabinet locations refer to the Fire System Schematic (Figure 1).

4.6 <u>Reagent and Fuel Storage</u>

The following lists the reagents and fuel stored at the Mill site:

- a sulfuric acid tank located northwest of the mill building which has a capacity of approximately 1.4 million gallons.
- a storage tank for propane is located on the north edge of the mill site, northwest of the mill building. It has a storage capacity of 30,000 gallons.
- four sodium chlorate tanks located east of SX building, north of the office building and east of the pulp storage tanks. The two tanks east of the SX building are for sodium chlorate storage and the other two tanks are for dilution of the sodium chlorate.
- two anhydrous ammonia tanks located east of the SX building, with capacity of 31,409 gallons each.
- three kerosene tanks located east of the SX building, with a capacity of 10,152 gallons each.
- one caustic soda tank north of the SX building, with a capacity of 19,904 gallons.
- three soda ash tanks which are located east of the SX building. One tank is the dry soda ash tank with a capacity of 70,256 gallons. Two of the tanks are soda ash dilution tanks with capacities of 16,921 gallons each.
- diesel fuel and gasoline are stored in two tanks located on the eastern side of the ore pad. The gasoline storage capacity is 3,200 gallons, while diesel storage capacity is 8,000 gallons.

Other reagents are stored in steel barrels or super sacs in a reagent yard located east of the office building. Typical reagents which are stored in this yard include:

- polymers and flocculants
- boiler feed water chemicals
- methanol
- tributyl phosphate
- "dirty" soda ash and ammonium sulfate
- SX amines and emulsion breakers
- decyl alcohol
- minimal amounts of acid in barrels
- used oil in drums and overpacks

4.7 Boiler Facilities

The main building (approximately 12,400 square feet) is located on the west side of the Mill site and contains air compressors and water treatment facilities. To the north of the main building is a building which houses a propane-fired boiler. The vanadium oxidation tank, oxidation thickener, and pH adjustment tank are located south of the boiler house facilities.

4.7.1 Electrical

The main electrical panel for the boiler house is located outside of the building, on the south wall.

4.7.2 Fire Protection System

The fire protection system for the boiler facilities is comprised of strategically located portable dry chemical extinguishers.

4.8 Sample Plant

The sample plant building (approximately 8,000 square feet) is located on the ore pad, east of the maintenance shop/warehouse building. The sampling plant equipment has been removed from the building and it is currently used as a storage area for maintenance.

4.8.1 Electrical

The electrical panel for this building is located on the east wall upstairs.

4.8.2 Fire Protection System

There are no extinguishers or sprinkler systems in the sample plant.

5. ORGANIZATION AND RESPONSIBILITIES

The organizational chart for an emergency situation is illustrated in Figure 2.

5.1 Mill Manager/Incident Commander

The Incident Commander has the responsibility for:

- preparing an Emergency Plan
- communicating the Plan,
- directing activities during emergencies; and,
- reporting to local, State and Federal authorities.

The Incident Commander will stop routine radio usage upon learning of an emergency and set up the base station in a safe location for directing activities. Radio usage will be limited to the emergency. The Incident Commander has the responsibility to contact all outside services.

The Incident Commander has the responsibility to account for all employees at the Mill, using the assistance of supervisors and/or any International Uranium (USA) Corporation ("IUSA") personnel. The Incident Commander has the responsibility for the news media and reports directly to the President of IUSA.

5.2 Mill General Superintendent

The Mill General Superintendent has the responsibility of directing outside emergency personnel and has the responsibility for plant security and will report directly to the Incident Commander. The Mill General Superintendent will act as Incident Commander in the absence of the Mill Manager.

5.3 Radiation Safety Officer/Fire Chief

The Radiation Safety Officer will direct rescue operations and provide the necessary emergency medical personnel and facilities to cope with the emergency. Adequately trained fire crews and operable emergency equipment will be maintained at all times.

As Fire Chief, the Radiation Safety Officer has the responsibility to maintain trained fire crews and operable equipment, mobilize and direct the fire crews and equipment in a fire emergency or one containing the threat of fire, and to assist in evacuation and rescue or recovery operations.

In the absence of the Radiation Safety Officer, the Mill Safety Coordinator will assume these duties.

5.4 Maintenance Supervisor

The Maintenance Supervisor will direct all personnel in evacuation and in activities to cope with the emergency, including isolation of utilities and providing technical advice as needed. The Maintenance Supervisor will be assisted by the Mill Safety Coordinator.

5.5 Laboratory Supervisor

The Laboratory Supervisor has the responsibility to direct and account for all office personnel (including IUSA personnel and office visitors) in evacuation and in activities to cope with the emergency. In case of a mill tour the Supervisor accompanying the tour will be responsible for evacuation of visitors.

5.6 Shift Foremen

Shift Foremen are in charge until the Incident Commander arrives and are responsible for all functions listed above. Shift Foremen have the responsibility to account for all of their people in addition to any visitors, contractors, etc., in their areas and report to the Incident Commander; or, in the absence of the Incident Commander, to administer all of the above duties.

5.7 Scale House Personnel

Scale house person on shift will be responsible to account for ore truck drivers and reagent truck drivers.

5.8 Emergency Response Teams

The response crew for each operating shift will normally consist of the following operators under the direction of the shift foreman. This organization may be changed for individual shifts subject to the approval of the Fire Chief.

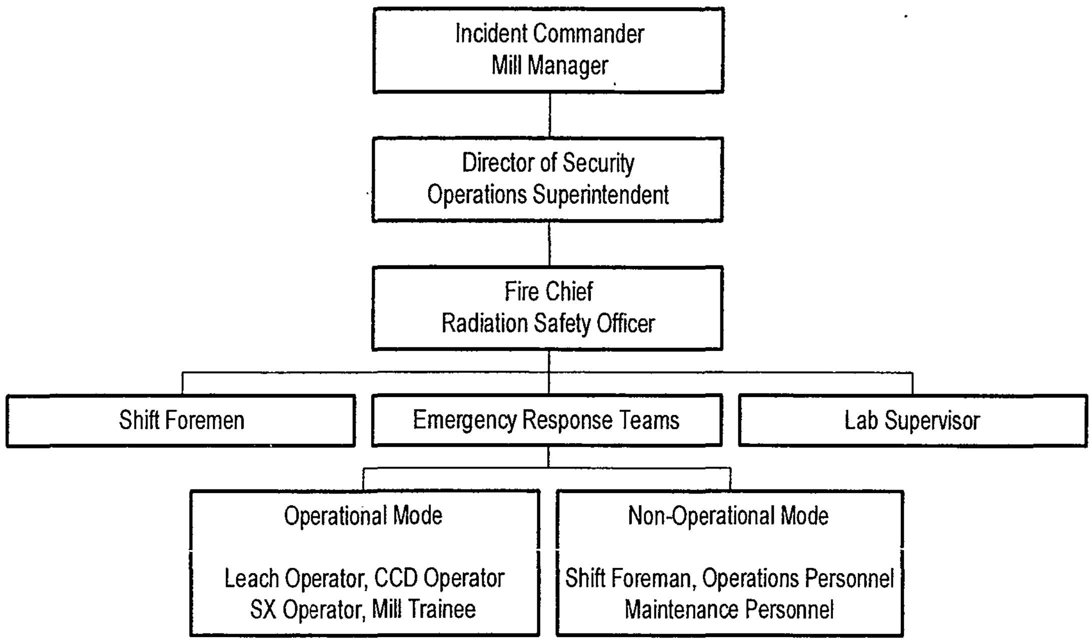
5.8.1 Operational Mode

Leach Operator
CCD Operator
Solvent Extraction Operator
Mill Trainee

5.8.2 Non-Operational Mode

Shift Foreman
Operations Personnel
Maintenance Personnel

Figure 2
Emergency Response Organizational Structure



6. SPECIFIC EMERGENCIES

The following details procedures to be followed during specific emergencies but are not limited to the following.

6.1 Fire

Should a fire occur, the procedure outlined in Appendix A for reporting and responding to fires will be followed. Particular areas of concern include:

- Solvent Extraction Building
- Propane Tanks
- Lab or Lab Storage Area

6.2 Chemical or Gas Release

The procedures for response to a chemical or gas release are outlined as Appendix B.

6.3 Earthquake

Although this is highly unlikely, an earthquake could occur at the Mill. A severe earthquake could cause buildings and other structures to collapse, chemical and/or gas releases, major fires as well as general panic. In the event of a major earthquake the evacuation procedures outlined in Appendix C will be followed.

6.4 Terrorist/Bomb Threat

In the event that any person should receive a threat of a bomb, the following evacuation procedure should be followed:

- Notify any person of authority, i.e., Superintendent, Foreman, Radiation Safety Officer, who will immediately notify law enforcement authorities and evacuate the threatened area.
- Evacuate all persons from the affected area and stop all radio transmissions.

6.5 Tailings Dam Break and Major Floods

Flood water breaching tailings embankments presents one of the greatest dangers for the sudden release of tailings solids and impounded water. The tailings cells are designed with sufficient freeboard (three feet) to withstand back-to-back 100-year storm events or 40% of the probable maximum flood (PMF) followed by the 100-year storm event. The flood design is equivalent to 15 inches of rainfall. In addition, the tailings dikes were designed in accordance with U.S. NRC regulations and allow a sufficient margin of safety even in the event of an earthquake.

The possibility of floods resulting from Westwater Creek, Cottonwood Creek, and Corral Creek causing a dam failure is extremely remote.

The tailings cells and dikes are inspected on both a daily and shift basis.

Discharges from a dike failure would extend three miles before leaving IUSA's property. In the event of a dam failure, large operating equipment will be mobilized to construct temporary earthen dikes or berms downgradient to the failed dike. In addition, the State of Utah, Department of Radiation Control Executive Secretary (the "Executive Secretary), MSHA, and State of Utah, Department of Natural Resources, Division of Dam Safety shall be notified.

In the event of a seismic rupture of tailings slurry pipelines, the released slurry will be contained in the tailings cells regardless of the quantity released.

7. EVACUATION PROCEDURE (See Appendix C)

7.1 Notification

Employees will be notified to evacuate the area by dialing 184 on any area telephone and announcing that the Mill should be evacuated. This announcement will be repeated twice. When the paging system cycles through, the evacuation siren (continuous frequency) will automatically sound for approximately forty-five seconds, and then automatically shut off, allowing communications by radio from that point. If the 184 number is dialed accidentally the evacuation alarm may be canceled by disconnecting the phone until the page cycle ends, then re-dial 184. (See Exhibits 1 and 2.)

7.2 Assembly

When the evacuation alarm sounds or when personnel are verbally notified by radio or other means, all personnel will assemble at:

- The parking lot south of the office,

- The scalehouse,
- North side of Tailings Cell 1, or
- North of the Mill

Assembly site will depend upon conditions, i.e. nature of the emergency, wind conditions, etc. The Fire Chief or Shift Foreman will specify the appropriate assembly site.

7.3 Specific Procedure for Operations Personnel

1. See specific emergency shutdown procedure for Operations by area under the relevant Operating Procedure for your area.

2. All employees not mentioned under Operating Procedures are to immediately report to the assembly area and congregate by crew so that all persons can be accounted for. As employees leave their work areas, they must pass the word to evacuate to any persons who may not be aware of the emergency.

3. After the Mill has been determined to be safe for re-entry, employees will be verbally notified to return to their work stations.

8. Off-Site Emergency Equipment/Personnel Release

Any emergency response equipment or personnel that enter the Restricted Area in response to an incident will be scanned and decontaminated prior to leaving the site according to the procedures included in PBL-9, End Dump Trailer Acceptance, Handling and Release. Any equipment will be decontaminated according to the requirements found in Table 1 of the Nuclear Regulatory Commission's (NRC's) Policy and Guidance Directive FC-85-23, "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material" issued May 1987.

Injured personnel should be evaluated for radiation contamination, if there was a potential for contamination, at the earliest convenience. Should it be necessary, contaminated articles will be gathered by the radiological staff after medical treatment has been rendered. If the personnel cannot be decontaminated, notify the clinic/hospital personnel in advance.

9. EMERGENCY EQUIPMENT

Emergency equipment for the Mill is provided as follows.

9.1 Fire Hose

Fire hose cabinets are located at the following sites with a minimum of 300 feet of 2-1/2" hose, two spanner wrenches, spray nozzles and one hydrant wrench.

- South of SX
- West of CCD
- North of Mill Building
- East of pulp storage tanks
- Northwest of Maintenance Shop
- West of Warehouse

- East of office building

9.2 Self Contained Breathing Apparatus

Two Self-Contained Breathing Apparatus are located at each of the following locations:

- Hose station east of office building
- Hose Station South of SX
- North End SX Outside Wall
- North end of Mill building, outside wall

9.3 Spill Clean-up Equipment

Barrels of soda ash are located throughout the Mill to be used in case of a chemical spill. Soda ash is also stored in bulk if needed. There are also a few drums of absorbent stored near the laboratory. The laboratory also contains acid spill kits and absorbent materials to be used in case of a spill.

9.4 Fire Fighting PPE

Two complete sets of turnout gear for fire fighting and/or emergency extrication are located in the Fire Hose Station located on the east side of the office building.

9.5 Maintenance of Emergency Equipment

Fire extinguishers are inspected on an annual basis, as well as the fire pump system. The Mill Safety Coordinator performs regular spot checks on the emergency equipment locations to ensure that all of the equipment is in place.

10. EMERGENCY TRANSPORTATION

One fully-equipped First Responder Unit (Ambulance) located west of the office building.

Other motor pool vehicles on the property will be utilized as needed in emergency situations with support as needed from the local Emergency Medical Services.

11. EMERGENCY DRILLS AND TRAINING

Quarterly drills, as required by MSHA, are prepared by the Safety and Radiation Departments to monitor performance of personnel responding to emergency situations. Each drill will be enacted upon one or more of the potential scenarios by this plan. The drill and evacuation activities are documented by the Mill's Safety Coordinator and maintained within plant files. Management will review all drills at quarterly ALARA Committee Meetings.

EXHIBIT 1
EMERGENCY NOTIFICATION LIST

ATTEND TO ANY INJURED PERSONS AND NOTIFY THE SUPERVISOR:

Give artificial respiration if necessary.
Control bleeding.
Treat for shock.
Immobilize fractures and stabilize for transportation.
Scan the injured for excessive alpha prior to transporting if time allows.
(If alpha is excessive or there is no time to scan, notify the clinic/hospital personnel and the Radiation Safety Office).

THE SUPERVISOR OR HIS DESIGNEE WILL NOTIFY THE FOLLOWING AS NEEDED:

Blanding Clinic .... 678-2254 or 678-3434 (930 N. 400 W.)
San Juan Hospital, Monticello .... 678-2830 or 587-2116 (364 W. 1st N.)

EMT and CPR TRAINED – The following personnel should be contacted, if they are on-site, in the event of an emergency to aid in the event of any injuries to personnel.

David Turk – EMT and CPR trained
Mike Spillman – CPR trained

AMBULANCE SERVICE

Blanding .... Dial 911

If the Company Ambulance is used, an attendant must ride with the injured in addition to the driver, except where the injured could normally be transported in a car or pickup.

OTHER EMERGENCY NUMBERS

Fire Department .... Dial 911 or 678-2313
County Sheriff............................ Dial 911 or 587-2237
Highway Patrol........................... Dial 911 or 587-2000
Blanding Police .... Dial 911, 678-2916 or 678-2334

MANAGERS

The Supervisor will notify one of the following of all incidents:

R.E. Bartlett................................ 435-678-2495
D. Turk .... 435-678-7802 or 435-459-1068
M. Spillman................................ 435-678-2761

A MEMBER OF <u>MANAGEMENT</u> WILL NOTIFY THE PROPER REGULATING AGENCIES AS REQUIRED FOR EACH INCIDENT:

State of Utah, Department of Radiation Control............ 801-536-4250
MSHA Field Off.--801-524-3450 Dist. Off. 303-231-5465
MSHA, Arlington... 800-746-1553
State Emergency Response Comm. 801-538-3400
State of Utah, Natural Resources, Dam Safety 801-538-7200
National Response Center 800-424-8802
Utah Poison Control Center 800-456-7707

Notification of surrounding communities and or residences will be handled by the appropriate agencies as required by EPCRA (Emergency Planning and Community Right to Know Act).

EXHIBIT 2
INTERNAL NOTIFICATIONS

Internal reporting requirements for Incidents, Spills and Significant Events are as follows:

Report Immediately:

Event Criteria:
Release of toxic or hazardous substances.
Fire, explosions or other accidents.
Government investigations information, requests or enforcement actions.
Private actions or claims (corporations or employees).
Deviations from Corporate policies or government requirements by Management.

Other significant events, which have resulted or could result in:
Death, serious injury or adverse health effect (employees or public).
Property damage exceeding $1,000,000.
Government investigation or enforcement action – limiting operation or penalties of $100,000 or more.
Significant criminal actions.
Substantial media coverage.
Unscheduled down time of more than 24 hours.

Report at the Beginning of the Next Business Day:

Incident Criteria:
Was reported to a government agency as required by law.
Worker (IUSA or contractor) recordable injury or illness associated with a release.
Community impact - reported or awareness.
Publicity resulted or is anticipated.
Release of process material, waste or product in excess of the Reportable Quantities listed in Section 1.5 of the Spill Prevention, Control, and Countermeasures Plan.

The local manager in charge is to call Ron Hochstein or Dave Frydenlund.

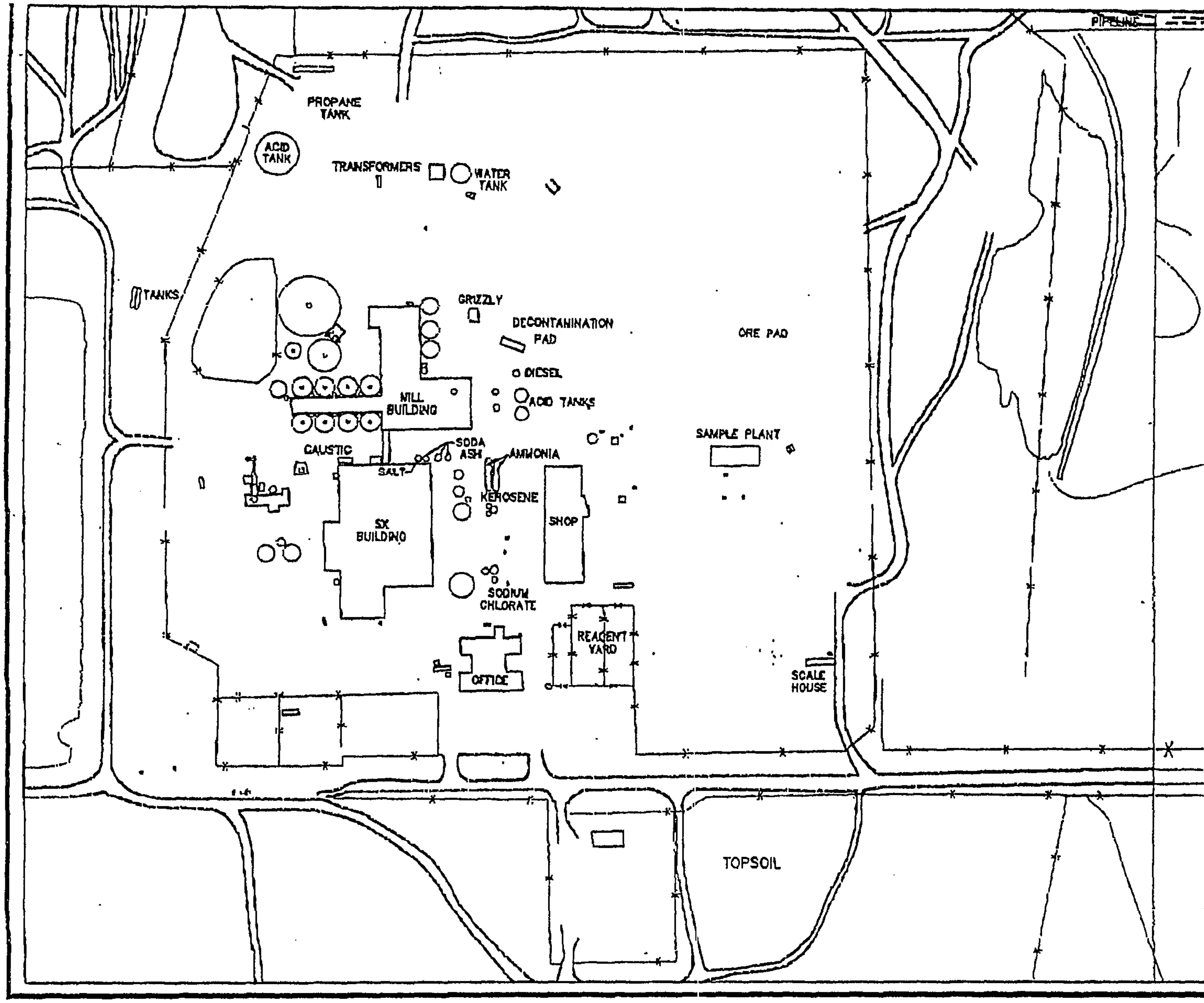
Name Title Office Phone Home Phone

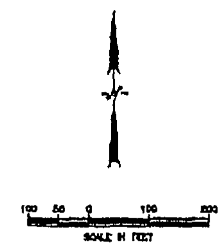
Ron Hochstein (President and COO)........................303-628-7798 (office)
604-931-6334 (home)
604-377-1167 (cell)

David Frydenlund (V.P. and General Counsel).........303-389-4130 (office)
303-221-0098 (home)
303-808-6648 (cell)

EXHIBIT 3

SITE LAYOUT MAP





International Uranium (USA) Corporation

Project	WHITE MESA MILL
Revisions	County: San Juan · State: Utah
Date · By	Location
	MILL SITE LAYOUT
	Scale: 1"=200' · Date: Nov. 14, 2002 · traffic-pal
	Author: unknown · Drafted by: StediCad

EXHIBIT 4

MAIN SHUT-OFF VALVES

During an emergency this list should be used along with Site Layout Map (Exhibit 3) to locate tanks and valves associated with these tanks.

REAGENT SHUT-OFF VALVE LOCATIONS

Sulfuric Acid

4" Main located south side of acid tank

East acid pump discharge valve

West acid pump discharge valve

3" Main (leach area) located 25 feet west of Derrick screens next to walkway

1-1/2" Main (SX area) located south of Central Control room

Ammonia

4" Main (east tank) located on end at bottom

4" Main (west tank) located on end at bottom

2" Valve located on top of tank (east tank)

2" Valve located on top of tank (west tank)

Kerosene

2" Main valve located at bottom of tank (east tank)

2" Main valve located at bottom of tank (north tank)

2" Main valve located at bottom of tank (south tank)

Pump discharge 2" valve

Soda Ash

Main valve located at bottom of tank (dry storage)

4" Main valve located at bottom of tank on 30% dilution tank

4" Main valve locate at bottom of tank on dilution tank

Salt

3" Main valve located at bottom of tank

Caustic Soda

3" Main valve located at bottom of tank east and west between supports

EXHIBIT 4

MAIN SHUT-OFF VALVES

Sodium Chlorate

3" Main valve located at bottom of tank (east tank)

3" Main valve located at bottom of tank (north tank)

3" Main valve located at bottom of tank (south tank)

Propane

4" Main located 15 feet east of tank

3" Main located on pipe off top of tank

3" Main located at bottom of tank (also fill pipe)

PLANT UTILITY SHUT-OFF VALVE LOCATIONS

Process Water

Main valve located on west side of water storage tank

Discharge valve off service water pump east

Discharge valve off service water pump west

Mill process water main located east wall by SAG mill

Fire Water

Main valve located west side of water storage tank

Emergency fire pump discharge valve to fire system

Emergency fire pump discharge valve to header west side of pump house

8" Main valve located south of Central Control room for SX and boilers

Potable Water

2" Main (suction) from potable water storage tank

2" Main (discharge) from potable water storage tank

4" Main located at east wall by SAG mill

4" Main located south of Central Control room for SX, Maintenance shop, and offices

Steam

Main discharge valve for Superior boiler located at top of boiler

Main steam valve located south side of boiler house

EXHIBIT 4

MAIN SHUT-OFF VALVES

Plant Air

Main valve located at receiver tank in compressor room at boiler house

Main valve to mill building located south of Central Control room

PROCESS SHUT-OFF VALVE LOCATIONS

Pulp Storage

No. 1 valve located on west side of tank

No. 3 valve located on west side of tank

Preleach (old No. 2 pulp storage) valve located on west side of tank

Preleach Thickener

Main valve located underneath at center cone

Clarifier

Main valve located underneath at center cone

Main valve located underneath at center cone

CCD Thickeners

Main valve located underneath at center cone of each thickener

APPENDIX A

EMERGENCY PROCEDURE RESPONSE TO FIRE

1. The fire will be reported by dialing 185 on any telephone in the area and announcing the location of the fire over the paging system. This announcement will be repeated twice, for a total of three announcements. When the paging system cycles through, the fire siren (alternating frequency) will automatically sound for approximately forty-five seconds then automatically shut off, allowing radio communications to resume.

2. Mobilize the fire crew.

3. Evacuate all personnel.

4. Rescue any victims of the fire; do this only with properly trained and equipped personnel.

5. Isolate utility lines affected by the fire.

6. Extinguish the fire and post a fire watch for flare-ups.

7. Report the fire to proper local, State, Corporate and Federal agencies.

8. In cases where the fire is not extinguished within thirty minutes of discovery, the area must be barricaded off after extinguishing and left undisturbed until released by MSHA and IUSA management.

9. Emergency off-site centers - Blanding Fire House and Sheriff's office:

   Blanding Fire
   350 West 200 South, Blanding
   Phone number is 911

   Sheriff's Office
   50 West 100 South, Blanding
   Phone number is 911 or (435) 587-2237

APPENDIX B

EMERGENCY PROCEDURE
RESPONSE TO CHEMICAL OR GAS RELEASE

A chemical or gas release would most likely occur very suddenly. The person who would first witness a chemical or gas release should immediately contact his supervisor who would initiate the procedures outlined below:

1. Activate evacuation alarm by using the "dial 184" notification system. Evacuate and account for all personnel.

2. Mobilize trained personnel and emergency equipment such as SCBA's, first aid equipment, etc.

3. Initiate rescue operations for any people who may be trapped by the release.

4. Provide first aid and emergency medical care for any ill or injured persons.

5. Initiate necessary steps to contain and/or neutralize the release, such as spraying with water fog, turning off valves, etc.

6. Guard against possible fires by shutting off electrical circuits, isolating gas lines and eliminating ignition sources from the affected area.

APPENDIX C

EMERGENCY EVACUATION PROCEDURE

1. Activate evacuation alarm by using the "dial 184" notification system. Evacuate and account for all personnel.

2. Personnel are to assemble in one of the following areas:
   - The parking lot south of the office building
   - The scalehouse
   - The north side of Tailings Cell 1, or
   - North of the Mill

3. Mobilize trained personnel and emergency equipment such as SCBA's, first aid equipment, etc.

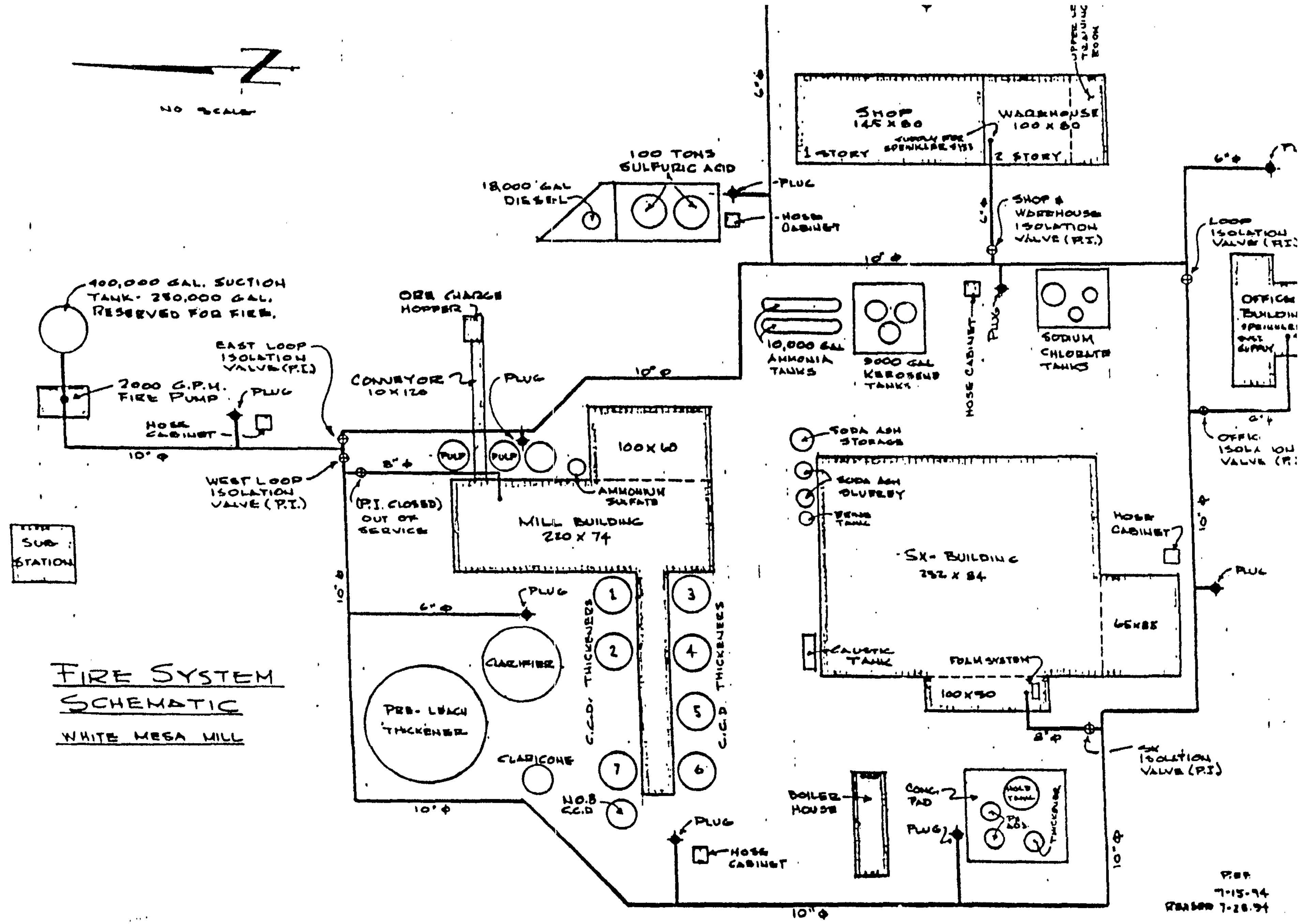
4. Initiate rescue operations for any people who may be trapped.

5. Provide first aid and emergency medical care for any ill or injured persons.

6. Guard against possible fires by shutting off electrical circuits, isolating gas lines and eliminating ignition sources from the affected area.

FIGURE 1

FIRE SYSTEM SCHEMATIC DRAWING



FIRE SYSTEM SCHEMATIC

WHITE MESA MILL

REF
7-15-94
REVISED 7-28-94

EMERGENCY RESPONSE PLAN
REVISION 1.1

Denison Mines (USA) Corp.
White Mesa Mill
Blanding, Utah

April 14, 1986

REVISED
February 16, 2007

Distribution List:

1. Ron F. Hochstein
2. Rich E. Bartlett
3. David Turk
4. Michael Spillman
5. Mill Shift Foremen
6. Blanding Fire Department
7. San Juan County EMS Coordinator
8. State of Utah, Department of Radiation Control

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1. INTRODUCTION

This Emergency Response Plan is written not only to comply with Federal, State and local regulations, but even more importantly to reduce the risk to our employees and that of the community in regards to Health, Safety and Environmental Emergencies.

This plan includes the following:

- evaluation of the potential risks for fire, explosions, gas releases, chemical spills and floods (including tailings dam failure);
- specific emergency programs for each potential event;
- definition of administrative response actions; and,
- definition of the emergency response contacts - both internal and external.

The White Mesa Mill (the "Mill") operates under the following regulatory agencies:

- Utah State Department of Environmental Quality, Division of Radiation Control;
- Mine Safety and Health Administration;
- Environmental Protection Agency;
- Utah State Department of Environmental Quality, Division of Air Quality; and,
- Utah State Division of Natural Resources Bureau of Dam Safety.

2. WHITE MESA MILL OVERVIEW

The Mill processes conventional uranium or uranium/vanadium ores to recover uranium and vanadium. In addition to the processing of conventional ores, the Mill also processes alternate feed materials using similar process steps and chemicals. The conventional ore is stored on the Ore Pad (shown in Exhibit 3). Alternate feed materials are also stored on the Ore Pad and may be stored in bulk form, lined burrito bags, liners or drums. The descriptions of each alternate feed material are maintained by the Mill's Radiation Safety Officer.

The Mill utilizes a semi-autogenous grind circuit followed by a hot sulfuric acid leach and a solvent extraction process to extract uranium and vanadium from ores, using large amounts of sulfuric acid, sodium chlorate, kerosene, amines, ammonia and caustic soda in the process The reagent storage tank locations are described in further detail in Section 4.6.

Emissions from the Mill process are in the form of air emissions from exhaust stacks and solid/liquid tailings which are stored in the Mill's tailings cells located west/southwest of the main Mill building. The major exhaust stack parameters are shown in the following table.

Description	Height (ft from surface)	Diameter (inches)	Estimated Flow Rate (cfm)
Leach Exhaust	~100	36	13,700
Yellow Cake Drying (3 stacks)	~85	18	4,000 per stack
Vanadium Roasting & Fusion	~85	38	4100

There are also smaller exhaust stacks associated with the Laboratory in the Mill Administration building and the boiler exhaust stack.

The Mill's tailings cells are comprised of four below grade engineered cells, Cell 1-I, 2, 3 and 4A. Liquids are stored in Cell 1-I and Cell 3, the active tailings cell. The liquid in the tailings cells is very acidic. In addition to the tailings cells, there is also an emergency lined catchment basin west of the Mill building. Solutions in this basin or the tailings cells should not be used to fight fires in the Mill facility.

The products of the Mill include ammonium metavanadate (AMV), vanadium pregnant liquor (VPL), vanadium pentoxide (V_2O_5), and yellowcake, or uranium concentrate (U_3O_8). The V_2O_5 and U_3O_8 products are packaged in steel drums for shipment. The AMV is packaged in either steel drums or super-saks while the VPL is sold in liquid form in bulk.

Master files containing Material Safety Data Sheets for all materials in use at the Mill are maintained at the Safety Office, Mill Maintenance Office, Mill Laboratory and Mill Central Control Room. Copies are also on file at the Blanding Clinic, Doctor's Offices, Blanding Fire House and Office of the San Juan County Emergency Medical Coordinator.

The nearest residence to the Mill is approximately one mile to the north of the Mill, the next is a residence approximately two miles north of the Mill, followed by the community of White Mesa, about 3.5 miles to the south. The City of Blanding is located approximately 6 miles to the northeast.

The Mill site is near Utah State Highway 191 and can be accessed by a paved access road from the highway to the Mill facilities.

3. PLAN OBJECTIVES

The primary objectives of this plan are:

1. To **save lives**, **prevent injuries**, prevent panic, and minimize property/environmental damage to the lowest possible level.

2. To evacuate and account for all people in the area including visitors, truck drivers, contractors, etc.

3. To provide assembly areas that are as safe as possible and which can be reached without traveling through a hazardous area. Assembly areas will be properly manned to deal with sick or injured persons, and provisions will be made to evacuate those persons to proper shelter.

4. To make adequately trained personnel available to cope with rescue and recovery operations as directed by the Incident Commander.

4. DESCRIPTION OF FACILITIES

The Mill facilities are shown on the Site Layout Map included as Exhibit 3.

4.1 Fire Water Supply and Alarm Systems

4.1.1 Fire Water Supply

The fire water supply facilities include:

- 400,000 gallon Storage Tank of which 250,000 gallons are reserved for fire emergencies
- Centrifugal diesel driven pump rated at 2,000 gpm at 100 psi. This pump starts automatically when the pressure in the fire main drops below 100 psi (See Figure 1, Fire System Schematic).

When more water is needed for an emergency an additional source is the Recapture Reservoir supply pipeline, which can be utilized in emergencies at a rate of about 1,200 gpm.

4.1.2 Alarm System

The alarm systems include the following:

- public address system
- hand held radios
- siren.

4.2 Office Building and Laboratory

4.2.1 Office Building

The office building (approximately 10,000 square feet) contains the administration offices, radiation health and safety offices and the Mill laboratory. The central file vault and the main computer system are also in this building. The ambulance is kept on the west side of the office building near the safety office entrance.

4.2.2 Laboratory

The laboratory facilities contain the following:

- three flammable cabinets (keys required)
- chemical storage room south of main lab
- six fume hoods - hoods 1,2, 3 and 4 are in the center of the laboratory and hoods 5 and 6 are along the west wall. Hoods 1 and 2 are no longer in service. Hoods 3 and 4 are on the west side, 1 and 2 are on the east side of the center cluster of hoods with 2 being in front. Only hoods 5 and 6 may be used for perchloric acid.
- outside laboratory chemical storage north of office building (key required)
- perchloric acid storage vault located underground west of office building (key required)

A wide variety of chemicals in small quantities are located in the laboratory. These chemicals range from acids to bases along with flammable metal compounds and peroxide forming compounds. Oxidizers and organic chemicals, which have a strong potential of producing harmful vapors if the containers are damaged to the point that the chemicals are exposed are stored in a storage room in the laboratory. There are no acids stored in this storage room. The acids (including but not limited to sulfuric, nitric, acetic, perchloric, phosphoric and hydrochloric acids) are stored in the main laboratory area in 2.5 liter or 500-ml bottles. MSDS books for all chemicals in the laboratory are located in the Laboratory, Safety Department, Mill Maintenance office and Mill Central Control room.

4.2.3 Electrical

Electrical transformers and electrical switches are located in the laboratory at the east end of the chemical storage room.

4.2.4 Fire Protection System

The fire protection systems in the office building and laboratory include:

- a fire hose station located on the east end of the office building. The station includes two sets of turnout gear, two SCBA units and Incident Commander materials.
- automatic "wet" sprinkler system which is actuated at 212° F
- portable dry chemical extinguishers strategically located throughout the building.

4.3 Solvent Extraction Building

The solvent extraction (SX) building (approximately 21,000 square feet) houses the uranium and vanadium solvent extraction circuits and the ELUEX circuit. The SX circuits may contain up to 200,000 gallons kerosene (757,000 liters) which has a flash point of 185° F.

Associated equipment in the SX building includes a temporary boiler located at the southwest end of the SX building which maintains the temperature for the fire system.

Chemicals which may be encountered in the SX building include:

- Kerosene
- Caustic Soda
- Anhydrous Ammonia
- Sulfuric Acid
- Salt (Brine)
- Soda Ash
- Ammonium Sulfate
- Amines
- Alcohol
- Sodium Chlorate
- Sodium Vanadate
- Propane

The VPL product is stored in the SX building.

4.3.1 Electrical

All electrical switches are located outside in the MCC room north of the SX building. The main control panel for all of the equipment is located in the Central Control Room in the main Mill building.

4.3.2 Fire Protection System

The SX building fire protection systems include:

- a "wet" AFFF foam sprinkler system with heat actuated sprinkler heads that release at 212°F.
- portable dry chemical extinguishers strategically located throughout the building.

For fire hydrant and hose cabinet locations in the SX building refer to the Fire System Schematic included as Figure 1 in this Plan.

4.4 Mill Building

The mill building (approximately 22,000 square feet) contains process equipment related to grind, leach, counter current decantation, precipitation, drying and packaging of uranium and vanadium products.

Chemicals which may be encountered in the mill building include:

- Caustic Soda
- Anhydrous Ammonia
- Sulfuric Acid
- Soda Ash
- Ammonium Sulfate
- Sodium Chlorate
- Sodium Vanadate
- Propane

The finished products which are contained in the mill building include AMV, V_2O_5 and U_3O_8 (or yellowcake).

4.4.1 Electrical

The main electrical switch gear is located west of the SAG mill on the ground floor in the north west corner of the mill building. Circuit control panels are located in the SAG mill control room, the central control room, the vanadium roaster control room and the AMV area.

4.4.2 Fire Protection System

The main mill building fire protection systems include:

- portable dry chemical extinguishers strategically located throughout the building.
- water hoses throughout the building.

For fire hydrant and hose cabinet locations in the Mill building refer to the Fire System Schematic included as Figure 1 of this Plan.

4.5 Maintenance Shop/Warehouse/Change Room Building

This building (approximately 20,000 square feet) contains the main maintenance shop area (located on the north end of the building), the main warehouse (located on the south end of the building) and the personnel change rooms and lunch/training room (located on the extreme south end of the building on the ground and second floors).

Within the maintenance shop area are the following work area and specialty shops:

- the main maintenance shop area contains welding and cutting equipment, lathes, presses, and drill presses.
- a carpenter shop which contains various saws and planes. Fiberglass work is also done within this shop area and it is located at the northwest end of the maintenance shop area.
- an electrical shop which is located south of the carpenter shop.
- a heavy equipment maintenance shop area is located at the north end of the maintenance shop in the center of the building.
- a rubber room for rubber lining of equipment is located east of the equipment shop area.
- the maintenance shop office, instrument shop and tool room are located at the south end of the maintenance shop area.

The warehouse area contains primarily dry good storage for repair parts and consumables for the operation of the Mill. There is an electrical water heater for the change room which is located in the warehouse area at the south end.

Within the warehouse and maintenance shops there are some oils and chemicals stored in the following locations:

- small quantities of flammable material such as starting fluid and spray paint are kept in the warehouse.
- drums of new oil and anti-freeze are stored along the east wall of the equipment maintenance area and on the east side of the warehouse on oil storage racks.
- used oil is stored in a tank located northeast of the equipment shop. The tank has a capacity of approximately 5,800 gallons.
- in the main maintenance shop area and the rubber room there are flammable storage cabinets and east of the warehouse there is a trailer which is used to store flammable items such as rubber cements, paints and fiberglass resins.
- compressed gas cylinder storage, both empty and full is located outside, east of the maintenance shop.

4.5.1 Electrical

The main electrical circuit breaker for the maintenance shop and warehouse building is located on the east wall inside the Maintenance shop. Auxiliary electrical panels for the change room and warehouse are located in the southwest corner of the warehouse area.

4.5.2 Fire Protection System

The fire protection system within the maintenance shop/warehouse/change room building includes:

- "wet" automatic sprinkler system that releases at 212° F.
- portable dry chemical extinguishers strategically located throughout the maintenance area, warehouse area and the change room and lunch room.

For fire hydrant and hose cabinet locations refer to the Fire System Schematic (Figure 1).

4.6 <u>Reagent and Fuel Storage</u>

The following lists the reagents and fuel stored at the Mill site:

- a sulfuric acid tank located northwest of the mill building which has a capacity of approximately 1.4 million gallons.
- a storage tank for propane is located on the north edge of the mill site, northwest of the mill building. It has a storage capacity of 30,000 gallons.
- four sodium chlorate tanks located east of SX building, north of the office building and east of the pulp storage tanks. The two tanks east of the SX building are for sodium chlorate storage and the other two tanks are for dilution of the sodium chlorate.
- two anhydrous ammonia tanks located east of the SX building, with capacity of 31,409 gallons each.
- three kerosene tanks located east of the SX building, with a capacity of 10,152 gallons each.
- one caustic soda tank north of the SX building, with a capacity of 19,904 gallons.
- three soda ash tanks which are located east of the SX building. One tank is the dry soda ash tank with a capacity of 70,256 gallons. Two of the tanks are soda ash dilution tanks with capacities of 16,921 gallons each.
- diesel fuel and gasoline are stored in two tanks located on the eastern side of the ore pad. The gasoline storage capacity is 3,200 gallons, while diesel storage capacity is 8,000 gallons.

Other reagents are stored in steel barrels or super sacs in a reagent yard located east of the office building. Typical reagents which are stored in this yard include:

- polymers and flocculants
- boiler feed water chemicals
- methanol
- tributyl phosphate
- “dirty” soda ash and ammonium sulfate
- SX amines and emulsion breakers
- decyl alcohol
- minimal amounts of acid in barrels
- used oil in drums and overpacks

4.7 Boiler Facilities

The main building (approximately 12,400 square feet) is located on the west side of the Mill site and contains air compressors and water treatment facilities. To the north of the main building is a building which houses a propane-fired boiler. The vanadium oxidation tank, oxidation thickener, and pH adjustment tank are located south of the boiler house facilities.

4.7.1 Electrical

The main electrical panel for the boiler house is located outside of the building, on the south wall.

4.7.2 Fire Protection System

The fire protection system for the boiler facilities is comprised of strategically located portable dry chemical extinguishers.

4.8 Sample Plant

The sample plant building (approximately 8,000 square feet) is located on the ore pad, east of the maintenance shop/warehouse building. The sampling plant equipment has been removed from the building and it is currently used as a storage area for maintenance.

4.8.1 Electrical

The electrical panel for this building is located on the east wall upstairs.

4.8.2 Fire Protection System

There are no extinguishers or sprinkler systems in the sample plant.

5. ORGANIZATION AND RESPONSIBILITIES

The organizational chart for an emergency situation is illustrated in Figure 2.

5.1 Mill Manager/Incident Commander

The Incident Commander has the responsibility for:

- preparing an Emergency Plan
- communicating the Plan,
- directing activities during emergencies; and,
- reporting to local, State and Federal authorities.

The Incident Commander will stop routine radio usage upon learning of an emergency and set up the base station in a safe location for directing activities. Radio usage will be limited to the emergency. The Incident Commander has the responsibility to contact all outside services.

The Incident Commander has the responsibility to account for all employees at the Mill, using the assistance of supervisors and/or any International Uranium (USA) Corporation ("IUSA") personnel. The Incident Commander has the responsibility for the news media and reports directly to the President of IUSA.

5.2 Mill General Superintendent

The Mill General Superintendent has the responsibility of directing outside emergency personnel and has the responsibility for plant security and will report directly to the Incident Commander. The Mill General Superintendent will act as Incident Commander in the absence of the Mill Manager.

5.3 Radiation Safety Officer/Fire Chief

The Radiation Safety Officer will direct rescue operations and provide the necessary emergency medical personnel and facilities to cope with the emergency. Adequately trained fire crews and operable emergency equipment will be maintained at all times.

As Fire Chief, the Radiation Safety Officer has the responsibility to maintain trained fire crews and operable equipment, mobilize and direct the fire crews and equipment in a fire emergency or one containing the threat of fire, and to assist in evacuation and rescue or recovery operations.

In the absence of the Radiation Safety Officer, the Mill Safety Coordinator will assume these duties.

5.4 Maintenance Supervisor

The Maintenance Supervisor will direct all personnel in evacuation and in activities to cope with the emergency, including isolation of utilities and providing technical advice as needed. The Maintenance Supervisor will be assisted by the Mill Safety Coordinator.

5.5 Laboratory Supervisor

The Laboratory Supervisor has the responsibility to direct and account for all office personnel (including IUSA personnel and office visitors) in evacuation and in activities to cope with the emergency. In case of a mill tour the Supervisor accompanying the tour will be responsible for evacuation of visitors.

5.6 Shift Foremen

Shift Foremen are in charge until the Incident Commander arrives and are responsible for all functions listed above. Shift Foremen have the responsibility to account for all of their people in addition to any visitors, contractors, etc., in their areas and report to the Incident Commander; or, in the absence of the Incident Commander, to administer all of the above duties.

5.7 Scale House Personnel

Scale house person on shift will be responsible to account for ore truck drivers and reagent truck drivers.

5.8 Emergency Response Teams

The response crew for each operating shift will normally consist of the following operators under the direction of the shift foreman. This organization may be changed for individual shifts subject to the approval of the Fire Chief.

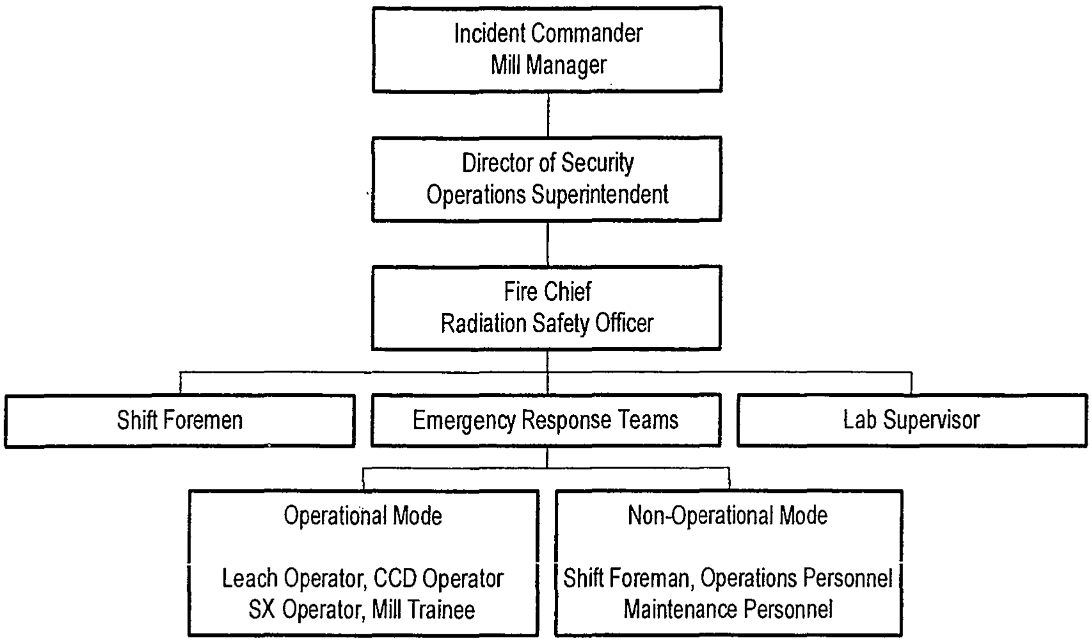
5.8.1 Operational Mode

Leach Operator
CCD Operator
Solvent Extraction Operator
Mill Trainee

5.8.2 Non-Operational Mode

Shift Foreman
Operations Personnel
Maintenance Personnel

Figure 2
Emergency Response Organizational Structure



6. SPECIFIC EMERGENCIES

The following details procedures to be followed during specific emergencies but are not limited to the following.

6.1 Fire

Should a fire occur, the procedure outlined in Appendix A for reporting and responding to fires will be followed. Particular areas of concern include:

- Solvent Extraction Building
- Propane Tanks
- Lab or Lab Storage Area

6.2 Chemical or Gas Release

The procedures for response to a chemical or gas release are outlined as Appendix B.

6.3 Earthquake

Although this is highly unlikely, an earthquake could occur at the Mill. A severe earthquake could cause buildings and other structures to collapse, chemical and/or gas releases, major fires as well as general panic. In the event of a major earthquake the evacuation procedures outlined in Appendix C will be followed.

6.4 Terrorist/Bomb Threat

In the event that any person should receive a threat of a bomb, the following evacuation procedure should be followed:

- Notify any person of authority, i.e., Superintendent, Foreman, Radiation Safety Officer, who will immediately notify law enforcement authorities and evacuate the threatened area.
- Evacuate all persons from the affected area and stop all radio transmissions.

6.5 Tailings Dam Break and Major Floods

Flood water breaching tailings embankments presents one of the greatest dangers for the sudden release of tailings solids and impounded water. The tailings cells are designed with sufficient freeboard (three feet) to withstand back-to-back 100-year storm events or 40% of the probable maximum flood (PMF) followed by the 100-year storm event. The flood design is equivalent to 15 inches of rainfall. In addition, the tailings dikes were designed in accordance with U.S. NRC regulations and allow a sufficient margin of safety even in the event of an earthquake.

The possibility of floods resulting from Westwater Creek, Cottonwood Creek, and Corral Creek causing a dam failure is extremely remote.

The tailings cells and dikes are inspected on both a daily and shift basis.

Discharges from a dike failure would extend three miles before leaving IUSA's property. In the event of a dam failure, large operating equipment will be mobilized to construct temporary earthen dikes or berms downgradient to the failed dike. In addition, the State of Utah, Department of Radiation Control Executive Secretary (the "Executive Secretary), MSHA, and State of Utah, Department of Natural Resources, Division of Dam Safety shall be notified.

In the event of a seismic rupture of tailings slurry pipelines, the released slurry will be contained in the tailings cells regardless of the quantity released.

7. EVACUATION PROCEDURE (See Appendix C)

7.1 Notification

Employees will be notified to evacuate the area by dialing 184 on any area telephone and announcing that the Mill should be evacuated. This announcement will be repeated twice. When the paging system cycles through, the evacuation siren (continuous frequency) will automatically sound for approximately forty-five seconds, and then automatically shut off, allowing communications by radio from that point. If the 184 number is dialed accidentally the evacuation alarm may be canceled by disconnecting the phone until the page cycle ends, then re-dial 184. (See Exhibits 1 and 2.)

7.2 Assembly

When the evacuation alarm sounds or when personnel are verbally notified by radio or other means, all personnel will assemble at:

- The parking lot south of the office,

- The scalehouse,
- North side of Tailings Cell 1, or
- North of the Mill

Assembly site will depend upon conditions, i.e. nature of the emergency, wind conditions, etc. The Fire Chief or Shift Foreman will specify the appropriate assembly site.

7.3 Specific Procedure for Operations Personnel

1. See specific emergency shutdown procedure for Operations by area under the relevant Operating Procedure for your area.

2. All employees not mentioned under Operating Procedures are to immediately report to the assembly area and congregate by crew so that all persons can be accounted for. As employees leave their work areas, they must pass the word to evacuate to any persons who may not be aware of the emergency.

3. After the Mill has been determined to be safe for re-entry, employees will be verbally notified to return to their work stations.

8. Off-Site Emergency Equipment/Personnel Release

Any emergency response equipment or personnel that enter the Restricted Area in response to an incident will be scanned and decontaminated prior to leaving the site according to the procedures included in PBL-9, End Dump Trailer Acceptance, Handling and Release. Any equipment will be decontaminated according to the requirements found in Table 1 of the Nuclear Regulatory Commission's (NRC's) Policy and Guidance Directive FC-85-23, "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material" issued May 1987.

Injured personnel should be evaluated for radiation contamination, if there was a potential for contamination, at the earliest convenience. Should it be necessary, contaminated articles will be gathered by the radiological staff after medical treatment has been rendered. If the personnel cannot be decontaminated, notify the clinic/hospital personnel in advance.

9. EMERGENCY EQUIPMENT

Emergency equipment for the Mill is provided as follows.

9.1 Fire Hose

Fire hose cabinets are located at the following sites with a minimum of 300 feet of 2-1/2" hose, two spanner wrenches, spray nozzles and one hydrant wrench.

- South of SX
- West of CCD
- North of Mill Building
- East of pulp storage tanks
- Northwest of Maintenance Shop
- West of Warehouse

- East of office building

9.2 Self Contained Breathing Apparatus

Two Self-Contained Breathing Apparatus are located at each of the following locations:

- Hose station east of office building
- Hose Station South of SX
- North End SX Outside Wall
- North end of Mill building, outside wall

9.3 Spill Clean-up Equipment

Barrels of soda ash are located throughout the Mill to be used in case of a chemical spill. Soda ash is also stored in bulk if needed. There are also a few drums of absorbent stored near the laboratory. The laboratory also contains acid spill kits and absorbent materials to be used in case of a spill.

9.4 Fire Fighting PPE

Two complete sets of turnout gear for fire fighting and/or emergency extrication are located in the Fire Hose Station located on the east side of the office building.

9.5 Maintenance of Emergency Equipment

Fire extinguishers are inspected on an annual basis, as well as the fire pump system. The Mill Safety Coordinator performs regular spot checks on the emergency equipment locations to ensure that all of the equipment is in place.

10. EMERGENCY TRANSPORTATION

One fully-equipped First Responder Unit (Ambulance) located west of the office building.

Other motor pool vehicles on the property will be utilized as needed in emergency situations with support as needed from the local Emergency Medical Services.

11. EMERGENCY DRILLS AND TRAINING

Quarterly drills, as required by MSHA, are prepared by the Safety and Radiation Departments to monitor performance of personnel responding to emergency situations. Each drill will be enacted upon one or more of the potential scenarios by this plan. The drill and evacuation activities are documented by the Mill's Safety Coordinator and maintained within plant files. Management will review all drills at quarterly ALARA Committee Meetings.

EXHIBIT 1
EMERGENCY NOTIFICATION LIST

ATTEND TO ANY INJURED PERSONS AND NOTIFY THE SUPERVISOR:

Give artificial respiration if necessary.
Control bleeding.
Treat for shock.
Immobilize fractures and stabilize for transportation.
Scan the injured for excessive alpha prior to transporting if time allows.

(If alpha is excessive or there is no time to scan, notify the clinic/hospital personnel and the Radiation Safety Office).

THE SUPERVISOR OR HIS DESIGNEE WILL NOTIFY THE FOLLOWING AS NEEDED:

Blanding Clinic .... 678-2254 or 678-3434 (930 N. 400 W.)
San Juan Hospital, Monticello .... 678-2830 or 587-2116 (364 W. 1st N.)

EMT and CPR TRAINED – The following personnel should be contacted, if they are on-site, in the event of an emergency to aid in the event of any injuries to personnel.

David Turk – EMT and CPR trained
Mike Spillman – CPR trained

AMBULANCE SERVICE

Blanding .... Dial 911

If the Company Ambulance is used, an attendant must ride with the injured in addition to the driver, except where the injured could normally be transported in a car or pickup.

OTHER EMERGENCY NUMBERS

Fire Department .... Dial 911 or 678-2313
County Sheriff............................. Dial 911 or 587-2237
Highway Patrol............................ Dial 911 or 587-2000
Blanding Police .... Dial 911, 678-2916 or 678-2334

MANAGERS

The Supervisor will notify one of the following of all incidents:

R.E. Bartlett................................. 435-678-2495
D. Turk .... 435-678-7802 or 435-459-1068
M. Spillman................................. 435-678-2761

A MEMBER OF MANAGEMENT WILL NOTIFY THE PROPER REGULATING AGENCIES AS REQUIRED FOR EACH INCIDENT:

State of Utah, Department of Radiation Control............. 801-536-4250
MSHA Field Off.--801-524-3450 Dist. Off. 303-231-5465
MSHA, Arlington.. 800-746-1553
State Emergency Response Comm. 801-538-3400
State of Utah, Natural Resources, Dam Safety 801-538-7200
National Response Center.. 800-424-8802
Utah Poison Control Center 800-456-7707

Notification of surrounding communities and or residences will be handled by the appropriate agencies as required by EPCRA (Emergency Planning and Community Right to Know Act).

EXHIBIT 2
INTERNAL NOTIFICATIONS

Internal reporting requirements for Incidents, Spills and Significant Events are as follows:

Report Immediately:

Event Criteria:
- Release of toxic or hazardous substances.
- Fire, explosions or other accidents.
- Government investigations information, requests or enforcement actions.
- Private actions or claims (corporations or employees).
- Deviations from Corporate policies or government requirements by Management.

Other significant events, which have resulted or could result in:
- Death, serious injury or adverse health effect (employees or public).
- Property damage exceeding $1,000,000.
- Government investigation or enforcement action – limiting operation or penalties of $100,000 or more.
- Significant criminal actions.
- Substantial media coverage.
- Unscheduled down time of more than 24 hours.

Report at the Beginning of the Next Business Day:

Incident Criteria:
- Was reported to a government agency as required by law.
- Worker (IUSA or contractor) recordable injury or illness associated with a release.
- Community impact - reported or awareness.
- Publicity resulted or is anticipated.
- Release of process material, waste or product in excess of the Reportable Quantities listed in Section 1.5 of the Spill Prevention, Control, and Countermeasures Plan.

The local manager in charge is to call Ron Hochstein or Dave Frydenlund.

<u>Name</u> <u>Title</u> <u>Office Phone</u> <u>Home Phone</u>

Ron Hochstein (President and COO).........................303-628-7798 (office)
604-931-6334 (home)
604-377-1167 (cell)

David Frydenlund (V.P. and General Counsel) ....303-389-4130 (office)
303-221-0098 (home)
303-808-6648 (cell)

EXHIBIT 3

SITE LAYOUT MAP

07/22/04 THU 17:10 FAX 604 689 4250 NAMDO MGMT. SERVICES 022

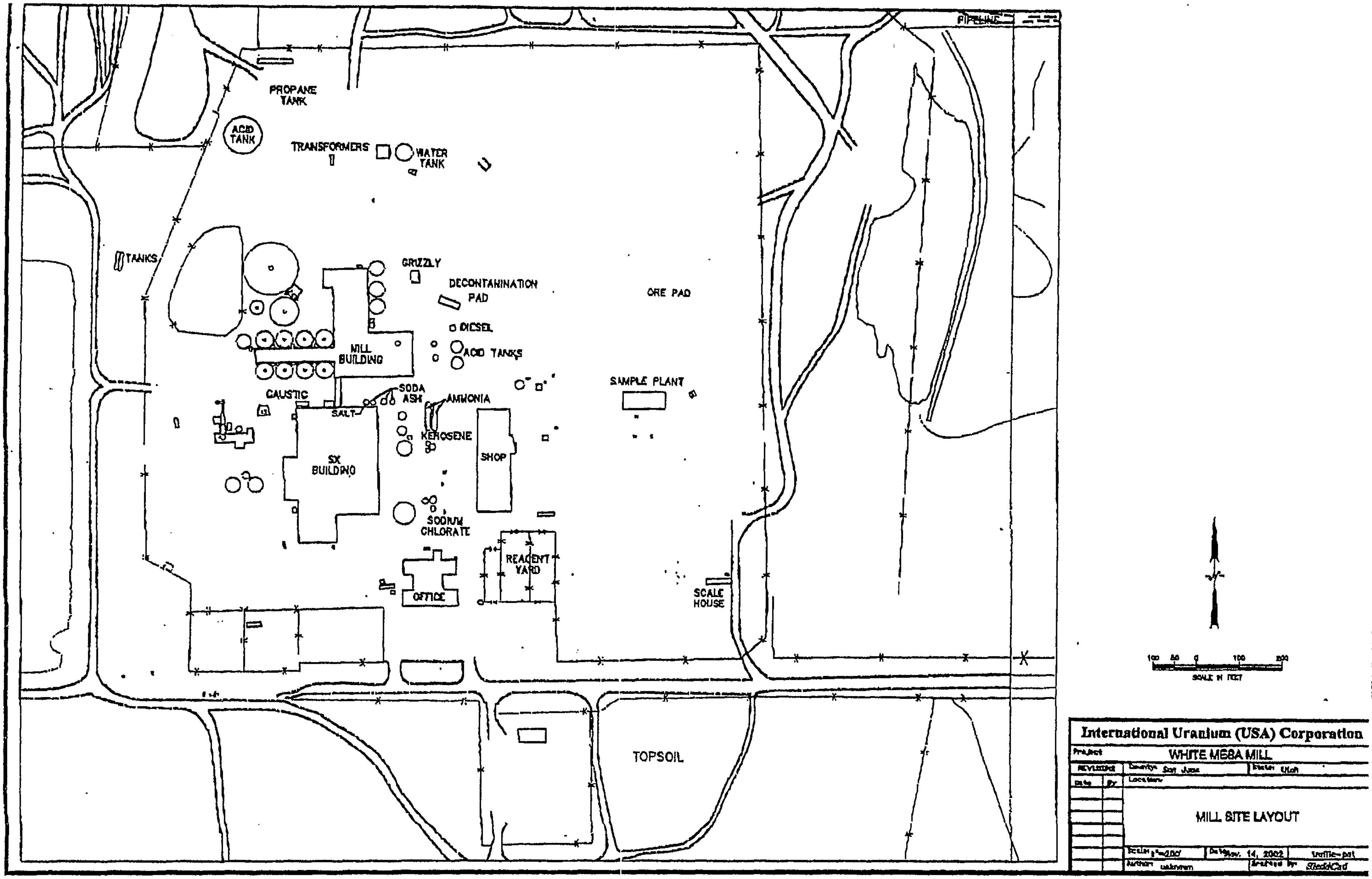


EXHIBIT 4

MAIN SHUT-OFF VALVES

During an emergency this list should be used along with Site Layout Map (Exhibit 3) to locate tanks and valves associated with these tanks.

REAGENT SHUT-OFF VALVE LOCATIONS

Sulfuric Acid

4" Main located south side of acid tank

East acid pump discharge valve

West acid pump discharge valve

3" Main (leach area) located 25 feet west of Derrick screens next to walkway

1-1/2" Main (SX area) located south of Central Control room

Ammonia

4" Main (east tank) located on end at bottom

4" Main (west tank) located on end at bottom

2" Valve located on top of tank (east tank)

2" Valve located on top of tank (west tank)

Kerosene

2" Main valve located at bottom of tank (east tank)

2" Main valve located at bottom of tank (north tank)

2" Main valve located at bottom of tank (south tank)

Pump discharge 2" valve

Soda Ash

Main valve located at bottom of tank (dry storage)

4" Main valve located at bottom of tank on 30% dilution tank

4" Main valve locate at bottom of tank on dilution tank

Salt

3" Main valve located at bottom of tank

Caustic Soda

3" Main valve located at bottom of tank east and west between supports

EXHIBIT 4

MAIN SHUT-OFF VALVES

Sodium Chlorate

3" Main valve located at bottom of tank (east tank)

3" Main valve located at bottom of tank (north tank)

3" Main valve located at bottom of tank (south tank)

Propane

4" Main located 15 feet east of tank

3" Main located on pipe off top of tank

3" Main located at bottom of tank (also fill pipe)

PLANT UTILITY SHUT-OFF VALVE LOCATIONS

Process Water

Main valve located on west side of water storage tank

Discharge valve off service water pump east

Discharge valve off service water pump west

Mill process water main located east wall by SAG mill

Fire Water

Main valve located west side of water storage tank

Emergency fire pump discharge valve to fire system

Emergency fire pump discharge valve to header west side of pump house

8" Main valve located south of Central Control room for SX and boilers

Potable Water

2" Main (suction) from potable water storage tank

2" Main (discharge) from potable water storage tank

4" Main located at east wall by SAG mill

4" Main located south of Central Control room for SX, Maintenance shop, and offices

Steam

Main discharge valve for Superior boiler located at top of boiler

Main steam valve located south side of boiler house

EXHIBIT 4

MAIN SHUT-OFF VALVES

Plant Air

Main valve located at receiver tank in compressor room at boiler house

Main valve to mill building located south of Central Control room

PROCESS SHUT-OFF VALVE LOCATIONS

Pulp Storage

No. 1 valve located on west side of tank

No. 3 valve located on west side of tank

Preleach (old No. 2 pulp storage) valve located on west side of tank

Preleach Thickener

Main valve located underneath at center cone

Clarifier

Main valve located underneath at center cone

Main valve located underneath at center cone

CCD Thickeners

Main valve located underneath at center cone of each thickener

APPENDIX A

EMERGENCY PROCEDURE RESPONSE TO FIRE

1. The fire will be reported by dialing 185 on any telephone in the area and announcing the location of the fire over the paging system. This announcement will be repeated twice, for a total of three announcements. When the paging system cycles through, the fire siren (alternating frequency) will automatically sound for approximately forty-five seconds then automatically shut off, allowing radio communications to resume.

2. Mobilize the fire crew.

3. Evacuate all personnel.

4. Rescue any victims of the fire; do this only with properly trained and equipped personnel.

5. Isolate utility lines affected by the fire.

6. Extinguish the fire and post a fire watch for flare-ups.

7. Report the fire to proper local, State, Corporate and Federal agencies.

8. In cases where the fire is not extinguished within thirty minutes of discovery, the area must be barricaded off after extinguishing and left undisturbed until released by MSHA and IUSA management.

9. Emergency off-site centers - Blanding Fire House and Sheriff's office:

   Blanding Fire
   350 West 200 South, Blanding
   Phone number is 911

   Sheriff's Office
   50 West 100 South, Blanding
   Phone number is 911 or (435) 587-2237

APPENDIX B

EMERGENCY PROCEDURE
RESPONSE TO CHEMICAL OR GAS RELEASE

A chemical or gas release would most likely occur very suddenly. The person who would first witness a chemical or gas release should immediately contact his supervisor who would initiate the procedures outlined below:

1. Activate evacuation alarm by using the "dial 184" notification system. Evacuate and account for all personnel.

2. Mobilize trained personnel and emergency equipment such as SCBA's, first aid equipment, etc.

3. Initiate rescue operations for any people who may be trapped by the release.

4. Provide first aid and emergency medical care for any ill or injured persons.

5. Initiate necessary steps to contain and/or neutralize the release, such as spraying with water fog, turning off valves, etc.

6. Guard against possible fires by shutting off electrical circuits, isolating gas lines and eliminating ignition sources from the affected area.

APPENDIX C

EMERGENCY EVACUATION PROCEDURE

1. Activate evacuation alarm by using the "dial 184" notification system. Evacuate and account for all personnel.

2. Personnel are to assemble in one of the following areas:
   - The parking lot south of the office building
   - The scalehouse
   - The north side of Tailings Cell 1, or
   - North of the Mill

3. Mobilize trained personnel and emergency equipment such as SCBA's, first aid equipment, etc.

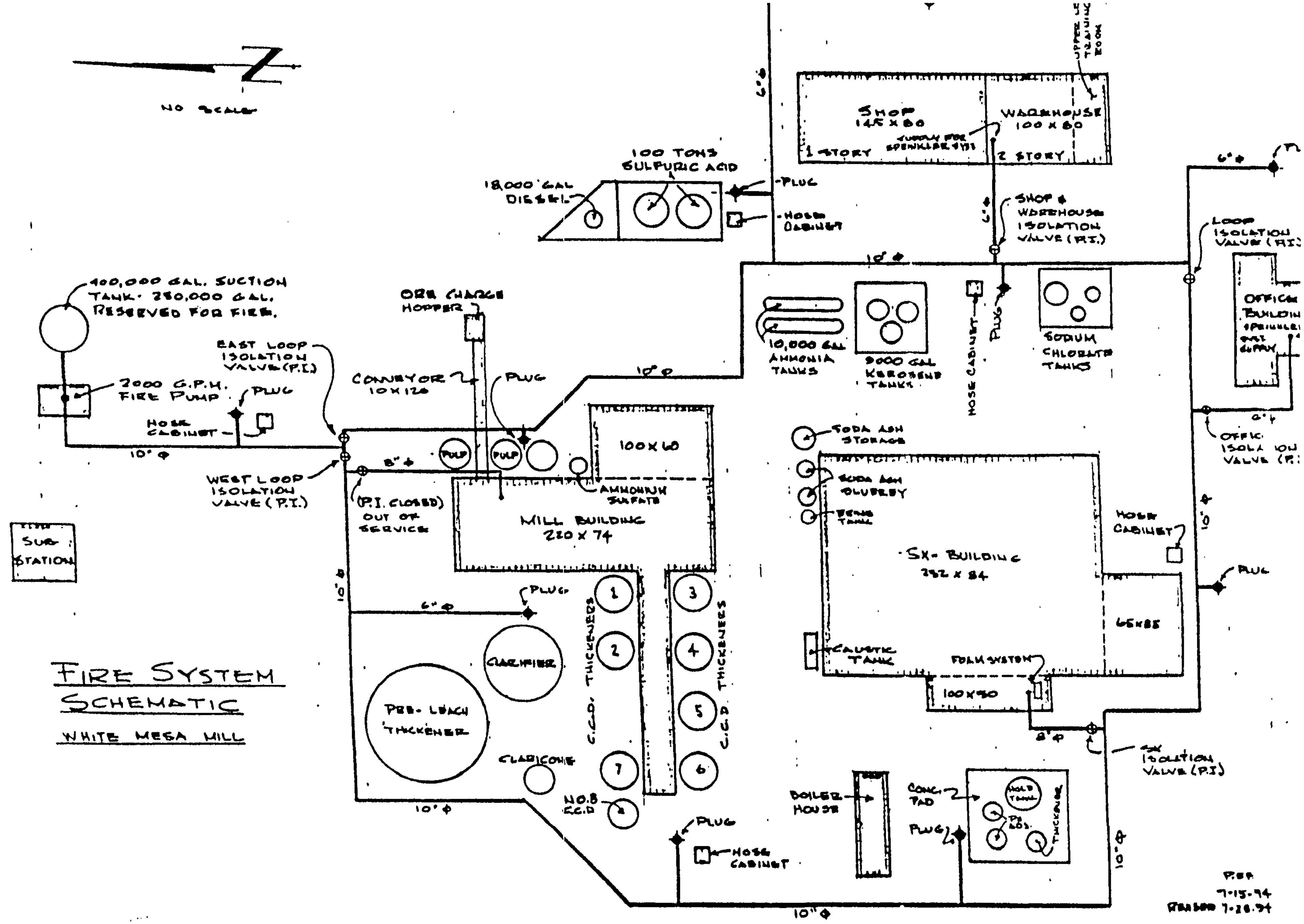
4. Initiate rescue operations for any people who may be trapped.

5. Provide first aid and emergency medical care for any ill or injured persons.

6. Guard against possible fires by shutting off electrical circuits, isolating gas lines and eliminating ignition sources from the affected area.

FIGURE 1

FIRE SYSTEM SCHEMATIC DRAWING



NO SCALE
400,000 GAL. SUCTION TANK. 250,000 GAL. RESERVED FOR FIRE.
2000 G.P.M. FIRE PUMP
EAST LOOP ISOLATION VALVE (P.I.)
PLUG
HOSE CABINET
10" Φ
WEST LOOP ISOLATION VALVE (P.I.)
SUB STATION
ORE CHARGE HOPPER
CONVEYOR 10 X 126
PLUG
PULP
PULP
8" Φ
(P.I. CLOSED) OUT OF SERVICE
MILL BUILDING 220 X 74
100 X 60
AMMONIUM SULFATE
18,000 GAL DIESEL
100 TONS SULFURIC ACID
PLUG
HOSE CABINET
SHOP 145 X 80
1 STORY
SUPPLY FOR SPRINKLER SYST
WAREHOUSE 100 X 80
2 STORY
6" Φ
SHOP & WAREHOUSE ISOLATION VALVE (P.I.)
10" Φ
10,000 GAL AMMONIA TANKS
9000 GAL KEROSENE TANKS
HOSE CABINET
PLUG
SODIUM CHLORATE TANKS
LOOP ISOLATION VALVE (P.I.)
OFFICE BUILDING SPRINKLER SYST SUPPLY
6" Φ
OFFICE ISOLATION VALVE (P.I.)
SODA ASH STORAGE
SODA ASH SLURRY
SX- BUILDING 232 X 84
HOSE CABINET
PLUG
10" Φ
CAUSTIC TANK
FOAM SYSTEM
100 X 30
8" Φ
SX ISOLATION VALVE (P.I.)
6" Φ
PLUG
C.C.D. THICKENERS
1
2
3
4
5
6
7
CLARIFIER
PRE- LEACH THICKENER
CLARICONE
NO. 8 C.C.D
10" Φ
PLUG
HOSE CABINET
BOILER HOUSE
CONC. PAD
PLUG
HOLD TANK
THICKENER
10" Φ
FIRE SYSTEM SCHEMATIC
WHITE MESA MILL
7-15-94
REVISED 7-28-94

DENISON MINES (USA) CORP

BOOK #9

RADIATION PROTECTION MANUAL

1.0 RADIATION MONITORING – PERSONNEL

This section contains the following procedures for personnel radiation monitoring including: (1) airborne particulates (2) alpha surveys (3) beta/gamma surveys and (4) urinalysis surveys.

1.1 AIRBORNE PARTICULATES

Sampling for personnel exposure to airborne particulate radionuclides, other than for radon progeny, will be done utilizing two distinct sampling protocols: (1) personnel breathing zone samplers, and (2) ambient air high volume samplers. Specific standard operating procedures for these two collection methods are described in Section 1.1.2 and 1.1.3 below.

1.1.1 Frequency

For work where there is the potential to cause airborne radiation doses to site personnel, the frequency and type of air sampling to be conducted is determined from measured air concentrations:

0.01 DAC – 0.1 DAC	Quarterly or monthly area air sampling and/or bioassay measurements
> 0.1 DAC	Continuous sampling is appropriate if concentrations are likely to exceed 0.10 DAC averaged over 40 hours or longer.

The RSO will determine the exact frequency of area air sampling, breathing zone sampling and/or bioassay measurements and determine how many workers in a group of workers performing similar jobs are to be equipped with breathing zone air samplers. Higher airborne concentrations warrant more frequent use of area air samplers, bioassay measurements, and breathing zone air samplers. Area air samplers may be used where documentation exists showing the sample is equivalent to a breathing zone sample. Breathing zone samples taken within one foot of the worker's head are considered representative without further documentation. Breathing zone air samplers are preferred under work conditions of higher airborne concentrations. Table 1.1.1-1 below, from Regulatory Guide 8.25, provides additional guidance for the RSO in designing and implementing air sampling programs for specific jobs.

Table 1.1.1-1
Air Sampling Recommendations Based on Estimated Intakes and Airborne Concentrations

Worker's Estimated Annual Intake as a Fraction of ALI	Estimated Airborne Concentrations as a Fraction of DAC	Air Sampling Recommendations
< 0.1	< 0.01	Air sampling is generally not necessary. However, monthly or quarterly grab samples or some other measurement may be appropriate to confirm that airborne levels are indeed low.
	> 0.01	Some air sampling is appropriate. Intermittent or grab samples are appropriate near the lower end of the range. Continuous sampling is appropriate if concentrations are likely to exceed 0.1 DAC averaged over 40 hours or longer.
> 0.1	< 0.3	Monitoring of intake by air sampling or bioassay is required by 10 CFR 20.1502(b).
	> 0.3	A demonstration that the air samples are representative of the breathing zone is appropriate if (1) intakes of record will be based on air sampling and (2) concentrations are likely to exceed 0.3 DAC averaged over 40 hours (i.e., intake more than 12 DAC-hours in a week).
Any annual intake	> 1	Air samples should be analyzed before work resumes the next day when potential intakes may exceed 40 DAC-hours in 1 week. When work is done in shifts, results should be available before the next shift ends. (Credit may be taken for protection factors if a respiratory protection program is in place.)
	> 5	Continuous air monitoring should be provided if there is a potential for intakes to exceed 40 DAC-hours in 1 day. (Credit may be taken for protection factors if a respiratory protection program is in place.)

1.1.2 Breathing Zone Sampling

1.1.2.1 General

Breathing zone samplers (SKC pumps and accessory kits, or equivalent) are used to determine airborne exposure to uranium while individuals are performing specific jobs. The units consist of a portable low volume pump that attaches to the individuals belt, tygon tubing and filter holder that is attached to the individual's lapel or shirt collar. The unit monitors airborne uranium in a person's breathing zone. Pumps must be recharged after 6 to 8 hours of use.

1.1.2.2 Applicability

Breathing zone samples are required:

- for all calciner maintenance activities,
- at least quarterly during routine operating and maintenance tasks on representative individuals performing these tasks,
- when radiation work permits are issued in which airborne concentrations may exceed 25% of 10CFR20 limits,
- weekly for yellowcake operations, or
- at the discretion of the RSO.

1.1.2.3 Procedure

The procedure for collecting a breathing zone sample is as follows:

1. Secure the breathing zone sampler, which has been charged and loaded with a filter paper from the radiation department.

2. Secure the pump to the worker's belt and the filter holder to the shirt collar or lapel. Try to secure pump tubing to minimize restriction of motion.

3. Turn pump on (record the time pump was turned on) and continue monitoring until the work being monitored is completed and the worker no longer is in the exposure area. Record the time at which the job is complete.

4. Return the pump and accessories to the RSO, who will remove the filter paper for analysis. Be sure to indicate accurately the total time taken by the work being monitored.

5. Analysis of filter samples will be performed using a sensitive alpha detector. The procedure is as follows: (a) count a background sample for ten minutes; (b) divide the

background count by ten to obtain the background count rate in cpm; (c) Place the breathing zone sample in the instrument and count the sample again for ten minutes; (d) divide the sample count by ten to obtain the count rate in cpm; (e) subtract the background count rate from the sample count rate; and, (f) record all data on the Breathing Zone sampling analysis form (a copy of which is attached).

6. Record the total hours of exposure that are being assigned to the employee on the Employee Exposure form, which is maintained in personnel folders. Be sure to consider protection factors permitted by respirator use if the employee was also wearing respiratory protection during the job.

7. The number of DAC hours assigned is calculated using the following formula:

$$\text{DAC hours of exposure} = \frac{\text{Measured air concentration}}{\text{(DAC)(PF)}} \times \text{Total hours of exposure}$$

where: DAC = Derived Air Concentration (for uranium; 10 CFR Part 20, Appendix B)

PF = protection factor for respirator use. If no respiratory protection was used PF =1.

The measured air concentration must be in uCi/cc.

1.1.2.4 Calibration

Prior to use, calibration of the breathing zone samplers will be done using the Bubble Tube Calibration method, described in Section 3.2.1.

1.1.2.5 Equipment – Breathing Zone Sampler

The equipment used for breathing zone samples consists of:

1. Personal sampling pumps
2. Gelman 37 mm Delrin filter holders, or equivalent
3. Gelman 37 mm type A/E glass fiber filters, or equivalent
4. Kurz Model 543 air mass flow meter, or equivalent

1.1.2.6 Data Record

Data maintained on file includes:

1. Time on and off for each sample pump.
2. Sampling location(s).

3. Individual's name, identification number, etc.
4. Date and sample number.
5. Sample count rate.

1.1.2.7 Calculations

The airborne concentration in uCi/cc is equal to the sample count rate minus the background count rate in cpm divided by the instrument alpha efficiency, the sample flow rate in cc/minute, the sample time in minutes and a conversion factor converting dpm to uCi.

The calculation is:

Equation Number 1:

$$\text{Airborne concentration} = \frac{\text{(Count Rate)}}{\text{(Time)((}\langle\text{eff)(conversion factor)(Flow Rate)}}$$

$$\text{i.e. } \frac{\text{uCi}}{\text{cc}} = \frac{\text{(cpm-Bkg)}}{\text{((}\langle\text{eff)}}\,\frac{1\text{ uCi}}{(2.22\text{x}10^{6}\text{dpm)}}\,\frac{(1)}{\text{(cc/min)}}\,\frac{(1)}{\text{(min)}}$$

where: ⟨eff = cpm/dpm for counting instruments
cpm = counts/min
dpm = disintegrations/min
conversion factor 1 uci = $2.22\text{x}10^{6}$ dpm
Flow Rate = cc/min
Collection time = min

Once the airborne concentration has been calculated it is possible to calculate personnel exposure in microcuries (uCi). Personnel exposure is determined for an individual who is working in an area at a known air concentration (uCi/cc) for a given amount of time (hours) breathing the area air at an assumed rate. The breathing rate for a standard person (Handbook of Radiological Health) is 1.20 cubic meters per hour (m^3/hr).

The calculation for personnel exposure is:

Equation Number 2:

Exposure uCi = (uCi/cc)(1.20m^3/hr)(hours of exposure)(conversion rate)

where: uCi/cc = air concentration from Equation 1

1.20 m^3/hr = breathing rate for standard man (ICRP)

hours of exposure = hours
conversion factor = 10^6cc/m^3

It is also possible to determine the percent or fraction of the Derived Air Concentration (DAC) for a particular radionuclide using the information obtained from the exposure calculation and dividing this value by the regulatory limit DAC listed in 10 CFR Part 20.

% DAC = Exposure in uCi/uCi limit 10 CFR Part 20

For the natural uranium (U-Nat) the DAC limits from 10 CFR Part 20 for insoluble Class Y compounds are as follows:

- Weekly 1.0×10^{-3} uCi/week
- Quarterly 1.25×10^{-2} uCi/Qt
- Yearly 5.0×10^{-2} uCi/yr

1.1.2.8 ALARA/Quality Control

The RSO reviews each monitored result and initiates action if levels exceed 25% of 10 CFR 20 limits. At a minimum, ten percent (10%) of the air samples collected in a given quarter will be recounted using the same instrument or using a different instrument and these results will be compared to the original sample results. Deviations exceeding 30% of the original sample results will be reviewed by the RSO and the samples will be recounted again until the sample results are determined to be consistent. Additional QA samples consisting of spiked air samples, duplicate samples and blank samples will be submitted to the radiation department for counting. This will be based on ten percent (10%) of the number of samples collected during a quarter. The sample results will be compared to the spiked values, duplicate values, or blank (background) values of the prepared sample. Deviations exceeding 30% of the determined spiked, duplicate or blank value will be recounted. If no resolution of the deviation exceeding 30% is made the QA samples preparation will be repeated. Periodic reviews by the RSO and the ALARA audit committee will be made and documented to ensure quality maintenance and ALARA control.

1.1.3 Airborne Uranium High Volume Sampling

Grab air sampling involves passing a representative sample of air through a filter paper disc via an air pump for the purpose of determining the concentration of uranium in breathing air at that location. Although the process is only measuring airborne concentrations at a specific place and at a specific time, the results can often be used to represent average concentration in a general area. A high volume sample pump will be used for this purpose. Samples will be analyzed as per standard gross alpha analysis procedures using a sensitive alpha detector.

1.1.3.1 Frequency and Locations

The following principles used for the collection of area grab samples must be considered when collecting a sample in order to obtain a representative air concentration that workers may be exposed to during their assigned work tasks.

1. The locations selected for sampling should be representative of exposures to employees working in the area.

2. For special air sampling, the sampling period should represent the conditions during the entire period of exposure. This may involve sampling during the entire exposure period.

3. For routine sampling, the sampling period must be sufficient to ensure a minimum flow rate of 40 liters per minute for at least 60 minutes.

4. Sample filters will be analyzed for gross alpha using a sensitive alpha detector.

5. Grab sampling procedures may be supplemented by use of Breathing Zone Samples for special jobs or non-routine situations.

1.1.3.2 Sampling Equipment

Monitoring equipment will be capable of obtaining an air sample flow rate of at least 40 liters per minute for one hour or longer. Equipment utilized will be and Eberline RAS-1, or a Scientific Industries Model H25004, or equivalent. Filter media will have a maximum of 0.8 micron pore diameter. Equipment is calibrated prior to each usage as per Section 3.6 of this manual.

1.1.3.3 Sampling Procedure

Steps for collection of area airborne grab samples are as follows:

1. A high volume pump will be used for sample collection.

2. Check sample pump calibration.

3. Locate sampler at designated site. Insert a clean filter, using tweezers, into the filter holder on the sampler. Do not contaminate the filter. Log start time and Mill operating conditions at the site.

4. Collect a sample for a minimum of 60 minutes at a flow rate of 40 liters per minute.

5. After sampling is completed, carefully remove the filter, using tweezers, from the filter holder and place it in a clean glassine envelope, or in the plastic casing furnished with the filter.

6. Log all sample data on the log sheet.
   A. Sample location and number (also on the envelope).
   B. Time on, time off and date.
   C. Mill operating conditions at the site.
   D. Sampler's initials.

7. Analyze for gross alpha

1.1.3.4 Calculations

Perform calculations as described in Section 1.1.2.7.

1.1.3.5 Records

Logs of all samples taken are filed in the RSO's files. Data are used to calculate radiation exposures as described in Section 4.0.

Whenever grab sampling results indicate that concentrations in work locations exceed 25% of the applicable value in 10 CFR Part 20, Appendix B, time weighted exposures of employees who have worked at these locations shall be computed. Calculations will reveal an individual's exposure in DAC hours. This value shall be assigned to the worker and logged onto the worker's "Employee Exposure to Airborne Radionuclides" form. This form is in Section 4. Whenever special air sampling programs (as required for cleanup, maintenance, decontamination incidents, etc.) reveal that an employee has been exposed to airborne radioactive material, the calculated value shall also be entered on the individual's exposure form.

1.1.3.6 Quality Assurance

Calibration checks on each air sampler, prior to field use, ensure accurate airflow volumes. Use of tweezers and new filter storage containers minimizes contamination potential. Field logging of data during sampling and logging of identifying data on sampled filter containers minimizes sample transposition. Quality control samples will be analyzed as described in Section 1.1.2.8

Review of data by the RSO and by the ALARA Audit committee further assures quality maintenance.

1.2 ALPHA SURVEYS

1.2.1 Restricted Area

The Restricted Area is defined as:

1. The property area within the chain link fence surrounding the mill property and the area enclosed to the north and east of the facility by the posted Restricted Area fence.

2. The active tailings and liquid waste disposal areas.

All personnel who enter the Restricted Area will monitor themselves each time they leave the Restricted Area and at the end of their shift. The Radiation Safety Department will review the monitoring information. All personnel exiting the Restricted Area must initial a record of their monitoring activity.

1.2.2 Instrumentation

The instrumentation utilized for personnel alpha scanning is listed in Appendix 1 at the end of this manual. Personnel alpha survey instruments are located at the exits from the Restricted Area.

1.2.3 Monitoring Procedures

The monitoring procedure includes the following steps:

1. The alarm rate meter is adjusted within the range of 500 to 750 dpm/100 cm^2 to ensure a margin of 250 dpm/100 cm^2 due to the low efficiency of this instrumentation.

2. An individual monitors himself by slowly passing the detector over their hands, clothing and shoes, including the shoe bottoms, at a distance from the surface of approximately ¼ inch. An area that is suspected of possessing any contamination (i.e. hands, boots, visible spotting/stain on clothing etc.) should be carefully monitored by placing the detector directly on the surface and note the measurement.

3. Should an alarm be set off indicating the presence of contamination, the individual should:
    a. Resurvey themself to verify the contamination.
    b. If contamination is present the individual must wash the affected area and again resurvey themself to ensure the contamination has been removed.

4. If the decontamination efforts by the individual are not successful, then the Radiation Safety personnel will be contacted to assess the situation. Further decontamination may be required.

5. If an individual's clothing cannot be successfully decontaminated, they must obtain clothing from the warehouse to use and must launder the personal clothing in the laundry room.

6. Individual surveys are to be logged and initialed.

1.2.4 Training

All employees will be trained on the proper scanning procedures and techniques.

1.2.5 Records

Log sheets will be collected daily and filed by the Radiation staff. Records will be retained at the Mill. Contamination incidents will result in a written record, which is maintained on file.

1.2.6 Limits/ALARA

Contamination limits for personnel scans are set at 1,000 dpm/100 square centimeters. Records will be reviewed by the RSO to maintain levels noted as low as reasonable achievable.

1.2.7 Quality Assurance

A random check of an individual's scanning technique provides quality assurance of the monitoring procedures. Daily function checks using calibrated sources assures instrumentation performance. Periodic review by the RSO and the ALARA audit committee document and ensure quality control and ALARA maintenance.

1.3 BETA-GAMMA SURVEYS

Site employees working within the Restricted Area will be required to wear a personal monitoring device (such as a TLD, LUXEL badge or other NVLAP approved device which has been approved by the RSO and the SERP) during their work period. The personal monitoring devices are normally issued to each employee quarterly; however, during pregnancy or if the radiological potential for exposure to an individual is anticipated to be elevated and requires quick assessment the badges may be issued monthly.

1.3.1 Monitoring Procedures

The monitoring procedures consist of:

1. Personnel issued personal monitoring devices will wear the device on the trunk (torso) of the body or visibly on the exterior of their hard hat. The personal monitoring device records beta/gamma radiation as well as other forms of penetrating radiation such as x-rays. A personal monitoring device is an exposure record of an individual's personal exposure to radiation while on the job. Therefore, personal monitoring devices are to remain at the Mill in the personal possession of each individual, in a locker or other secure area. All exposure records obtained by a personal monitoring device which are not consistent with the exposure rates of work tasks or work location measurements made throughout the Mill will be evaluated by the RSO. This evaluation will result in an investigation by the RSO and a written explanation of the findings. These written records will be maintained at the Mill.

2. Personal monitoring devices will be issued at a minimum quarterly and will be exchanged by the Radiation Safety Department. Missing or lost badges will be reported to management.

3. Female employees that become pregnant and continue to work during the course of their pregnancy will be placed on a monthly personal monitoring device exchange during this period. NRC Regulation Guide 8.13 provides guidelines to be followed during pregnancy and is made part of this procedure.

1.3.2 Records

The Radiation Safety Department will maintain all occupational exposure records in the departmental files:

1. Occupational exposure records are a part of an individual's health record and, as such, will be considered private information.

2. An individual may examine his/her exposure record upon request.

3. An employee terminating his/her employment with Denison Mines (USA) Corp. may request a copy of his/her occupational exposure records.

4. The Radiation Safety Department on the signature of the employee will request prior occupational exposure records.

5. Occupational exposure records will be made available to authorized company or regulatory personnel.

1.3.3 Quality Assurance

Periodic reviews by the RSO and the ALARA audit committee document and ensure quality control and maintenance of conditions ALARA.

1.4 URINALYSIS SURVEYS

1.4.1 Frequency

Urinalyses will be performed on those employees that are a) exposed to airborne yellowcake or involved in maintenance tasks during which yellowcake dust may be produced, or b) routinely exposed to airborne uranium ore dust. Baseline urinalyses will be performed prior to initial work assignments.

Urine samples are collected on a routine basis from mill employees as required in Regulatory Guide 8.22. Urine samples will be collected from employees who have worked in yellowcake packaging, yellowcake precipitation, grind area (SAG mill), ore feed, sample plant, scale house, and the sample preparation room every two weeks during production periods. Samples will be collected from all other employees monthly during production periods. During non-production periods, bi-weekly samples will be collected if individual exposures are expected to exceed 25% of the DAC value otherwise samples will be collected from all employees quarterly. Non-routine urinalyses will usually be performed on employees who have been working on assignments that require a Radiation Work Permit, and always on any individual that may have been exposed to airborne uranium or ore dust concentrations that exceed the 25% of the DAC level.

1.4.2 Specimen Collection

Clean, disposable sample cups with lids will be provided to each employee that will be required to submit a urine specimen. The containers will be picked up at the administration building before the individual enters the Restricted Area.

The container, filled with specimen, will be returned to the bioassay laboratory prior to reporting to work. The name of the employee and the date of collection will be indicated on the specimen cup.

A valid sample must be collected at least 40 hours, but not more than 96 hours, after the most recent occupancy of the employee's work area (after two days, but not more than four days off).

The specimen should be collected prior to reporting to the individual's work location. To prevent contamination, the hands should be carefully washed prior to voiding.

Under unusual circumstances where specimens cannot be collected in this manner, the worker will shower immediately prior to voiding.

1.4.3 Sample Preparation

Equipment required:

- 15 ml disposable centrifuge tubes with lids
- 10 ml pipette
- 5 ul pipette
- 10 ul pipette
- Disposable tips for the above pipettes
- Spiking solution – 0.03 or 0.02 g/l of uranium in de-ionized water

After the specimens are received, they will be stored in a refrigerator until they are prepared for analysis.

Sample preparation will be done in an area decontaminated to less than 25 dpm alpha (removable) per 100 cm^2 prior to preparation of samples. All of the equipment that is used in sample preparation will be clean and maintained in such condition.

A log will be prepared and the following information will be kept for each urinalysis performed:

Sample identification number
Name of employee submitting the specimen
Date of sample collection
Date the sample was sent to the laboratory
Date the results were received
Results of the urinalysis in ug/1
Indication of any spike used in ug/1

The centrifuge tubes will be marked with a sample identification number. 10 milliliters of urine will then be pipetted into the centrifuge tube using the pipette device. (To prevent contamination, a new tip must be used for each specimen.) After each step of the procedure, the proper entry must be made in the logbook.

The samples that are to be spiked for quality assurance purposes will then be prepared. The spikes will be introduced into the sample with 5 ul or 10 ul pipettes. A new tip must be used with each spike. With the standard spike solution (0.03 g/l of U), a 5 ul spike will result in a 15 ug/l concentration for the 10 ml sample; the 10 ul spike will give 30 ug/l). The proper entry must be made in the logbook for each sample spiked.

After preparation has been completed, the QA samples are securely packaged as soon as practicable and sent to the contract laboratory for analysis.

The samples that are to be analyzed in-house will be placed in the chemistry laboratory's refrigerator until the analysis can be completed. A copy of the in-house analytical procedure is described in Section 1.4.7.6.

1.4.4 Quality Assurance

To assure reliability and reproducibility of results, at least 25% of the samples that are submitted for analysis will be used for quality assurance purposes. These samples will consist of spikes, duplicates, and blanks (samples collected from individuals known to have no lung or systemic uranium burden).

Spiked samples will be prepared as stated under sample preparation of this procedure.

Duplicates will be identical samples of the same specimen and/or spikes of identical concentrations.

To assure reliability of the in-house analytical procedure, 10% of the samples will be sent to a contractor laboratory for analysis. These samples will contain quality assurance items designed to provide intra-laboratory comparisons.

1.4.5 Analysis

After the samples are collected as outlined in Guide 8.22, they are identified to the lab by collection date and number. Urinalysis results must be completed and reported to the Radiation Safety Department within seven days of the sample collection.

1.4.5.1 Equipment List

1. Specimen collection cups with disposable lids (VWR No. 15708-711 or equivalent)
2. Screw cap, disposable, graduated 15 ml centrifuge tubes (Corning No. 25310 or equivalent)
3. Micro-pipettes 1 each 5, 5 each 10 microliters (Oxford Model 7000 or equivalent)
4. 20 ml Scintillation Vials
5. Disposable micro-pipette tips for micro-pipettes (Oxford No. 910A or equivalent)
6. Lab Oven
7. Hot Plate
8. Fume Hood
9. Ultrasonic Cleaner
10. ICP-MS

11. Forceps with curved tips

1.4.5.2 Reagent List

1. 1% to 2% Nitric Acid
2. Concentrated Nitric Acid
3. Perchloric Acid, Concentrated 70%
4. Wetting Agent
5. 1,000 ug/ml Uranium Stock Solution, certified vendor prepared
6. Dilutions of the above stock solution, replaced bi-annually. Used for QA/QC.
7. Appropriate Cleaning Solution for Ultrasonic Cleaner

Ensure that all reagents used are within their expiration dates listed on each reagent package, if applicable.

1.4.5.3 Premise

A portion of urine is digested in the presence of a strong oxidizer, and the sample is heated at 550 degrees Celsius for ½ hour to destroy all organics and insure proper oxidation state of any uranium present to allow the uranium to solubilize in a dilute matrix mix.

1.4.5.4 Safety Precautions

1 Follow laboratory guidelines when working with acids.

1. Utilize all appropriate PPE.

2. All digestions must be done under a working fume hood.

3. Working with perchloric acid in the presence of organic material can be hazardous. Do not overheat to dryness. Excess nitric acid is required to insure all organic material is destroyed prior to perchloric phase of digestion.

1.4.5.5 Sample Preparation Procedure

1. Compare sample numbering with bioassay result sheet to insure order and eliminate discrepancies.

2. To 20 ml scintillation vials, add 5 mls instrument grade concentrated nitric acid and 1 ml concentrated perchloric acid.

3. Maintaining sample order of left to right, front to back, lowest sample number to highest sample number in the set, add 5 ml to 10 ml of sample to the scintillation vial.

4. Swirl the vial and place on hot plate, again maintaining the above stated sample order. Hot plate should be set to allow sample to cook down for approximately 2 hours prior to perchloric phase of digestion.

5. Cook samples down to perchloric salts. If there is any brown color left in the sample, repeat digestion. It is important that wet ashing of sample is complete to insure oxidation of the uranium.

6. Place the samples in oven at 550°C for at least ½ hour.

7. Remove samples from the oven, allow to cool and add 10 ml of 1% or 2% nitric acid that has 0.2% wetting agent to the samples.

8. Heat the samples to digest salts.

9. Analyze using procedure on the ICP-MS described in section 1.4.7.6.

1.4.5.6 ICP-MS Procedures

Special considerations: Because of the high salt content of the samples, it is necessary to clean the skimmer and sampler cones after each use.

1. Turn the argon on at the tank and set the delivery pressure at 80 pounds per square inch (psi).

2. The ICP-MS is in a continuous standby mode because it is necessary to maintain a vacuum on the detector. To move from the standby mode to the operating mode press the **ON** button.

3. There are two turbo vacuum pumps that need to come up to speed prior to operating the ICP-MS. While waiting for the pumps, purge the interface area with argon by pressing the + and – buttons. The argon light will come on while the argon is purging. It is a good idea to purge at least 3 times.

4. Turn on the exhaust fan and the water supply to the ICP-MS. The water supply has to have a delivery pressure of 70 psi. It may be necessary to change the filters on the water supply in order to achieve sufficient water supply pressure. The ICP-MS will not operate below this pressure.

5. Turn on the computer and enter the Spectro program.

6. Press the **START** button to start the ignition sequence. The ignition step is 60 seconds. At 10 seconds the vacuum pump for the interface starts. If the exhaust fan is not on, the plasma will shut off a few seconds after ignition.

7. After the plasma ignites, the electronics go through a check loop. Avoid any input to the computer during this time.

8. Under the instrument window in the generator parameters turn the pump on and set the nebulizer flow to the appropriate amount determined from previous set up operations.

9. Under Utilities, select the Scan Manager window. From this window, select the time scan that has previously been set up for your operation.

10. Using the instrument settings, adjust or verify that the Rh line is about 3×10^5 counts. Close and exit Scan Manager.

11. Under Measure, select Quantitative and then Bioanalysis.

12. After entering this window under Function, select Standardize Method and follow prompts. After verifying standardization values are close to previous operation, begin sample analysis.

13. Because of the nature of the sample, it is necessary to aspirate a blank in between each sample. After 5 to 7 samples, the blank needs to be aspirated for a sufficient time to clean the salt build up.

14. To begin sample analysis, press F2 or click the Start button at the bottom left side of the window. Record the value and move to the next sample.

15. After the last sample, exit window and aspirate the blank long enough to clean the lines and chambers.

16. Allow the pump to run long enough without aqueous uptake to void all lines and chambers.

17. Turn the pump off and relax lines off of pump.

18. Push the STOP button to go back to the standby mode.

19. After 5 to 10 minutes turn off the water supply, exhaust fan and argon.

All bioassay samples need to be analyzed three (3) working days from receipt in the laboratory. Samples are extremely susceptible to contamination. Precautions should be taken to minimize traffic and fugitive dust while samples are digesting.

Volume additions are made with an auto-pipette for which the calibration has been checked.

1.4.6 Reporting and Corrective Actions

As soon as the analytical results are received, they are entered in the logbook and the entries are checked for correctness and completeness.

The lab report is returned to the Radiation Safety Department with results reported as micrograms/liter of uranium. The information must be placed in the individual employee's exposure file and maintained as directed by the DRC.

The Radiation Safety Department is notified immediately of any sample with a concentration greater than 35 micrograms/liter of uranium. Corrective actions will be taken when the urinary uranium concentration falls within the limits listed in Table 1 (attached).

The Radiation Safety Department should compute the error on the control spiked samples and advise the lab if the results are more than ± 30% of the known values. If any of the results obtained for the quality assurance control samples are in error by a ± 30%, the analysis must be repeated.

1.5 IN-VIVO MONITORING

In-vivo body counting for lung burdens of U-natural and U-235 will not be routinely conducted. Monitoring will be conducted at the discretion of the RSO in consultation with DUSA management should potential exposure to an individual warrant.

Table 1

CORRECTIVE ACTIONS BASED ON MONTHLY URINARY URANIUM RESULTS[a]

Urinary Uranium Concentration	Interpretation	Actions
Less than 15 μg/L	Uranium confinement and air sampling programs are indicated to be adequate.[b]	None. Continue to review further bioassay results.
15 to 35 μg/L	Uranium confinement and air sampling may not provide an adequate margin of safety.[b]	1. Confirm results (repeat urinalysis). 2. Identify the cause of elevated urinary uranium and initiate additional control measures if the result is confirmed. 3. Examine air sampling data to determine the source and concentration of intake. If air sampling results are anomalous, investigate sampling procedures. Make corrections if necessary. 4. Determine whether other workers could have been exposed and perform bioassay measurements for them. 5. Consider work assignment limitations until the worker's urinary uranium concentration falls below 15 μg/L. 6. Improve uranium confinement controls or respiratory protection program as investigation indicates.
Greater than 35 μg/L	Uranium confinement and perhaps air sampling programs are not acceptable.[c]	1. Take the actions given above. 2. Continue operations only if it is virtually certain than no other worker will exceed a urinary uranium concentration of 35 μg/L. 3. Establish work restrictions for affected employees or increase uranium confinement controls if ore dust or high-temperature-dried yellowcake are involved. 4. Analyze bioassay samples weekly.
Confirmed to be greater than 35 μg/L for two consecutive specimens, confirmed to be greater than 130 μg/L for any single specimen, or air sampling indication of more than a quarterly limit of intake	Worker may have exceeded regulatory limit on intake.	1. Take the actions given above. 2. Have urine specimen tested for albuminuria. 3. Obtain an in vivo count if worker may have been exposed to Class Y material or ore dust. 4. Evaluate exposures. 5. Establish further uranium confinement controls or respiratory protection requirements as indicated. 6. Consider continued work restrictions on affected employees until urinary concentrations are below 15 μg/L and laboratory tests for albuminuria are negative.

[a]Use Figures 1-3 to adjust action levels for other frequencies of bioassay sampling. The model used in NUREG-0874 (Ref. 1) employs fractional composition values (F_1, F_2, F_3) for Class D, Class W, and Class Y components of yellowcake compounds. The assigned values in NUREG-0874 are based on data from available literature. The use of alternative values of F_1, F_2, and F_3 specific for a particular operation are acceptable provided (1) details regarding their determination are described and mentioned in employee exposure records (see paragraph 20.401(c)(1) of 10 CFR Part 20) and (2) the model as published in NUREG-0874 is then used in the determination of alternative urinalysis frequencies and action levels.

[b]However, if a person is exposed to uranium ore dust or other material of Class W or Y alone, refer to Section 6 of NUREG-0874 about the possibility of the need for conducting in vivo lung counts on selected personnel or about using alternative urine sampling times and associated action levels computed using NUREG-0874.

[c]Unless the result was anticipated and caused by conditions already corrected.

2.0 RADIATION MONITORING – AREA

2.1 HIGH VOLUME AIRBORNE AREA AIR SAMPLING

Area air sampling involves passing a representative sample of air through a filter paper disc via an air pump for the purpose of determining the concentration of uranium in breathing air at that location. Although the process is only measuring airborne concentrations at a specific place and at a specific time, the results can often be used to represent average concentration in a general area. A high volume sampler or similar high volume pump will be used for this purpose. Samples will be analyzed as per standard gross alpha analysis procedures using a sensitive alpha detector.

2.1.1 Equipment

Monitoring equipment will be capable of obtaining an air sample flow rate of 40 lpm or greater for one hour or longer. A variety of equipment may be used for area air sampling, however normally the equipment used is an Eberline RAS-1, Scientific Industries Model H25004, or equivalent. Filter media will have a maximum of 0.8 micron pore diameter. Equipment is calibrated prior to each usage as per Section 3.6 of this manual.

2.1.2 Frequency/Locations

Area uranium dust monitoring frequency is monthly for the locations shown in Table 2.1.2-1.

Table 2.1.2-1
Airborne Radiation Sample Locations

Code	Location/Description
BA1	Ore Scalehouse
BA2	Ore Storage
BA7	SAG Mill Area
BA7A	SAG Mill Control Room (radon only)
BA8	Leach Tank Area
BA9	Washing Circuit CCD Thickness
BA10	Solvent Extraction Building/Stripping Section
BA11	Solvent Extraction Building/Control Room
BA12	Yellowcake Precipitation & West Storage Area
BA12A	North Yellowcake Dryer Enclosure
BA12B	South Yellowcake Dryer Enclosure
BA13	Yellowcake Drying & Packaging Area
BA13A	Yellowcake Packaging Enclosure
BA14	Packaged Yellowcake Storage Room

Code	Location/Description
BA15	Metallurgical Laboratory Sample Preparation Room
BA16	Lunch Room Area (New Training Room)
BA17	Change Room
BA18	Administrative Building
BA19	Warehouse
BA20	Maintenance Shop
BA21	Boiler
BA22	Vanadium Panel
BA22A	Vanadium Dryer
BA23	Filter Belt/Rotary Dryer
BA24	Tails
BA25	Central Control Room
BA26	Shifter's Office
BA27	Operator's Lunch Room
BA28	Dump Station
BA29	Filter Press
BA30	Truck Shop

Areas BA-10 and BA-12 are soluble uranium exposure areas. These areas are areas where the uranium compounds that are produced are soluble in lung fluids and are comparatively quickly eliminated from the body. All the other areas are insoluble exposure areas. Insoluble uranium areas are areas where the uranium compounds are not readily soluble in lung fluids and are retained by the body to a higher degree. Temperature of drying operations has a significant impact on solubility of uranium compounds. High drying temperatures produce insoluble uranium compounds. Area uranium dust monitoring, during production periods, is weekly in the designated yellowcake production areas. Monitoring increases to weekly in other monitored areas with the observance of levels exceeding 25% of 10 CFR 20 limits and reverts to monthly upon a continued observance of levels below 25% of 10 CFR 20 limits as determined by the RSO.

The RSO will designate those areas involved in area monitoring during non-production periods. Non-production period monitoring becomes effective one month following the cessation of production.

Annually, the licensee shall collect, during mill operations, a set of air samples covering eight hours of sampling, at a high collection flow rate (i.e., greater than or equal to 40 liters per minute), in routinely or frequently occupied areas of the mill. These samples shall be analyzed for gross alpha. In addition, with each change in mill feed material or at least annually, the licensee shall analyze the mill feed of production product for U-Nat, Ra-226 and PB-210 and use the analysis and results to assess the fundamental constituent composition of air sample particulates.

2.1.3 Sampling Procedures

1. A RAS-1 or similar high volume pump shall be used for area grab sampling. Insure the pump has been recently calibrated within the past month.

2. The locations selected for area air samples should be representative of exposures to employees working in the area.

3. For routine sampling, the sampling period should be for a minimum collection duration of 60 minutes at a flow of 40 lpm or greater.

4. Insert a clean filter into the filter holder on the sampler. Note start time of pump and record unusual mill operating conditions if they exist.

    A. Stop sample collection and note time. Normally, an automatic timer is connected to the sampler and a 1 hour sample collection time is used.

6. Remove the filter from the sampler and place in a clean glassine envelope or the package supplied by the manufacturer for delivery to the Radiation Department.

7. Count the sample by gross alpha counting techniques and enter the result and sampling information into the record.

2.1.4 Calculations

Perform calculations as specified in Section 4.0.

2.1.5 Records

Logs of all samples taken are filed in the Radiation Safety Officer's files. Data is utilized to calculate radiation exposures as specified in Section 4.0.

2.1.6 Quality Assurance

Calibration checks on each air sampler are made at least monthly to ensure accurate airflow volumes are being collected. Usage of tweezers and new filter storage containers minimizes contamination potential. Field logging of data during sampling and logging of identifying data on sampled filter containers minimizes sample transposition. Samples may periodically be submitted for chemical analysis and a comparison of these results to the radiometric measurements will be made.

Review of data by the RSO and by the ALARA audit committee further assure quality maintenance.

2.2 RADON PROGENY

2.2.1 Definitions

Working Level:

A. The exposure to 1.3E + 05 MEV of alpha energy or the potential alpha energy in one liter of standard air containing 100 pCi each of RaA (Polonium-218), RaB (Lead-214), RaC (Bismuth-214), and RaC prime (Polonium-214). (Exposure level, not a dose rate)

Kusnetz Method: Method of radon progeny measurement and calculation based upon a 10 liter sample and at least 40 minutes decay time before counting.

2.2.2 Equipment

The equipment utilized consists of the following, or appropriate equivalents:

- Portable personal sampler
- Gelman 25 mm filter holder with end cap
- Gelman Type A/E 25 mm diameter glass fiber filters
- Counter-Scaler – Eberline MS-3 with SPA-1 probe

2.2.3 Frequency/Location

Radon progeny samples are obtained monthly at those locations included for area particulate uranium monitoring during production periods. Monitoring is increased to weekly upon observance of levels exceeding 25% of 10 CFR 20 limits. Monitoring is reduced to monthly upon the continued observance of levels below 25% of 10 CFR 20 limits. During non-production periods, monitoring is done monthly for only those locations occupied by personnel where exposures may have the potential of exceeding 25% of 10 CFR 20 limits. The RSO shall so designate those areas to be monitored during non-production periods.

2.2.4 Procedures

The procedures to be utilized are as follows:

1. Assemble filter trains.

2. Ensure pump batteries are fully charged.

3. Calibrate pump (see Section 3.5).

4. Attached filter trains at sample locations; disconnect end plug.

5. Collect sample in the breathing zone of the employee.

6. Collect sample for five minutes at 4.0 lpm.

7. Log sample site, time started, time stopped, and filter pump number prior to leaving each site on the field log notebook.

8. Samples are counted between 40 minutes and 90 minutes after collection using sensitive alpha detector.

9. Check the calibration and function check information to ensure the detector is calibrated and operating.

10. If the calibration check correlates, proceed with sample analysis.

11. Radon progeny samples are normally counted for three minutes, however any sample count time may be selected for counting.

12. Run background detector count prior to running sampled filters.

13. After counting, calculate working levels.

Equation:

$$\frac{(\text{CPM - BKg})}{(\alpha\text{eff})\ (\text{20 liters})\ (\text{Time Factor})} = \text{W.L.}$$

Where:

CPM - sample count per minute
BKg - counter-detector background count per minute
α Efficiency - :The efficiency of the counting system (See Section 3.2.3.3)
Time Factor - Values determined from Kusnetz method (See attached Table 2.2.4-1)
W.L. - Working Levels

TABLE 2.2.4-1
Time Factors

Min.	Factor	Min.	Factor
40	150	71	89
41	148	72	87
42	146	73	85
44	142	75	83
45	140	76	82
46	138	77	81
47	136	78	78
48	134	79	76
49	132	80	75
50	130	81	74
51	128	82	73
52	126	83	71
53	124	84	69
54	122	85	68
55	120	86	66
56	118	87	65
57	116	88	63
58	114	89	61
59	112	90	60
60	110		
61	108		
62	106		
63	104		
64	102		
65	100		
66	98		
67	96		
68	94		
69	92		
70	90		

2.2.5 Exposure Calculations

The personnel exposure calculations are a job-weighted average of those areas and concentrations that an individual is exposed to. The procedure is:

1. Determine areas and durations (hrs.) each individual worked during the period (month and quarter).

2. Determine monitored concentrations (W.L.) for each area so noted.

3. The multiplication of the hours worked in each area by the area concentration (W.L.) noted is added to the result for each area involved in the period.

4. The result is the Working Level Hours exposed (WLH) for the period.

5. The working level hours (WLH) divided by 173 (30 CFR 57.5-40 note); or hours per month gives the working level months (WLM) exposure. (The limit is 4 working level months exposure per year.)

6. If calculated per quarter, the working level hours summed for the quarter are divided by 519 (173 X 3) to obtain the working level quarter exposure.

See Section 4.0 for details on how to perform exposure calculations and maintain the exposure records.

2.2.6 Records

Data records, which are filed in the Radiation Safety files, include:

1. Sample location
2. Date and time of sample
3. Time on and off of sample pump
4. Counts per minute of sample
5. Elapsed time after sampling
6. Background detector count
7. Appropriate Kusnetz time factor
8. Working level
9. Sampler identification

Employee exposure records include:

1. Month monitored
2. Areas and duration worked
3. Employee identification
4. Concentrations (W.L.) observed
5. Calculated WLMs

2.2.7 Quality Assurance

Calibration checks each month assure proper calibration of the counting equipment. Documented semi-annual calibrations of the counting equipment using certified alpha calibration and pulse meter sources ensure proper calibration of the equipment over the anticipated ranges. The air sampling system has documented calibration prior to each use, ensuring sampling the appropriate air volumes. Duplicate counts of select data may be counted to assure instrument precision. Field documentation is maintained for each sample during monitoring. This methodology provides assurance in data quality.

Review of data by the RSO and the ALARA audit committee further assures quality maintenance.

2.3 ALPHA SURVEYS

2.3.1 Equipment

Equipment to be utilized in area alpha surveys are shown in Appendix 1. Pre-use function checks will be performed on all radiation survey equipment as specified in Section 3.1.2.3.2.

2.3.2 Frequency/Locations

Fixed and removable alpha surveys are made at those general locations on the Table 2.3.2-1, "Alpha Area Survey Locations." Surveys are completed weekly during production periods. During non-production periods, only those areas designated by the RSO as authorized lunchroom/break areas are monitored.

Table 2.3.2-1
White Mesa Mill
Alpha Area Survey Locations

Scale House Table
Warehouse Office Desks
Maintenance Office Desks
Change Room Lunch Tables
Maintenance Lunchroom Tables
Mill Office Lunchroom Tables
Metallurgical Laboratory Desks
Chemical Laboratory Desks
Administrative Break Room Counter
Administrative Office Desks

2.3.3 Procedures

2.3.3.1 *Respirators*

Respirators are monitored utilizing a sensitive alpha meter such as a Ludlum Model 3 meter with a 43-2 detector or other equivalent radiological instruments. As an example, the 43-2 detector's active surface area is 11.6 square centimeters. Metered readings are adjusted from x dpm per 11.6 square centimeters to y dpm per 100 square centimeters. Each cleaned respirator is monitored inside the face seal with the detector located ¼ inch from the respirator surface. Readings exceeding 100 dpm/100 square centimeters result in re-cleaning or discarding of the respirator. Respirator cleaning and monitoring is a function of the Radiation Safety staff assigned to this duty. The detector's surface and performance is checked prior to each use period.

2.3.3.2 *Fixed Alpha Surveys*

Alpha surveys for fixed alpha contamination are performed using a variety of alpha detecting instruments, as listed in Appendix 1. Each instrument is checked using a calibrated alpha source for proper function and operation prior to use, as described in Section 3.1.2.3.2.

Adjustments to the surface area being measured must be made to convert from the particular detector's surface area to the commonly used surface area of 100 square centimeters. Therefore when converting a measurement to the commonly used unit of dpm/100cm^2, a multiplying area factor must be applied to the measurement. For the Ludlum instrument with a 43-1 detector of 75 cm^2 surface, multiply the value by 1.33 (i.e. 100cm^2 divided by 75cm^2). For an ESP-1 with a detector surface of 59cm^2, multiply the measured value by 1.70, again the 100cm^2 divided by 59cm^2 for the detector's surface area.

The procedures are:

1. Turn the meter on and check the meter battery condition.

2. Check alpha detector mylar surface for pinholes, etc. Replace if necessary and repeat calibration.

3. As specified in Section 3.1.2.3.2, perform a function calibration check using calibrated alpha source.

4. If check is acceptable, proceed with monitoring.

5. At each designated site, monitor designated surfaces, table tops, etc., holding within ¼ inch of the surface.

6. Record data, location, cpm/cm^2 monitored on data sheet.

7. At the conclusion of the survey, transpose results to the file log, correcting to dpm/100 cm^2, using correction for detector's surface area and cpm/dpm conversion factor.

2.3.3.3 *Removable Alpha Surveys*

The Ludlum Model 2200 scaler with 43-17 detector, or a variety of other sensitive alpha detection instruments such as Model 2929 or equivalent, counts wipe samples collected during removable alpha surveys. Glass fiber filters, sized to fit the detector sample slot, are utilized as the wipe medium. A template having a 100 square centimeter surface area maybe used to standardize the surface area wiped.

The procedure is:

1. Perform function check calibration of the scaler/detector. Ensure that this measurement is within ± 10% of the value obtained from the calibration laboratory.

2. If so proceed with the survey and counting.

3. Obtain clean filters and clean envelopes for filter storage.

4. At a location to be surveyed, remove the filter from the envelope and wipe the surface covering approximately 100cm^2. This is easily accomplished by making a "S" shaped smear for approximately 10 inches using normal swipes (approximately 2.5 cm diameter).

5. Record on envelope the date and location of the sample.

6. Upon returning to counting lab, place an unused filter in the counting unit for at least 1 minute and obtain a background count rate.

7. Repeat procedure for each used filter, extracting filter from envelope, immediately prior to counting, using tweezers and placing in the detector slot with the wiped surface facing the detector, and count for at least 1 minute.

8. Convert results from cpm/filter to dpm/filter (100 cm^2 wiped) after subtracting the blank background count.

9. Record on the alpha survey form the following information:

   A. Sample location and conditions
   B. Sample date
   C. Sampler identification
   D. Wipe count dpm/100 cm^2

10. Discard the filters and envelopes

2.3.4 Action Limits

2.3.4.1 *Respirators*

Levels greater than 100 dpm/100 cm squared require re-cleaning or discarding of a respirator.

2.3.4.2 *Fixed Alpha Surveys*

Levels greater than 1,000 dpm/100 cm squared require remedial action by management. ALARA criterion ensures that the RSO takes action where necessary to maintain levels as low as reasonably achievable.

2.3.4.3 *Removable Alpha Surveys*

Levels greater than 1,000 dpm/100 cm squared require remedial action and decontamination. ALARA criteria ensures that the RSO takes action where necessary to maintain levels as low as reasonably achievable.

2.3.5 Records

Records of fixed and removable alpha surveys are maintained in the Radiation Safety office files. Records include:

1. Sample location/conditions
2. Sample date
3. Sampler identification
4. Fixed alpha determination – dpm/100 cm^2
5. Removable alpha determination – dpm/100 cm^2
6. Remedial action taken, where necessary

2.3.6 Quality Assurance

Calibration function checks of detector performance and visual observation of detector surfaces prior to each survey ensures counting reliability and consistency. Usage of clean containers and tweezers minimizes contamination of wipe samples. Field logs of sample I.D.'s on sample containers minimizes transposition of samples. Data review by the RSO and by the Audit Committee further assures quality maintenance.

2.4 BETA-GAMMA SURVEYS

2.4.1 Equipment

Beta/Gamma surveying instruments used for beta-gamma surveys are listed in Appendix 1 and the sources used are listed in Appendix 2.

Some instruments read directly in MREM/hour while others read in CPM (with a conversion to MREM/hour). The model 44-6 detector has a removable beta shield allowing discrimination between beta and gamma contributions. Each instrument has a manufactures user's manual which describes the function, use and capability of each instrument. These manuals must be understood before surveying proceeds. Calibration of Beta/Gamma and functional checks are performed using calibrated CS-137 or SR-Y 90 sources

2.4.2 Frequency/Locations

The sites noted on Table 2.4.2-1 are monitored on a monthly basis by of the Radiation Safety staff during production periods. During non-production periods, only areas routinely occupied by personnel are monitored as designated by the RSO.

Table 2.4.2-1
Beta-gamma Survey Locations

Identification Number	Description of Possible Source of Area of Exposure	Distance from Source in cm
WM-1	Mill Feed Hopper & Transfer Chute	1
WM-2	SAG Mill Intake-Feed Chute	1
WM-3	Screens-Area Floor Between Screen	1
WM-4	Leach Operator's Desk	1
WM-5	Leach Tank Vent #3	1
WM-6	Leach Tank #3 – Wall	1
WM-7	CCD Thickeners	1
WM-8	Pumphouse Tailings Discharge	1
WM-9	Oxidant Makeup Room-Sump Pump	1
WM-10	Shift Foreman's Office-Work Desk	1

Identification Number	Description of Possible Source of Area of Exposure	Distance from Source in cm
WM-11	SX Operator's Area	1
WM-12	Precipitation Tanks #1 Tank; Wall	1
WM-13	Precipitation Section "Lab Bench"	1
WM-14	Precipitation Vent	1
WM-15	Yellowcake Thickener #1; Wall	1
WM-16	Centrifuge Discharge-Chute Wall	1
WM-17	Yellowcake Thickener #2; Wall	1
WM-18	Yellowcake Packaging Room	1
WM-19	Yellowcake Dryer	1
WM-20	Yellowcake Dust Collector	1
WM-21	SX Uranium Mixer #1 Extractor	1
WM-22	SX Uranium Mixer #1 Stripping	1
WM-23	SX Vanadium Mixer #1 Stripping	1
WM-24	Vanadium Dryer	1
WM-25	Mill Laboratory Fume Hood	1
WM-26	Chemical Laboratory Work Area	1
WM-27	Metallurgical Laboratory Work Area	1
WM-28	Lunchroom Eating Area	1
WM-29	Lunchroom Wash Area	1
WM-30	Maintenance Shop – Work Area	1
WM-31	Maintenance Shop – Rubber Coating	1
WM-32	Tailings Impoundment Discharge	1
WM-33	Tailings Impoundment Dike 1	1
WM-34	Tailings Impoundment Dike 2	1
WM-35	Tailings Impoundment Dike 3	1
WM-36	Scalehouse	1
WM-37	Tailings Impoundment Dike 4	1

2.4.3 Procedures

The monitoring procedures are:

1. Check meter battery condition.

2. Check detector using a check source.

3. If the calibration function check indicates that the instrument is operating within calibration specifications, proceed with monitoring.

4. Survey each designated location on Table 2.4.2-1 and record in the field log:

   A. Site location/condition
   B. Date
   C. Instrument used

D. Sampler's initials
E. Meter reading (beta + gamma)
F. Meter reading (gamma)

5. Upon returning to the office, record the mr/hr reading into a permanent file which is maintained for beta-gamma exposure evaluation.

2.4.4 Action Levels

The ALARA concept is utilized in action levels. Responses include operative cleaning of the area or isolation of the source. The Radiation Safety Department will ensure levels ALARA.

2.4.5 Records

Records maintained in the Radiation Safety office files include:

1. Date monitored
2. Site location/condition
3. Instrument used
4. Sampler's initials
5. Beta/Gamma level, mr/hr
6. Remedial action taken, if necessary

2.4.6 Quality Assurance

Quality of data is maintained with routine calibration and individual function checks of meter performance. Personnel utilizing equipment are trained in its usage. Records of the operational checks and calibrations are maintained in the files. The RSO routinely reviews the data and the ALARA audit committee periodically analyzes the performance of the management of the monitoring and administrative programs.

2.5 EXTERNAL GAMMA MONITORING

External gamma area monitoring is conducted at various locations around the Mill site in order to provide Radiation Safety Staff with area-specific gamma measurements. The procedures applicable to such monitoring are set out in Section 4.3 of the Mill's Environmental Protection Manual.

2.6 EQUIPMENT RELEASE SURVEYS

2.6.1 Policy

Materials leaving a Restricted Area going to unrestricted areas for usage must meet requirements of NRC guidance for "Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use" (dated May 1987).

All material originating within the restricted area will be considered contaminated until checked by the Radiation Safety Department. All managers who desire to ship or release material from the facility will inform the RSO of their desires. The RSO has the authority to deny release of materials exceeding NRC guidance for "Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use" (dated May, 1987). No equipment or materials will be released without documented release by the RSO or his designee.

2.6.2 Limits

The release limits for unrestricted use of equipment and materials is contained in the NRC guidance listed above in Section 2.6.1 and are summarized as follows:

Limits for Alpha emissions for U-Nat and its daughter products are:

Average	5,000 dpm/100 cm^2
Maximum	15,000 dpm/100 cm^2
Removable	1,000 dpm/100 cm^2

Limits for Beta-gamma emissions (measured at a distance of one centimeter) for Beta/Gamma emitting radioisotopes are:

Average	0.2 mr/hr or 5,000 dpm/100 cm^2
Maximum	1.0 mr/hr or 15,000 dpm/100 cm^2

2.6.3 Equipment

Radiological survey instruments are listed in Appendix 1.

2.6.4 Procedures

Upon notification that materials are requested for release, the Radiation Safety Department shall inspect and survey the material. Surveys include fixed and removable alpha surveys and beta-gamma surveys. An equipment inspection and release form is to be prepared and signed by the RSO or his designee. Any material released from the mill will be accompanied with the appropriate release form. If contamination exceeds levels found in NRC guidance "Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use", dated May, 1987, then decontamination must proceed at the direction of the RSO. If the material cannot be decontaminated, then it will not be released.

2.6.5 Records

Documented records for each released item are filed in the Radiation Safety Department files.

2.6.6 Quality Assurance

The RSO and the ALARA Audit Committee periodically review the policy and documented release forms to ensure policy and regulatory compliance.

2.7 PRODUCT SHIPMENT SURVEYS

2.7.1 Policy

The Radiation Safety Department, prior to shipment release, will survey product shipments from the facility. Product shipments include uranium concentrate and solid vanadium products.

The Radiation Safety Department is to be notified in advance of each shipment. The shipment will not be released prior to the Radiation Safety Department's authorization.

2.7.2 Equipment

Equipment used for product shipment surveys is the same as equipment used for material release surveys and is listed in Appendices 1 and 2.

2.7.3 Frequency

All barrels are fixed alpha and gamma scanned prior to shipment. A minimum of 25 percent of the barrels consigned are also wipe tested.

2.7.4 Solid Vanadium Shipments

The procedure to be followed for solid vanadium shipments were detailed in the Radiation Safety Manual in Section 2.7.4. These procedures have been replaced with procedures No.: PBL-15 Book 10 Dated March 9, 2004 "Release and Shipping of Vanadium Blackflake".

2.7.5 Uranium Concentrate Shipments

The procedures for exclusive use uranium concentrate shipments are:

1. Inspect each product barrel that makes up the consigned shipment for leaks, holes in the barrels, cleanliness, etc.

2. Barrels requiring repair shall be repaired prior to the radiation survey.

3. Perform a fixed alpha survey of each barrel. The release limits for fixed alpha radiation contamination is an average of 5,000 dpm/100 cm^2 and a maximum of 15,000 dpm/100 cm^2. Any barrel that exceeds 1,000 dpm/100 cm^2 fixed alpha contamination requires a removable alpha smear/wipe test to be performed.

Perform a removable alpha survey of each barrel exceeding 1,000 dpm/100 cm^2 fixed alpha contamination. The release limit for removable alpha radiation contamination is 1,000 dpm/100 cm^2. Perform a smear/wipe test and analyze filters for removable alpha on 25% of the barrels at a minimum, and perform a smear/wipe test and analyze

2.7.6 Records

The attached form serves as a record of shipment and is retained in the Radiation Safety files.

2.7.7 Quality Assurance

Periodic reviews of transport forms and policies by the RSO and the ALARA Audit Committee ensures quality assurance for product shipment surveys.

White Mesa Mill
Radiation Monitoring
Area Airborne Sampling Location's Field Sheet

Month: **Sampled By:**

Filter Id.	Location/Description	Pump #	Date	Time On	Time Off	Total Sample Time in Minutes	Volume in L/Min.	Total Volume
1	Scalehouse						40	
2	Ore Storage						40	
6	Sample Plant						40	
7	SAG Mill						40	
7A	SAG Mill Control Room						40	
8	Leaching Tank Area						40	
9	CCD Circuit Thickeners						40	
10	SX Building North						40	
11	SX Building South						40	
12	YC Precipitation Area						40	
12A	N. YC Dryer Enclosure						40	
12B	S. YC Dryer Enclosure						40	
13	YC Drying Area						40	
13A	YC Packaging Enclosure						40	
14	Packaged YC Storage Area						40	
15	Bucking Room (Smpl. Prep Rm.)						40	
16	Lunch Room (Training Room)						40	
17	Change Room & Lunch Area						40	
18	Administration Building						40	
19	Warehouse						40	
20	Maintenance Shop						40	
21	Boiler						40	
22	Vanadium Panel						40	
22A	Vanadium Drying Area						40	
23	Vanadium Filter Press Area						40	
24	Tails						40	
25	Central Control Room						40	
26	Shifter's Office						40	
27	Operator's Lunch Room						40	
28	Dump Station						40	
29	Filter Press						40	
30	Truck Shop						40	

Monthly Area Airborne Sampling Field Sheet

Month: November-00 Sampled By:

Filter ID	Location	Air Sampler	Sample Run Time Start	Sample Run Time Stop	Run Time (Min.)	Flow Rate (LPM)	Volume (mL)	Sampled By	Comments

Reviewed by: ____________________

Air Particulate Calculations Summary Sheet

Count Date/Time	Filter ID	Instrument Serial No.	Efficiency	Total Count/Time	CPM	Bkg. Count/Time	Net Count (Tot.-Bkg.)	LLD (uCi/mL)	Concentration uCi/ mL	Percent of DAC	Sample Counted By

$$\text{Concentration } (\mu Ci/cc) = \frac{(\text{Net CPM})}{(2.22\text{ E6})(V)(\text{Eff.d})}$$

$$\text{LLD or MDA} = \frac{2.71+3.29\sqrt{\text{Bkg.}*Ts(1+Ts/Tb)}}{(Ts)(\text{Eff. d})(\text{Eff. f})(FF)(V)(2.22E6)}$$

$$\text{Percent of DAC} = \frac{\text{Actual Concentration}}{\text{DAC}}$$

Ts= Time of Sample
Tb= Background Count Time in Minutes
Eff. d= Detector efficiency in Counts per Disintegration
Eff. f= Filter Efficeincy
V= Total Volume in millilitres of Cubic centimeters
2.22E6 = Factor to convert DPM to uCi
Net CPM = Total Counts - Background Count

Breathing Zone Sampling Field Sheet

Denison Mines (USA) Corp. White Mesa Mill

Month: ____________________ **Sampled By:** ____________________

Filter ID	Location	Date	Run Time (Min.)	Flow Rate (LPM)	Volume (mL)	Sampled By	Comments

Reviewed by: ____________________

Air Particulate Calculations Summary Sheet

Count Date/Time	Filter ID	Instrument Serial No.	Efficiency	Total Count/Time	CPM	Bkg. Count/Time	Net Count (Tot.-Bkg.)	LLD (uCi/mL)	Concentration uCi/ mL	Percent of DAC	Sample Counted By

Concentration (μCi/cc)= $\dfrac{\text{(Net CPM)}}{\text{(2.22 E6)(V)(Eff.d)}}$

LLD or MDA= $\dfrac{2.71+3.29\sqrt{\text{Bkg.*Ts(1+Ts/Tb)}}}{\text{(Ts)(Eff. d)(Eff. f)(FF)(V)(2.22E6)}}$

Percent of DAC= $\dfrac{\text{Actual Concentration}}{\text{DAC}}$

Ts= Time of Sample
Tb= Background Count Time in Minutes
Eff. d= Detector efficiency in Counts per Disintegration
Eff. f = Filter Efficeincy
V= Total Volume in millilitres of Cubic centimeters
2.22E6 = Factor to convert DPM to uCi
Net CPM = Total Counts - Background Count

EXPOSURE TIME SHEET

EMPLOYEE NAME: **COMPANY ID:**

WEEK BEGINNING: **WEEK ENDING:**

AREA	SUN	MON	TUE	WED	THU	FRI	SAT	TOTAL
BA 1 SCALEHOUSE								
BA 2 ORE STORAGE								
BA 7 SAG MILL								
BA 8 LEACH								
BA 9 CCD CIRCUIT								
BA 10 SX BUILDING								
BA 12 YC PRECIP								
BA 12A NORTH YC DRYER ENC								
BA 12B SOUTH YC DRYER ENC								
BA 13 YC PACKAGING								
BA 13A YC PKG ENCLOSURE								
BA 15 BUCKING ROOM								
BA 16 LUNCH ROOM								
BA 17 CHANGE ROOM								
BA 18 ADMINISTRATION BLDG								
BA 19 WAREHOUSE								
BA 20 MAINT SHOP								
BA 21 BOILER								
BA 22 VANADIUM PANEL								
BA 22A VANADIUM DRYER								
BA 23 VANADIUM BELT SCRN								
BA 24 TAILINGS								
BA 25 CONTROL ROOM								
BA 26 MILL OFFICE								
BA 27 OPERATIONS LUNCH RM								
BA 28 DUMP STATION								
BA 29 FILTER PRESS								
BA 31 OXIDATION								

EMPLOYEE SIGNATURE: ______________________ TOTAL__________

White Mesa Mill Weekly Alpha Survey

Date: ______________________

Tech: ______________________

Alpha Survey Instruments

Fixed		Removable	
Model #:	____________	Model #:	____________
Serial #:	____________	Serial #:	____________
Calibration:	____________	Calibration:	____________
Efficiency:	____________	Efficiency:	____________
Factor:	____________	Factor:	____________
Background:	____________	Background	____________
MDA:	____________	MDA:	____________

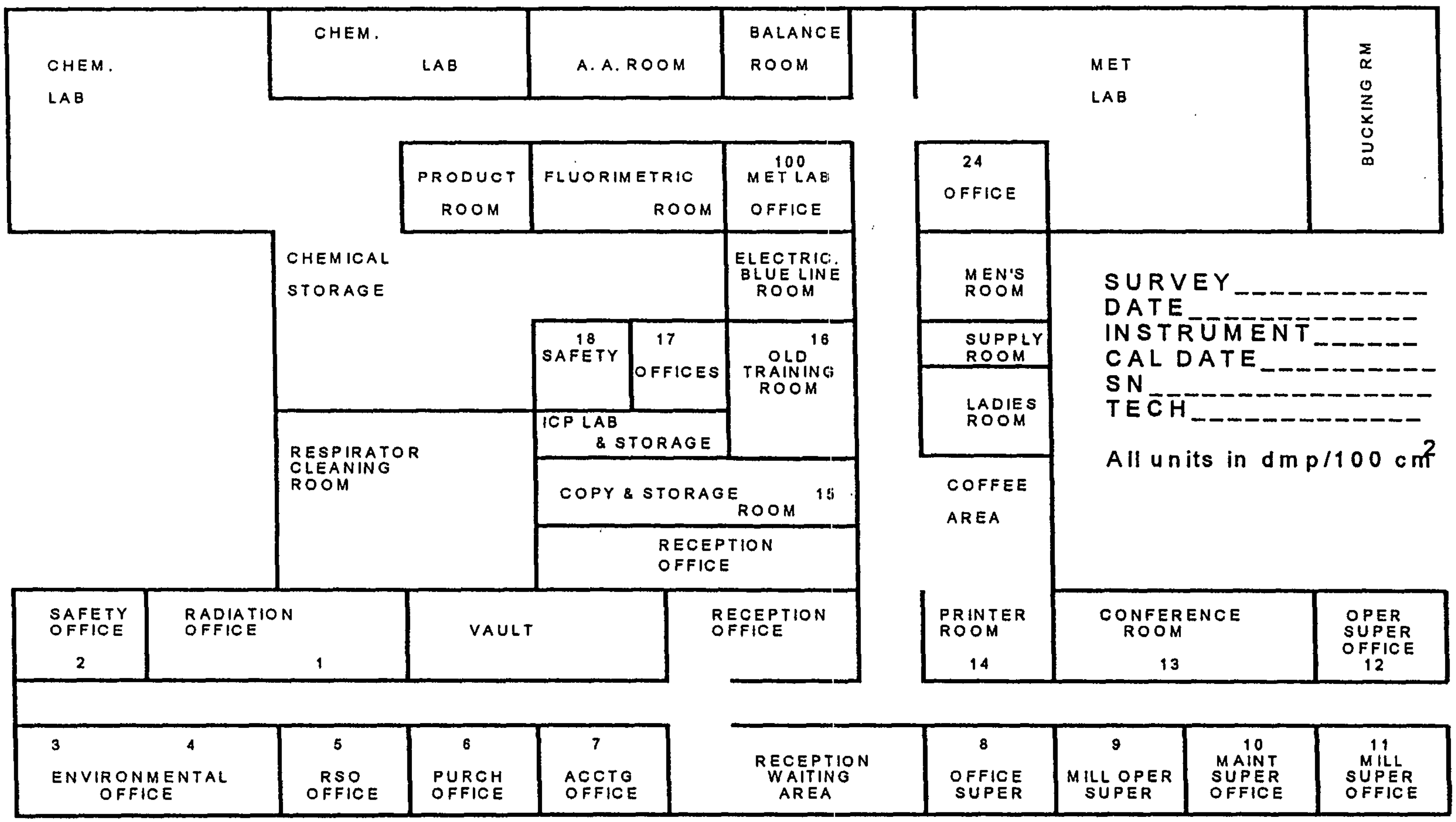
Notes:

*All fixed readings are in DPM/100 cm^2.

T or t = Total or Fixed Alpha Reading in DPM/100 cm^2

R = Removable Alpha Reading per Swipe or Filter (Approximately 100 cm^2)

ADMINISTRATION BUILDING

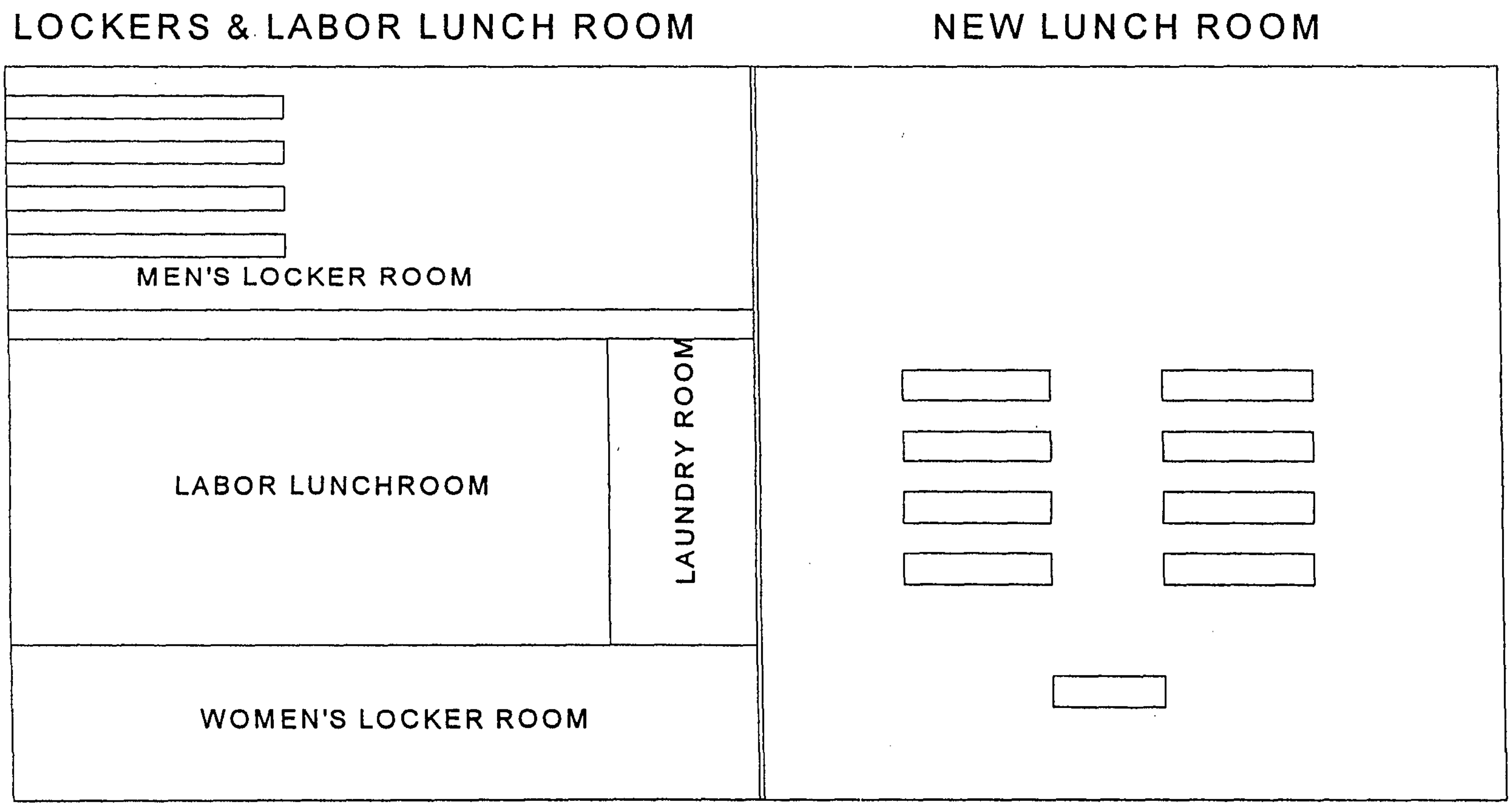


SURVEY___________
DATE_____________
INSTRUMENT______
CAL DATE__________
SN________________
TECH_____________

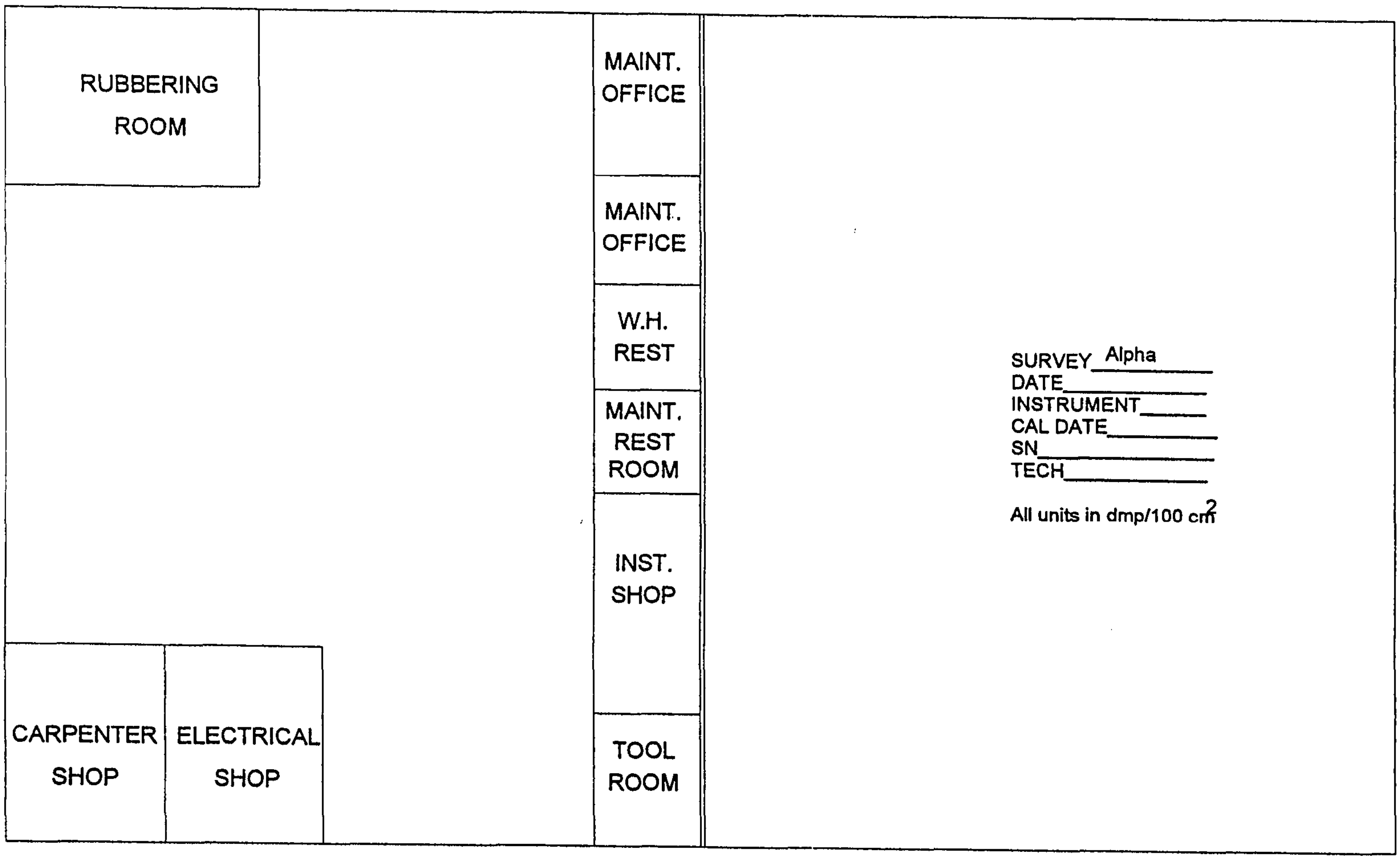
All units in dmp/100 cm^2

SURVEY Alpha
DATE
INSTRUMENT
CAL DATE
SN
TECH

All units in dmp/100 cm^2



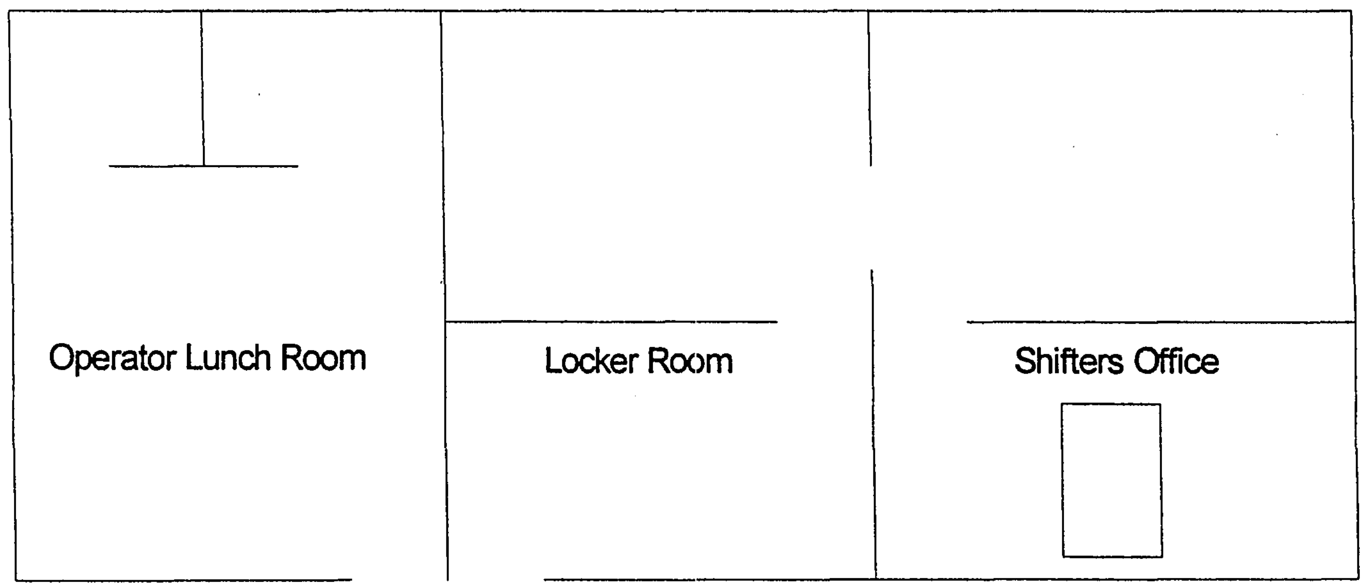
MAINTENANCE AND WAREHOUSE AREAS



SURVEY Alpha
DATE
INSTRUMENT
CAL DATE
SN
TECH

All units in dmp/100 cm^2

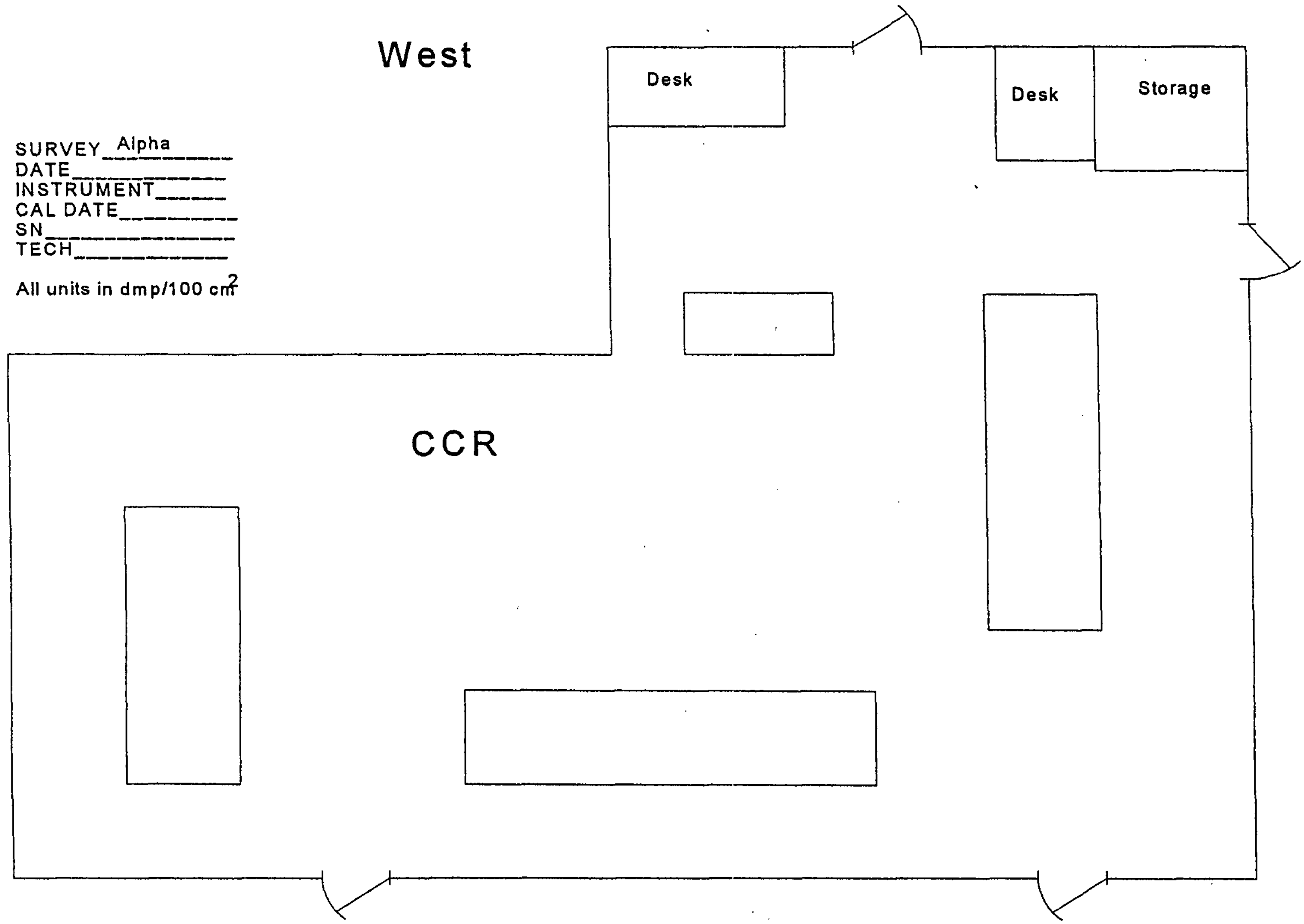
Alpha Survey



West

SURVEY Alpha
DATE
INSTRUMENT
CAL DATE
SN
TECH

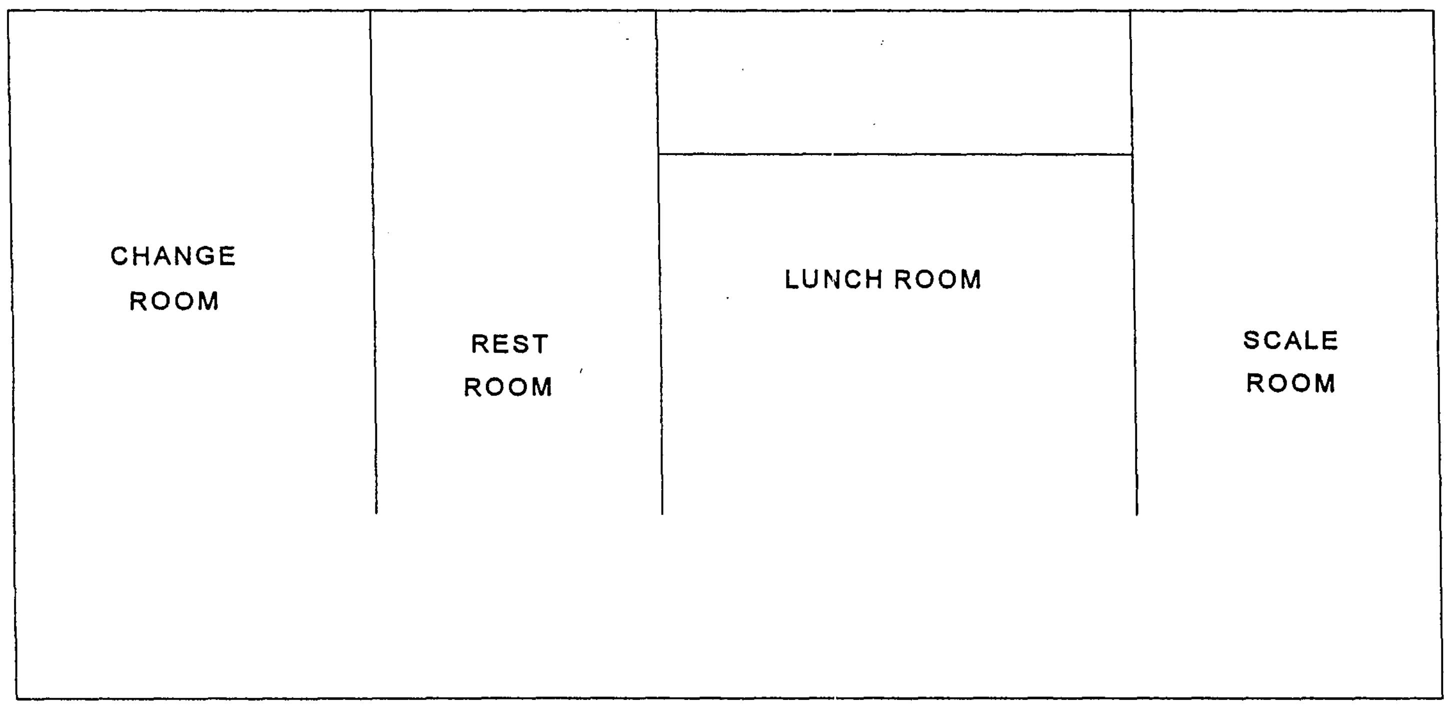
All units in dmp/100 cm^2



SURVEY_Alpha_____
DATE____________
INSTRUMENT______
CAL DATE__________
SN______________
TECH_____________

All units in dmp/100 cm^2

SCALE HOUSE



DENISONMINES

SHIPMENT SURVEY		LOT NO.	
CONTRACT NO.		TRUCK CARRIER	
TRACTOR NO.		TRAILER NO.	

ALPHA SURVEY INSTRUMENTS			
TOTAL		REMOVEABLE	
MODEL NO.		MODEL NO.	
SERIAL NO.		SERIAL NO.	
CALIBRATION		CALIBRATION	
EFFICIENCY		EFFICIENCY	
FACTOR		FACTOR	
ALLOWABLE LIMITS (FIXED) 5,000 DPM AVG. 15,000 DPM MAX (REMOVEABLE) 1,000 DPM			

$$\frac{1.0}{\dfrac{\text{SURFACE AREA OF PROBE}}{100\ \text{cm}^2} \times \dfrac{\text{EFFICIENCY OF INSTRUMENT (\%)}}{100}} = \textbf{FACTOR}$$

$$\frac{\text{(EFFICIENCY/100cm}^2\text{)}}{\text{Factor X counts/minute = Disintegrations/minute/100cm}^2}$$

GAMMA SURVEY (49 CFR 173.441 (b) (1))		
INSTRUMENT NO.		MEASURED IN MILLIREMS/ HOUR (MR/HR)
SERIAL NO.		
CALIBRATION		
TRAILER SURFACE		200 MR/HR ALLOWABLE
SIX FEET DISTANCE		10 MR/HR ALLOWABLE
DRIVERS SEAT		5 MR/HR ALLOWABLE

ALL DRUMS WERE INSPECTED PRIOR TO LOADING. ALL DRUMS WERE TIGHTLY SEALED. NONE LEAKED AND THERE WAS NO LOOSE MATERIAL IN THE VEHICLE.

INSPECTOR SIGNATURE ______________________________ DATE ____________

DATE ____________ LOT NO. ____________________

BACKGROUND ___________ EFFICIENCY FACTOR _______

BARREL NUMBER	FIXED ALPHA DPM/100cm^2	REMOVEABLE	
		CPM	DPM

BARREL NUMBER	FIXED ALPHA DPM/100cm^2	REMOVEABLE	
		CPM	DPM

TRAILER SAMPLE #1

TRAILER SAMPLE #2 (IF NEEDED)

3.0 EQUIPMENT/CALIBRATION

All radiation detection instruments used at the Mill are sent to a qualified independent laboratory for calibration every six months. If necessary, Radiation Safety Staff can use the procedures outlined below to verify calibration.

3.1 Counters/Detectors

3.1.1 General

All radiation detectors require determination of detector optimal voltage performance or plateau operating point. The graph of voltage applied to a detector versus detector response is referred to as a plateau curve. The plateau curve typically has two rapidly sloping sections and a stable, flat region. The optimal operating point is typically located at the beginning of the flat, or flatter, section of the graph. The plateau curve is specific for a particular detector and its accompanying readout, or measuring meter, and may vary over time depending upon electronic component condition.

The equipment used to determine detector plateau curves includes:

1. Appropriate radiation sources
2. Electrostatic voltmeter
3. Radiation detecting instrument
4. Graph paper
5. Manufacturer's technical manual

The procedure is:

1. Ensure instrument batteries are fresh or fully charged, if applicable.

2. Turn the instrument on.

3. Adjust the instrument voltage control starting at voltage of 600 using electrostatic voltmeter to monitor voltage setting.

4. Expose detector to a radiation source applicable to the type of detector and in the appropriate setting.

5. Record voltage and instrument response for each adjustment of voltage applied; increments of 50 volts are adequate.

6. Repeat steps 4 and 5 until instrument response rapidly increases versus voltage level. At this point, the detector is approaching potential differentials across the electrode that may damage the detector.

7. Graph instrument response versus voltage applied.

8. Set equipment high voltage control to the optimum operating point. Record on graph voltage selected.

9. Retain graph with calibration records.

3.1.2 Function Checks

Calibration function checks are required prior to use of radiation detection instruments used at the Mill for the purpose of verifying that the instruments are operating at the same efficiency as when they were calibrated by the calibration laboratory (i.e., within +/-10%). Function checks are also used for verifying repeatability, reliability, and comparability of an instrument's measurements from one period to another. By performing function checks for extended time periods, or on a larger sample size, these goals are met.

Function checks involve two basic elements:

(1) calibration laboratory efficiency is compared to the instrument's efficiency on the date of the function check; and
(2) the function check is verified with a check source having similar isotopic composition as the one that was used by the calibration laboratory to calibrate the instrument.

Function checks are made for all types of radiation survey instruments. The basic principle in performing a function check is measuring the radiation field using a survey instrument against a known amount of radiation from a calibrated source. These measurements are made for the specific type of radiation occurring. For example, when performing a beta/gamma survey, the instrument function check is performed using a beta/gamma check source, such as a (SrY)-90. When performing an alpha survey, use an alpha check source, such as Th-230 or Pu-239 for performing the function check.

Function checks are documented on the Calibration Check Forms (see Attachment A for copies of forms to be used) for each specific instrument. They will be maintained in the instrument's' calibration and maintenance file.

A number of radiation detection instruments are used at the Mill. An Instrument Users Manual for each instrument is maintained in the calibration files, together with calibration documentation. The Users Manuals are to be considered the primary reference for operating a particular instrument. This Standard Operating Procedure (SOP) is not intended to replace the Users Manual, but rather to supplement the Manual by providing steps to be performed for function checks. Before operating an instrument, personnel should read the Users Manual and become familiar with the instrument's operation, capabilities, and special features. Personnel will also receive on the job training on each instrument.

3.1.3 Alpha Monitors

Alpha particles travel very short distances in the air due to their high ionization ability – typically ¼ to ½ inch. Due to this limitation, alpha monitoring must be done at a distance of ¼ inch or less between the detector face and the source. Alpha monitoring, to be consistent, requires ensuring a consistent distance be utilized between the detector face and the source. Alpha detectors read out in counts per minute (cpm). A correlation relationship, known as the efficiency factor, between the meter response and the actual disintegration rate of the source is used to determine actual calibration of the meter.

Radioactivity is measured in curies (Ci), which, by definition, is 3.7×10^{10} disintegrations per second (dps), or 2.2×10^{12} disintegrations per minute (dpm). Another measurement unit is the Becquerel, or one dps. Alpha radiation is usually monitored as dpm, per surface area measured.

Radiation survey equipment used at the Mill for alpha surveys are listed in Appendices 1 and 2.

3.1.3.1 *Calibration and Function Check Frequency*

The frequency of calibration is specified in individual instrument user manuals and manufacturer's specifications.

During production periods, the following frequencies are observed for calibration and function checks of radiation detection instruments:

	Type	Calibration Frequency	Function Checks
1.	Employee scans	6 month	5 days/week
2.	Radon progeny	6 month	each use
3.	Respirator checks	6 month	each use
4.	Area fixed scans	6 month	Daily or each use
5.	Area wipe scans	6 month	Daily or each use

During non-production periods, the following frequencies are observed:

	Type	Calibration Frequency	Function Checks
1.	Employee scans	6 month	bi-monthly
2.	Radon progeny	6 month	each use
3.	Respirator checks	6 month	each use
4.	Area fixed scans	6 month	Daily or each use
5.	Area wipe scans	6 month	Daily or each use

3.1.3.2 *Function Check Procedures – Alpha Counters and Scaler Instruments*

The following steps will be used for function checks for alpha counters and alpha scaler instruments.

1. Turn the instrument on and place a calibrated alpha check source in the detector holder on or the face of the detector.

2. Count the source for 1 minute and record this value in cpm.

3. Repeat step 2 four more times.

4. Average the five readings and divide the average in cpm by the know activity on the alpha source. This is the efficiency of the instrument and detector.

5. Compare this efficiency with the efficiency obtained from the calibration lab. If the efficiency comparison is within ±10% deviation the instrument needs is calibrated if not the instrument needs to be recalibrated.

6. If this efficiency comparison is within ±10% deviation the instrument is in calibration.

7. Proceed with monitoring activities.

3.1.3.3 *Function Check Procedures - ESP-1*

There are special performance considerations when using the Eberline Smart Portable (ESP-1) instrument with an Eberline AC-# alpha detector because the ESP-1 contains a microcomputer to perform its internal calculations. Once the user has adjusted the calibration constant (CC), which is a special feature of the ESP-1, the value obtained during a measurement event will be converted to 100% and displayed as such. Adjusting the CC of the ESP-1 in no way changes the laboratory calibration performed on the instruments. The calibration constant is set to a value of "one" at the laboratory and calibration proceeds as detailed by the manufacturer specifications.

The following steps will be used for function checks for the ESP-1.

1. Turn the instrument on and set the calibration constant (CC) to 1.00. This is the setting the calibration laboratory uses for performing calibration of the instruments.

2. Place a calibrated alpha check source on the face of the detector and count the source for one minute and record this value in cpm.

3. Repeat step 2 four more times.

4. Average the five readings in cpm and divide by the known activity of the alpha check source. Note: use an alpha check source which is the same radioisotope, i.e.) Th-230 or Pu-239 or one of equivalent energy emission for this procedure. The instrument efficiency is now established.

5. Compare the efficiency to the value obtained from the calibration lab. If the efficiency comparison is within ±10% deviation the instrument is calibrated; if not the instrument requires recalibration.

6. Set the calibration constant (CC) to the efficiency value obtained in step 4. For instance if the efficiency value is 20% from step 4 change the CC from 1.00 to 0.20. This setting changes the calibration constant to the efficiency of the detector, by introducing a multiplier into the microprocessor. Then, individual measurements are obtained at a 100% level.

7. Place a calibrated alpha check source on the detector and take five readings. Average the five readings and divide this value by the known activity of the check source. This value should be 100% ±5% of the known activity of the check source. If it is not within this range (100%±5%) readjust the CC (fine tune) slightly and count the source five times and average. Compare the average value to the check source keeping in mind you want to be within 100± 5.0% of the total activity of the check source. Continue this step until that objective is achieved. The instrument is not only in calibration as observed by step 5; it is now functionally capable of measuring at 100% efficiency. Proceed with use.

3.1.3.4 *Calibration Procedures*

All radiation detection instruments used at the Mill are sent to a qualified offsite laboratory every six months for calibration. However, if additional onsite calibration is required the calibration procedures are:

1. Set the detector high voltage at the prior determined operating point using an electrostatic voltmeter.

2. For counter/scalers (radon progeny/wipes), close the detector, without source present, obtain a reading for a set time. This is a background reading.

3. Place a calibrated source for the type of radiation being measured in the source holder and obtain reading.

4. Observe the counts per minute for both the background and the source.

5. Subtract the cpm value of background from the cpm value of the source to obtain the net cpm.

6. Divide the net cpm value by the known dpm of the source. This is the percentage efficiency of the instrument system for this energy source.

7. By dividing 100 by this efficiency, an efficiency factor is obtained.

8. Dpm equals the cpm divided by the efficiency of the instrument detector system:

Note: *1 curie = 2.22 E + 12 dpm*
1 microcurie = 2.22 E + 6 dpm
1 picocurie = 2.22 dpm

3.1.4 Beta-gamma Monitors

Equipment utilized for beta-gamma monitoring is listed in Appendices 1 and 2.

3.1.4.1 *Function Check Procedure*

The following steps will be used for function checks on beta/gamma instruments:

1. Turn the instrument on and place the calibrated beta/gamma (SR-Y)-90 check source on the face of the detector.

2. Let the reading stabilize to a constant value.

3. Record this value in cpm.

4. Divide this value by the known activity on the check source. This is the efficiency of the instrument and detector.

5. Compare this efficiency to the efficiency obtained from the calibration laboratory. If the efficiency comparison is within ±10% deviation the instrument needs is calibrated if not the instrument needs to be recalibrated.

6. If this efficiency comparison is within ±10% deviation the instrument is in calibration.

7. Proceed with monitoring activities.

3.1.4.2 *Calibration*

All beta-gamma survey instruments are sent out every six months for calibration. Additional calibration, if necessary, may be performed on site using techniques described in Reg. Guide 8.30, Appendix C – Beta Calibration of Survey Instruments for calibration performed by a qualified calibration laboratory using the indicated source as listed in Appendix 2.

3.1.5 Gamma Monitors

Instruments for gamma measurements are listed in Appendix 1.

3.1.5.1 *Calibration*

Independent calibration service laboratories perform calibration every six months. Meters are calibrated to Cesium-137 or other radioisotopes as suggested by the calibration laboratory or manufacturer. Most calibration service laboratories calibrate Beta/Gamma instruments electronically in accordance with their standard calibration procedures. However, electronic calibration basically consists of the steps described below:

1. Connect survey instrument to be calibrated to the model 500.

2. Turn both instruments on.

3. Record high voltage reading on model 500.

4. Set cpm and the range multiplier on the model 500 to the desired meter deflection. The model 500 frequency controls consist of the three-digit readout, range selector, coarse tuning know, and the fine tuning knob. The three-digit readout is in cpm times the frequency multiplier.

5. Calibrating survey instruments in cpm:

   A. Set model 500 frequency to value that will provide a ¾ meter deflection on the survey instrument's highest count scale. Set pulse height/amplitude to twice instrument input sensitivity.

   B. Adjust the range calibration potentiometer on the survey meter to provide correct reading record.

   C. De-code model 500 frequency to next lower value; then do the same for the survey instrument.

   D. Adjust the range calibration potentiometer for correct reading on survey instrument. Record readings.

   E. Repeat process until all ranges have been calibrated at ¾ meter deflection. Record readings.

   F. Return to highest count scale on survey meter.

   G. Set model 500 for ¼ scale deflection readings.

   H. Survey instrument should read within ± 10% of model 500 frequency. Record readings.

      1) If readings are outside of the tolerance, re-calibrate for ¾ meter deflection.

      2) Tap instrument meter lightly to check for sticky meter. Meter tolerance is ± 3% from the initial readings to the final reading.

   I. Decode M 500 to next lower scale. Check survey instruments for ¼ scale reading. Record.

6. Record input sensitivity.

   A. Select the most sensitive amplitude range 0-5 mv on the model 500.

   B. Observe meter on survey instrument.

   C. Increase pulse amplitude, switching to next higher range, if necessary, until the rate meter indicates a stable reading (i.e., further increase of pulse amplitude does not cause an increase in meter reading). Now, decrease pulse height until the survey instrument meter reading drops 15 ± 5%. Record this pulse height as the instrument sensitivity.

D. If your instrument has a gain or threshold control to set instrument sensitivity, set pulse height on the model 500 to desired sensitivity level. Now adjust your instrument threshold or gain control until the rate meter reading is within 85 ± 5% of its stable reading value (see step C). Record the pulse height as instrument sensitivity.

7. Calibrating survey instrument to cps.

   A. Set frequency in model 500. Divide model 500 readings by 60 to convert to counts per second.

   B. Repeat calibration steps as in item 5 above.

3.1.5.2 *Frequency of Calibration*

If electronic calibration is performed using the above method by the Radiation Safety Department, the model 500 pulse generator will be sent out for calibration on an annual basis.

3.2 PERSONNEL AIR SAMPLERS

The calibration procedure for personnel air samplers involves primary and secondary calibration procedures. Samplers will be calibrated prior to each use by either of two methodologies: bubble tube or mass flow determinations. Air samplers may be calibrated to standard air conditions.

3.2.1 Bubble Tube Calibration Method

The Bubble Tube Calibration Method is a primary calibration method and does not require corrections to or from standard conditions for temperature and pressure. Personal air samplers are calibrated for the flow rate for the sampling being performed, typically 2-4 liters per minute.

The equipment utilized is as follows:

1. Burette – 1,000 ml capacity, 10 ml divisions
2. Support, iron, rectangular base, with rod
3. Burette clamps – 2
4. Soap solution, dish
5. Tubing, Gelman filter holder, filter media (0.8 micron glass fiber Gelman type A/E)

6. Stopwatch
7. Small screwdriver
8. Sample pump

The procedures utilized are:

1. Assemble a filter train – place a filter in an in-line filter. Attach two lengths of tubing to each connector of the in-line filter holder.

2. Make sure the Burette is clean. Clamp the 1,000 ml Burette upside down on the ring stand with the Burette clamps.

3. Attach the pump to be calibrated to one end of the filter train, connect the other end of the filter train to the small end of the 1,000 ml Burette, as per Figure 1.

4. Check all tubing connections for air tightness.

5. Pour approximately ½ inch (12 mm) of soap solution into the dish.

6. Start the pump.

7. Raise the dish up under the Burette opening, and then immediately lower the dish. This should cause a film of soap to form over the Burette opening (i.e., a bubble). Repeat this procedure until the film (bubble) will travel up the inverted Burette the length of the graduation marks on the Burette without breaking.

8. When the film (bubble) has wetted the Burette inside and will travel the entire length of the graduated area of the Burette, proceed with the actual calibration run.

9. Quickly form three bubbles and start the stopwatch when the middle bubble is at the bottom graduation line (actually the 1,000 ml mark, but for purposes here, it will be called the "zero" line).

10. Time the travel of the bubble from the zero line to the top line of the graduated distance (0 ml). Since the capacity of the Burette is 1,000 ml (1.0 liter), then the volume of air that is displaced above the bubble (i.e., needed to raise the bubble) is 1.0 liter. Stopping the stopwatch at the top mark is the time elapsed for the pump to accomplish this. The rate of rise of the bubble through the apparatus is the flow rate of air being pulled by the pump.

11. Increase or decrease the pump collection rate by adjusting the appropriate screw or knob designed for this purpose.

12. Set the pump flow collection rate to the desired valued usually between 2 and 4 liters per minute for low volume collection pumps and between 30 and 80 liters per minute for high volume collection pumps.

3.2.2 Mass Flow Method

Mass flow meters are manufactured equipment designed to measure air collection flow rates for a variety of purposes. Mass flow meters may be subject to temperature and pressure corrections of air movement depending on whether they are calibrated/manufactured for standard conditions.

Utilizing an air mass flow meter, traceable to NBS, the airflow rate of pumps can be quickly adjusted to correct standard flow rate conditions. However, the mass flow meter must be calibrated annually using a primary calibration method.

The equipment consists of the following:

1. Kurz air mass flow model 543 or equivalent
2. Suitable filter head adapter connections
3. Filter heads with filter media
4. Pump to be calibrated

Note: The meter is calibrated directly in standard air conditions – 25° C., 29.82" Hg.

The procedures utilized are:

1. Ensure pump batteries are fully charged.

2. Ensure flow meter batteries are fully charged.

3. Assemble filter train.

4. Connect (with a suitable adapter) the Kurz probe onto the filter train. Ensure an airtight seal with tape, if necessary.

5. Set the meter function switch to the highest range: 40 std liters per minute.

6. Turn the pump on.

7. Select appropriate range on the meter. (Do not allow meter needle to be forcibly pegged.)

8. Adjust the pump flow rate as necessary to desired flow rate. Allow the meter to stabilize before adjustment of the pump.

9. Meter reads directly in standard air conditions, correcting for temperature and barometric pressure.

Pump is now calibrated. Low volume pumps are set at 2 to 4 lpm.

3.3 AREA AIR SAMPLERS

The calibration procedure for area air samplers involves one of the following procedures; Kurz Mass Flow, Wet Test Gas Meter or Bubble Tube Method.

3.3.1 Kurz Mass Flow Method

Repeat procedures discussed in 3.2.2 – except – airflow rate is adjusted to 40 slpm and samplers utilized are:

1. Eberline RAS-1
2. Scientific Industries Model H25004
3. Equivalent

3.3.2 Wet Test Gas Meter Method

The wet test gas meter method utilizes a Precision Scientific wet test meter rated at one cubic foot per revolution of the main dial. This method is used to calibrate the Kurz air mass flow meter in addition to direct calibration of the area air samplers.

The procedures are:

1. Attached coupling to sampler filter assembly; secure it with tape.

2. Connect wet test meter hose to coupling.

3. Check water level of wet test meter. The needle should be on slightly above the water level.

4. Check the thermometer temperature of the wet test meter. Record this on the calibration sheet. Assume that the wet and dry bulb temperatures are the same.

5. Turn on the sampler. Check the west test meter's manometer reading. This reading is obtained by adding the left and right column values. (A typical reading might be .3). Log these values for each ball height on the "Static pressure … H_2O" column.

6. For the following sampler approximate settings, pull one cubic foot of air through the wet test meter and record the time (in seconds) for each: 20, 30, 40, and 50 lpm.

<u>Sampler Calibration Procedures – Calculations and Equations</u>

1. To convert the static pressure (of the manometer attached to the wet test meter) from inches of water to inches of mercury, divide the number of inches to water by 13.6. Example: 0.4/13.6-0.02941176" Hg

2. To compute the actual flow rate ("Q rate act. lpm"), first divide the number of cubic feet by the number of seconds. Example: 1 ft.^{3}/90 sec = .01111 ft.^{3}/awx. Convert the cubic feet to liters. The conversion factor is 28.317. Example: .01111 ft.^{3}/sec x 28.317 L ft.^{3} = .3146 L/sec. Multiply this by 60 to convert from seconds to minutes. Example: .3146 L/sec x 60 sec = 1888 L/m or 18.88 lpm.

3. Using the "Vapor Pressures of Water" chart, find the vapor pressure inside the wet test meter by matching the wet bulb temperature with the corresponding vapor pressure. This number is the vapor pressure at the standard wet bulb (Pvpstw).

4. Find the vapor pressure at dewpoint using this formula: Pv dewpoint = Pvpstw = 0.0003613 (td-tw) Bp (Where +d = dry bulb temp; tw = wet bulb temp; bp = barometric pressure in inches of mercury.) Assume that the dry bulb temperature and the wet bulb temperature are the same, so the difference between them will always be zero. Thus, Pv dewpoint will equal Pvpstw.

5. Determine the actual air density (D act) with this formula:

$$\text{D act} = \frac{1.327}{\text{td} + 459.67\ \ [(\text{Pg-Sp}) - 0.378\ (\text{Pv dewpoint})]}$$

   (Where td - dry bulb temp in degrees F.; Bp = barometric pressure in inches of mercury; Sp = static pressure of wet test meter in inches of mercury.)

Example:

$$D\ act = \frac{1.327}{70.5 + 459.67} \quad [(24{,}8031 - 0.02941176) - 0.378\,(.875)]$$

$$= \frac{1.327}{530.17} \quad (24{,}773688 - 0.33075)$$

$$= (0.00250297)\ (24.442938)$$

$$D\ act = 0.06117996$$

Log this in "Air Density lbs/ft^3" column of log sheet.

6. Find the flow rate of the sampler at standard conditions (Q std) using this formula:

$$Q\ std = Q\ act \quad \frac{D\ act}{D\ std}$$

(Where D std = .075 lbs/ft^3)

$$\text{(i.e., } Q\ std = 18.88 \quad \frac{(0.06117996)}{0.075}$$

$$= 18.88 \quad (0.8157328)$$

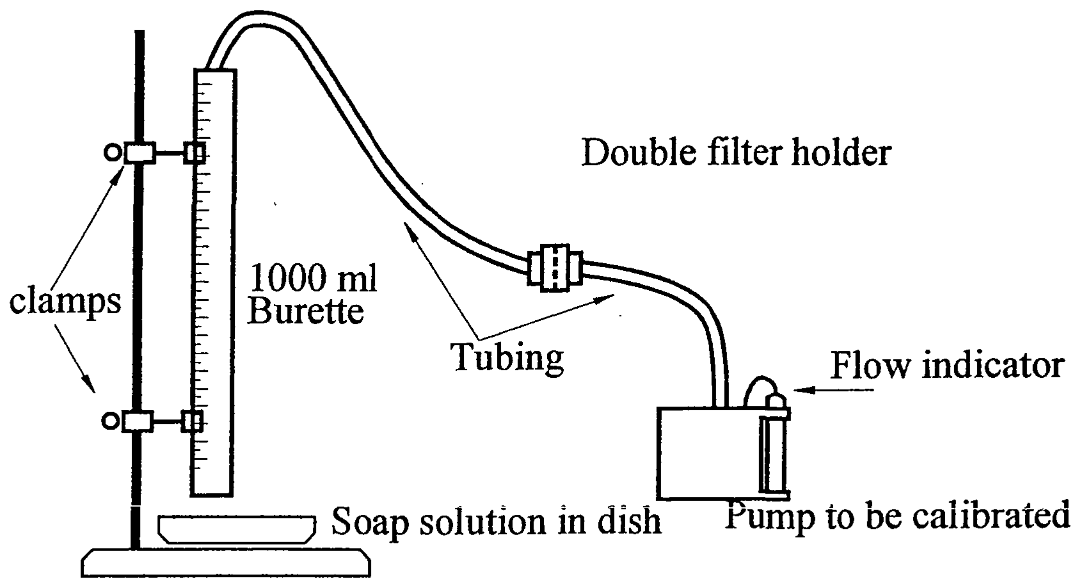
$$= 15.40$$

Q std = 15.40 (write this down for each position in the Q 0.075 column)

3.3.3 Bubble Tube Method

Refer to Section 3.2.1 to perform this method.

Figure 1 - Apparatus for bubble method of pump calibration



Denison Mines (USA) Corp.

WHITE MESA MILL

Area Air Sampler Calibration Record

Method: Wet Gas Meter

Month & Date:______________________ Sampler No.____________

Barometric Pressure (Inches of Mercury)________ Filter Type:___________

Air Temperature: Dry Bulb________ °F Meter Air Temp. Dry Bulb____ °F

Wet Bulb________ °F Wet Bulb___ °F

Humidity____________ Calibrated by______________

Meter Volume Ft	Estimate Flow (slpm)	Time (sec.)	Static Pressure H20	Calc. Act. Vol. at Sat Wet Bulb aLpm	Calc. Std Volume sLpm
	20				
	30				
	40				
	50				

Calculations: With wet-gas meter, the actual meter volume is at 100% humidity. A correction back to actual humidity needs to be done to get actual air density and volume sampled.

Equivalents: 1" H_2O = 0.0735"Hg; 28.317 liters = 1 cubic foot Std. Air = 70°F, 29.92"Hg B.P. = 0.075 lbs/ft^3 density.

VAPOR PRESSURES OF WATER

In Inches of Mercury

Temp. Deg. F.	0	1	2	3	4	5	6	7	8	9
—20	.0126	.0119	.0112	.0106	.0100	.0095	.0089	.0084	.0080	.0075
—10	.0222	.0209	.0199	.0187	.0176	.0168	.0158	.0150	.0142	.0134
—	.0376	.0359	.0339	.0324	.0306	.0289	.0275	.0259	.0247	.0233
0	.0376	.0398	.0417	.0441	.0463	.0489	.0517	.0541	.0571	.0598
10	.0631	.0660	.0696	.0728	.0768	.0810	.0846	.0892	.0932	.0982
20	.1025	.1080	.1127	.1186	.1248	.1302	.1370	.1429	.1502	.1567
30	.1647	.1716	.1803	.1878	.1955	.2035	.2118	.2203	.2292	.2383
40	.2478	.2576	.2677	.2782	.2891	.3004	.3120	.3240	.3364	.3493
50	.3626	.3764	.3906	.4052	.4203	.4359	.4520	.4686	.4858	.5035
60	.5218	.5407	.5601	.5802	.6009	.6222	.6442	.6669	.6903	.7144
70	.7392	.7648	.7912	.8183	.8462	.8750	.9046	.9352	.9666	.9989
80	1.032	1.066	1.102	1.138	1.175	1.213	1.253	1.293	1.335	1.378
90	1.422	1.467	1.513	1.561	1.610	1.660	1.712	1.765	1.819	1.875
100	1.932	1.992	2.052	2.114	2.178	2.243	2.310	2.379	2.449	2.521
	2.596	2.672	2.749	2.829	2.911	2.995	3.081	3.169	3.259	3.351
	3.446	3.543	3.642	3.744	3.848	3.954	4.063	4.174	4.289	4.406
130	4.525	4.647	4.772	4.900	5.031	5.165	5.302	5.442	5.585	5.732
140	5.881	6.034	6.190	6.350	6.513	6.680	6.850	7.024	7.202	7.384
150	7.569	7.759	7.952	8.150	8.351	8.557	8.767	8.981	9.200	9.424
160	9.652	9.885	10.12	10.36	10.61	10.86	11.12	11.38	11.65	11.92
170	12.20	12.48	12.77	13.07	13.37	13.67	13.98	14.30	14.62	14.96
180	15.29	15.63	15.98	16.34	16.70	17.07	17.44	17.82	18.21	18.61
190	19.01	19.42	19.84	20.27	20.70	21.14	21.59	22.05	22.52	22.99
200	23.47	23.96	24.46	24.97	25.48	26.00	26.53	27.07	27.62	28.18
210	28.75	29.33	29.92	30.52	31.13	31.75	32.38	33.02	33.67	34.33
220	35.00	35.68	36.37	37.07	37.78	38.50	39.24	39.99	40.75	41.52
230	42.31	43.11	43.92	44.74	45.57	46.41	47.27	48.14	49.03	49.93
240	50.84	51.76	52.70	53.65	54.62	55.60	56.60	57.61	58.63	59.67
250	60.72	61.79	62.88	63.93	65.10	66.23	67.38	68.54	69.72	70.92
260	72.13	74.36	74.61	75.88	77.16	78.46	79.78	81.11	82.46	83.83
270	85.22	86.63	88.06	89.51	90.97	92.45	93.96	95.49	97.03	98.61
280	100.2	101.8	103.4	105.0	106.7	108.4	110.1	111.8	113.6	115.4
290	117.2	119.0	120.8	122.7	124.6	126.5	128.4	130.4	132.4	134.4
300	136.4	138.5	140.6	142.7	144.8	147.0	149.2	151.4	153.6	155.9
310	158.2	160.5	162.8	165.2	167.6	170.0	172.5	175.0	177.5	180.0
320	182.6	185.2	187.8	190.4	193.1	195.8	198.5	201.3	204.1	206.9
330	209.8	212.7	215.6	218.6	221.6	224.6	227.7	230.8	233.9	237.1
340	240.3	243.5	246.8	250.1	253.4	256.7	260.1	263.6	267.1	270.6
350	274.1	277.7	281.3	284.9	288.6	292.3	296.1	299.9	303.8	307.7
360	311.6	315.5	319.5	323.5	327.6	331.7	335.9	340.1	344.4	348.7
	353.0	357.4	361.8	366.2	370.7	375.2	379.8	384.4	389.1	393.8
	393.6	403.4	403.2	413.1	418.1	423.1	428.1	433.1	438.2	443.4
390	448.6	453.9	459.2	464.6	470.0	475.5	481.0	486.6	492.2	497.9
400	503.5	509.3	515.1	521.0	526.9	532.9	538.9	545.0	551.1	557.3

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Efficiency Function Check For Eberline Model ESP-1 Instruments at White Mesa Mill

Date: 18-Dec-00 **Checked By:** Wally Brice

Count Number	Eberline Model ESP-1 Serial Number 02286 CPM Th-230 11695	Background	Eberline Model ESP-1 Serial Number 02286 CPM Th-230 Source S-1738	Background
1	515	0	27850	59.5
2	505	0	32300	178.5
3	423.5	0	30450	0
4	453	0	29100	0
5	448	0	31350	297.5

Instrument set to count for time period of?
12 seconds

ESP-1 Alpha Efficiency Check	
Inst. Serial No.:	02286
Source Serial No.:	11695
Th230 4Pi DPM:	6180
Th230 2Pi DPM:	3140
CPM Average	468.9
4Pi Alpha Efficiency:	7.59%
2Pi Alpha Efficiency:	14.93%
Background Av.	0
Souce Std. Dev.	39.30
Calibration Date	09/28/2000
Calibration Const.	1

ESP-1 Alpha Efficiency Check	
Inst. Serial No.:	02286
Source Serial No.:	S-1738
Th230 Source DPM:	30300
CPM Average	30210
Alpha Efficiency:	100%
Background Av.	107.1
Souce Std. Dev.	1769.68
Calibration Date	09/28/2000
Calibration Const.	0.084

$$MDA = \frac{2.71 + 4.65\sqrt{Bkg. * t}}{(t)(E)(A/100)}$$

Where:

t=	0.2
A=	0.59
E=	0.99
Bkg.=	Average Background

MDA DPM/100 cm²= 205.96

At WMM Rad. Lab.	
Th-230 4Pi Eff.:	7.59%
Th-230 2Pi Eff.:	14.93%
CC=	1
At Calibration Lab.	
Th-230 4Pi Eff.:	7.11%
Th-230 2Pi Eff.:	13.98%

10% of 2Pi Eff. At Lab	0.71%
Difference between Lab and WMM Eff:	0.48%
Does inst. meet 10% deviation of efficiency at calibration?	yes

Sep-99	3	8	9144	38462	3	105	51008	107622
Sep-99	4	10	9002	38512	4	93	51208	107481
Sep-99	5	9	9009	38555	5	97	50944	107669
Sep-99	6	11	8902	38523	6	105	51343	105980
Sep-99	7	8	9151	38499	7	89	50781	108164
Sep-99	8	12	9068	38806	8	95	50612	107558
Sep-99	9	7	8976	38340	9	101	51155	107292
Sep-99	10	11	9020	38365	10	85	51122	107534
Sep-99								
Sep-99	Aver. Counts	9.2	9045.6	38512.2	Aver. Counts	95.3	50953.3	107446
Sep-99	Aver. CPM	0.92	904.56	3851.22	Aver. CPM	9.53	5095.33	10744.6
Sep-99	Efficiency	N/A	5.84%	24.85%	Efficiency	N/A	32.87%	35.45%
Sep-99	STD. DEV.	1.75	78.32	158.23	STD. DEV.	8.90	258.59	568.13

October 1999 Monthly Instrument Efficeincy Check

Date	Count #	CPM Bkgd.	CPM per 10 Minute Count	CPM per 10 Minute Count	Count #	CPM Bkgd.	CPM per 10 Minute Count	CPM per 10 Minute Count	Count #	CPM Bkgd.	CPM per 10 Minute Count	CPM per 10 Minute Count
Oct-99	1	5	8509	37960	1	105	11602	100645				
Oct-99	2	16	8549	37862	2	126	11280	100401				
Oct-99	3	7	8525	37881	3	104	11398	100487				
Oct-99	4	9	8561	37901	4	117	11321	100524				
Oct-99	5	15	8731	37428	5	99	11643	100651				
Oct-99	6	10	8651	37589	6	109	11459	101242				
Oct-99	7	12	8357	37611	7	115	11378	100883				
Oct-99	8	8	8533	37756	8	103	11615	101610				
Oct-99	9	11	8614	37689	9	121	11531	100942				
Oct-99	10	11	8606	37469	10	99	11522	100886				

Aver. 10 min.	10.4	8563.6	37714.6	Aver. CPM	109.8	11474.9	100827.1
Aver. CPM	1.04	856.36	3771.46	Aver. CPM	10.98	1147.49	10082.71
Efficiency		23.92%	24.33%	Efficiency		32.05%	33.28%
STD. DEV.	3.41	99.06	187.30	STD. DEV.	28.97	21469.95	34155.72

Monthly Instrument Efficiency Log

MS-3 Efficiency Check

Date				
	Instrument Serial No.:	11695	Source #1	Source #2
	458	Source	Th-230	Th-230
	Probe Model:	Serial #	11694	1856/90
	SPA-1	DPM	3580	15500
	Probe Serial Number:	Count Time in Minutes	10	10
	RN 012494			
Date	Count #	CPM Bkgd.	CPM per 10 Minute Count	CPM per 10 Minute Count

Ludlum 2200 Efficiency Check

Instrument Serial No.:		Source #1	Source #2
17534	Source	Th-230	Th-230
Probe Model:	Serial #	11694	1856/90
NA	DPM	3580	30300
Probe Serial Number:	Count Time in Minutes	10	10
PR 3177			
Count #	CPM Bkgd.	CPM per 10 Minute Count	CPM per 10 Minute Count

RD-14 Efficiency Check

Instrument Serial No.:		Source #1	Source #2
17534	Source	Th-230	Th-230
Probe Model:	Serial #	11694	1856/90
NA	DPM	3580	15500
Probe Serial Number:	Count Time in Minutes	10	10
PR 3177			
Count #	CPM Bkgd.	CPM per 10 Minute Count	CPM per 10 Minute Count

August 1999 Monthly Instrument Efficiency Check

Date				
	Instrument Serial No.:	11695	Source #1	Source #2
	458	Source	Th-230	Th-230
	Probe Model:	Serial #	11695	11273
	SPA-1	DPM	11300	6680
	Probe Serial Number:	Count Time in Minutes	10	10
	RN 012494			
Date	Count #	CPM Bkgd.	CPM per 10 Minute Count	CPM per 10 Minute Count
Aug-99	1	13	21707	17167
Aug-99	2	13	21870	17232
Aug-99	3	14	21973	17194
Aug-99	4	20	21932	17174
Aug-99	5	11	21983	16833
Aug-99	6	18	21892	16927
Aug-99	7	11	21798	16862
Aug-99	8	13	21834	16920
Aug-99	9	9	21921	16874
Aug-99	10	4	21836	17036
	Aver. Counts	12.6	21874.6	17021.9
	Aver. CPM	1.26	2187.46	1702.19
	Efficiency	N/A	19.36%	25.48%
	STD. DEV.	3.47	88.49	186.00

Count #	CPM Bkgd.	CPM per 10 Minute Count	CPM per 10 Minute Count

Count #	CPM Bkgd.	CPM per 10 Minute Count	CPM per 10 Minute Count

September 1999 Monthly Instrument Efficiceincy Check

Date					Count #	CPM Bkgd.	CPM per 10 Minute Count	CPM per 10 Minute Count
Sep-99	1	7	9081	38733	1	95	50773	107382
Sep-99	2	9	9103	38327	2	88	50587	107778

Attachment A
Calibration Check Form

Instrument Serial Number:

Date of Function Check	Calibration Constant Setting at Cal. Lab.	2Pi Efficiency at Calibration Laboratory	4Pi Efficiency at Calibration Laboratory	Calibration Constant Setting at WMM Rad. Office	2Pi Efficiency at This Date's Function Check	4Pi Efficiency at This Date's Function Check	Meet 10% Deviation Standard (yes or no)

Attachment A
Eberline ESP-1 Calibration Check Form

Instrument Serial Number:

Date of Function Check	Calibration Constant Setting at Cal. Lab.	2Pi Efficiency at Calibration Laboratory	4Pi Efficiency at Calibration Laboratory	Calibration Constant Setting at WMM Rad. Office	2Pi Efficiency at This Date's Function Check	4Pi Efficiency at This Date's Function Check	Meet 10% Deviation Standard (yes or no)

4. EXPOSURE CALCULATIONS AND RECORD MAINTENANCE

4.1 PERSONNEL EXPOSURE CALCULATIONS

4.1.1 DACs for Conventional Ores

4.1.1.1 *Solubility Classes*

The solubility class, chemical form and abundance of conventional ores at the Mill, and the resulting DACs to be used are as set out in the following table:

Table 4.1.1.1-1
Solubility Class, Chemical Form And Abundance of Conventional Ores

Location	DAC	U_{nat}	Th-230	Ra-226	Pb-210
Ore-Grind	6.00E-11	DAC is specified in 10 CFR Part 20			
Leach	1.1E-10	½ Ore, ½ Precipitation	½ Ore, ½ Precipitation	½ Ore, ½ Precipitation	½ Ore, ½ Precipitation
CCD	1.2E-11	Class D Sulfate 25%	Class W [1] Sulfate 25%	Class W [1] Sulfate 25%	Class D [1] Sulfate 25%
SX	1.2E-11	Class D Sulfate 25%	Class W [1] Sulfate 25%	Class W [1] Sulfate 25%	Class D [1] Sulfate 25%
Precipitation	5.00E-10	Class D [2] Diuranate 100%	NA	NA	NA
Yellowcake Packaging	2.20E-11	Class Y: 90 % and Class W: 10 % Oxide 100%	NA	NA	NA
Tailings	1.70E-11	Class Y Oxide 4%	Class Y [2] Oxide 32%	Class W [1] Oxide 32%	Class W [1] Oxide 32%

[1] 10 CFR Part 20, Appendix B
[2] NUREG/CR-0530, PNL-2870, D.R. Kalkwarf, 1979, "Solubility Classifications of Airborne Products from Uranium Ores and Tailings Piles"

4.1.1.2 *Application of Conventional Ore DACs to Workplace Locations*

The Conventional Ore DACs will be applied as follows to the various locations in the Mill site:

Table 4.1.1.2-1
Application of Conventional Ore DACs to Workplace Locations

Type of DAC	DAC (μCi/ml)	Individual Location
Ore/Grind	6.00E-11	Ore Scalehouse Ore Storage Maintenance Shop Warehouse Lunch Room Change Room Administration Bldg
Ore/Grind	6.00E-11	Dump Station
Ore/Grind	6.00E-11	SAG Mill SAG Mill Control Shifter's Office Operations Lunch Rm Filter Press
Leach	1.1E-10	Leach Tank Area
CCD	1.20E-11	CCD Circuit Thickeners
SX	1.20E-11	SX Building South Boiler
Ore/Grind	6.00E-11	Control Room
Yellowcake Precipitation	5.00E-10	YC Precipitation &Wet Storage
Yellowcake Packaging	2.20E-11	North YC Dryer Enc South YC Dryer Enc YC Pkg Enclosure YC Drying & Packaging Area Packaged YC Staging Area
Tailings	1.70E-11	Truck Shop Tailings
Yellowcake Precipitation	5.00E-10	Vanadium Circuit

4.1.2 DACs for Alternate Feed Materials

In determining the applicable DACs for alternate feed materials, the following procedures will be followed:

a) Ore/Grind DAC

If the generator of the alternate feed material is regulated by the NRC or an Agreement State under a source material or 11e.(2) byproduct material license and such regulatory authority has approved a DAC in connection with handling the material in the same form as it will be received at the Mill, then that DAC may be used as the Ore/Grind DAC. If such a DAC has not been so approved, then a DAC will be calculated based on the mixture rule set out in Section 4.1.3.3 below if the solubilities and relative activities of radionuclides in the mixture are known or can be determined. If not known or determined, the mixture will be assumed to be comprised entirely of the most restrictive radionuclide and solubility class, until the relative activities and solubilities of the radionuclides in the mixture become known or determined.

b) Leach

The Leach DAC will be a DAC equal to one half of the Ore/Grind DAC and one half of the Yellowcake Precipitation DAC.

c) CCD

The CCD DAC will be calculated based on the mixture rule set out in Section 4.1.3.3 below if the solubilities and relative activities of radionuclides in the mixture are known or can be determined. If not known or determined, the mixture will be assumed to be comprised entirely of the most restrictive radionuclide and solubility class, until the relative activities and solubilities of the radionuclides in the mixture become known or determined, provided that the solubility class of uranium can be assumed to be Class D Sulfate.

d) SX

The SX DAC will be the same as the CCD DAC.

e) Yellowcake Precipitation

The Yellowcake precipitation DAC will be the same as for conventional ores, that is 5.00E-10.

f) Yellowcake Packaging

The yellowcake packaging DAC will be the same as for conventional ores, that is 2.20E-11.

g) Tailings

The tailings DAC will be the same as for conventional ores, that is 1.70E-11, unless it is expected that the addition of tailings from the alternate feed material will significantly impact the radiological make-up of the exposed tailings, in which case the mixture rule set out in sections 4.1.3.2 (where the radionuclide with the most restrictive DAC is assumed to comprise 100% of the tailings) and 4.1.3.3, as applicable will be applied.

Once calculated, the foregoing DACs will be applied to the areas set out in Table 4.1.1.2-1 above.

DACs will be calculated in accordance with the foregoing procedure prior to receipt or handling of the alternate feed materials. If additional characterization information becomes available at a later date, the DACs may be adjusted to reflect such additional characterization information.

4.1.3 DACs for Mixtures

Both uranium ore and uranium mill tailings consist of a mixture of radionuclides each with their individual DAC's. Unless otherwise specified or determined in accordance with Section 4.1.1 or 4.1.2 above, the DAC for a mixture is as follows:

4.1.3.1 *Ore Prior to Leach*

6E-11 uCi of gross alpha from U-238, U-234, Th-230, and Ra-226 per ml of air, or 3E-11 uCi of natural uranium per ml of air

4.1.3.2 *Tailings When the Concentration of the Radionuclides in the Mixture is Unknown*

6E-12 uCi/ml = DAC for Th-230

4.1.3.3 Tailings or Other Mixture When the Identity and Concentration of Each Radionuclide is Known

.The DAC for the mixture is calculated by the following (see Regulatory Guide 8.30, page 2).

$$DAC_m = \left[\frac{f_1}{DAC_1} + \frac{f_2}{DAC_2} + \ldots + \frac{f_n}{DAC_n} \right]^{-1}$$

where DAC_m = DAC for the mixture of radionuclides 1 through n.

DAC_1 = DAC for the first radionuclide in the mixture.

DAC_n = DAC for the n^{th}, the last, radionuclide in the mixture.

f_1 = Fraction of alpha activity from the first radionuclide in the mixture.

f_n = Fraction of alpha activity from radionuclide n in the mixture.

For example:

Ra-226	80 pCi/g	DAC = 3E - 10 uCi/ml
Th-230	20 pCi/g	DAC = 2E - 12 uCi/ml

$$DAC_m = \left[\frac{\frac{80}{100}}{3E\text{-}10} + \frac{\frac{20}{100}}{2E\text{-}12} \right]^{-1}$$

$$= \left[2.67E9 + 1.00E11 \right]^{-1}$$

$$= \frac{1}{1.0E11}$$

$$= 9.7E\text{-}12 \ \frac{uCi}{ml}$$

4.1.4 Sampling Time

Calculate the sampling time required to detect 10% of the DAC by solving for sampling time in the following equation:

$$\frac{LLD}{(\text{Sampling Time})\ (\text{Flow Rate of Sampler})} = 0.1\ DAC$$

For example:

To detect 10% of the DAC for U-nat, a 40 lpm air sampler would have to operate 57 minutes, assuming the sample counter has a lower level of detection of 10 dpm above background, i.e.:

$$\frac{(10\ \text{DPM})\left(\frac{\text{pCi}}{2.22\ \text{DPM}}\right)\left(\frac{\text{E-6 uCi}}{\text{pCi}}\right)}{(\text{X min.})\left(\frac{40\ \text{lit}}{\text{min.}}\right)\left(\frac{10^3\text{ml}}{\text{lit}}\right)} = 2\text{E-12}\ \frac{\text{uCi}}{\text{ml}}$$

X = 56.8 minutes

4.1.5 Dose Calculations (10 CFR 20.1201-20.1202)

1. Analytical results of airborne particulate samples may be obtained in several different units that need to be converted into mg soluble natural uranium to determine the weekly exposures and into uCi-hr/ml or WL-hr to determine annual exposures. The following table presents a summary of the conversions that may be necessary. The first row of the table presents the operations to be performed in the conversions. Enter the measured weight or activity, the sampler flow rate, the sampling time, and the exposure time into the first four columns. Divide the values in column 1 by the values in column 2 and column 3, and then multiply by the values in columns 4 and 5 to obtain the units in column 6, or:

$$\frac{(\text{Column 1})\ (\text{Column 4})\ (\text{Column 5})}{(\text{Column 2})\ (\text{Column 3})} = \text{Column 6}$$

UNIT CONVERSION TABLE

1	2	3	4	5	6
OPERATION	DIVIDE	DIVIDE	MULTIPLY	MULTIPLY	ANSWER
MEASURED VALUE	SAMPLER FLOW RATE	SAMPLING TIME	EXPOSURE TIME	CONSTANT	ANSWER
ug soluble U-natural	L/min	min	hrs	1.2	mg soluble U-natural
pCi soluble U-natural	L/min	min	hrs	1.77	mg soluble U-natural
pCi gross alpha	L/min	min	hrs	E-9	UCi-hrs / ML
ug U-nat	L/min	min	hrs	6.77E-10	UCi-hrs / ML
uCi / mL Radon	---	---	hrs	E7	WL-hrs

For example:

$$\frac{(10\ \text{ug Soluble U-nat})\ (10\ \text{hrs})\ (1.2)}{(2\ \text{L/min})\ (30\ \text{min})} = 2\ \text{mg Soluble U-nat}$$

See notes for a description of the unit conversions.

2. The table on the following page is divided into four quadrants. Different quadrants are for soluble uranium, insoluble uranium, tailings dust, and radon. Select the proper quadrant for the type of airborne particulate being sampled. Enter the area, particulate concentration, and hours of exposure in the labeled columns of the selected quadrant.

3. The protection factors are whole numbers, e.g., 10, 50, 1,000. Divide 1 by the protection factor and enter the quotient in the fourth column of each quadrant, e.g., for a protection factor of 1,000, enter 1/1,000 or 0.001 in the column. The 1/PF values are unit-less.

4. Enter the product of the airborne concentration, the hours of exposure, the time, and 1/PF in the fifth column of each quadrant. Add these values and enter the total at the bottom of the column.

5. On the dose calculations form which follows, enter the total for Soluble Uranium in the equation and calculate the corresponding mg. If a value exceeds 10 mg, an over-exposure may have occurred. If verified by a high uranium in urine results, an over-exposure has probably occurred and needs to be reported to the NRC.

6. Enter the totals for Soluble Uranium, Insoluble Uranium, Tailings Dust, and Radon in their respective equations. Perform the indicated calculations, add the fractions together, and record as the subtotal. (Use the DAC for Th-230 or the DAC for tailings dust to determine the contribution of tailings dust to the subtotal.) If a subtotal exceeds 1, an over-exposure may have occurred. If verified by a high uranium in urine result, an over-exposure has probably occurred and needs to be reported to the NRC.

7. Enter the TLD determinations of whole body dose as the Deep Dose Equivalent on the form. If the Deep Dose Equivalent exceeds 5 rems, an over-exposure may have occurred and needs to be reported to the NRC.

8. If the Deep Dose Equivalent exceeds 0.5 rem and the subtotal exceeds 0.1, calculate the Total Effective Dose Equivalent by adding the Deep Dose Equivalent to the product of 5 rems times the subtotal and enter on the form. If the total effective dose equivalent exceeds 5 rems, an over-exposure may have occurred and may have to be reported to the NRC.

DOSE CALCULATIONS (10 CFR 20.1201 + 20.1202)

Name __________ Soc. Sec. No. __________ Co. I.D. No. __________ Week ______ Year ______

AREA	SOL. U uCi/ML	HR	$\frac{1}{PF}$	$\frac{uCi\text{-}HR}{ML}$	AREA	INSOL. U uCi/ML	HR	$\frac{1}{PF}$	$\frac{uCi\text{-}HR}{ML}$
TOTAL	---	---	---		**TOTAL**	---	---	---	---
AREA	**TAILINGS DUST uCi/ML**	**HR**	$\frac{1}{PF}$	$\frac{uCi\text{-}HR}{ML}$	**AREA**	**RADON WL**	**HR**	$\frac{1}{PF}$	**WL-HR**
TOTAL	---	---	---		**TOTAL**	---	---	---	

DOSE CALCULATIONS (10 CFR 20.1201 + 20.1202)

________	________	________	________	________
Name	Soc. Sec. No.	Co. I.D. No.	Week	Year

Weekly Soluble Uranium $\frac{(\text{uCi-hr})\ (1.77E9)}{(\text{mL})}$ = ____________ mg

Limit 10 mg

Annual Soluble Uranium $\frac{\left(\frac{\quad\text{uCi-hr}}{\text{mL}}\right)}{(2000\ \text{hr})\ (5E\text{-}10)}$ = ____________

Annual Insoluble Uranium $\frac{\left(\frac{\quad\text{uCi-hr}}{\text{mL}}\right)}{(2000\ \text{hr})\ (2E\text{-}11)}$ = ____________

Annual Tailings Dust $\frac{\left(\frac{\quad\text{uCi-hr}}{\text{mL}}\right)}{(2000\ \text{hr})\ (\quad *)}$ = ____________

* = DAC for Th-230 = 6E-12;
or = DAC for tailings dust.

Annual Radon with Daughters Present $\frac{(\quad\text{WL-hr})}{(2000\ \text{hr})\ (0.33\ \text{WL})}$ = ____________

Subtotal ____________

Limit 1

Deep Dose Equivalent = TLD Whole Body Dose in rem = ____________ rem

Limit 5 rem

If the Deep Dose Equivalent is > 0.5 rem
and
the Subtotal is > 0.1, then

Total Effective Dose Equivalent = Deep Dose Equivalent + Committed Effective Dose Equivalent

= (rem) + (5 rem) (Subtotal) = ____________ rem

Limit 5 rem

DOSE CALCULATIONS (10 CFR 20.1201 + 20.1202)

Notes:

1. PF = Respiratory Protection Factor.

2. The 10 mg soluble uranium per week limit in 10 CFR Part 20.1201 is more restrictive than the (40 hour) (DAC) limit for natural uranium, thus compliance is based on 10 mg per week.

3. The conversion of uCi-hr/mL to mg natural uranium is the product of:

   (air concentration) (hours of exposure) (breathing rate for light work) (conversion of minutes to hours) (specific activity of natural uranium) (conversion of ug to mg) which is:

$$\left(\frac{\text{uCi-hr}}{\text{mL}}\right)\left(\frac{\text{2E4 mL}}{\text{min}}\right)\left(\frac{\text{60 min}}{\text{hr}}\right)\left(\frac{\text{ug}}{\text{6.77E-7 uCi}}\right)\left(\frac{\text{E-3 mg}}{\text{ug}}\right) =$$

$$\left(\frac{\text{uCi-hr}}{\text{mL}}\right)(1.77\text{E}9) = \text{mg U natural}$$

   Thus to obtain mg natural uranium, multiply the uCi-hr/mL by 1.77E9.

4. Soluble Uranium DAC (Class D) = 5E-10 uCi/mL
   Insoluble Uranium DAC (Class Y) = 2E-11 uCi/mL
   Thorium-230 DAC (Class Y) = 6E-12 uCi/mL
   Radon with Daughters DAC = 3E-8 uCi/mL = 0.33 WL
   Tailings Dust DAC is a Site Specific Value = uCi/mL

5. Description of unit conversions:

   a. ug soluble U-nat → mg soluble U-nat

$$\left(\frac{\text{ug}}{\left(\frac{\text{L}}{\text{min}}\right)(\text{min sampler})\left(\frac{\text{E3 mL}}{\text{L}}\right)}\right)\left(\frac{\text{E-3 mg}}{\text{ug}}\right)\left(\frac{\text{60 min}}{\text{hr}}\right)(\text{hr exposure}) =$$

$$\left(\frac{\text{ug}}{\left(\frac{\text{L}}{\text{min}}\right)(\text{min sampler})}\right)(\text{hr exposure})\ (1.2) = \text{mg soluble U-nat.}$$

b. pCi soluble U-nat → mg soluble U-nat

$$\left(\frac{\text{pCi}}{\left(\frac{\text{L}}{\text{min}}\right)(\text{min sampler})\left(\frac{\text{E3 mL}}{\text{L}}\right)}\right)\left(\frac{\text{E-9 mCi}}{\text{pCi}}\right)\left(\frac{\text{mg}}{\text{6.77E-7 mCi}}\right)\left(\frac{\text{2E4 mL}}{\text{min}}\right) \rightarrow$$

$$\left(\frac{\text{60 min}}{\text{hr}}\right)(\text{hr exposure}) =$$

$$\left(\frac{\text{pCi}}{\left(\frac{\text{L}}{\text{min}}\right)(\text{min sampler})}\right)(\text{hr exposure})\ (1.77) = \text{mg soluble U-nat.}$$

c. pCi gross alpha → uCi-hr

$$\left(\frac{\text{pCi}}{\left(\frac{\text{L}}{\text{min}}\right)(\text{min sampler})\left(\frac{\text{E-3 mL}}{\text{L}}\right)}\right)\left(\frac{\text{E-6 uCi}}{\text{pCi}}\right)(\text{hr exposure}) =$$

$$\left(\frac{\text{pCi}}{\left(\frac{\text{L}}{\text{min}}\right)(\text{min sampler})}\right)(\text{hr exposure})\ (\text{E-9}) = \frac{\text{uCi-hr}}{\text{mL}}$$

d. ug U-nat → $\frac{\text{uCi- hr}}{\text{mL}}$

$$\left(\frac{\text{ug}}{\left(\frac{\text{L}}{\text{min}}\right)(\text{min sampler})\left(\frac{\text{E3 mL}}{\text{L}}\right)}\right)\left(\frac{\text{6.77E-7 uCi}}{\text{ug}}\right)(\text{hr exposure}) =$$

$$\left(\frac{\text{uCi}}{\left(\frac{\text{L}}{\text{min}}\right)(\text{min sampler})}\right)(\text{hr exposure})\ (\text{6.77E-10}) = \frac{\text{uCi-hr}}{\text{mL}}$$

e. $\frac{\text{uCi}}{\text{mL}}$ of Radon-222 → WL

$$\left(\frac{\text{uCi}}{\text{mL}}\right)\left(\frac{\text{E6 pCi}}{\text{uCi}}\right)\left(\frac{\text{E3 mL}}{\text{L}}\right)\left(\frac{\text{L-WL}}{\text{E2 pCi}}\right) =$$

$$\left(\frac{\text{uCi}}{\text{mL}}\right)(\text{E7}) = \text{WL}$$

4.2 Personnel Exposure Files

Denison Mines (USA) Corp. will generate and maintain individual exposure records for each employee that works at the White Mesa Mill. The record system will be designed to meet the specifications of the Federal Code of Regulations 10 CFR Part 20.

When an employee is hired, a file will be generated specifically for that individual. All records that are to be in the radiation exposure file will be maintained during the term of employment. When the employee terminates, all records will be preserved until the Nuclear Regulatory Commission authorizes their disposition.

Personnel exposure records will be maintained at the mill site and will be accessible only to the employee and the Radiation Protection staff. No copy of the exposure history will be furnished to anyone outside of the Radiation Protection Department without a signed consent form from the employee.

Contents of the exposure file:

Each personnel exposure file will contain the following records:

1. Information Sheet – Each information sheet will include the following information:

    A. Employee's full name
    B. Birth date
    C. Social Security number
    D. Date of hire
    E. Date of termination

Record of Urinalyses – A multiple entry log of all urinalyses conducted at this work site will include the following information:

    A. Employee's full name
    B. Sample dates
    C. Sample identification number
    D. Concentration of uranium in ug/l
    E. An entry for any quality assurance "spikes" entered in ug/l

3. Internal personnel Exposure Records – These will be calculated and prepared using the forms above or by the computer and the printout will be used as the permanent record in the exposure file. The internal exposure records will contain the following information:

    A. Employee's full name

B. Social Security number
C. Birth date
D. Exposure to airborne uranium expressed in both uCi and percent MPC
E. Any breathing zone samples collected for airborne uranium to be expressed in uCi
F. Radon daughters expressed in working levels (WL) and period of exposure (date)

4. External Exposure Record (OSL, Dosimeter) – The date received from the Dosimeter contractor will be posted to the Dosimeter record in the exposure file. The following information will be included on the Dosimeter record:

   A. Employee's full name
   B. Birth date
   C. Social Security number
   D. Period of exposure (dates)
   E. Exposure in millirems (MR) for a given period
   F. Total accumulated exposure while at the White Mesa Mill
   G. Identification number of the Dosimeter badge

5. Record of Exposure from Previous Employment (NRC form 4 or similar) – A record of occupational exposures that occurred prior to employment at the mill must be obtained for each employee. If no such exposure record is available, the employee must sign a statement to that affect. If previous exposure records were kept, a copy must be secured and placed in the individual's file.

6. Reports of Over-exposure – If an individual has been found to be over-exposed, the Radiation Safety Officer will draft a letter of explanation. The report will explain the circumstances and/or reasons for the over-exposure. It will also state any actions taken to correct the problem or to prevent future over-exposures. The report must be placed in the individual's exposure file.

EXPOSURE TIME SHEET

EMPLOYEE NAME: **COMPANY ID:**

WEEK BEGINNING: **WEEK ENDING:**

AREA	SUN 1/0	MON 1/1	TUE 1/2	WED 1/3	THU 1/4	FRI 1/5	SAT 1/6	TOTAL	SUN 1/7	MON 1/8	TUE 1/9	WED 1/10	THU 1/11	FRI 1/12	SAT 1/13	TOTAL
BA 1 SCALEHOUSE																
BA 2 ORE STORAGE																
BA 7 SAG MILL																
BA 8 LEACH																
BA 9 CCD CIRCUIT																
BA 10 SX BUILDING																
BA 12 YC PRECIP																
BA 12A N. YC DRYER ENC																
BA 12B S. YC DRYER ENC																
BA 13 YC PACKAGING																
BA 13A YC PKG ENCL.																
BA 15 BUCKING ROOM																
BA 16 LUNCH ROOM																
BA 17 CHANGE ROOM																
BA 18 ADMIN. BLDG																
BA 19 WAREHOUSE																
BA 20 MAINT SHOP																
BA 21 BOILER																
BA 22 VAN. PANEL																
BA 22A VAN. DRYER																
BA 23 VAN. BELT SCRN																
BA 24 TAILINGS																
BA 25 CONTROL ROOM																
BA 26 MILL OFFICE																
BA 27 OPER. LUNCH RM																
BA 28 DUMP STATION																
BA 29 FILTER PRESS																
BA 30 TRUCK SHOP																

EMPLOYEE SIGNATURE: ______________________ **Total:** ______ **Total:** ______

5. RADIATION WORK PERMITS

5.1 General

A Radiation Work Permit ("RWP") system has been established for non-routine activities where there is a potential for a significant radiation exposure, or for certain routine activities where there is a potential to spread radioactive materials.

Specifically, an RWP is required for:

a) All non-routine maintenance work, or work for which there is no effective operating procedure, which may, by the determination of the Radiation Safety Officer, exceed 25% of the R313-15 limits;

b) All routine work, not covered by an operating procedure, that could involve the spread of radioactive materials; and

c) The receipt, handling or processing of any alternate feed material or other radioactive material, which has been determined by the Radiation Safety Officer, not to fall within an existing operating procedure.

An RWP may also be used on a temporary basis for routine activities in lieu of an operating procedure, while an operating procedure is being developed for the activity.

5.2 All Non-Routine Activities Require Radiation Safety Officer Review

All non-routine activities require review by the Radiation Safety Officer. The Radiation Safety Officer will advise the Mill Manager on a regular basis of any activities that require an RWP.

5.3 Radiation Work Permit

The RWP is a form that describes the work to be performed, the location, duration and personnel involved, and the radiological controls needed, such as respirator, urine samples, breathing zone monitoring, time limitations for the activity, etc. The form must also have an area for the Radiation Safety Officer, or his designee's, signature. A copy of a form of RWP is attached.

5.4 Procedure for Obtaining a Radiation Work Permit

The procedure for obtaining an RWP is:

a) When RWP-type work is to be performed, the Shift Foreman, Maintenance Superintendent or other supervisory personnel shall complete the top portion of the RWP, which will provide information on the specific work locations, estimated work duration, type of work to be performed, and personnel utilized, and present it to the Radiation Safety Officer;

b) The Radiation Safety Officer will indicate the radiological controls needed based on the information given and the safety of personnel. The Radiation Safety Officer or his designee will provide the necessary surveillance and respiratory protection equipment;

c) No work can be performed until the Radiation Safety Officer or his designee has approved the RWP;

d) Any maintenance or RWP jobs done in the yellowcake dryer or packaging enclosures will require a member of the Radiation Staff to be present for the duration of the job;

e) All supervisors will be given training in and copies of the requirements for using RWPs, with the permits remaining on file for five years; and

f) Any supervisor found to be knowingly and willfully violating these procedures will be issued a written warning, and the situation will be reviewed by appropriate management for remedial action.

APPENDIX 1

Denison Mines (USA) Corp.
White Mesa Mill Radiation Detection Instrument List

Model	Probe	Inst. Ser. #	Probe Ser. #	Type of Radiation Monitored with Instrument
Model 177	43-5	41298	RN011964	Alpha
Model 177	43-5	116481	RN012992	Alpha
Model 177	43-1	41261	RN012833	Alpha
Model 177	43-5	12970	PR026346	Alpha
Model 177	43-5	159117	PR168949	Alpha
Model 177	43-5	159170	PR165054	Alpha
Model 177	43-5	189581	PR192467	Alpha
Model 177	43-5	185035	PR191566	Alpha
Model 177	43-5	189581	PR192467	Alpha
Model 3	HP 270	12658	RN01026	Beta/Gamma
Model 3	43-2	12661	PR3178	Beta/Gamma
Model 3	44-6	164493	167608	Beta/Gamma
Model 3	44-9	158587	PR163554	Alpha/Beta/Gamma
Model 3	44-9	235288	PR247246	Alpha/Beta/Gamma
Model 3	44-9	158588	PR163578	Alpha/Beta/Gamma
Model 2	44-6	4796	RN012171	Beta/Gamma
Model 2	44-6	12859	12214	Beta/Gamma
ESP-1	AC-3-8	2286	RN012172	Alpha
ASP-1	HP210L & HP260	2972	718951 & 718952	Alpha/Beta/Gamma
Model 2929	43-10-1	146781	PR145343	Alpha/Beta/Gamma
E600	AC-3-7	1367	724663	Alpha/Beta/Gamma
Model 2350	43-90	175862	PR180506	Alpha
Model 2200	PR-3174	17534	15200-35	Alpha
Model 19	None	160104	None	Beta/Gamma

APPENDIX 2

Denison Mines (USA) Corp.
White Mesa Mill Radiation Detection Instrument
Check Source List

Isotope	Source Serial No.	DPM or uCi	Source Type
StrontiumYttrium-9	98SR4700903	39,300	Beta/Gamma
Thorium-230	S-1738	30,300	Alpha
Thorium-230	11694	3,580	Alpha
Thorium-230	1856/90	15,500	Alpha
Thorium-230	11693	1,630	Alpha
Thorium-230	S-2349	16,700	Alpha
Thorium-230	11695	6,180	Alpha
Thorium-230	11273	6,680	Alpha
Thorium-230	11964	6,670	Alpha
Technetium-99	S-2350	11,600	Beta
Cesium-137	S-2351	0.72 uCi	Beta/Gamma
Cesium-137	CS-7A #1	8uCi	Beta/Gamma
Cesium-137	CS-7A #2	8uCi	Beta/Gamma
Cesium-137	CS-7A #3	8uCi	Beta/Gamma
Cesium-137	S-2044	1.656 uCi	Beta/Gamma
Plutonium-239	C. S. 2039	38,000	Alpha
Uranium-238	1121/89	234 mr/hr	Alpha/Beta/Gamma

DENISON MINES (USA) CORP.

BOOK #1

ORE RECEIVING, FEED & GRIND

INTRODUCTION

Mill Process

Operations at the White Mesa Mill begin with the weighing, receiving, sampling, and stockpiling of the ore from the various mines. Mine run ore, as well as crushed ore from the stockpile, will be fed at the rate of approximately 2,000 tons-per-day to the semi-autogenous grinding (SAG) mill. The ground ore will be stored as a wet pulp in three agitated tanks. The processing stages will include two-stage acid leaching, followed by the recovery of uranium and vanadium bearing pregnant solution in a counter-current decantation (CCD) system.

The uranium is recovered from the leach pregnant solution utilizing a conventional solvent extraction system. Vanadium will be recovered from the barren uranium raffinate also utilizing a solvent extraction circuit.

The pregnant uranium strip solution is precipitated with Anhydrous Ammonia and the resultant yellowcake is dewatered, dried, and packaged.

The pregnant vanadium strip solution is precipitated with Ammonia Sulfate, filtered, dried, and melted to produce a concentrated vanadium black flake for packaging.

Process Controls

A process control panel is provided in the grinding area (CP-1), and uranium and vanadium product recovery (CP-4 and 5), areas. All other process control panels are located in the central control room.

Denison Mines (USA) Corp. has outlined, and will implement, an on-going personnel radiation protection program to ensure that operations at the plant are conducted in a safe and efficient manner and in accordance with approved procedures.

This radiation protection program is documented and administered by the State of Utah Division of Radiation Control under the direction of the Executive Secretary. These applicable regulations are detailed in Code of Federal Regulations Title 10 Energy and the State of Utah regulations.

Ore Receiving

1. Uranium and vanadium ores are received at the White Mesa Mill by truck and trailers. Each load of ore weighs approximately 50,000 to 65,000 pounds (25 to 32 tons). Truck scales will be checked for zero balance at beginning of each shift. Trucks loaded with ore are weighed in at the scalehouse for gross weight. The truck driver will be directed to dump in a specific area or stockpile by the scale house operator. After the truck has dumped its load of ore, the empty truck and trailers are re-weighed for a tare weight. Gross weight minus (-) tare weight equals (=) net weight of ore received. An ore receipt slip is made for each load of ore which records:
   a. Gross weight
   b. Tare weight
   c. Net weight
   d. Mine from which ore is shipped
   e. Truck and trailer numbers
   f. Scale ticket number
   g. Shipping lot numbers (stockpile numbers)
   h. Mill lot number
   i. Seller name (if applicable)
   j. Transportation delivery number or tag number (If necessary)
   k. Date

3. Each ore stockpile will be assigned a lot number.

4. Each Ore Receipt Slip will be assigned a Shipping Lot Number and a Mill Lot Number. A Shipping Lot will be approximately 1000 to 1500 tons of ore. A Mill Lot will be approximately 2000 to 5000 tons of ore.

5. Each Shipping Lot will be closed after receiving 1000 to 1500 tons of ore.

6. After a load of ore is dumped, the Scalehouse Operator will take a hand sample of ore from three different places and put it into a five (5) gallon sample buckets until the Shipping Lot is closed. The lid is to be sealed tightly on a five gallon bucket after each sample is taken to prevent losing moisture from the ore.

7. After the ore is sampled, the truckload will be probed a minimum of 15 times from different locations in the pile, with the probe readings recorded on the attached Probe sheet. The probe must be inserted to the minimum depth, which is marked on the shaft of the T-Probe. The probe reading will be averaged and recorded on the Probe sheet.

8. After the ore is sampled and a Shipping Lot is closed, the ore can be pushed up into a designated Mill Lot pile. After a Shipping Lot has been closed, the sample bucket containing the moisture sample of ore (with control number corresponding to the Shipping Lot) will be crushed and dried to determine moisture content. Percent of moisture will be calculated and recorded on Ore Receipt Slip and Moisture Certificate.

9. Procedure to prepare ore sample for moisture calculation:
   a. Contents of the ore sample bucket corresponding to the assigned control number will be taken to the bucking room and be put through the jaw crusher (set at about 3/8 inch opening).
   b. Place an empty five gallon bucket under the jaw crusher. Pour contents of ore sample bucket through the jaw crusher. The bucket(s) will be blended for at least 15 minutes. .
   c. The mixed ore will then be poured through a splitter box. Place two empty pans under the splitter box, pour ground sample of ore into top of splitter box. When the two pans are full of ore, reject one pan of sample and pour ore from the other pan into a clean bucket. Continue this procedure until ore sample is split down to approximately 2,000 grams (5 pounds).

d. Using the 2,000 grams of ore sample, which has been collected through the splitter, place an empty drying pan on the scales, push the tare button, add 2,000 grams (five pounds of sample to pan), push the clear button which will give the gross weight of the pan and sample. Record on a Moisture Certificate:

1. Wet weight
2. Pan tare weight
3. Date
4. Control number
5. Lot number
6. Mine from which the ore was received

e. Place the weighted pan of sample in the oven, dry the sample up to 150° C for approximately 24 hours (no less than 16 hours).

f. After 24 hours, the dried sample will be removed from the oven and allowed to cool for 30 minutes.

g. The cooled sample is then weighed and the percent of moisture calculated as follows: Wet weight minus (-) dry weight equals (=) moisture loss in grams. Calculation is as follows: Loss grams divided (÷) by original weight times (x) 100% = the percent of moisture.

h. All reject from the original truck load moisture samples will be retained for later testing.

The dried moisture sample after being cooled and weighed is put into a plastic bag with the third copy of the Moisture Certificate. The first two copies of the Moisture Certificate are turned in with the Ore Receipt Slip for further distribution. Make sure all information on the Moisture Certificate is correct and legible. The ore sample is filed as a future assay and amenability sample. A portion of that moisture sample may be further prepped for chemical analysis

9. When each ore truck driver and reagent truck driver enter the mill area for the first time, the Scale house Operator on duty will give Hazard Training for Ore Delivery

Personnel and Reagent Delivery Personnel. This procedure involves providing the driver with a typed form. All drivers will be required to read the form and sign and date the procedure form indicating that they understand and agree to follow Denison Mines (USA) Corp.'s safety rules and procedures while on Company property. The Scale house operator will sign the procedure form as the instructor for Denison Mines (USA) Corp. Completed procedure forms will be turned in to the Safety Department for future reference.

Ore Receiving Safety

1. Do not operate loaders near ore trucks dumping ore.
2. Be aware of heavy truck and equipment traffic.
3. Use caution when operating loader on slick and muddy ore pads.
4. Wear eye protection when crushing ore sample.
5. Practice and observe all Denison Mines (USA) Corp.'s safety rules.

HAZARD TRAINING FOR ORE DELIVERY PERSONNEL

Revised: December 2006

Welcome to Denison Mines (USA) Corp.'s, White Mesa Mill. In order to assure your safety while on our property, we would like to acquaint you with the safety rules and procedures, which you will be required to follow while on our property.

1.0 General Safety

1. Approved hard hats and safety glasses are required at all times except when inside the cab of your truck.

2. This is a smoke free facility. No smoking is allowed on the property. Eating anything, drinking, chewing candy, gum, or tobacco is not allowed in the Mill Restricted Area, which encompasses the fenced and posted portions of the Mill, due to radiation hazards.

3. Maintain a safe speed at all times when driving in the Mill Restricted Area. The maximum speed limit is posted at 15 mph Denison Mines' equipment has the right of way on the ore pad and Mill roadways.

4. Personnel other than direct employees of the trucking company are not allowed in the Mill Restricted Area.

5. No person under 18 years of age is allowed in the Mill Restricted Area.

6. Check for potential overhead hazards prior to dumping.

7. Use caution when entering or exiting equipment.

8. Be aware of the possibility of a truck turning over while dumping. Keep yourself and your truck clear of this possibility at all times and ensure brakes are set prior to dumping.

9. If the trailer dumper is utilized to dump your load, check it thoroughly for safety defects before operating. Do not attempt to operate unsafe equipment. Be sure to utilize stabilizers properly.

10. If ore is hung up in the truck bed, it is not permissible to work in the bed while it is in the dump position. If it is necessary to get in the bed of the truck to free a hang up, the bed must be lowered.

11. If the ore is frozen in the truck, it is not permissible to build fires under the bed in an attempt to thaw it out. Do not use diesel fuel, antifreeze, or other petroleum-based products to prevent ore from freezing to the trailer.

12. Be aware of slippery conditions on the ore pad during periods of inclement weather.

13. Be aware of the potential for ice build-up on and around the decontamination pad during periods of cold weather.

2.0 Radiation Safety

1. All drivers will be required to scan for alpha radiation prior to leaving the Mill Restricted Area.

2. All equipment, i.e. trucks and trailers, will be scanned for radiation prior to leaving the Mill's Restricted Area.

These standards will be strictly enforced and we expect your full cooperation in their implementation. Failure to abide by these standards may result in denial of entry to the property.

Instructor: ______________________________ Date: ___________________________

I have been fully informed of the above standards and agree to abide by them at all times while on Denison Mines (USA) Corp. property.

Name: ___________________________________ SS No.: _________________________

Company: ________________________________ Date: ___________________________

Signature: _______________________________

HAZARD TRAINING FOR REAGENT DELIVERY PERSONNEL

Revised: December 2006

Welcome to Denison Mines (USA) Corp.'s, White Mesa Mill. In order to assure your safety while on our property, we would like to acquaint you with the safety rules and procedures, which you will be required to follow while on our property.

1.0 General Safety

1. Approved hard hats and safety glasses are required at all times except when inside the cab of your truck. Approved safety shoes or boots may be required for certain activities.

2. This is a smoke free facility. No smoking is allowed on the property. Eating anything, drinking, chewing candy, gum, or tobacco is not allowed in the Mill Restricted Area, which encompasses the fenced and posted portions of the Mill, due to radiation hazards.

3. Maintain a safe speed at all times when driving in the Mill Restricted Area. The maximum speed limit is posted at 15 mph Denison Mines' equipment has the right of way on the ore pad and Mill roadways.

4. Use caution when entering or exiting equipment.

5. Respirators should be worn in dusty areas or where posted with signs.

6. Hearing protection should be worn when working around high noise levels.

7. Do not drink water from any source other than standard drinking fountains.

8. Do not look at the flash from welding operations.

9. Personnel other than direct employees of the trucking company are not allowed in the Mill Restricted Area.

10. No person under 18 years of age is allowed in the Mill Restricted Area.

11. Be aware of slippery conditions on the ore pad during periods of inclement weather.

12. Be aware of the potential for ice build-up on and around the decontamination pad during periods of cold weather.

13. When unloading corrosive chemicals:

    a. Full protective equipment is required when working with corrosive chemicals. This includes protective clothing, gloves, boots, chemical splash goggles, and face shields in addition to the hard hat.

    b. Prior to hooking up to unload, check the emergency eye-wash and shower to assure that water is available in case of emergency.

    c. Ensure that either a member of the Mill staff or another qualified delivery person is present during the unloading of the shipment.

    d. Never exceed 30 psi working pressure when using air pressure to unload trucks.

    e. In case of accidents, never remove your protective equipment until it has been thoroughly washed off under the emergency shower. All incidents must be reported to the Shift Foreman on duty as soon as possible.

2.0 Radiation Safety

1. All drivers will be required to scan for alpha radiation prior to leaving the Mill Restricted Area.

2. All equipment, i.e. trucks and trailers, will be scanned for radiation prior to leaving the Mill's Restricted Area.

These standards will be strictly enforced and we expect your full cooperation in their implementation. Failure to abide by these standards may result in denial of entry to the property.

Instructor: ______________________ Date: ______________________

I have been fully informed of the above standards and agree to abide by them at all times while on Denison Mines (USA) Corp. property.

Name: ______________________ SS No.: ______________________

Company: ______________________ Date: ______________________

Signature: ______________________

Grind Circuit

The purpose of the grind circuit is to grind the uranium and vanadium ores to the proper size for maximum leaching, recovery, and accountability of the uranium and vanadium in the ores.

Ore is segregated on the ore pad by mine name and stockpile number. Only one stockpile of ore is fed to the grind circuit at a time and is normally fed in a minimum of 600 ton or a maximum of 2,400 ton lots. The reason for running one stockpile of ore at a time and grinding a minimum of 600 ton lots is to get a good representative sample of each stockpile of ore. The reason for a 2,400 ton maximum on lots is to prevent having too much sample to blend. The mines are paid by the grades from the grind samples. Also, the grind samples are used for mill accountability and recoveries.

Ore from the ore pad is fed to a grizzly by the feed loader operator. The grizzly has 20"x20" openings to prevent rocks that are too big from falling into the ore hopper and plugging the apron feeder. As the ore is dumped on the grizzly, it falls through the 20" opening into an ore hopper.

The ore hopper has a capacity of 50 tons. From the ore hopper, the ore is fed by a hydraulic vara-speed drive apron feeder to a 54" conveyor belt. The speed of the apron feeder drive controls the ore feed rate to the 54" conveyor. The 54" conveyor belt drops the ore on to a vibrating feeder at the intake of the SAG mill. The vibrating feeder feeds the ore into the SAG mill.

The SAG mill is a semi-autogenous grind mill. The mill is run by a 700 H.P. electric motor through a gear box and air clutch. The bearings on the SAG mill are fed a steady flow of oil from a hydrostatic recirculating oil pump. The oil recirculates through a cooling water jacket for cooling. The water flows through the cooling jacket and discharges into the SAG mill intake. There are sensors on all bearings to monitor the bearing temperatures and flow of oil to the bearing. The SAG mill drive clutch will not engage if oil flow is not going through the bearings. If the temperature gets too high or oil flow to the bearings stop, an alarm on the control panel will sound and the air clutch will disengage. If the alarm sounds, check the oil pump to be sure it is running. Shut off ore feed to the mill. Shut down the SAG mill and notify your foreman immediately.

Grease for the ring gear and pinion is pumped by an automatic grease system at the north side of the SAG mill.

All the lubrication to the SAG mill (oil to bearings and grease to the ring gear and pinion) is very critical. Do not operate the SAG mill if lubrication is not operating properly. Notify your supervisor immediately if there are any questions or doubts about the mill getting proper lubrication.

The SAG mill has lifter plates around the inside and is charged with 3" grinding balls. The mill rotates, lifting the balls and ore inside the mill with the lifter plates. As the balls and ore inside the mill rotate to the top of the mill, they fall from the lifter plates back to the bottom of the mill. When the balls and ore hit the bottom of the mill, the ore is broken into smaller pieces. The mill continues to rotate breaking up the ore into smaller and smaller pieces. Water is added to the ball mill at the intake and discharge ends continuously while the ore is being crushed. As the ore inside the mill is crushed to grain size, it is slurried with the water that is being added.

The slurry overflows the discharge end of the mill through grates and a reject trommel screen, and into the mill discharge sump. If the overflowed slurry has any oversized ore in it, the oversized ore (rock) is caught in an ore return chute and a stream of water on the discharge end of the mill washes the oversized ore back into the mill to re-grind. If the oversized ore is too big for the water stream to wash back into the mill, it will discharge into a reject hopper. The amount of oversized ore is controlled by the density of the slurry; if the density is too light or too heavy, there will be an excessive amount of rejects from the mill. The density of the slurry should run approximately 70%.

The overflow slurry from the SAG mill discharge sump is pumped through a direct drive pump to a splitter head tank. The splitter head tank splits the slurry evenly on to three (3) Derrick screens. The Derrick screens have wire type mesh screens that vibrate. As the slurry is vibrated down the screens, the properly ground slurry drops through the screens. Any oversized sand in the slurry will not drop through the screens and is vibrated down the screens to a launder and is washed back to the intake of the SAG mill to be reground. The slurry that drops through the screens flows through a launder and a primary sample is taken by a sample cutter bar moving through the slurry stream flowing into the screen underflow sump. The slurry from the screen underflow sump is pumped to a head tank and slurry can be diverted to pulp storage tanks by manually controlled valves.

The slurry cut by the primary sampler (mentioned above) flows to a secondary Vezin sampler where the sample is cut again. The portion of sample cut by the secondary sampler is stored in a small mix tank where the sample is agitated until the ore lot is finished or ore stockpile is changed. After the ore lot is finished or ore stockpile changed, the agitated slurry stored in the mix tank is run through a tertiary Vezin sampler. The slurry cut from the tertiary sampler goes to a five (5) gallon sample bucket. Sample buckets are to be properly tagged with **mine name, stockpile number, mill lot number**, and **date**. Completed sample buckets are to be tightly lidded. It is very important that mill lot samples are properly taken. The finished mill lot sample is sent to the lab for analysis and is used for accountability and ore recovery. After each sample has been taken and put in a bucket, all samplers and mix tanks are to be washed with water before starting a new sample.

Mill Lot Sample Equipment

Primary Sampler – Straight line, continuous sampler
13 cuts per minute, 36" travel, 7½" per second cutter speed and adjustable cutter opening

Secondary Sampler – 16" Vezin, continuous cutter rotation, 2½% cut at 44 R.P.M.

Agitated Storage Tank – Plastic 36½"x38" I.D. Lightening agitator, 32" shaft, and 4" two-blade impeller

Tertiary Sampler – Same as secondary sampler

The pulp tanks are located outside at the east side of the leach and grind building. Each tank is 35 feet in diameter and 34 feet high and holds approximately 600 dry tons of ore. Each tank has an agitator in it. The agitators are used to keep the slurry mixed so the sand will not separate from the water. The agitator must be running when slurry is in the tank or the sand will settle to the bottom and stop the agitator and plug the pre-leach feed pumps. Minimum freeboard level on pulp storage tanks will be 18".

There is a bag house located northwest of the ore grizzly. The purpose of the bag house is to collect dust from the apron feeder area and the 54" conveyor belt. Dust is sucked through the bag house by a fan on top of the bag house. The bags inside the bag house collect the dust. The bags are shaken periodically to drop the dust they contain. As the dust drops to the bottom of the bag house, an auger carries it to the 54" conveyor belt going to the SAG mill.

Do not feed the grizzly or run the apron feed unless the bag house is operating properly.

Switches for the bag house fan and auger are located at the east side of the bag house.

There is a fan located in the roof above the apron feeder to control radon in the apron feeder area. This fan is to be running when the SAG mill is operating. The start/stop switch is located below the bag house.

Also, there are two (2) wall fans on the bottom floor of the SAG mill. One of the fans is located at the northeast side of the SAG mill and the other is located on the southeast side of the SAG mill. There are two (2) exhaust fans: one is located above the vibrating feeder and one is above the trommel reject screen. These fans are to be run when the SAG mill is operating. The start/stop switches are located at the fans.

All controls, indicators, readouts, alarms, and start/stop switches for operating the apron feeder, 54" feed belt, SAG mill, and related pumps are located on the CP-1 panel in the grinding control room. The main electrical disconnect panels are located in the MCC room under the shifter's office.

Mill Feed Operating Procedure

1. Before operating the loader or haul truck, check the engine water and cooling system, engine oil, hydraulic oil, air filter, tires, and fuel.

2. Lubricate the loader and haul truck at the beginning of each shift.

3. After mobile equipment is started, check the brakes and back up alarm. Fill out Mobile Equipment Checklist sheet. Any defects must be corrected before equipment can be used.

4. Obtain ore stockpile name and stockpile number from your shift foreman.
   a. Check ore stockpile identification sign to be sure ore stockpile name and stockpile number correspond with the stockpile name and number obtained from your shift foreman.

5. Start bag house dust control equipment, screw conveyor rotary valve and fan.

6. Start apron feeder area exhaust fan.

7. Moisture sample: Take one (1) dipper of ore from every fourth (4^{th}) bucket of ore; if a truck is used to haul ore, take one (1) dipper of ore from each truck load.
   a. Sample is to be kept in a five (5) gallon bucket and tagged with the mine name, stockpile number, mill lot number, and the date. Keep the sample bucket cover on at all times.
   b. Mill ore lots normally will be at least 600 tons and not more than 2, 400 tons.

8. Clean up ore pad at the end of each stockpile. Do not mix ore stockpiles.

9. Clean up grizzly area after each mill lot.
   a. Use safety cables and safety belts when cleaning the grizzly.

10. Keep the SAG mill rejects dumped north of the mill building, scraped up and piled north of the grizzly.

11. Always be cautious of traffic congestion, ore delivery trucks, reagent trucks, mill vehicles, etc.

12. Good housekeeping is part of your job – see that it is done.

13. Observe safety rules and wear safety equipment at all times.

Vibrating Feeder

The vibrating feeder is used as a transient conveyor from the 54" conveyor belt to the SAG mill intake.

The vibrating feeder is a type of feeder supported on coiled springs. The drive mechanism is fitted with off-center mounted rotating weights driven through "V" belts by an electric motor. By use of an adjustable pitch sheave, the drive speed can be changed. The force developed by the rotating weights vibrate the entire feeder. The vibrating feeder is equipped with adjustable counter weights and variable speed drive sheave to allow the feeder to be timed. If the feeder is not properly timed and vibrates excessively, the unit can be damaged. If the feeder does not vibrate enough, the ore will not move down the chute to the SAG mill intake.

Proper timing of the feeder is very important for correct operation. The feeder can only be timed by qualified personnel.

Any ore build up on the vibrating feeder unit will cause the timing of the feeder to be off.

Start Up Procedure for Grind Circuit

1. Get ore stockpile name and number from Shift Foreman.

2. Record starting belt scale reading on log sheet.

3. Check all panel alarms and indicator lights.

4. Start SAG mill motor (motor will warm up to operating temperature while making circuit checks).

5. Check vibrating screens and vibrating screen lubrication system.
   a. Check oil supply bottles for adequate supply of lubrication oil.

6. Check pulp tank levels and the valve settings from pulp head tank to pulp storage tanks.

7. Check ring and pinion gear lubrication barrel to be sure there is an adequate supply of grease.

8. Check all process sampling equipment.
   a. All samplers will be cleaned before changing to a different ore stock pile.

9. Before starting any equipment, make sure all safety guards are in place and area is clear of personnel.

10. Start grind mill oil circulating and hydrostatic oil pumps, turn on and check water flow through oil tank heat exchanger.

11. Turn on water to mill discharge and screen underflow pumps.

12. Turn on air supply valve.

13. Turn ring and pinion gear lubrication system switch to automatic position.

14. Start all three (3) vibrating "Derrick" screens.

15. Start direct drive pump.

16. Start screen underflow pump.

17. Pump up any water in floor sumps.

18. Turn main mill feed water valve on. If recycle grind water is used, start recycle grind water feed pump.
    a. Recycle grind water is metered and sampled. Before starting recycle grind water pump, record meter reading on log sheet and place sample bucket under sampler.
    b. Start vibrating screen reject launder water.

19. Engage mill air clutch which, in turn, starts the SAG mill.

20. Start vibrating feeder.

21. Start 54" conveyor belt and belt cleaning brush.

22. Start apron feeder.

23. Start and adjust dust control sprays.

24. Adjust grind water to obtain as high a density as the mill discharge and screen underflow pumps will pump.

25. After SAG mill has been running for 15 minutes, put the mill lot sample bucket under the samplers and start all samplers.

26. Good housekeeping is part of your job – see that it is done.

27. Observe all safety rules and wear safety equipment at all times.

Shut Down Procedure for Grind Circuit

1. Clean up all ore around grizzly walls and grate.

2. Empty grizzly, run all the ore off the 54" belt and vibrating feeder.

3. Stop apron feeder, 54" conveyor belt, conveyor belt brush, and vibrating feeder.

4. Turn off dust control sprays.

5. Grind out SAG mill until the SAG mill motor drops to 50 amps.

6. Stop the SAG mill motor.

7. Turn off the ring and pinion gear lubrication.

8. Turn off air supply valve.

9. Stop the SAG mill oil circulating and hydrostatic oil pumps; turn off the oil heat exchanger cooling water.

10. Turn off the SAG mill grind water.

11. Stop the mill direct drive pump.

12. Stop the screen underflow pump.

13. Turn off the glad seal water to direct the drive and screen underflow pumps.

14. Stop the vibrating "Derrick" screens.
    a. Check the "Derrick" screens for holes.

15. Stop the ore samplers.

16. Record the ending belt scale reading on the log sheet.

17. Record the recycle grind water meter reading on the log sheet when the recycle grind water is being used.

Emergency Shut Down Procedures for Grind Circuit

1. Stop the apron feeder.
2. Stop the conveyor belt.
3. Stop the vibrating feeder.
4. Stop the SAG mill.
5. Stop the mill discharge pump.
6. Stop the "Derrick" screens.
7. Stop the screen underflow pump.
8. Close all water valves.

Power Outage

1. Close water valves.

Shift Inspection – Grind Operator

1. Inspect all moving equipment for proper guards and guards in place once per shift.
    a. Shut off equipment, lock out, and replace guard if not in place.

2. Inspect eye wash fountain for proper operation once per shift.
    a. Repair immediately, if needed.

3. Inspect 54" feed belt condition during the first hour of the shift.
    a. Immediately report to your supervisor if a tear is noted or splices are bad.

4. Inspect 54" feed belt tail pulley clearance during the first hour of the shift – ore spillage around the tail pulley can damage the belt.
    a. Notify your supervisor and shut off the belt, lock out, and clean up ore spillage.

5. Inspect the trommel screen and rock return chute every four (4) hours for holes.
    a. Notify your supervisor if any are noted.

6. Inspect the "Derrick" screens for holes and leaks at the beginning of the shift.
    a. Replace screens as necessary and repair leaks.

7. Inspect and calibrate density scales during the first hour of the shift.

8. Inspect vibrating feed every four (4) hours for ore build up or rocks jammed around moving parts.

9. Inspect and test 54" feed belt emergency stop cable and switch at the beginning of the shift.
    a. <u>Do Not</u> operate the belt if the emergency stop is not operating properly.

10. Inspect the pulp tank agitators for proper running conditions once a shift.
    a. Notify your supervisor if any problems are noted.

11. Inspect sulfuric acid lines and valves on top of pre-leach tanks and the pulp tank for leaks or seeps every four (4) hours.
    a. Notify your supervisor immediately if any are noted.

12. Inspect roof fans every four (4) hours for proper operation.
    a. Notify your supervisor immediately if problems are noted.

13. Inspect all wall and ventilating fans every four (4) hours for proper operation.
    a. Notify your foreman if problems are noted.

14. Inspect agitator shafts and props in the pulp tanks for rubber damage each time the ore slurry is below prop.
    a. Notify your supervisor if damage is noted.

15. Inspect ore samplers every one (1) hour for plugs and proper operating conditions.
    a. Unplug immediately if necessary.
    b. If samplers are not operating properly, notify your supervisor immediately.

CHEMICALS AND REAGENTS

Introduction: Numerous inorganic and organic chemicals are used in the processing of uranium. These include such items as:

1. Inorganic Acids
2. Organic Acids
3. Petroleum Products
4. Fuels
5. Solvents
6. Ammonia
7. Inorganic Bases
8. Flocculents
9. Degreasing Agents
10. Fiberglassing Compounds
11. Oxidizing and Reducing Agents
12. Other chemicals as required

All relevant safety, first aid handling procedures and physical chemical information, etc., is contained in the Material Safety Data Sheet (MSDS) provided in strategic locations throughout the mill area. These can be found in the following locations; safety office, laboratory, maintenance break room and central control room.

The MSDS supplies a description of the chemicals and reagents. The MSDS also explains the hazards, spill procedures, safe use, and first aid procedures for each chemical and reagent.

Each operator must read and understand the MSDS of all chemicals and reagents used in his/her department, and be familiar with the chemicals and reagents used in all operating departments.

Each operator must know the location of all MSDS's for his/her operating circuit at all times.

Information Contained on Hazardous Material Safety Data Sheets

Hazardous Material

Shipping Name	The proper shipping name or other common name for the material; also any synonyms for the material.
DOT Hazard Class	The hazard class designation for the material as found in the Department of Transportation regulations.
Chemical Name	The chemical name of the material and its chemical formula.
I.D. Number	The four-digit identification number assigned to hazardous material by the Department of Transportation; also includes the prefix "UN" or "NA."
S.T.C.C. Number	The Standard Transportation Commodity Code number used in the rail industry; a seven-digit number assigned to a specific material or group of materials and used in the determination of rates; for a hazardous material, the S.T.C.C. number will begin with the digits "49."

Physical Description

Normal Physical State	Physical state or form of the material at normal ambient temperatures (68°F - 77°F).
Color	The color of the material under normal conditions.
Odor	The odor of the material upon its release.

Chemical Properties

Specific Gravity	The weight of a material as compared with the weight of an equal volume of water; if the specific gravity is less than 1, the material is lighter than water and will float; if the specific gravity is greater than 1, the material is heavier than water and will sink.
Vapor Density	The weight of a pure vapor or gas compared with the weight of an equal volume of dry air at the same temperature and pressure; if the vapor density is less than 1, the material is lighter than air and may rise; if the vapor density is greater than 1, the material is heavier than air and will stay low to the ground.
Boiling Point	The temperature at which a liquid changes to a vapor or gas; i.e., the temperature where the pressure of the liquid equals atmospheric pressure.

Melting Point The temperature at which a solid changes to a liquid; this temperature is also the freezing point depending on the direction of the change.

Vapor Pressure The pressure exerted by the vapor within the container against the sides of a container. This pressure is temperature dependent; as the temperature increases, so does the vapor pressure, thus, more of the liquid evaporates or vaporizes. The lower the boiling point of a liquid, the greater the vapor pressure it will exert at a given temperature.

Solubility The ability of a solid liquid, gas, or vapor to dissolve in water; the ability of one material to blend uniformly with another, such as a solid in liquid, liquid in liquid, gas in liquid, or gas in gas.

Degree of Solubility Indication of the solubility of the material.

Other Any additional pertinent information or data found.

Health Hazards

Are there any health hazards associated with the material?

Inhalation Hazard Is there any hazard from breathing this material?
T.L.L./T.W.A. Threshold Limit Value/Time Weighted Average
The concentration of a material to which an average, healthy person may be repeatedly exposed for eight hours per day, 40 hours per week, without suffering adverse health effects.
LC_{50} The concentration in p.p.m. that kills 50% of the laboratory animals in a given length of time.

Ingestion Hazard Is there any hazard from ingesting (eating) this material?
LD_{50} Lethal Dose – the dose that kills 50% of the test animals.

Absorption Hazard Is there any hazard from absorbing this material into the body?
Skin Absorption Can material be absorbed through the skin?
Eye Absorption Can material be absorbed through the eyes?
I.D.H.L. Value Immediately Dangerous to Life and Health Value – an indication of atmospheres that are immediately dangerous to life and health. Within 30 minutes of exposure, death or irreversible health implications to the person exposed are expected.
S.T.E.L. Value Short Term Exposure Limit Value – maximum allowable concentration or ceiling, not to be exceeded during a 15 minute period.

Chronic Hazard Are there any chronic hazards associated with this material?
Carcinogen A material that can cause cancer in an organism.
Mutagen A material that creates a change in gene structure that is potentially capable of being transmitted to offspring.

Teratogen A material that causes the production of a physical defect in a developing embryo.

Hazardous to Aquatic Life Is the material harmful to aquatic life?

Other Any additional pertinent information or data found.

Decontamination Procedures Decontamination is the removal of hazardous materials from the skin, clothing, equipment, etc.; the purpose of decontamination is to prevent or reduce the physical transfer of any contaminants by people or equipment from onsite to offsite locations. List methods available for decontamination for this material.

First Aid Procedures What procedures should be followed for someone contaminated with this material?

<u>**Fire Hazard**</u>

Fire Hazard Will the material burn or support the combustion process of other materials?

Flash Point The minimum temperature at which a liquid gives off enough vapors to ignite and flash over, but will not continue to burn without the addition of more heat.

Ignition Auto-ignition Temperature – the minimum temperature required to ignite gas or vapor without a spark or flame being present.

Flammable Explosive Range – the range of a gas or vapor concentration (percentage by volume in air) that will burn or explode if an ignition source is present. Limiting concentrations are commonly called the "L.E.L." (Lower Flammable Explosive Limit) and the "U.E.L." (Upper Flammable Explosive Limit). Below the lower flammable limit, the mixture is too lean to burn; above the upper flammable limit, the mixture is too rich to burn.

Toxic Products of Combustion The toxic by-products of the combustion process.

Other Any additional pertinent information or data found.

Possible Extinguishing Agent What extinguishing agents are suitable for control/extinguishment of a fire involving this material?

Reactivity

Reactivity	Will the material react with any other materials?
With what?	What is this material reactive with in what ways?
Other	Any additional pertinent information or data found.

Corrosive Hazards

Corrosivity Hazards	Is the material corrosive to other materials?
pH	Acidic or basic corrosives are measured to one another by their ability to dissociate in solution. Those that form the greatest number of hydrogen ions are the strongest acids, while those that form the hydroxide ion are the most potent bases. The measurement of the hydrogen ion concentration in solution is called the pH of the compound in the solution. Strong acids have low pH values and strong bases have high pH values; the pH scale ranges from 0 to 14.
Corrosive to what?	Materials with which the material is corrosive, particularly skin and steel.
Other	Any additional pertinent information or data found.
Neutralizing Agents	Those materials that can be used to neutralize the effects of the corrosive material.

Radioactivity Hazards

Radioactivity Hazards	Will the material emit radioactivity?
Type of Radiation Emitted	Indicate the type of radiation emitted, either alpha particles, beta particles, or gamma radiation.
Other	Any additional pertinent information or data found.

Recommended Protection

For the Public	Recommended action to protect public health and safety; indicate evacuation distances for various amounts of the material.
For Response	Level of protection required for emergency response personnel

Personnel working in the danger zone:

Level A – Requires the highest level of respiratory, skin, and eye protection, that is, a fully encapsulating, chemically appropriate, protective suit with its own self-contained breathing apparatus.

Level B – Requires the highest level of respiratory protection, but a lower level of skin protection. It is the minimum level recommended on initial entries until the hazards have been further identified and defined by complete monitoring, sampling, and evaluation.

Level C – Requires air purifying respirators with adequate protection factors; coveralls and other protective equipment may be required. This level is selected when types and concentrations of respirable materials are knows to have adequate warning properties.

Level D – Requires no respiratory protection; basic work clothing should be worn when sites are positively identified as having no toxic hazards.

For the Environment Potential mitigation schemes to protect the environment.

Note: The back of the Hazardous Material Data Sheet can be used to collect additional information of a more specific nature.

Feed and Grind

Some of the major chemicals used in the Feed and Grind process areas are listed as examples:

1. Sulfuric Acid – -93 to 95% strength
2. Monowet
3. Gear Grease Compound – Surett Fluid 4K
4. Petroleum Lubricating Oil – Spartan EP220
5. Petroleum Lubricating Grease – Ronex MP

Spill/Disposal Procedures

Certain chemicals, when spilled or disposed of, have reporting requirements associated with them. The M.S.D.S. forms for all chemicals used in Uranium Recovery Operations are listed, along with an indication of which chemicals have reporting obligations. The following is an explanation of the actions required of the Mill Operator when dealing with these chemicals. Without exception, your supervisor will make any required reports. Refer to Emergency Response Plan for specific details regarding spill procedures.

Resource Conservation and Recovery Act (R.C.R.A.)

R.C.R.A. regulates the manner in which hazardous materials can be disposed. The specific requirements will be delineated by the Environmental Department. If you need to dispose of any chemicals, contact your supervisor for instructions. The containers that held these products may be disposed of in any trash receptacle if:

1. The container has less than 5% left in the bottom, or
2. The container has been triple rinsed into any mill sump.

Spill Reporting

Reportable spills of certain chemicals must be immediately reported to governmental agencies, depending on the quantity and type of chemical spilled. A reportable spill is basically when the chemical hits the ground (earth), as opposed to a spill to a concrete pad, asphalt pad, sump, etc. If a spill occurs, immediately notify your supervisor. Your supervisor will determine if a report to an agency is necessary. Your supervisor will make the report, if needed. Do not attempt to make a report yourself. If there is any doubt, contact your supervisor for advice and direction.

Hazards – Ore Receiving, Feed, and Grind Circuit

1. Moving Mobile Equipment
    a. Ore delivery truck
    b. Front end loaders
    c. Dump trucks
    d. Pickup trucks
    e. Water wagon
    f. Fork lifts
    g. Delivery and shipping vehicles
2. Uneven Ground
3. Cleaning Ore Grizzly
4. Moving Conveyor Belts
5. Falling Rocks
6. Dust
7. Noise
8. Cleaning Plugged Feeders and Chutes
9. High Pressure Air Lines – 100 p.s.i.
10. Overhead Crane
11. Rotating SAG Mill
12. High Pressure Oil Lines
13. Slick Ore Pad Area When Wet

Items listed above can be hazards if not controlled properly. If controlled properly and to operating standards, they are safe.

Hazard Recognition – Scalehouse

1. Hazards
    a. Delivery Trucks
    b. Ore Haulers
    c. Product Haulers
        1. Must read and sign Hazard Training Sheet
        2. Must be issued a hard hat and safety glasses
    d. Loaders – Haulage Trucks (Denison Mines (USA) Corp.)
    e. Jaw Crusher and Drying Unit in Bucking Room – Pinch Points – Heat
    f. Stockpile Hazards
        1. Falling rocks on stockpiles
        2. Tripping hazards during sampling operation
        3. Radiation hazards from stockpiles
        4. Lifting of sample buckets
        5. Weather condition considerations

Hazard Recognition – Mill Feed and Stockpiles

1. Hazards
    a. Delivery Trucks – Speed Limit of 15 M.P.H.
    b. Ore Haulers – Speed Limit of 15 M.P.H.
    c. Product Haulers – Speed Limit of 15 M.P.H.
    d. Denison Mines (USA) Corp. equipment has the right of way. **BE AWARE OF ALL PERSONNEL AND TRUCKS IN YOUR AREA.**
    e. Grizzly
        1. Safety belt must be used during work on the grizzly
        2. Safety chain must be installed during maintenance work
    f. Dust Collection
        1. System must be stared before ore is fed to SAG mill – possible electrical shock
    g. Cleaning of Tunnel
        1. Conveyor must be locked out to clean underneath
        2. Respirator required – radiation and silica dust
        3. Hearing protection must be worn when the dust collection system is operating
        4. Replace guards when finished cleaning
        5. The biggest hazard in the tunnel is the moving conveyor
        6. Radiation Work Permit will be required if it is determined that there is a potential for elevated radiation exposure based on an assessment of the work environment.
    h. SAG Mill Area
        1. Rotating mill
        2. Moving conveyor
        3. Vibrating feeder
        4. Guards must be in place
        5. Falling rocks from the SAG mill feed chute – above vibrating feeder
        6. Hot oil system

7. Foaming of #1 pre-leach tank
8. Traffic in north door of mill building
    a. Using a forklift to remove rejects – BEWARE OF TRAFFIC AND PERSONNEL
9. Lifting of sample buckets – using proper lifting techniques

2. Health Hazards
    a. Silica and Nuisance Dusts and Mists
    b. Hearing Protection
    c. Radiation
        1. Airborne uranium
        2. Radon progeny
        3. Beta gamma

Hazard Recognition – SAG Mill Operator

1. Hazards
    a. Conveyor
    b. Rotating Mill
    c. Vibrating Feeder – Apron Feeder
    d. Hot Oil System
    e. Falling Rock from SAG Mill Feed Chute Above Vibrating Feeder
    f. Foaming of #1 Pre-leach Tank
    g. Using Forklift to Empty Reject Bin – **BE AWARE OF PERSONNEL AND TRAFFIC** in north door of the mill building
    h. Acid Lines – Pump Storage
    i. Steam Lines
    j. High Pressure Air Lines
    k. Guards
    l. Pinch Points
        1. Idlers and rollers
        2. Head and tail pulley
        3. All guards must be in place before running
        4. Cleaning up around pumps
    m. Overhead Crane During Loading Balls into SAG Mill
    n. Overhead Crane During Relining SAG Mill (must be roped off)
    o. Overhead Crane Must Not be Used when SAG Mill is Rotating
    p. **CAUTION** – Wet Decks are Slick and Fall Hazard

2. Health Hazards
    a. Radiation
        1. Radon progeny
        2. Airborne uranium
        3. Beta gamma

b. Silica and Nuisance Dusts, Mists and Fumes

c. Hearing Protection

JOB PROCEDURES

This section covers job procedures for non-daily routine jobs that are performed in:

ORE RECEIVING, FEED, AND GRIND

All non-routine jobs will be initiated by your supervisor. Non-routine jobs will not be performed unless directed by your supervisor.

Operator Procedure for Cleaning Ore Grizzly

1. Safety cables are installed at the north and south sides of the grizzly.
    a. One end of the cable is attached to the bin.
    b. The other end of the cable is looped so that a safety belt can be attached.

2. Do not work in the grizzly area without a properly secured safety belt.

3. Before entering the grizzly area:
    a. Park the loader approximately 10 feet east of the ore bin with the brake set, bucket down, and the engine off.
    b. Inspect the safety cable to be sure it is attached securely to the grizzly wall.
    c. Inspect the safety cable for defects. If defects are seen, do not use the cable. Notify your foreman. Do not work in the grizzly area.
    d. Inspect the safety belt and tie rope for defects. Do not use if defects are noted.
    e. Put on the safety belt.
    f. Attach the tie rope on the safety belt to looped end of the safety cable.
    g. Check the length of the safety cable and tie rope so that if you slip or fall, you will not fall between the grizzly bars.

4. Clean grizzly as needed.

5. After cleaning is completed, move out of the ore bin and away from the grizzly, and take off the safety belt.

6. Hang cable away from the area so that the loader will not catch the cable when it is dumping ore.

Hazards of the Job

1. Slipping on the grizzly and falling between the bars.

2. Stepping on ore material and twisting an ankle.
3. Pinch points when handling materials.
4. Potential foot hazards.

I have read and understand the above job procedures.

Date ______________________ Names ______________________________

____

____

____

____

SAFETY RULES AND PROCEDURES

Safety rules will be followed ***without exception***. Listed on the following pages are general safety rules and safety rules for Ore Receiving, Feed Operator, and Grind.

These rules do not cover all the White Mesa Mill safety rules. Each operator is to know and understand all White Mesa Mill safety rules that are described in the White Mesa Mill Safety Rules manual.

GENERAL RULES

Introduction

All safety rules are listed in the White Mesa Mill Safety Manual. However, several general rules applicable to this process area are delineated below.

Reporting Unsafe Conditions and Injuries

1. Correct or report all unsafe conditions to a supervisory person as soon as possible.

2. Report all injuries – no matter how slight – to your supervisor immediately. Also, report all accidental occurrences or conditions that may have a potential for injuring someone.

3. If you wish to see a physician for any occupational injury or illness, contact your supervisor for an authorization slip before seeing the doctor.

Personal Protective Equipment and Clothing

1. Hard hats, safety shoes, and safety glasses with side shields must be worn at all times in the plant area – except in control rooms, offices, and change rooms.

2. "Bump" caps, metal hard hats, and contact lenses are not permitted.

3. Other personal protective equipment includes, but is not limited to: ear plugs, respirators, wet suits, welding helmets, goggles, gloves, and rubber boots. Face shields and safety belts are required in designated areas and/or while performing certain jobs. If in doubt, contact your supervisor.

4. Each employee is responsible for the condition of their protective equipment. Report any defects, etc., to your supervisor.

5. The following equipment is required when working on pipelines or vessels containing acids or caustics:
    a. Face shield and chemical splash goggles
    b. Rubber coat and pants
    c. Rubber gloves and rubber boots
    d. Other equipment specified by the foreman for that particular job listed on the Safe Work Permit

6. Hair that extends below the T-shirt collar or extends two inches laterally from the head (on a natural lay) must be contained by a net of other adequate means.

7. Rings or other hazardous items of jewelry shall not be worn except while working in the office.

8. The use of a safety belt and properly adjusted life line is required where there is a danger of falling four feet or more, except while performing work under the Ladder and Scaffold section of this manual. This rule applies when going beyond the handrails of walkways on top of any tanks in the mill area.

9. Proper clothing shall be worn at all times. Loose, ragged clothing which could create a hazard will not be permitted on the job.

10. It is a condition of employment that all personnel who may be required to wear a respirator must be clean shaven to assure that the respirator fits properly. Personnel will be fully trained prior to using respirators.

<u>Conduct</u>

Employees will be subject to disciplinary action, up to and including discharge, for any of the following safety offenses:

1. Violation of any safety rule.

2. Entering the plant while under the influence of alcoholic beverage or drugs, or having them in your possession while in the plant area.

3. Fighting, wrestling, or engaging in "horseplay" while on the premises.

4. Water fights will not be tolerated.

5. Removal without authority, or destroying, or tampering with any safety device, sign, or signal.

6. Removal of company property without specific written authorization.

7. Carrying firearms into the plant area without specific written permission.

8. Giving false information or testimony during an investigation of incidents.

9. When going down steps, <u>do not</u> slide down the handrails.

OPERATIONS - SAFETY RULES

General

1. Operators are not to open electrical panels. Doors on electrical panels must be kept closed at all times. All electrical equipment repairs are to be completed by an DMUSA approved electrician.

2. When lighting oil or gas-fired equipment of any type, follow the specific instructions posted. If you smell gas or detect a leak, notify your supervisor at once.

3. Open steam valves slowly to permit condensation to escape. A sudden surge of condensation may rupture the line and scald you.

4. Never "block in" magnetic switches. If the switch will not close, notify your supervisor.

5. Know the location and how to use the exits, eye wash fountains, showers, protective equipment, and fire extinguishers in your area. Know the hazards presented by chemicals used in your area and how to defend against them. Material Safety Data Sheets (MSDS) are available.

6. If a valve refuses to open or close, ask your supervisor to have it repaired. Do not use a wrench or cheater to open or close a valve unless it has been thoroughly inspected to determine its condition.

7. All personnel shall know the location of all main block valves for fuel, kerosene, gas steam, air, water, sulfuric acid, and ammonia lines which pass through their area. Even though the respective valve may not be in the operator's area, he or she must know how to shut off each line in case of an emergency.

8. Safe operation of conveyors requires that you shall:
   a. Be sure everyone is clear of all belts and pulleys before starting the conveyors.
   b. Lock out the main drive motor switch before cleaning or repairing head or tail pulleys, idlers, or the belt. If guards must be removed to grease or use belt dressing, the conveyor shall be locked out.
   c. Never ride a conveyor belt.
   d. Cross conveyors only at walkways provided.
   e. Check and record each shift to be sure all emergency stop lines are operative.

ORE RECEIVING AND GRIND - SAFETY RULES

Ore Receiving and Sampling

1. Personnel shall stand well clear of trucks when the bed is inclined. Trucks can turn over and there is always danger from falling rocks. When the dump trucks are unloading, stand at least 50 feet away.

2. Loader and truck operators should be aware of personnel and equipment entering their area, but people should be aware that the operator may not see them and, therefore, should stay clear of the equipment.

3. Axle high berms shall be maintained on all stockpiles driven upon.

4. A Safe Work Permit and a confined space entry permit must be obtained before entering any bin or hopper. A Radiation Work Permit will be required if it is determined that there is a potential for elevated radiation exposure.

5. Safety belts and lines must be worn and tied off while working on the grizzly.

6. When sampling loads of ore, be careful not to step on rocks and turn your ankle or fall.

Grind

1. No one shall go into the SAG mill until a Safe Work Permit and Confined Space Entry Permit have been completed to cover the work to be done. The person entering the mill must comply with these permits. A radiation work permit will be required if it has been determined that there is a potential for elevated radiation exposure.

2. If the dust collector is inoperative, notify your supervisor at once.

3. Spills (i.e., ore, water, grease) must be cleaned up at once and the cause corrected as soon as possible.

4. All safety guards, including dust hoods, must be replaced before a piece of equipment is started.

5. A careful inspection shall be made before starting equipment to ensure that all personnel and obstructions are clear.

6. Entry into the slurry storage tanks shall be covered by a Safe Work Permit and a Radiation Work Permit.

7. Do not unplug the apron feeder or vibrating feeder by getting in chutes or inside feeders. If plugs or rocks cannot be removed without getting inside feeders, notify your foreman before continuing.

<u>Conveyor Belts</u>

1. Conveyor belts are sometimes called "silent killers." Be aware and alert at all times when working around them.

2. Never attempt to clean conveyor idlers, head, or tail pulleys while the belt is in motion. Never attempt any work on a conveyor unless the motor is shut off and the lockout procedure has been followed.

3. Never ride on, cross over or under a moving conveyor. Use walkways and crossovers that are provided.

4. Know the location of emergency stop cords and how to use them.

5. Emergency stop cords on all conveyors must be tested for proper operation by the operator on each shift and a notation entered on the log sheet that the test was completed. All malfunctions must be reported and repaired before belt is operated. Never operate the conveyor if the emergency stop cord is not working properly.

6. All guards must be kept in place, except when the conveyor is properly locked out.

7. Remember that a tool can be caught in a pulley or idler so quickly that you will not have time to let go before it catches you. Be extremely cautious when working around conveyors.

8. Always wear close fitting clothing that cannot become caught in moving parts.

9. When shoveling clean up material onto a moving conveyor, always face in the direction of conveyor travel. Never shovel onto a conveyor that is moving toward you.

MOBILE EQUIPMENT - SAFETY RULES

General

1. Only trained and authorized persons may operate mobile equipment.

2. All mobile equipment shall be inspected by the operator and any safety defects corrected before the equipment is used. This needs to be documented on the forms provided. If safe to do so, the equipment may be driven to the shop for repairs. Otherwise, the equipment must be towed or repaired at the location.

3. Audible backup alarms shall be in operating condition.

4. Walk around any piece of equipment before starting or moving it. Make certain no one is in a dangerous position and there are no obvious defects or hazards.

5. Use care when getting on or off equipment. Use the handholds provided. **NEVER JUMP** from equipment.

6. No person shall get on or off of moving equipment.

7. Seat belts shall be used at all times when equipment is in motion.

8. Equipment shall be operated at a reasonable speed consistent with road and weather conditions.

9. Equipment shall not be started or otherwise operated unless the operator is seated at the controls of the equipment.

10. Keep the cabs of equipment clean. Loose items which could jam controls or create other hazards are not allowed.

11. Only those persons that can be seated safely in the operator's compartment will be permitted to ride as passengers.

12. Report all accidents to your supervisor regardless of how minor they are. If property damage or personal injury is involved, do not move the equipment until your supervisor has released it.

13. All gasoline engines must be shut off when refueling.

14. Stunt driving and horseplay are strictly forbidden.

15. Keep equipment clear of edges, drop offs, and unstable banks. Maintain adequate berms where required.

Dump Trucks

1. Do not move the truck until the air pressure is built up to normal.

2. Do not overload the truck.

3. Release the parking brake before moving the truck. Use a low enough gear to start the truck without slipping the clutch.

4. Except to shake out the load, no truck shall be driven until the bed is in the full down position.

5. Never work under a raised bed of a truck unless it is securely blocked.

6. Park the truck in its designated parking place with the brakes set and engine off.

Front End Loaders

1. No one but the operator is permitted to ride on the loader.

2. Never leave the loader without dropping the bucket to the ground.

3. Do not jump off loaders. Use hand rails and steps when getting on or off equipment.

4. When stepping from the loader to the ground, be sure there are no rocks that you could step on and turn your ankle.

5. Do not strike the dump truck with the loader bucket or wheels.

6. Avoid spinning or slipping the drive wheels of the loader as much as possible.

7. Do not move loaders equipped with air brakes until the air pressure is built up to normal.

8. Park the loader out of the way or in the designated parking place with the brakes set and engine off.

9. Always keep the bucket as low as possible when traveling.

10. When lubricating front end loaders, park the loader on flat ground, bucket down, parking brake set, and the engine off.

Operator Procedure for Cleaning Ore Grizzly

1. Safety cables are installed at the north and south sides of the grizzly.
    a. One end of the cable is attached to the bin.
    b. The other end of the cable is looped so that a safety belt can be attached.

2. Do not work in grizzly area without a properly secured safety belt.

3. Before entering the grizzly area:
    a. Park loader approximately 10 feet east of the ore bin with the brake set, bucket down, and the engine off.
    b. Inspect the safety cable to be sure it is attached securely to the grizzly wall.
    c. Inspect the safety cable for defects. If defects are seen, do not use the cable – notify your foreman. Do not work in the grizzly area.
    d. Inspect the safety belt and tie rope for defects. Do not use if defects are noted.
    e. Put on the safety belt.
    f. Attach tie rope on the safety belt to looped end of the safety cable.
    g. Check length of the safety cable and tie rope so that if you slip or fall, you will not fall between the grizzly bars.

4. Clean the grizzly as needed.

5. After cleaning is completed, move out of the ore bin and away from the grizzly and remove the safety belt.

6. Hang cable away from the area so that the loader will not catch the cable when dumping ore.

RADIATION SAFETY PROCEDURES

These rules do not cover all of the White Mesa Mill Radiation Safety Procedures, but are supplied as a guide to be utilized as a supplement to the training which you have received.

Listed below are the Radiation Safety Procedures for ore receiving and grind which, when followed, will maintain your exposures A.L.A.R.A. Remember, you are the person most responsible for controlling your radiation exposure. If the Radiation Safety Procedures are followed and protective equipment is utilized correctly, your exposure will be maintained A.L.A.R.A.

Ore Receiving and Grind Radiation Safety Procedures

1. **A.L.A.R.A. Program Policy Statement**

   The policy of Denison Mines (USA) Corp. to maintain good radiation protection practices is the expenditure of every reasonable effort to achieve and maintain low levels of contamination and radiation in occupational exposures. By definition, the A.L.A.R.A. program shall result in radiation exposures being maintained to levels as far below any applicable limits of the N.R.C. regulations as is reasonable.

   This policy and program is to be achieved through systematic employee monitoring and an on-going review process between the radiation protection staff and plant operations management with secondary audits performed by corporate environmental radiation safety personnel.

   Denison Mines (USA) Corp. is committed to maintaining occupational exposures of personnel at White Mesa to levels as low as reasonably achievable. This commitment is supported by the training program conducted for facility personnel, and continuous reviews of radiation, environmental, and industrial hygiene protection policies.

   It is the policy that occupational exposure records of personnel at the White Mesa Mill are readily available for review when requested. The radiation protection staff will review and discuss any aspect of radiation safety at any time.

2. **Radiation Work Permit**

   The Radiation Work Permit is designed to provide a job procedure plan to prevent unknown or excessive exposure when any non-routine (i.e., maintenance, etc.) work is to be performed in the mill area. The procedure ensures that radiation hazards which cannot be contained will be controlled by the use of protective equipment. An initial assessment of the work environment and associated work tasks as related to potential radiation exposure will be made for those non-routine work activities which may require the issuance of a Radiation Work Permit. If it is determined, by this initial assessment, that there is a potential for elevated radiation exposure, a Radiation Work Permit will be issued.

a. A Radiation Work Permit will be issued by the radiation staff.

b. Before work starts on the job outlined on the work permit, the radiation safety staff must review and approve the permit after being certain there is no health hazard to employees.

c. The permit must be signed by all personnel involved in the work and posted in the work area.

d. After work has been completed, the permit will be sent to the radiation safety office for calculations of exposures and filed for future reference.

e. The jobs mentioned below at ore receiving and grind will require a Radiation Work Permit if is determined that there is a potential for elevated exposure based on an assessment of the work environment.

1. Ore Receiving

    a. Entry into the ore receiving bin for any repairs.

    b. Clean up of ore spills in the SAG mill tunnel.

2. Grind

    a. Entry into the SAG mill.

    b. Any repairs to the discharge or screen underflow sumps.

    c. Entry into the pulp storage tanks.

    d. Clean up of spills around the pulp storage tanks.

This is not an all-inclusive list of jobs at ore receiving and grind that could require a Radiation Work Permit, but is intended as a guide.

3. **Posting of Specific Areas**

As a part of A.L.A.R.A. practices and controlling your exposures, the following signs could be posted in your work area. It is important that you understand what these signs mean.

CAUTION – AIRBORNE RADIOACTIVE AREA This sign is posted in an area in which airborne uranium or radon progeny concentrations are, or at above 25% of the specified limits for airborne concentrations. Any time this posting is observed, respiratory protection is required to minimize your exposure until conditions can be corrected and airborne concentrations are below 25% D.A.C. The following areas have required that they be posted as an "airborne radioactivity area" requiring the use of full-face respirators due to airborne or radon progeny concentrations above 25% D.A.C.:

a. SAG Mill Tunnel

b. SAG Mill

c. Pre-leach Area

CAUTION – RADIATION AREA This sign is posted in an area where beta and gamma radiation levels are at, or above 2 mr/hr. Methods of controlling your exposure to beta or gamma radiation are listed below.

a. Our primary means of control for gamma or beta is limiting time spent in the radiation area.

b. The ore stockpiles are the only current location within this circuit where gamma radiation levels have been identified as being at 5 mr/hr.

4. **Procedures to Follow Regarding the Use of Respirators**

a. When issued a new respirator, the respirator shall be fit-tested with irritant smoke and logged on the forms provided at the shifters office. After the initial fit-testing, a positive-negative pressure test will be done each time the respirator is donned to ensure a proper fit.

b. If you are using a respirator in a very dusty area, it may be necessary to change the filter after two to three hours. When resistance to breathing becomes uncomfortable, it is a sign that the filters have served their useful life and need to be replaced.

c. At the White Mesa Mill facility, we use only one type of respirator cartridge for the full-face respirators. The combination cartridge is acceptable for nuisance dusts, chemical mists and radiological dusts..

5. **Radiation Safety Procedures**

These are practices that, if you follow, will minimize your radiation exposure while working at the White Mesa Mill:

a. Practice good housekeeping to prevent build up of ore spills in the tunnel and around the SAG mill.

b. Follow good personal hygiene habits.

   1. Wash your hands prior to eating and before leaving the plant.

   2. Change and wash your clothes regularly and bathe regularly.

   3. All mill personnel will be provided with a change room, showers, and laundry facilities so that they may leave their work clothes at the mill. All coveralls and contaminated clothing will be laundered on the property.

   4. Store your lunch box and eat only in a designated eating area.

   5. Scan your clothes, hands, and bottoms of your shoes with the alpha scanner prior to leaving the restricted area.

c. Cooperate with the people making the radiation surveys by doing your job in a normal manner. If you think sampling is being done under abnormal conditions, tell the person doing the surveys.

d. Always wear your dosimetry device when you are assigned one. Put it in the designated area when leaving work.

e. Wear appropriate respiratory protection while the SAG mill is operating (full-face respirator).

f. If any of the equipment listed below is not operating, or if there is evidence of excessive dusting, notify your shift foreman.

   1. Baghouse at Grizzly

   2. Tunnel Mine Fan

   3. Conveyor Drop Fan

   4. North Wall Fan

   5. East Wall Fan

6. Electrostatic Precipitator in the SAG Mill Control Room

7. Roof Fan

g. If you are concerned or have any questions about the amount of radiation you are being exposed to, contact the Radiation Safety Officer.

6. **Urinalysis Sampling**

Routine urinalysis samples for operators at ore receiving and grind will be taken every two weeks. Urinalysis samples are utilized to determine the uranium content contained in the urine of the operator. The frequency of sampling is dependent on the airborne concentrations and will be changed if airborne levels exceed 25% of the airborne standards.

To minimize the chance of contaminating a urine sample, the following practices should be followed:

a. Urinalysis containers can be picked up at the administration building upon returning from your scheduled days off (two and four days). The sample containers should be filled after washing your hands and prior to changing into your work clothes or reporting to your work location. The samples can then be placed in the bioassay laboratory.

Under unusual circumstances where specimens cannot be collected in this manner, the worker should shower immediately prior to voiding. When a shower is not possible, disposable plastic or rubber gloves should be worn during voiding. Take all necessary precautions to ensure that your urine sample is not contaminated.

OPERATOR'S RESPONSIBILITIES

1. Shift change between operators will be made in assigned circuits. Shift change between operators will not be made in the mill lunchroom or the mill change room. An operator leaving his work station before being relieved will be leaving without permission and will be subject to disciplinary action which could lead to termination.

2. After the shift change has been made, the oncoming operator will read the circuit log book at the beginning of the shift for any operating changes or information pertaining to the circuit since the last log book review. The operator will be required to initial the log book stating he or she understands the information in the log book. If the information concerning your operation is not clearly understood, contact your shift foreman as soon as possible. Review the log book during your shift for any operating changes made during your shift.

3. The first hour of each shift will be spent checking all equipment and conditions of the circuit to determine that the circuit is operating safely and to operating parameters stated in the circuit log book.

4. It will be the responsibility of each operator to:
   a. Operate the circuit in a safe and efficient manner while following all company safety rules.
   b. Operate equipment within specified parameters.
   c. No alarms are to be blocked out or otherwise made to be inoperable at any time.
   d. Maintain a proper operating log sheet.
   e. Collect and properly label all mill control samples and avoid sample contamination.

8. Prior to leaving the restricted area, all operators will monitor themselves with an alpha radiation survey meter located at the guard house. If the alarm sounds, re-survey. If the alarm sounds again, contact the Shift Foreman, Radiation Safety Officer, or a radiation staff member.

9. Operators of company vehicles must have a valid driver's license.

10. Operators will not operate mobile equipment until trained to operate mobile equipment by a qualified trainer.

11. Mobile equipment is to be checked before use on each shift. A Mobile Equipment Check List will be filled out and maintained with the each piece of equipment. Any equipment defects must be corrected before equipment is operated. The Mobile Equipment Check List must be available for inspection at all times.

1.0 PURPOSE

The alternate feed material received at the White Mesa Mill often will contain debris of one sort or another. The debris ranges from large concrete chunks to limbs and branches, and miscellaneous smaller forms of debris. The alternate feed material normally contains uranium values on the surfaces of the large debris and/or is included in fine particles; therefore, the alternate feed material generally does not require size reduction (e.g. crushing or grinding) for liberation of values.

1.1 Trommel Operation

Processing of this type of material commences with sizing and washing of the material. The sizing starts with the material being passed across a stationary grizzly having approximately 6-inch spacing between the parallel bars. Large material and some of the plastic liner is rejected from the smaller material. This oversize material may be passed across the grizzly more than once to enhance separation by size. The oversize material is periodically loaded onto a dump truck, which then proceeds to the debris-washing pad (See Section 1.2).

Material passing the 6-inch stationary grizzly is conveyed to the trommel screen, which has openings of approximately 3/8-inch. Water is applied to the material in the rotating trommel screen to wash off the fines. The oversize material proceeds up the inclined trommel and is discharged out the end, and stacked. This washed oversize material is periodically loaded onto dump trucks to be hauled to a designated area for disposal. This oversized material may be loaded onto the truck hauling the oversize material from the grizzly.

Undersize material from the trommel is collected and pumped to feed the derrick screens within the Mill building. The screen surfaces of the derrick screens can be changed for screens with different sized openings. The usual screen size here, effects a size separation at about 28-mesh.

The oversize material (plus 28-mesh) from the derrick screens is washed down a system of troughs and piping to a collection area just outside the Mill building. The stacked material is periodically loaded onto trucks to be hauled to the tailings area for disposal (See Section 1.2).

The underflow from the derrick screen (minus 28-mesh) is collected and pumped to the 100-foot thickener (neutral thickener). Flocculant and, possibly coagulants, may be added to assist the settling of solids within the thickener. The settled solids are mechanically raked to the center to be discharged from the thickener. The underflow of the neutral thickener is the feed to the leach circuit. The density of the leach feed is controlled by the speed of the thickener underflow pump.

The solution overflowing the neutral thickener is pumped to a surge tank and is recycled to be used for the washing of solids in the trommel and elsewhere. Fresh water is added to make up for the water discharged with the solids at the thickener underflow and is added to the trommel for solids washing and at various places (e.g. transfer points and stationary grizzlies) for dust suppression.

Process control is provided both locally, within the circuit, and in the central control room in the main Mill building.

1.2 Debris Leach Operation

At the debris-washing pad, the end gate of the truck is partially opened, the bed is raised, and water is sprayed onto the debris. The elevated bed and the partially opened gate retain the debris and allow the water and the fines to leave the truck bed. Other equipment may be used for the washing of large debris, and may be altered to allow ease of operation.

After draining, the truck may be directed to the collection points for the trommel oversize and the Derrick screen oversize and this additional oversize can be loaded with the large washed debris. The load can then be taken to the designated area of tailings, in Cell 2 or 3, for disposal. Debris will be disposed of in a manner to minimize void spaces and nesting and to enhance compaction. All drums or barrels will be crushed to minimize void spaces. Random fill or tailings will be used to fill voids in and around the debris. The fill and cover material will be compacted with at least one pass of the construction equipment prior to advancement of any final reclamation cover layers.

The fine material washed from the coarse debris is collected into a sump and pumped to join the trommel undersize and is pumped to the derrick screens for further sizing.

2.0 TROMMEL SCREEN PROCEDURES

2.1 Start-up Procedures

1. Perform a pre-operational inspection of the area and equipment to be operated. Assure that all maintenance has been completed and those areas picked up and guards reinstalled. Assure that all walkways are clear, hoses and tools picked up, and the power to each unit is available (check MCC for lockout of starters).

2. Assure that sufficient flocculant and/or other reagents have been mixed and are available for use.

3. Check that the downstream circuits are ready to have material sent to them and notify your supervisor that you are ready to start-up.

4. Check the rake drive and lift on the neutral (100ft) thickener. The rakes can be lowered until there is an increase in torque at which time the neutral thickener underflow pump can be started and slurry delivered to the leach circuit. Before starting the pump, assure that gland water is on to the seal.

5. Start adding flocculant to the neutral thickener feed trough or center well.

6. Start the motors for the derrick screen(s).

7. Start the neutral thickener overflow pump to the water surge tank.

8. Start the water to the trommel screen and start the trommel screen drive motor.

9. Start the sump pump and the trommel undersize pump to feed the derrick screens.

10. Start the conveyor and belt feeder to feed the trommel screen.

11. Start the water sprays at the stationary grizzly and at the transfer points. During cold weather periods, check with the shifters on the use of water sprays for dust suppression.

12. Start feeding the designated feed to the grizzly.

13. Remove materials from the collection points and load onto trucks for haulage to the tailings area for disposal.

14. Adjust flows as needed.

15. Check that all equipment is functioning correctly.

2.2 Shut Down Procedures

1. Stop the feed to the grizzly and empty the hopper, conveyor and belt feeder.

2. Continue operating the trommel screen until the trommel screen is empty or near empty, then stop the water to the trommel screen and shut down the trommel screen drive motor.

3. Wash out the sump from the debris washing pad and flush the derrick screen feed pump and lines, then shut down both pumps.

4. Shut down the water sprays at the stationary grizzly and transfer points.

5. Wash off the derrick screens and the oversize trough, then shut down the derrick screen and the underflow pump feeding the neutral thickener

6. Stop the flocculant addition to the neutral thickener.

The feed to the neutral (100 ft) thickener is now off. The thickener rake drive and the underflow pump should continue to operate until the underflow density is low and/or instructions are given to shut the underflow pump down. Supervision will determine how far the rakes should be lifted prior to shutting down the drive motor.

2.3 Emergency Shut Down Procedures

1. Stop feeding the grizzly.

2. Shut down the water supply to the trommel screen.

3. Shut down the sump pump and the derrick screen feed pump.

If time permits:

4. Shut down the derrick screen motors and the derrick screen underflow pump.

5. Raise the neutral thickener rakes to relieve the torque.

6. Shut down the conveyors and feeders.

7. Shut down the fresh water sprays.

8. Flush the line from the trommel screen underflow to the derrick screens.

2.4 General Inspection Procedures

The following are procedures that should be done on a regular basis throughout the shift.

1. Inspect reagent lines, feed lines and water lines for leaks and immediately notify your supervisor if any leaks are noted.

2. Inspect motors on pumps to be sure they are not running hot and immediately notify your supervisor if a motor is found to be running hot.

3. Assure that water sprays are functioning and wash water is sufficient in volume and pressure.

4. Assure that the trommel is not over loaded.

5. Check that all equipment is running and there is no blockage at transfer points.

3.0 CHEMICALS AND REAGENTS

3.1 Introduction

Numerous inorganic and organic chemicals are used in the processing of uranium. These include such items as:

- Inorganic Acids
- Organic Acids
- Petroleum Products
- Fuels
- Solvents
- Ammonia
- Inorganic Bases
- Flocculants
- Degreasing Agents
- Fiberglassing Compounds
- Oxidizing and Reducing Agents
- Other chemicals as required

3.2 Debris Leach and Trommel Screen Operation

Some of the major chemicals used in the debris leach and trommel process areas are listed as examples:

- Sulfuric Acid – 93 to 95% strength
- Monowet
- Gear Grease Compound
- Petroleum Lubricating Oil
- Petroleum Lubricating Grease
- Flocculants and Coagulants

3.3 Material Safety Data Sheets

All relevant safety, first aid handling procedures and physical chemical information, etc., is contained in the Material Safety Data Sheet (MSDS) provided in strategic locations throughout the mill area. These can be found in the following locations; safety office, laboratory, maintenance break room and central control room.

The MSDS supplies a description of the chemicals and reagents. The MSDS also explains the hazards, spill procedures, safe use, and first aid procedures for each chemical and reagent.

Each operator must read and understand the MSDS of all chemicals and reagents used in his/her department, along with the chemicals and reagents used in all operating departments.

Each operator must know the location of all MSDS's for his/her operating circuit at all times.

3.4 Information Contained on Hazardous Material Safety Data Sheets

Hazardous Material

Shipping Name The proper shipping name or other common name for the material; also any synonyms for the material.

DOT Hazard Class The hazard class designation for the material as found in the Department of Transportation regulations.

Chemical Name The chemical name of the material and its chemical formula.

ID Number The four-digit identification number assigned to hazardous material by the Department of Transportation; also includes the prefix "UN" or "NA."

STCC Number The Standard Transportation Commodity Code number used in the rail industry; a seven-digit number assigned to a specific material or group of materials and used in the determination of rates; for a hazardous material, the STCC number will begin with the digits "49."

Physical Description

Normal Physical State Physical state or form of the material at normal ambient temperatures (68°F - 77°F).

Color The color of the material under normal conditions.

Odor The odor of the material upon its release.

Chemical Properties

Specific Gravity The weight of a material as compared with the weight of an equal volume of water; if the specific gravity is less than 1, the material is lighter than water and will float; if the specific gravity is greater than 1, the material is heavier than water and will sink.

Vapor Density The weight of a pure vapor or gas compared with the weight of an equal volume of dry air at the same temperature and pressure; if the vapor density is less than 1, the material is lighter than air and may rise; if the vapor density is greater than 1, the material is heavier than air and will stay low to the ground.

Boiling Point The temperature at which a liquid changes to a vapor or gas; i.e., the temperature where the pressure of the liquid equals atmospheric pressure.

Melting Point The temperature at which a solid changes to a liquid; this temperature is also the freezing point depending on the direction of the change.

Vapor Pressure The pressure exerted by the vapor within the container against the sides of a container. This pressure is temperature dependent; as the temperature increases, so does the vapor pressure, thus, more of the liquid evaporates or vaporizes. The lower the boiling point of a liquid, the greater the vapor pressure it will exert at a given temperature.

Solubility The ability of a solid liquid, gas, or vapor to dissolve in water; the ability of one material to blend uniformly with another, such as a solid in liquid, liquid in liquid, gas in liquid, or gas in gas.

Degree of Solubility Indication of the solubility of the material.

Other Any additional pertinent information or data found.

<u>Health Hazards</u>

Are there any health hazards associated with the material?

Inhalation Hazard Is there any hazard from breathing this material?

TLL/TWA Threshold Limit Value/Time Weighted Average - concentration of a material to which an average, healthy person may be repeatedly exposed for eight hours per day, 40 hours per week, without suffering adverse health effects.

LC_{50} The concentration in ppm that kills 50% of the laboratory animals in a given length of time.

Ingestion Hazard Is there any hazard from ingesting (eating) this material?

LD_{50}	Lethal Dose – the dose that kills 50% of the test animals.
Absorption Hazard	Is there any hazard from absorbing this material into the body?
Skin Absorption	Can material be absorbed through the skin?
Eye Absorption	Can material be absorbed through the eyes?
IDHL Value	Immediately Dangerous to Life and Health Value – an indication of atmospheres that are immediately dangerous to life and health. Within 30 minutes of exposure, death or irreversible health implications to the person exposed are expected.
STEL Value	Short Term Exposure Limit Value – maximum allowable concentration or ceiling, not to be exceeded during a 15 minute period.
Chronic Hazard	Are there any chronic hazards associated with this material?
Carcinogen	A material that can cause cancer in an organism.
Mutagen	A material that creates a change in gene structure that is potentially capable of being transmitted to offspring.
Teratogen	A material that causes the production of a physical defect in a developing embryo.
Hazardous to Aquatic Life	Is the material harmful to aquatic life?
Other	Any additional pertinent information or data found.
Decontamination Procedures	Decontamination is the removal of hazardous materials from the skin, clothing, equipment, etc.; the purpose of decontamination is to prevent or reduce the physical transfer of any contaminants by people or equipment from onsite to offsite locations. List methods available for decontamination for this material.
First Aid Procedures	What procedures should be followed for someone contaminated with this material?

<u>Fire Hazard</u>

Fire Hazard	Will the material burn or support the combustion process of other materials?

Flash Point	The minimum temperature at which a liquid gives off enough vapors to ignite and flash over, but will not continue to burn without the addition of more heat.
Ignition	Auto-ignition Temperature – the minimum temperature required to ignite gas or vapor without a spark or flame being present.
Flammable	Explosive Range – the range of a gas or vapor concentration (percentage by volume in air) that will burn or explode if an ignition source is present. Limiting concentrations are commonly called the "LEL" (Lower Flammable Explosive Limit) and the "UEL" (Upper Flammable Explosive Limit). Below the lower flammable limit, the mixture is too lean to burn; above the upper flammable limit, the mixture is too rich to burn.
Toxic Products of Combustion	The toxic by-products of the combustion process.
Other	Any additional pertinent information or data found.
Possible Extinguishing Agent	What extinguishing agents are suitable for control/extinguishment of a fire involving this material?

Reactivity

Reactivity	Will the material react with any other materials?
With what?	What is this material reactive with in what ways?
Other	Any additional pertinent information or data found.

Corrosive Hazards

Corrosivity Hazards	Is the material corrosive to other materials?
pH	Acidic or basic corrosives are measured to one another by their ability to dissociate in solution. Those that form the greatest number of hydrogen ions are the strongest acids, while those that form the hydroxide ion are the most potent bases. The measurement of the hydrogen ion concentration in solution is called the pH of the compound in the solution. Strong acids have low pH values and strong bases have high pH values; the pH scale ranges from 0 to 14.

Corrosive to what?	Materials with which the material is corrosive, particularly skin and steel.
Other	Any additional pertinent information or data found.
Neutralizing Agents	Those materials that can be used to neutralize the effects of the corrosive material.

Radioactivity Hazards

Radioactivity Hazards	Will the material emit radioactivity?
Type of Radiation Emitted	Indicate the type of radiation emitted, either alpha particles, beta particles, or gamma radiation.
Other	Any additional pertinent information or data found.

Recommended Protection

For the Public — Recommended action to protect public health and safety; indicate evacuation distances for various amounts of the material.

For Response Personnel — Level of protection required for emergency response personnel working in the danger zone:

Level A – Requires the highest level of respiratory, skin, and eye protection, that is, a fully encapsulating, chemically appropriate, protective suit with its own self-contained breathing apparatus.

Level B – Requires the highest level of respiratory protection, but a lower level of skin protection. It is the minimum level recommended on initial entries until the hazards have been further identified and defined by complete monitoring, sampling, and evaluation.

Level C – Requires air purifying respirators with adequate protection factors; coveralls and other protective equipment may be required. This level is selected when types and concentrations of respirable materials are knows to have adequate warning properties.

Level D – Requires no respiratory protection; basic work clothing should be worn when sites are positively identified as having no toxic hazards.

For the Environment Potential mitigation schemes to protect the environment.

Note: The back of the Hazardous Material Data Sheet can be used to collect additional information of a more specific nature.

3.5 Spill/Disposal Procedures

Certain chemicals, when spilled or disposed of, have reporting requirements associated with them. The following is an explanation of the actions required when dealing with these chemicals. Without exception, your supervisor will make any required reports. Refer to Emergency Response Plan for specific details regarding spill procedures.

Resource Conservation and Recovery Act (RCRA)

RCRA regulates the manner in which hazardous materials can be disposed. The specific requirements will be specified by the Environmental Department. If you need to dispose of any chemicals, contact your supervisor for instructions. The containers that held these products may be disposed of in any trash receptacle if:

a.) the container has less than 5% left in the bottom, or
b.) the container has been triple rinsed into any mill sump.

Spill Reporting

Reportable spills of certain chemicals must be immediately reported to governmental agencies, depending on the quantity and type of chemical spilled. A reportable spill is basically when the chemical hits the ground (earth), as opposed to a spill to a concrete pad, asphalt pad, sump, etc. If a spill occurs, immediately notify your supervisor. Your supervisor will determine if a report to an agency is necessary. Your supervisor will make the report, if needed. Do not attempt to make a report yourself. If there is any doubt, contact your supervisor for advice and direction.

4.0 HAZARD RECOGNITION

1. Hazards

   a. Moving Mobile Equipment – mobile equipment has the right of way. Be aware of all personnel and equipment in your area.
      1. Alternate feed IMC transfer trucks – speed limit of 15 mph.
      2. Front end loaders

        3. Dump trucks
        4. Pickup trucks
        5. Water Wagon
        6. Fork lifts
    b. Cleaning Grizzly
    c. Moving Conveyor
    d. Rotating Trommel
    e. High Pressure Air Lines
    d. Guards
    e. Pinch Points
        1. Idlers and rollers
        2. Head and tail pulley
    f. All guards must be in place before running
    g. Cleaning up around pumps

CAUTION – Wet Decks are Slick and Fall Hazard

2. Health Hazards
    a. Radiation
        1. Radon progeny
        2. Airborne uranium
        3. Beta gamma
    b. Silica and Nuisance Dusts, Mists and Fumes
    c. Hearing Protection

Items listed above can be hazards if not controlled properly. If controlled properly and to operating standards, they are safe.

5.0 JOB PROCEDURES

All non-routine jobs will be initiated by your supervisor and will not be performed unless directed by your supervisor. For any non-routine job a Radiation Work Permit and/or a Safe Work Permit may be required.

6.0 SAFETY RULES

Safety rules will be followed ***without exception.*** Listed in this section are general safety rules for Debris Leach and Trommel Screen operations. These rules do not cover all the White Mesa Mill safety rules. Each operator is to know and understand all White Mesa Mill safety rules that are described in the Safety Manual.

6.1 Debris Loading and Unloading

1. Personnel shall stand well clear of trucks when the bed is inclined. Trucks can turn over and there is always danger from falling rocks. When the dump trucks are unloading, stand at least 50 feet away.

2. Loader and truck operators should be aware of personnel and equipment entering their area, but people should be aware that the operator may not see them and, therefore, should stay clear of the equipment.

6.2 Conveyor Belts

1. Conveyor belts are sometimes called "silent killers." Be aware and alert at all times when working around them.

2. Never attempt to clean conveyor idlers, head, or tail pulleys while the belt is in motion. Never attempt any work on a conveyor unless the motor is shut off and the lockout procedure has been followed.

3. Never ride on, cross over or under a moving conveyor. Use walkways and crossovers that are provided.

4. Know the location of emergency stop cords and how to use them. Do not operate the conveyor if the emergency stop cord is not working properly.

5. All guards must be kept in place, except when the conveyor is properly locked out.

6. Remember that a tool can be caught in a pulley or idler so quickly that you will not have time to let go before it catches you. Be extremely cautious when working around conveyors.

7. Always wear close fitting clothing that cannot become caught in moving parts.

8. When shoveling clean up material onto a moving conveyor, always face in the direction of conveyor travel. Never shovel onto a conveyor that is moving toward you.

6.3 General Safety Rules

1. Operators are not to open electrical panels. Doors on electrical panels must be kept closed at all times. All electrical work must be completed by a qualified electrician.

2. Open steam valves slowly to permit condensation to escape. A sudden surge of condensation may rupture the line and scald you.

3. Know the location and how to use the exits, eye wash fountains, showers, protective equipment, and fire extinguishers in your area. Know the hazards presented by chemicals used in your area and ho to defend against them.

4. If a valve refuses to open or close ask your supervisor to have it repaired. Do not use a wrench or cheater to open or close a valve unless it has been thoroughly inspected to determine its condition.

5. All personnel shall know the location of all main block valves for fuel, kerosene, gas, steam, air, water, sulfuric acid and ammonia lines which pass through their area. Even though the respective valve may not be in your area, you must know how to shut off each line in case of an emergency.

6. Chemical or solvent splashes must be washed from skin and clothing to prevent irritation. Know the effects of all materials you handle and wear protective equipment to keep them from coming in contact with you.

7. A Safe Work Permit and a confined space entry permit must be obtained before entering any bin or hopper. A Radiation Work Permit will be required if it is determined that there is a potential for elevated radiation exposure.

6.4 Reporting Unsafe Conditions and Injuries

1. Correct or report all unsafe conditions to a supervisory person as soon as possible.

2. Report all injuries to your supervisor immediately. Also, report all accidental occurrences or conditions that may have a potential for injuring someone.

3. If you wish to see a physician for any occupational injury or illness, contact your supervisor for an authorization slip before seeing the doctor.

6.5 Personal Protective Equipment and Clothing

1. Hard hats, safety shoes and safety glasses with side shields must be worn at all times in the plant area – except in control rooms, offices and change rooms.

2. Other personal protective equipment includes, but is not limited to: ear plugs, respirators, wet suits, welding helmets, goggles, gloves and rubber boots. Face shields and safety belts are required in designated areas and/or while performing certain jobs. If in doubt contact your supervisor.

3. Each employee is responsible for the condition of their protective equipment. Report any defects, etc. to your supervisor.

4. The following equipment is required when working on pipelines or vessels containing acids or caustics:
   a. Face shield and chemical splash goggles.
   b. Rubber coat, pants, gloves and boots.
   c. Other equipment specified by the foreman for that particular job listed on the Safe Work Permit

5. The use of safety belt and properly adjusted life line is required where there is a danger of falling four feet or more.

7.0 MOBILE EQUIPMENT – SAFETY RULES

7.1 General

1. Only trained and authorized persons may operate mobile equipment.

2. All mobile equipment shall be inspected by the operator and any safety defects corrected before the equipment is used. This needs to be documented on the forms provided. If safe to do so, the equipment may be driven to the shop for repairs. Otherwise, the equipment must be towed or repaired at the location.

3. Audible backup alarms shall be in operating condition.

4. Walk around any piece of equipment before starting or moving it. Make certain no one is in a dangerous position and there are no obvious defects or hazards.

5. Use care when getting on or off equipment. Use the handholds provided. **NEVER JUMP** from equipment.

6. No person shall get on or off of moving equipment.

7. Seat belts shall be used at all times when equipment is in motion.

8. Equipment shall be operated at a reasonable speed consistent with road and weather conditions.

9. Equipment shall not be started or otherwise operated unless the operator is seated at the controls of the equipment.

10. Keep the cabs of equipment clean. Loose items which could jam controls or create other hazards are not allowed.

11. Only those persons that can be seated safely in the operator's compartment will be permitted to ride as passengers.

12. Report all accidents to your supervisor regardless of how minor they are. If property damage or personal injury is involved, do not move the equipment until your supervisor has released it.

13. All gasoline engines must be shut off when refueling.

14. Stunt driving and horseplay are strictly forbidden.

15. Keep equipment clear of edges, drop offs, and unstable banks. Maintain adequate berms where required.

7.2 Dump Trucks

1. Do not move the truck until the air pressure is built up to normal.

2. Do not overload the truck.

3. Release the parking brake before moving the truck. Use a low enough gear to start the truck without slipping the clutch.

4. Except to shake out the load, no truck shall be driven until the bed is in the full down position.

5. Never work under a raised bed of a truck unless it is securely blocked.

6. Park the truck in its designated parking place with the brakes set and engine off.

7.3 Front End Loaders

1. No one but the operator is permitted to ride on the loader.

2. Never leave the loader without dropping the bucket to the ground.

3. Do not jump off loaders. Use hand rails and steps when getting on or off equipment.

4. When stepping from the loader to the ground, be sure there are no rocks that you could step on and turn your ankle.

5. Do not strike the dump truck with the loader bucket or wheels.

6. Avoid spinning or slipping the drive wheels of the loader as much as possible.

7. Do not move loaders equipped with air brakes until the air pressure is built up to normal.

8. Park the loader out of the way or in the designated parking place with the brakes set and engine off.

9. Always keep the bucket as low as possible when traveling.

10. When lubricating front end loaders, park the loader on flat ground, bucket down, parking brake set, and the engine off.

8.0 RADIATION SAFETY PROCEDURES

These rules do not cover all of the White Mesa Mill Radiation Safety Procedures, but are supplied as a guide to be utilized as a supplement to the training which you have received.

Listed below are the Radiation Safety Procedures for debris leaching and trommel operation which, when followed, will maintain your exposures ALARA. Remember, you are the person most responsible for controlling your radiation exposure. If the Radiation Safety Procedures are followed and protective equipment is utilized correctly, your exposure will be maintained ALARA.

8.1 ALARA Program Policy Statement

The policy of Denison Mines (USA) Corp. to maintain good radiation protection practices is the expenditure of every reasonable effort to achieve and maintain low levels of contamination and radiation in occupational exposures. By definition, the ALARA program shall result in radiation exposures being maintained to levels as far below any applicable limits of the NRC regulations as is reasonable.

This policy and program is to be achieved through systematic employee monitoring and an on-going review process between the radiation protection staff and plant operations management with secondary audits performed by corporate environmental radiation safety personnel.

Denison Mines (USA) Corp. is committed to maintaining occupational exposures of personnel at White Mesa to levels as low as reasonably achievable. This commitment is supported by the training program conducted for facility personnel, and continuous reviews of radiation, environmental, and industrial hygiene protection policies.

It is the policy that occupational exposure records of personnel at the White Mesa Mill are readily available for review when requested. The radiation protection staff will review and discuss any aspect of radiation safety at any time.

8.2 Radiation Work Permit

The Radiation Work Permit is designed to provide a job procedure plan to prevent unknown or excessive exposure when any non-routine (i.e., maintenance, etc.) work is to be performed in the mill area. The procedure ensures that radiation hazards, which cannot be contained, will be controlled by the use of protective equipment. An initial assessment of the work environment and associated work tasks as related to potential radiation exposure will be made for those non-routine work activities which may require the issuance of a Radiation Work Permit. If it is determined, by this initial assessment, that there is a potential for elevated radiation exposure, a Radiation Work Permit will be issued.

a. A Radiation Work Permit will be issued by the radiation staff.

b. Before work starts on the job outlined on the work permit, the radiation safety staff must review and approve the permit after being certain there is no health hazard to employees.

c. The permit must be signed in ink by all personnel involved in the work and posted in the work area.

d. After work has been completed, the permit will be sent to the radiation safety office for calculations of exposures and filed for future reference.

8.3 Posting of Specific Areas

As a part of ALARA practices and controlling your exposures, the following signs could be posted in your work area. It is important that you understand what these signs mean.

CAUTION – AIRBORNE RADIOACTIVE AREA - This sign is posted in an area in which airborne uranium or radon progeny concentrations are, or at above 25% of the specified limits for airborne concentrations. Any time this posting is observed, respiratory protection is required to minimize your exposure until conditions can be corrected and airborne concentrations are below 25% DAC. The following areas have required that they be posted as an "airborne radioactivity area" requiring the use of full-face respirators due to airborne or radon progeny concentrations above 25% DAC:

CAUTION – RADIATION AREA - This sign is posted in an area where beta and gamma radiation levels are at, or above 2 mr/hr. Methods of controlling your exposure to beta or gamma radiation are listed below.

a. Our primary means of control for gamma or beta is limiting time spent in the radiation area.

8.4 Procedures to Follow Regarding the Use of Respirators

a. When issued a new respirator, the respirator shall be fit-tested with irritant smoke and logged on the forms provided at the shifters office. After the initial fit-testing, a positive-negative pressure test will be done each time the respirator is donned to ensure a proper fit.

b. If you are using a respirator in a very dusty area, it may be necessary to change the filter after two to three hours. When resistance to breathing becomes uncomfortable, it is a sign that the filters have served their useful life and need to be replaced.

c. At the White Mesa Mill facility, there is only one type of cartridge used for the full face respirator. The combination cartridge is used for nuisance dust, chemical mists and radiological dust.

8.5 Radiation Safety Procedures

These are practices that, if you follow, will minimize your radiation exposure while working at the White Mesa Mill:

a. Practice good housekeeping to prevent build up of ore spills near the trommel operation.

b. Follow good personal hygiene habits.

   1. Wash your hands prior to eating and before leaving the plant.
   2. Change and wash your clothes regularly and bathe regularly.
   3. All Mill personnel will be provided with a change room, showers, and laundry facilities so that they may leave their work clothes at the Mill. All coveralls and contaminated clothing will be laundered on the property.
   4. Store your lunch box and eat only in a designated eating area.
   5. Scan your clothes, hands, and bottoms of your shoes with the alpha scanner prior to leaving the restricted area.

c. Cooperate with the people making the radiation surveys by doing your job in a normal manner. If you think sampling is being done under abnormal conditions, tell the person doing the surveys.

d. Always where your personal monitoring device when you are assigned one. Put it in the designated area when leaving work.

e. Wear appropriate respiratory protection while the SAG mill is operating (full-face respirator).

f. If you are concerned or have any questions about the amount of radiation you are being exposed to, contact the Radiation Safety Officer.

8.6 Urinalysis Sampling

Urinalysis samples are utilized to determine the uranium content contained in the urine of the operator. The frequency of sampling is dependent on the airborne concentrations and will be changed if airborne levels exceed 25% of the airborne standards.

To minimize the chance of contaminating a urine sample, the following practices should be followed:

> Urinalysis containers can be picked up at the administration building upon returning from your scheduled days off. The sample containers should be filled after washing your hands and prior to changing into your work clothes or reporting to your work location. The samples can then be placed in the bioassay laboratory.

Under unusual circumstances where specimens cannot be collected in this manner, the worker should shower immediately prior to voiding. When a shower is not possible, disposable plastic or rubber gloves should be worn during voiding. Take all necessary precautions to ensure that your urine sample is not contaminated.

9.0 GENERAL OPERATOR'S RESPONSIBILITIES

1. It will be the responsibility of each operator to:

    a. Operate the circuit in a safe and efficient manner while following all company safety rules.
    b. Operate circuits within specified parameters.
    c. No alarms are to blocked out or otherwise made to be inoperable at any time.
    d. Maintain a proper operating log sheet.
    e. Collect and properly label all mill control samples and avoid sample contamination.
    f. If a sample is contaminated, start a new sample and mark "contaminated sample" on the item what was contaminated
    g. Maintain and practice good housekeeping.

2. All operators will be provided with a change room, shower and laundry facilities so that they may leave their work clothes at the Mill. All coveralls and contaminated clothing will be laundered on the property.

3. All operators will wear personal sampling equipment when asked to do so by the radiation or safety departments.

4. Prior to leaving the Restricted Area, all operators will monitor themselves with an alpha radiation survey meter located at the guard house and Mill administration office. If the alarm sounds, re-survey. If the alarm sounds again contact the Shift Foreman, Radiation Safety Officer, or a radiation staff member.

5. Operators of company vehicles must have a valid driver's license.

6. Operators will not operate mobile equipment until trained to operate mobile equipment by a qualified trainer.

7. Mobile equipment is to be checked before use on each shift. A Mobile Equipment Check List will be filled out and turned in to your shift foreman each shift. Any equipment defects must be corrected before equipment is operated.

DENISON MINES (USA) CORP.

BOOK #5

YELLOWCAKE PRECIPITATION

INTRODUCTION

Mill Process

Operations at the White Mesa Mill begin with the weighing, receiving, sampling, and stockpiling of the ore from the various mines. Mine run ore, as well as crushed ore from the stockpile, will be fed at the rate of 2,000 tons-per-day to the semi-autogenous grinding (SAG) mill. The ground ore will be stored as a wet pulp in three agitated tanks. The processing stages will include two-stage acid leaching, followed by the recovery of uranium and vanadium bearing pregnant solution in a counter-current decantation (CCD) system.

The uranium is recovered from the leach pregnant solution utilizing a conventional solvent extraction system. Vanadium will be recovered from the barren uranium raffinate also utilizing a solvent extraction circuit.

The pregnant uranium strip solution is precipitated with Anhydrous Ammonia and the resultant yellowcake is dewatered, dried, and packaged.

The pregnant vanadium strip solution is precipitated with Ammonia Sulfate, filtered, dried, and melted to produce a concentrated vanadium black flake for packaging.

Process Controls

A process control panel is provided in the grinding area (CP-1), and uranium and vanadium product recovery (CP-4 and 5), areas .All other process control panels are located in the central control room.

Denison Mines (USA) Corp. has outlined, and will implement, an on-going personnel radiation protection program to ensure that operations at the plant are conducted in a safe and efficient manner and in accordance with approved procedures.

This radiation protection program is documented and administered by the State of Utah Division of Radiation Control under the direction of the Executive Secretary. These applicable regulations are detailed in Code of Federal Regulations Title 10 Energy and the State of Utah regulations at R313-15.

Radiation Protection Operating Procedures are included in this manual for each Unit Operation.

YELLOWCAKE PRECIPITATION – DRYING AND PACKAGING

Preface

Extreme care must be taken in the operation of the yellowcake precipitation, drying, and packaging circuits to prevent spills and dust. Spills and dust can result in over-exposure of operators and employees working in the Yellowcake area. All spills must be cleaned up immediately. Scrubber systems must be in good operational conditions and operating at required standards.

Good personal hygiene must be practiced at all times to prevent ingestion of yellowcake. Keep all yellowcake washed off of your hands and clothing. Coveralls, rubber boots, and gloves must be worn when working in the yellowcake area.

Full face respirators must be worn when in the yellowcake dryer enclosure, Yellowcake packaging enclosure, and when placing lids and rings on filled yellowcake drums to prevent over-exposure. **No exceptions**.

Full-face respirators may be required at designated times and in designated areas. For your protection, they must be worn when required.

Following are descriptions and procedures that operators must learn and understand. Notify your supervisor if you have any questions about operating procedures or conditions.

Yellowcake Precipitation, Drying, and Packaging Circuit

The purposes of the yellowcake precipitation and drying circuits are to precipitate the uranium solution produced in the uranium SX, remove impurities from the precipitate, dry the precipitate, and package the dried precipitate for shipping.

The yellowcake precipitation and drying circuits consist of two precipitation tanks, two thickeners, one re-dissolve tank, two Bird centrifuges, two dryer with scrubber systems, and all associated pumps and piping.

The feed solution for the yellowcake precipitation circuit is pumped from the loaded strip tank in the uranium SX building to the number one yellowcake precipitation tank. Ammonia is added and mixed with the loaded strip solution. As ammonia is added, the pH is raised from 1.2 to the 7.4 range causing the strip solution to precipitate. The precipitate or yellowcake overflows through an outlet pipe in the number one yellowcake precipitation tank to the centerwell of the number one yellowcake thickener. Six to 10 gallons per minute of water is continuously added to the precipitate as it flows into the thickener centerwell to wash sodium out of the yellowcake.

In the number one yellowcake thickener, the heavy precipitated yellowcake settles to the bottom of the thickener. The clear solution that separates from the yellowcake as it settles overflows a launder and is pumped to either the strip makeup tank at SX, or the overflow launder in the number one CCD thickener. The bottom of the thickener is cone-shaped with an outlet at the bottom center of the cone. Rakes in the cone of the thickener turn and push the yellowcake to the cone outlet where it is pumped out by a Moyno pump to the re-dissolve tank. The Moyno pump is of variable speed and is set at a speed to maintain a density of 1,700 spg, or above, in the bottom of the yellowcake thickener. The density is obtained by letting the yellowcake build up in the thickener.

The purpose of the re-dissolve tank is to dissolve the yellowcake back into a solution and remove contaminates (primarily sodium) from the dissolved yellowcake. Sulfuric acid is added to the re-dissolve tank to drop the pH of the yellowcake to a 1.0 causing the yellowcake to go into the solution. Steam is added to bring the temperature of the solution to 60°C which helps in separating the contaminates from the yellowcake. Wash water is also added to wash out contaminates. As the yellowcake, acid, steam, and water are added to the re-dissolve tank, the solution in the tank overflows into an overflow pipe to the number two yellowcake precipitation tank.

Ammonia is added and mixed with the solution from the re-dissolve tank raising the pH back up to a 7.8 to 8.2 pH. As the pH raises, the yellowcake in the solution will precipitate as it did in the number one yellowcake precipitation tank. A saturated solution of ammonium sulfate is added to the number two precipitation tank to remove impurities. The precipitate, or yellowcake, overflows the number two yellowcake precipitation tank through an overflow pipe to the centerwell of the number two yellowcake thickener. Water is added to the yellowcake as it flows into the centerwell of the number two yellowcake thickener.

The number two yellowcake thickener is identical to the number one yellowcake thickener and operates the same. The heavy precipitated yellowcake settles to the bottom of the thickener. The clear solution that separates from the yellowcake as it settles overflows a launder and is pumped to the number one CCD thickener overflow launder. The bottom of the yellowcake thickener is cone-shaped with an outlet at the bottom center of the cone. Rakes in the cone of the thickener turn and push the yellowcake to the cone outlet where it is pumped by a Moyno pump to the Bird centrifuges. Density is also maintained in the number two yellowcake thickener. The Moyno pump is a variable speed pump and the density is controlled by the speed of the pump.

The purpose of the Bird centrifuge is to wash the yellowcake to remove sodium and then de-water the yellowcake so that it can be dried in the yellowcake dryer. The Bird Soid Bowl centrifuge is a settling vessel with overflow weir and drainage deck containing a conveyor which continuously picks up settled solids and discharges them from the vessel by way of the draining deck. The settling vessel is made to rotate. Thus, the settling forces acting on the solids particles can be many times gravity and ensure a thorough separation of solids from the suspending liquid. The solids from the drainage deck drop into an auger that feeds to the yellowcake dryer. The liquid overflows the overflow weir and then flows to the number two yellowcake thickener centerwell.

Yellowcake Dryer Description

Two Yellowcake dryers are used. The dryers are designated as the North and South dryers. The North dryer is 6'0" I.D. and the South dryer is 8'0" I.D. Both dryers are Skinner dryers and the descriptions are the same, except for the size. The yellowcake dryers are six hearth, refractory lined, multiple hearth unit with burners on hearths two, four, and six with a rotating central shaft with attached rabble arms and angled rabble teeth used to move the yellowcake material down through the dryer. The arms and shaft are cooled by air forced into the bottom of the shaft by the cooling air fan. After passing through the arms and shaft, the cooling air will have been heated to a temperature of 300° to 450°F and is vented out through the cooling air stack to the atmosphere.

There are two doors per hearth located 180° apart and directly in line with each other.

The yellowcake is delivered to the dryer top hearth. The yellowcake material is moved through the dryer by means of rabble arms with attached rabble teeth which are angled so that, as the shaft rotates, the teeth distribute the cake over each hearth, in or out as the case may be and down until it reaches the bottom hearth where the teeth plow the dried cake into one product outlet. From here, the dried cake drops through a chute to the lump breaker and then to the yellowcake packaging bin.

Air is drawn through the dryer by suction created by the exhaust gas system. The actual amount of gas flow is determined by the furnace pressure. The furnace pressure is automatically controlled by means of a pressure transmitter and controller. The dryer pressure (or draft) is measured at the top hearth of the dryer. The dryer pressure (or draft) controller operates a control damper located in the ductwork at the outlet of the gas scrubber to control the pressure.

An increase in dryer pressure will result in an opening of the damper which will increase the flow of gasses from the dryer and a decrease in pressure will, conversely, decrease the damper opening and reduce the gas flow.

An increase in the feed rate or moisture content of the feed will increase the rate of gas generation and, thereby increase dryer pressure. The control system will respond by increasing the flow to the scrubber system. Thus, the dryer pressure controller acts to compensate for changes in the feed rate or moisture in the feed. The dryer works best when the furnace draft (negative pressure) is between -0.1 and -0.2 inches water column, but this is dependent on many variables.

The burner system is designed to burn propane with gas pilots. There are a total of six burners, two each on hearths two, four, and six. Both burners on each hearth are controlled from a single set point controller and operate in unison. The installed capacity of the six burners is approximately 1.6 million BTU/hour. The six burners are equipped with automatic, electrically ignited, interrupted gas pilots. The burner flame is monitored by ultra violet flame scanners. Each burner can be started or stopped individually from the panel mounted start/stop stations.

The gas systems incorporates the necessary safety valves, regulators, and pressure switches. The flame safety equipment is housed in the main control panel which also contains the necessary interlocks and controls for the rest of the system.

Ideal dryer temperatures are 1,000°F to 1,200°F in the number two hearth, 1,200°F to 1,400°F in the number four hearth, and 1,400°F to 1,600°F in the number six hearth. Hearth temperatures will vary due to moisture content of the centrifuged yellowcake and the feed rate to the dryer. Hearth temperatures will normally be over 800°F for a low hearth temperature and not over 1,600°F for a high hearth temperature.

Lump Breaker

Both North and South dryers use a lump breaking machine to break any lumps in the yellowcake.

Yellowcake Storage and Package Bin

The packaging bin will hold approximately 17,000 pounds (or 20 drums) of dried yellowcake. The package bin is equipped with a high level indicating probe and indicating high level alarm and light on the yellowcake dryer control panel. The bin is completely sealed with a Star Feeder at the bottom. The Star Feeder is designated to keep the dried yellowcake from sifting through the bottom opening in the bin. Barrels are filled from the bottom of the bin. A barrel is placed on a platform scale directly under the Star Feeder. An adjustable barrel hood between the Star Feeder and the barrel form a dust-tight seal.

The yellowcake packaging room is a negative pressure packaging room. Negative pressure is controlled by the dust and gas handling scrubber system.

The drying of the yellowcake material in the dryer gives rise to water vapor and gaseous products of combustion from fuel used, which are discharged through a gas outlet on top of the dryer and into the exhaust gas handling system.

Exhaust Gas Scrubber System

Both North and South dryers have separate Exhaust Gas Scrubbers. The Scrubbers are not identical in configuration, but both operate in the same manner

As the yellowcake dries, dust is formed in the dryer which follows the air and off-gas flow out of the top of the dryer. The purpose of the scrubber system is to remove any dust carried in the dryer exhaust stream before the gases are released to the atmosphere.

The off-gas scrubber is a large stainless steel cylinder with three internal compartments. Flow generated by the scrubber fan draws the exhaust gases from the dryer. The dusty gas stream enters the scrubber near the bottom and at one side of the circular scrubber to create a swirling pattern of the gas; a water spray dispenses a fine spray to blend into a swirling mass. This is called the "humidification section" and serves to wet the dust particles. The gas stream then passes upward through a stationary air vane to amplify the swirling (or mixing) action, then into the fan inlet. The fan is a set-type fan and a larger volume water spray introduces water particles into the turbulent atmosphere of the fan where they wet all the dust particles, or scrub them from the gas screen. The fan discharges the wet gas stream into the second compartment, or demister section of the scrubber where an additional, low volume, fine water spray is again introduced into the turbulent air stream. The second section, since it is on the discharge of the fan, is under positive pressure while the first section on the fan intake is, of course, under suction or negative pressure.

The second section (demister section) is equipped with a conical bottom and, at the bottom of the cone, is located an orifice plate to discharge the dirty water (from collecting the dust) into the modification section. The bottom of the first section (or modification section) is also conical and is connected to a discharge pipe submerged in the yellowcake scrubber tank to form an air seal (or barometric leg). The scrubber gases are passed through a demister pad to remove entrained moisture before discharging through the stack to the atmosphere. The demister pad is a six inch thick pad made of a stainless steel material. The pad may become partially plugged and restrict air flow and must be cleaned from the access door above the pad if this should occur. The entire scrubber system and dryer will need to be shutdown during scrubber cleaning.

To achieve efficient scrubbing of the gases, certain conditions must be maintained in the scrubber system, as well as meeting the normal operating conditions of the dryer system.

Since the dryer needs to be maintained under negative pressure to prevent the exit of dust and gas into the enclosure, a gauge is provided at the number six hearth (the point furthest from the scrubber). This gauge is provided with an alarm that will sound, should negative pressure drop below 0.04 inches water column. A gauge is provided that measures differential pressure across the off-gas scrubber in inches of water column. This gauge will sound an alarm and shut down the yellowcake dryer if the differential pressure drops to 2.0 inches of water column. Normal differential pressure readings on the off-gas scrubber are at three to four inches water column.

Additionally, water flow measurements to the sprays are measured by a flow meter at each spray and should be controlled at the following:

1. Modification Section 2 – 3 gpm
2. Scrubber Fan 7 – 9 gpm
3. Demister Spray 3 - 4 gpm

Typically, 16 to 17 gpm of water are utilized through the off-gas scrubber spray system.

If the flow rate drops below 14 gpm water, a low water alarm will sound on the control panel. The inner lock on the off-gas scrubber will shut the dryer down if water flow to the scrubber drops to 12 gpm.

The following operating parameters are the limits, if reached, that require the off-gas scrubber system be taken down and cleaned or inspected:

1. Negative pressure on the dryer below 0.04 inches water column.
2. Differential pressure on the yellowcake dryer off-gas scrubber manometer readings at 2.5 inches water column.
3. If water flow drops below 14 gpm total, or if the flow rate to any spray drops below the following settings:
   a. Humidification Section 2.0 gpm
   b. Scrubber Fan 7.0 gpm
   c. Demister Spray 3.0 gpm

After the gas stream leaves the off-gas scrubber, it is ducted into the packed tower demister scrubber. The purpose of the packed tower demister is to remove soluble gases contained in the exhaust stream from the off-gas scrubber.

The exhaust from the off-gas scrubber enters the packed tower demister at the inlet near the bottom. There is no scrubber fan with the packed tower demister so the exhaust gas stream moves by force through the packing section. The packing section of the tower is packed with seven feet of polypropylene saddles which are sprayed with water at 35 gpm. The exhaust gas stream hits the wetted surface of the packing and transfers the contaminates in the gas stream into the water. The bottom of the packing tower is connected to a discharge pipe submerged in the scrubber tank which serves as an air seal (or barometric leg) for the packing tower. The upper section of the packed tower demister is the demister portion of the scrubber. Contained in the demister section of the tower is a demister pad to remove any fine particulates of dust which may have passed through the off-gas scrubber (or the packed section) of the tower and any entrained water in the gas stream. The demister section of the tower utilizes a five gpm water flow rate of clean water for flushing purposes. The gas stream then exits the packed tower demister into the yellowcake stacks which is released into the atmosphere.

Since the off-gas scrubber and packed tower demister are in a series, if the packed tower becomes partially plugged and restricts air flow, this will affect the negative pressure reading on the dryer which will then sound the panel alarm, or increase the differential pressure reading on the off-gas scrubber.

The upper differential pressure reading on the manometer at the off-gas scrubber is set at six inches of water column. If the differential pressure reach six, an alarm will sound on the panel and the packed tower will need to be cleaned.

Normal water flow to the sprays are measured by a flow meter and should be controlled at the following:

1. Packed Section of the Tower 30 - 40 gpm
2. Demister Section 4 - 6 gpm

The yellowcake packaging and enclosure scrubbers' main function is to remove any dust from the yellowcake packaging process and maintain a slight negative pressure on the yellowcake dryer and packaging enclosures.

Flow generated by the scrubber fan draws the exhaust dust from the barreling station and room atmosphere at the yellowcake enclosures. The dusty stream enters the scrubber near the bottom in the spray section which serves to take out the large particles from the incoming stream to cool and humidify, and wash the bottom of the impingement plate stage to minimize build up. The impingement plate stages form droplets as the air stream passes through, which creates an interaction between the gas stream and liquid. The gas stream then passes through the impingement plates to a stationary, fixed blade moisture eliminator which removes the water droplets in the gas stream. The scrubber outlet of the scrubber is exhausted into the yellowcake stack and released to the atmosphere. Differential pressure is measured across the yellowcake packaging and enclosure scrubber with the following parameters utilized. The normal operating range is between four and six inches of water column. When the manometer reading drops below 3.0 inches water column, the yellowcake scrubber system is shut down to be cleaned.

Normal water flow to the sprays is measured by a flow meter at each spray and should be controlled at the following:

1. Spray Section		9 - 11 gpm
2. Impingement Plates		14 - 16 gpm
Total Water Flow	=	25 gpm

If water flow levels drop below 25 gpm, a low water alarm to the yellowcake packaging scrubber will sound on the control panel and the scrubber should be cleaned.

Yellowcake Packaging – Operating Procedures

1. Operator will wear coveralls and rubber boots.

2. Operator will wear rubber gloves when operating the circuit.

3. Operator will wear a full face respirator when in the yellowcake dryer enclosure or the barreling enclosure.

4. Inspect and calibrate drum scales at the beginning of each shift before weighing drums.

5. Inspect the packaging scrubber system for proper operating conditions.

6. Each drum is to be stenciled on one side and the lid with the following information:
   a. Company name
   b. Lot number
   c. Drum number
   d. Gross weight
   e. Tare weight
   f. Net weight
   g. The term "Radioactive LSA"

7. Drums are to be inspected before each use for safe conditions.
   a. No dents
   b. No holes
   c. No bungs
   d. Proper lids

8. Drum lids will be fitted with a new gasket.

9. Drums will be tared before filling and the tare weight marked on the drum lid, on the side, and on the Product Log Sheet.

10. Placed the tared drum on the roll conveyor at the west end of the packaging room and move it through the self-closing doors into the packaging room.

11. Remove the lid from the tared drum.
    a. Put the lid beside the drum on the scales so that the lid will be weighed with the drum to get the gross weight of the lid and drum.

12. Position the tared drum directly below the yellowcake storage bin and in the center of the drum scale.

13. Lower the drum hood down on the drum.

14. Fill the drum by activating the star feeder rotary valve.

15. Fill the drum to 950 to 1,000 pounds gross weight.
    a. Do not exceed 1,000 pounds gross weight.
    b. Do not overfill the drum and cause spillage.

16. Take a sample of the yellowcake from the top of the drum after it has been filled.

17. Split the sample of yellowcake into a one quart jar for the lot sample and a one pint jar for the 10 drum composite sample. Jars are to be labeled as follows:
    a. YC Sample
    b. Date
    c. Lot Number
    d. Drum Numbers

18. A 10 drum composite sample is to be made from the lot.
    a. The pint jar will contain yellowcake samples taken from each of 10 drums that were filled.
    b. Example of 10 drum composites as follows:
        1. Drums 1 through 10
        2. Drums 11 through 20
        3. Drums 21 through 30
        4. Drums 31 through 43
    c. Number of drums in a lot may vary due to weight of yellowcake.
19. In addition to the above, a drum lot sample is to be made.
    a. The quart jar will contain yellowcake samples taken from each of the drums of yellowcake filled in a lot.

20. Place the lids on the filled yellowcake drums, activate the roll conveyor, and move the filled drums through the self-closing doors at the east side of the packaging room.

21. Outside the packaging room, secure the lids on the filled yellowcake drums by tightening the lid ring bolts.

22. After the lids have been tightened to the drums, place a wire seal on the drum lid ring bolts.

23. Mark the gross weight, tare weights, drum number, lot number, and date on 1 side and top of each drum.

24. Record the gross weight, net weight, lot number, drum number, and date on the Product Log Sheet.

25. Yellowcake will be packaged in drum lots. Lot size will be determined by weight of yellowcake being packaged.

a. A lot will consist of a designated number of drums as set by mill management.
b. After the designated number of drums in a lot have been filled, proceed to the next lot number.
c. Each time a lot number is changed, start with drum number one and fill to the designated drum number.

26. Wash down the packaging area once per shift, or as needed, to keep the area clean.

Safety

1. Extreme care must be taken during the packaging operation to prevent spills and dust. Any spills that might occur must be washed up immediately. Do not use air hoses to clean.

2. Coveralls, rubber boots, and rubber gloves are required when packaging yellowcake.

3. Full-face respirators are required when entering the packaging enclosure and when securing the lids on the yellowcake drums.

Yellowcake Precipitation Start Up Procedures

1. Start the number one precipitation tank agitator.

2. Start the number one yellowcake thickener rake drive and lower the thickener rakes.

3. Set the number one precipitation tank pH controller for a pH of 7.0 to 7.2.

4. Open the manual ammonia valve to the number one precipitation tank.

5. Turn on the instrument air to the number one precipitation tank automatic ammonia control valve.

6. Turn on the mill air to the number one precipitation tank ammonia spargue.

7. Start the uranium precipitation feed from the uranium solvent extraction loaded strip tank.
    a. Set the loaded strip flow to maintain a balance with the uranium solvent extraction strip circuit.

8. Start the required wash water to the number one yellowcake thickener centerwell.

9. Maintain a pH of 7.0 to 7.2 in the number one precipitation tank.

10. Set the re-dissolve tank pH controller to maintain a pH of 1.0 to 1.2.
    a. Start the re-dissolve tank agitator and air agitator.
    b. Open the manual sulfuric acid valve.
    c. Open the manual steam valve to the re-dissolve tank; maintain a temperature of 55°C - 80°C.
    d. Start the wash water; maintain a ratio of 2:1 wash water to the yellowcake flow.

11. When the underflow density from the number one yellowcake is 1,700+, start the Moyno underflow pump and pump yellowcake to the re-dissolve tank. Adjust the underflow to the re-dissolve tank to maintain a 1,700 density in the number one yellowcake thickener.

12. Start the number two yellowcake precipitation tank agitator.

13. Start the number two yellowcake thickener rake drive; lower the thickener rakes.

14. Start the required wash water to the number two yellowcake thickener centerwell.

15. Set the number two precipitation tank pH controller for a pH of 7.8 to 8.0.

16. Open the manual ammonia valve to the number two precipitation tank.

17. Turn on the instrument air to the number two precipitation tank automatic ammonia control valve.

18. Turn on the mill air to the number two precipitation tank ammonia sparge.

19. Start the ammonia sulfate pump; set the ammonia sulfate flow to the number two precipitation tank at 1.5 gpm.

20. Start the yellowcake dryer (see the yellowcake dryer start up procedures).

21. Start the Bird centrifuge and the yellowcake dryer feed auger (see the centrifuge start up procedures).

22. When the underflow density from the number two yellowcake thickener is at 1,700+, start the Moyno underflow pump and pump yellowcake to the centrifuge, and adjust the underflow to the centrifuge to maintain a 1,700 density in the number two yellowcake thickener.

Yellowcake Dryer Start Up Procedures

1. Push the panel power switch to the "on" position on the panel face. Alarms will light and the alarm horn will sound. The horn can be silenced by pressing the "silence" button, but the lights will remain on until alarm conditions are cleared (i.e., equipment start up).
    a. Panel power will normally be on unless mill power failure has been experienced. The alarm will have been silenced, but alarm lights will remain on until the equipment is re-started.

2. Check and close all hearth doors, including the peep hole doors.

3. Start the dryer scrubber water flow and adjust the flow indicator to the scrubber as required (normally 14 to 16 gpm). Proper water flow to the scrubber will clear the alarm light for the "dryer-scrubber water-low flow."

Purging

1. Close the draft control damper by setting the furnace draft controller at a +0.1 setting.

2. Start the induced draft (I.D.) fan. This will start as long as the scrubber water flow is proper, the I.D. fan inlet temperature is not high, and the draft control damper is closed. This will cause a differential pressure switch across the scrubber to cause the alarm light for the "I.D. fan - low flow" to go out.

3. After the I.D. fan has reached full speed, set the furnace draft controller to a -0.2 setting.

4. Start the combustion air blower. This will cause the "Combustion air blower - low pressure" alarm light to go out.

5. Open the temperature control valves by setting the three temperature controllers to a temperature setting higher than that indicated on the controller. This will cause the valves to drive to the high fire position which is necessary to supply maximum purge air.

6. Start the lump breaker. This will cause the "Lump breaker failure" alarm light to go out.

7. Start the shaft drive. This will cause the "Shaft drive - low speed" alarm light to go out after the shaft rotation sensor has been passed by the rotating plate attached to the shaft.

8. Start the cooling air fan. The "Cooling air fan - low pressure" light will then go out. This fan should never be stopped when dryer temperatures at any hearth exceed 500°F. (Damage to arms might occur by over-heating.)

   Caution: The cooling air fan control is installed utilizing a latching relay. This means that during a power failure, the fan will naturally turn off, but when power is restored, the fan will automatically start unless the stop button has been pushed.

9. The low pressure switch will close and the "Fuel oil supply - low pressure" alarm light will go out.

   Note: As the equipment is started, the appropriate alarm lights will go out. Equipment will not start if the appropriate interlock sequence is not made.

10. If all of the equipment is functioning properly and the temperatures on hearths two, four, and six are not high (above the present alarm temperatures), the purge timer will energize and the purge period will be initiated, and the amber purging light will come on.

11. After the required purge time (this is set at the panel-mounted, key-operated purge timer) has elapsed, the green "Purge complete" light will come on. The burners can now be started.

12. Open the manual reset safety shut-off valve for the main fuel. The red fuel safety valve "open" light will come on when the valve is manually opened.

13. Close the temperature control valves by setting the three temperature indicating controllers to a temperature setting <u>lower</u> than that indicated on the controller. (This will cause the valves to drive to the low fire position which is necessary before the burners can be started.)

14. Light the selected burner(s) by pushing in and holding the start button(s) of those to be turned on. The pilot must light and be proven by the ultra violet flame scanner and then the main fuel valve for the burner to automatically open to establish "main" flame. When the desired burners have started, the red burner "on" indicator light will come on and the alarm light for that burner will go out.
    a. The burners will operate normally until they are shut off manually by depressing the stop button, or until a power failure, limit action (including fan failure), or flame failure at any burner.
    b. In the event of a power failure, all lights will go out and all fuel is cut off. With restoration of power and after the equipment has been started up again as outlined under the purging section, the "purging" light comes on and the system automatically repurges. At the end of the purge period, the "Purge complete" light comes on and the system is ready for another start.
    c. Set the three temperature indicating controllers to the desired hearth temperature and the burners will automatically modulate and vary the firing rate, as required, to maintain the set-point temperature.
    d. When any one of the six burners go off, the burner can be restarted by setting the temperature indicating controller controlling the temperature on the hearth

of the burner to be started must be set at a temperature lower than indicated on the controller. This is required to drive the temperature controller valve to the low fire position. Start the burner that is off and then set the temperature indicating controller to the desired temperature.

15. After operating temperatures have been reached, feeding of the yellowcake material may start. (Minimum operating temperature on each fired hearth is 800°F.)

Yellowcake Precipitation Shut Down Procedures

1. Shut off the loaded strip feed pump to the number one yellowcake precipitation tank.
    a. Start/stop switches and pumps are located in the uranium SX building at the south side of the loaded strip tank.

2. Wash out the loaded strip feed line with water.

3. Shut off the ammonia and air valves to the number one precipitation tank.

4. Shut off the wash water to the number one yellowcake thickener centerwell.

5. Shut off the number one yellowcake thickener underflow valve.

6. Wash out the number one yellowcake thickener underflow pump and line to the re-dissolve tank with water.

7. Shut off the number one yellowcake thickener underflow pump.

8. Shut off the acid, steam, and water valves to the re-dissolve tank.

9. Shut off the ammonium sulfate to the number two precipitation tank.

10. Shut off the ammonia and air valves to the number two precipitation tank.

11. Shut off the wash water to the number two yellowcake thickener centerwell.

12. Shut off the number two yellowcake thickener underflow valve.

13. Wash out the number two yellowcake thickener underflow pump and line to the Bird centrifuge.

14. Shut off the number two yellowcake thickener underflow pump.

15. Wash out the Bird centrifuge with water .
    a. Add approximately 10 gallons per minute of water.
    b. **Caution**: If too much water is added when washing out the Bird centrifuge, water will flood into the yellowcake dryer feed auger and put water into the yellowcake dryer which could damage the dryer.

16. After the Bird centrifuge has washed out, shut off the wash water to the centrifuge.

17. Shut off the bowl wash water on the centrifuge

18. Shut off the Bird centrifuge.

19. Shut off the Bird centrifuge discharge auger that feeds the yellowcake dryer.

20. Shut down the yellowcake dryer as per the shut down procedures as outlined above.

Yellowcake Dryer Shut Down Procedures

1. Ensure that the product feed system has been shut down. (No additional yellowcake can enter the dryer.)

2. Allow the equipment to operate under normal conditions until all of the yellowcake in the dryer that can be rabbled out has been discharged into the packaging bin.

3. Lower the temperatures at a rate of 50°F per hour. This is accomplished by adjusting the temperature indicating controllers on the control panel. Continue to decrease the hearth temperatures at 50°F per hour until no hearth temperature is above 500°F.

4. Turn the temperature indicating controllers to a set point of 0°F.

5. Shut off <u>all</u> burners.

6. Propane gas maxie valve will close automatically.

7. Shut off the combustion air blower.

8. Shut off the induce draft fan.

9. Shut off the scrubber water supply.

10. Shut off the shaft drive.

11. Shut off the lump breaker.

12. Allow the dryer heat to dissipate at its own rate.

13. When all of the dryer hearth temperatures are 500°F maximum, the cooling air fan may be turned off.

    Note: As equipment is shut down, the alarms will sound. Push the alarm "silence" button.

14. Ensure the dryer is closed up (all doors, etc.) and let the heat dissipate at its own rate.
15. Note: Do not open dryer doors as this may result in thermal shock to the refractory.

Yellowcake Precipitation and Drying Emergency Shut Down Procedures

1. Shut off the loaded strip feed pump.
2. Shut off the ammonia and air valves to the number one and two precipitation tanks.
3. Shut off the ammonium sulfate to the number two precipitation tank.
4. Shut off the acid to the re-dissolve tank.
5. Shut off the steam to the re-dissolve tank.
6. Shut off the water to the re-dissolve tank.
7. Shut off the water to the number one and two yellowcake thickener centerwells.
8. Shut off the underflow pumps under numbers one and two yellowcake thickeners.
9. Shut off the Bird centrifuge.
10. Shut off the wash water to the Bird centrifuge.
11. Shut off the burners on the yellowcake dryer.
12. Shut off the diesel fuel pump to the yellowcake dryer.
13. Shut off the scrubber fan on the yellowcake dryer.
14. Shut off the wash water to the yellowcake dryer scrubber.

Power Outages

1. Shut off the ammonia to the numbers one and two precipitation tanks.

2. Shut off the acid to the re-dissolve tank.
3. Shut off the steam to the re-dissolve tank.

Yellowcake Precipitation and Drying – Shift Inspections

1. Inspect acid and ammonia lines every four hours for seeps and leaks.
   a. Immediately notify your supervisor if any are noted.

2. Inspect for any yellowcake spillage.
   a. Clean up all spills immediately.

3. Inspect guards on all moving equipment once per shift for condition and if in place.
   a. If guards are not in place, shut off the equipment, lock out, and install the guard.
   b. Notify your supervisor if the guards are not in good condition.

4. Inspect all moving equipment for proper operating condition.
   a. Notify your supervisor if problems are noted.

5. Inspect and test all panel alarms at the beginning of the shift and every four hours thereafter.
   a. Immediately notify your supervisor if the alarms are not operating properly.
   b. Circuits <u>are not</u> to be operated unless all alarms are operating properly.

6. Inspect and calibrate the density scales once per shift.

7. Inspect the yellowcake thickeners and precipitation tanks once per shift for leaks.
   a. Immediately notify your supervisor if the fans are not operating or problems are noted.

8. Inspect the roof fans for proper operation every four hours.
   a. Immediately notify your supervisor if the fans are not operating or problems are noted.

9. Inspect the yellowcake dryer burners every two hours for fuel leaks.
    a. Immediately notify your supervisor if any leaks are noted.

10. Inspect the yellowcake dryer scrubber system every two hours for proper water flow and draft.
    a. Adjust water flow as needed.
    b. Adjust draft as needed.
    c. If conditions cannot be adjusted to the proper operating conditions, shut down the dryer circuit, and notify your supervisor immediately.

11. Inspect the yellowcake dryer arms and rabbles every four hours for breaks.
    a. If any are noted, shut off the feed to the dryer, shut off the shaft drive, and notify your supervisor immediately.

12. Inspect the area for good housekeeping every four hours.
13. Clean areas as needed.

CHEMICALS AND REAGENTS

Introduction: Numerous inorganic and organic chemicals are used in the processing of uranium. These include such items as:

1. Inorganic Acids
2. Organic Acids
3. Petroleum Products
4. Fuels
5. Solvents
6. Ammonia
7. Inorganic Bases
8. Flocculents
9. Degreasing Agents
10. Fiberglassing Compounds
11. Oxidizing and Reducing Agents
12. Other chemicals as required

All relevant safety, first aid handling procedures and physical chemical information, etc., is contained in the Material Safety Data Sheet (MSDS) provided in strategic locations throughout the mill area. These can be found in the following locations; safety office, laboratory, maintenance break room and central control room.

The MSDS supplies a description of the chemicals and reagents. The MSDS also explains the hazards, spill procedures, safe use, and first aid procedures for each chemical and reagent.

Each operator must read and understand the MSDS of all chemicals and reagents used in his/her department, along with the chemicals and reagents used in all operating departments.

Each operator must know the location of all MSDS's for his/her operating circuit at all times.

Information Contained on Hazardous Material Safety Data Sheets

Hazardous Material

Shipping Name The proper shipping name or other common name for the material; also any synonyms for the material.

DOT Hazard Class The hazard class designation for the material as found in the Department of Transportation regulations.

Chemical Name The chemical name of the material and its chemical formula.

I.D. Number The four-digit identification number assigned to hazardous material by the Department of Transportation; also includes the prefix "UN" or "NA."

S.T.C.C. Number The Standard Transportation Commodity Code number used in the rail industry; a seven-digit number assigned to a specific material or group of materials and used in the determination of rates; for a hazardous material, the S.T.C.C. number will begin with the digits "49."

Physical Description

Normal Physical State Physical state or form of the material at normal ambient temperatures (68°F - 77°F).

Color The color of the material under normal conditions.

Odor The odor of the material upon its release.

Chemical Properties

Specific Gravity The weight of a material as compared with the weight of an equal volume of water; if the specific gravity is less than 1, the material is lighter than water and will float; if the specific gravity is greater than 1, the material is heavier than water and will sink.

Vapor Density The weight of a pure vapor or gas compared with the weight of an equal volume of dry air at the same temperature and pressure; if the vapor density is less than 1, the material is lighter than air and may rise; if the vapor density is greater than 1, the material is heavier than air and will stay low to the ground.

Boiling Point The temperature at which a liquid changes to a vapor or gas; i.e., the temperature where the pressure of the liquid equals atmospheric pressure.

Melting Point The temperature at which a solid changes to a liquid; this temperature is also the freezing point depending on the direction of the change.

Vapor Pressure The pressure exerted by the vapor within the container against the sides of a container. This pressure is temperature dependent; as the temperature increases, so does the vapor pressure, thus, more of the liquid evaporates or vaporizes. The lower the boiling point of a liquid, the greater the vapor pressure it will exert at a given temperature.

Solubility The ability of a solid liquid, gas, or vapor to dissolve in water; the ability of one material to blend uniformly with another, such as a solid in liquid, liquid in liquid, gas in liquid, or gas in gas.

Degree of Solubility Indication of the solubility of the material.

Other Any additional pertinent information or data found.

Health Hazards

Are there any health hazards associated with the material?

Inhalation Hazard Is there any hazard from breathing this material?

T.L.L./T.W.A. Threshold Limit Value/Time Weighted Average
The concentration of a material to which an average, healthy person may be repeatedly exposed for eight hours per day, 40 hours per week, without suffering adverse health effects.

LC_{50} The concentration in p.p.m. that kills 50% of the laboratory animals in a given length of time.

Ingestion Hazard Is there any hazard from ingesting (eating) this material?

LD_{50} Lethal Dose – the dose that kills 50% of the test animals.

Absorption Hazard Is there any hazard from absorbing this material into the body?

Skin Absorption Can material be absorbed through the skin?

Eye Absorption Can material be absorbed through the eyes?

I.D.H.L. Value Immediately Dangerous to Life and Health Value – an indication of atmospheres that are immediately dangerous to life and health. Within 30 minutes of exposure, death or irreversible health implications to the person exposed are expected.

S.T.E.L. Value Short Term Exposure Limit Value – maximum allowable concentration or ceiling, not to be exceeded during a 15 minute period.

Chronic Hazard Are there any chronic hazards associated with this material?

Carcinogen A material that can cause cancer in an organism.

Mutagen A material that creates a change in gene structure that is potentially capable of being transmitted to offspring.

Teratogen A material that causes the production of a physical defect in a developing embryo.

Hazardous to Aquatic Life Is the material harmful to aquatic life?

Other Any additional pertinent information or data found.

Decontamination Procedures Decontamination is the removal of hazardous materials from the skin, clothing, equipment, etc.; the purpose of decontamination is to prevent or reduce the physical transfer of any contaminants by people or equipment from onsite to offsite locations. List methods available for decontamination for this material.

First Aid Procedures What procedures should be followed for someone contaminated with this material?

<u>Fire Hazard</u>

Fire Hazard Will the material burn or support the combustion process of other materials?

Flash Point The minimum temperature at which a liquid gives off enough vapors to ignite and flash over, but will not continue to burn without the addition of more heat.

Ignition Auto-ignition Temperature – the minimum temperature required to ignite gas or vapor without a spark or flame being present.

Flammable Explosive Range – the range of a gas or vapor concentration (percentage by volume in air) that will burn or explode if an ignition source is present. Limiting concentrations are commonly called the "L.E.L." (Lower Flammable Explosive Limit) and the "U.E.L." (Upper Flammable Explosive Limit). Below the lower flammable limit, the mixture is too lean to burn; above the upper flammable limit, the mixture is too rich to burn.

Toxic Products of Combustion The toxic by-products of the combustion process.

Other Any additional pertinent information or data found.

Possible Extinguishing Agent What extinguishing agents are suitable for control/extinguishment of a fire involving this material?

Reactivity

Reactivity Will the material react with any other materials?

With what? What is this material reactive with in what ways?

Other Any additional pertinent information or data found.

Corrosive Hazards

Corrosivity Hazards Is the material corrosive to other materials?

pH Acidic or basic corrosives are measured to one another by their ability to dissociate in solution. Those that form the greatest number of hydrogen ions are the strongest acids, while those that form the hydroxide ion are the most potent bases. The measurement of the hydrogen ion concentration in solution is called the pH of the compound in the solution. Strong acids have low pH values and strong bases have high pH values; the pH scale ranges from 0 to 14.

Corrosive to what? Materials with which the material is corrosive, particularly skin and steel.

Other Any additional pertinent information or data found.

Neutralizing Agents Those materials that can be used to neutralize the effects of the corrosive material.

Radioactivity Hazards

Radioactivity Hazards Will the material emit radioactivity?

Type of Radiation Emitted Indicate the type of radiation emitted, either alpha particles, beta particles, or gamma radiation.

Other Any additional pertinent information or data found.

Recommended Protection

For the Public Recommended action to protect public health and safety; indicate evacuation distances for various amounts of the material.

For Response Personnel Level of protection required for emergency response personnel working in the danger zone:

Level A – Requires the highest level of respiratory, skin, and eye protection, that is, a fully encapsulating, chemically appropriate, protective suit with its own self-contained breathing apparatus.

Level B – Requires the highest level of respiratory protection, but a lower level of skin protection. It is the minimum level recommended on initial entries until the hazards have been further identified and defined by complete monitoring, sampling, and evaluation.

Level C – Requires air purifying respirators with adequate protection factors; coveralls and other protective equipment may be required. This level is selected when types and concentrations of respirable materials are knows to have adequate warning properties.

Level D – Requires no respiratory protection; basic work clothing should be worn when sites are positively identified as having no toxic hazards.

For the Environment Potential mitigation schemes to protect the environment.

Note: The back of the Hazardous Material Data Sheet can be used to collect additional information of a more specific nature.

Yellowcake Precipitation and Drying

1. Sulfuric Acid – -93 to 95% strength
2. Ammonia
3. Ammonium Sulfate
4. Hydrochloric Acid
5. Propane

Spill/Disposal Procedures

Certain chemicals, when spilled or disposed of, have reporting requirements associated with them. The M.S.D.S. forms for all chemicals used in Uranium Recovery Operations are listed, along with an indication of which chemicals have reporting obligations. The following is an explanation of the actions required of the Mill Operator when dealing with these chemicals. Without exception, your supervisor will make any required reports. Refer to Emergency Response Plan for specific details regarding spill procedures.

Resource Conservation and Recovery Act (R.C.R.A.)

R.C.R.A. regulates the manner in which hazardous materials can be disposed. The specific requirements will be delineated with by the Environmental Department.

If you need to dispose of any chemicals, contact your supervisor for instructions. The containers that held these products may be disposed of in any trash receptacle if:

1. The container has less than 5% left in the bottom, or
2. The container has been triple rinsed into any mill sump.

Spill Reporting

Reportable spills of certain chemicals must be immediately reported to governmental agencies, depending on the quantity and type of chemical spilled. A reportable spill is basically when the chemical hits the ground (earth), as opposed to a spill to a concrete pad, asphalt pad, sump, etc. If a spill occurs, immediately notify your supervisor. Your supervisor will determine if a report to an agency is necessary. Your supervisor will make the report, if needed. Do not attempt to make a report yourself. If there is any doubt, contact your supervisor for advice and direction.

State of Utah Division of Radiation Control

The DRC must be notified if a spill and/or accident causes more than $2,000.00 worth of damage or 24 hours of down time. If either of these conditions exist and is unknown by your supervisor, contact your supervisor immediately. Your supervisor will make any required reports.

Hazards in the Yellowcake Circuit

1. Sulfuric acid – 93% to 95% strength
2. High pressure steam lines – 100 psi
3. High pressure air lines – 100 psi
4. High pressure ammonia lines – 100 psi
5. Ammonia fumes
6. Elevated walkways
7. Propane gas
8. Yellowcake dust
9. Yellowcake ingestion
10. High yellowcake dryer temperatures – 1,400°F.
11. Moving heavy yellowcake drums – 1,000 pounds gross weight

Items above can be hazards if not controlled properly. If controlled properly and to operating standards, they are safe.

<u>Hazard Recognition – Yellowcake Precipitation and Packaging</u>

1. Hazards

    a. Sulfuric Acid Lines

        1. Open slowly
        2. Use personal protective equipment

    b. Ammonia

        1. Open valve slowly
        2. Use personal protective equipment
        3. Report leaks promptly
        4. Adjust pH properly so as not to use excessive ammonia

    c. Steam Lines and Valves

        1. Open valves slowly
        2. **<u>Caution</u>** – hot valve handles

    d. Air Lines and Valves

        1. Open valves slowly
        2. Whip checks on hose connections
        3. <u>Do not</u> use to blow off clothing

    e. Guards

        1. Pump
        2. Drive units
        3. Centrifuges
        4. Driven rollers
        5. Augers

    f. Bird Centrifuges

        1. Lock out when operator changes keys

2. Check guards on auger before working on centrifuge

g. Health Hazards
    1. Ammonia
    2. Sulfuric acid – H_2S in area
    3. Airborne uranium
    4. Beta - Gamma - Radon Daughters
        a. Yellowcake precip
        b. Enclosure
        c. Centrifuge area
        d. Packaging area
        e. Scrubber – barometric tank
    5. Radiation Work Permit will be issued for any work for any department other than operations.
    6. Sampling will be done in this area on a regular basis.
        a. Radon – monthly
        b. Airborne
            1. Weekly
            2. Monthly
        c. Ammonia
            1. Monthly or whenever the need arises
        d. Silica
            1. At least two samples yearly
h. Decks and Walkways
    1. Slippery after a washdown
    2. Hoses in walkway and on deck
    3. Sample cup is long-handled
i. Heat
    1. Dryer enclosure – up to 150°F.
    2. Scrubber deck – off gas drying ducting

o. Scrubbers

JOB PROCEDURES

This section covers job procedures for non-daily routine jobs that are performed in:

YELLOWCAKE PRECIPITATION, DRYING, AND PACKAGING

All non-routine jobs will be initiated by your supervisor. Non-routine jobs will not be performed unless directed by your supervisor.

Procedures for Preparing Yellowcake Drums and Shipping

Purpose: Cleaning, inspecting, preparing, and shipping drums of yellowcake.

1. Yellowcake lots are stored in drums which are stacked two high in the International Uranium Corporation's storage yards.

2. Each lot will have to be moved so that each drum can be inspected and prepared for shipping and/or storage.

3. As an A.L.A.R.A. measure, lots will be isolated from other lots, or moved to the equipment shop for preparation.

4. Inspecting and preparing drums consists of the following steps:
   a. Check for any holes in the top, bottom, and sides of the drum. (Notify your supervisor before repairing drums – a Radiation Work Permit will be required.)
   b. Check that lids and rings are properly secured and tightened.
   c. All rust is to be cleaned from drums and when drums are repainted. (Wear a face shield when using and electric wire brush; wear a leather jacket and pants; use only heavy duty woven wire brushes when grinding.)
   d. All drum numbers, lot numbers, dates, and weights are listed on each drum and are legible.
   e. All drum numbers, lot numbers, dates, and weights are correct.

5. Safety is the most important aspect of the job. Do not rush the job to be done.
   a. Always keep people away from the drums when lifting the drums from a stack or when moving the drums to prevent dropping them on someone or getting a person in a pinch point.
   b. <u>Remember</u> – the drums can weigh up to 1,000 pounds.

c. Do not use mobile equipment unless you have been trained and signed off by a qualified instructor.

d. Do not use a blasting machine until you have been trained and signed off by a qualified instructor.

e. Always wear proper protective equipment when performing the job.

f. Use ground fault receptacles on electrical equipment.

g. Do not use any defective equipment.

h. Always contact your supervisor with any problems or questions.

i. Read and understand all MSDS for paints and thinners used.

j. Mobile equipment will be inspected at the beginning of each shift and a Mobile Check List will be filled out and signed.

Procedures

1. Move drums from stacked lots and place on ground space so that sides and tops can be easily inspected and prepared as necessary. The bottoms of the drums are to be inspected by lifting the drums with a barrel grab and visually checking for leaks and rust. Do not get under the drums when checking or cleaning and painting the bottoms.

2. After the drums are placed on the ground, tap the lids and rings with a rubberhead hammer and watch for any dusting. (Important: full-face respirators with a proper canister must be worn during this procedure to prevent the inhalation of dust if there is a leak.)

3. After the drums have been checked for leaks, remove any rust from the drums and paint those areas. Paint any areas where the metal is bare.

4. Inspect stenciling and numbers on the tops and sides of each drum making sure all are legible.

5. Check the drum number, date, lot number, gross weight, tare weight, and net weight on the tops and sides of each drum against the numbers on the master sheet given you by the accounting department.
    a. If numbers do not match exactly, note on the master sheet and notify your shift foreman.

6. Loading of drums onto the truck:
    a. Place the truck loading ramp up to the truck trailer.
    b. Chain the ramp to the truck trailer after placing the ramp up to the trailer so that the ramp cannot move away from the trailer.
    c. Secure the truck trailer by chocking the rear wheels so that the trailer cannot move.
    d. Inspect the ramp after placing it at the trailer to be sure chains and blocks are secure.
    e. Do not use the ramp at any time if there are any defects in the ramp, chains, or blocks.
    f. Drums have to be scanned by trained personnel for surface contamination prior to loading on the truck.
    g. Prior to the truck leaving the yard area, scanning has to be done for gamma on the truck cab and trailer. The trailer has to be placarded and the driver has to receive our driver's shipping packet.

Precautions

1. Do not clamp barrel too tightly with the barrel grab.
    a. It will bend the sides of the drums.
    b. It will cause the lid to leak around the ring.

2. Do not clamp the barrel too lightly with the barrel grab.
    a. It will fall and spill the material.
    b. It will fall and could injure someone.

3. Always wear proper protective equipment.

4. Do not hurry or rush – use caution at all times.

5. Do not use defective equipment.

6. Always wear a face shield and leather jacket and pants when using the electric wire brush to remove rust from the drums.

7. Always wear a respirator with the correct canister when blasting and painting. See your supervisor for the correct canister.

8. Watch for pinch points. Fingers could be smashed between drums when moving them by hand.

9. Follow all safety rules and procedures.

10. Report any spills of yellowcake to your supervisor immediately.

I have read and understood the above job procedures.

Date ____________________ Names ______________________________

____

____

____

SAFETY RULES AND PROCEDURES

Safety rules will be followed ***without exception***. Listed on the following pages are general safety rules and safety rules for Ore Receiving, Feed Operator, and Grind.

These rules do not cover all the White Mesa Mill safety rules. Each operator is to know and understand all White Mesa Mill safety rules that are described in the White Mesa Mill Safety Rules manual.

GENERAL RULES

Reporting Unsafe Conditions and Injuries

1. Correct or report all unsafe conditions to a supervisory person as soon as possible.

2. Report all injuries – no matter how slight – to your supervisor immediately. Also, report all accidental occurrences or conditions that may have a potential for injuring someone.

3. If you wish to see a physician for any occupational injury or illness, contact your supervisor for an authorization slip before seeing the doctor.

Personal Protective Equipment and Clothing

1. Hard hats, safety shoes, and safety glasses with side shields must be worn at all times in the plant area – except in control rooms, offices, and change rooms.

2. "Bump" caps, metal hard hats, and contact lenses are not permitted.

3. Other personal protective equipment includes, but is not limited to: ear plugs, respirators, wet suits, welding helmets, goggles, gloves, and rubber boots. Face shields and safety belts are required in designated areas and/or while performing certain jobs. If in doubt, contact your supervisor.

4. Each employee is responsible for the condition of their protective equipment. Report any defects, etc., to your supervisor.

5. The following equipment is required when working on pipelines or vessels containing acids or caustics:
    a. Face shield and chemical splash goggles

b. Rubber coat and pants
c. Rubber gloves and rubber boots
d. Other equipment specified by the foreman for that particular job listed on the Safe Work Permit

6. Should length of hair present a safety hazard, it must be contained.

7. Rings or other hazardous items of jewelry shall not be worn except while working in the office.

8. The use of a safety belt and properly adjusted life line is required where there is a danger of falling four feet or more, except while performing work under the ladder and scaffold section of this manual. This rule applies when going beyond the handrails of walkways on top of any tanks in the mill area.

9. Proper clothing shall be worn at all times. Loose, ragged clothing which could create a hazard will not be permitted on the job.

10. It is a condition of employment that all personnel who may be required to wear a respirator must be clean shaven to assure that the respirator fits properly. Personnel will be fully trained prior to using respirators.

Conduct

Employees will be subject to disciplinary action, up to and including discharge, for any of the following safety offenses:

1. Violation of any safety rule.

2. Entering the plant while under the influence of liquor or drugs, or having them in your possession while in the plant area.

3. Fighting, wrestling, or engaging in "horseplay" while on the premises.

4. Water fights will not be tolerated.

5. Removal without authority, or destroying, or tampering with any safety device, sign, or signal.

6. Removal of company property without specific written authorization.

7. Carrying firearms into the plant area.

8. Giving false information or testimony during an investigation of incidents.

9. When going down steps, <u>do not</u> slide down the handrails.

MOBILE EQUIPMENT – SAFETY RULES

General

1. Only trained and authorized persons may operate mobile equipment.

2. All mobile equipment shall be inspected by the operator and any safety defects corrected before the equipment is used. If safe to do so, the equipment may be driven to the shop for repairs. Otherwise, the equipment must be towed or repaired at the location.

3. Audible backup alarms shall be in operating condition.

4. Walk around any piece of equipment before starting or moving it. Make certain no one is in a dangerous position and there are no obvious defects or hazards.

5. Use care when getting on or off equipment. Use the handholds provided. **NEVER JUMP** from equipment.

6. No person shall get on or off of moving equipment.

7. Seat belts shall be used at all times when equipment is in motion.

8. Equipment shall be operated at a reasonable speed consistent with road and weather conditions.

9. Equipment shall not be started or otherwise operated unless the operator is seated at the controls of the equipment.

10. Keep the cabs of equipment clean. Loose items which could jam controls or create other hazards are not allowed.

11. Only those persons that can be seated safely in the operator's compartment will be permitted to ride as passengers.

12. Report all accidents to your supervisor regardless of how minor they are. If property damage or personal injury is involved, do not move the equipment until your supervisor has released it.

13. All gasoline engines must be shut off when refueling.

14. Stunt driving and horseplay are strictly forbidden.

15. Keep equipment clear of edges, drop offs, and unstable banks. Maintain adequate berms where required

OPERATIONS – SAFETY RULES

General

1. Operators are not to open electrical panels. Doors on electrical panels must be kept closed at all times. All electrical work must be completed by a qualified electrician.

2. When lighting oil or gas-fired equipment of any type, follow the specific instructions posted. If you smell gas or detect a leak, notify your supervisor at once.

3. Open steam valves slowly to permit condensation to escape. A sudden surge of condensation may rupture the line and scald you.

4. Never "block in" magnetic switches. If the switch will not close, notify your supervisor.

5. Know the location and how to use the exits, eye wash fountains, showers, protective equipment, and fire extinguishers in your area. Know the hazards presented by chemicals used in your area and how to defend against them. Material Safety Data Sheets (MSDS) are available.

6. If a valve refuses to open or close, ask your supervisor to have it repaired. Do not use a wrench or cheater to open or close a valve unless it has been thoroughly inspected to determine its condition.

7. All personnel shall know the location of all main block valves for fuel, kerosene, gas steam, air, water, sulfuric acid, and ammonia lines which pass through their area. Even though the respective valve may not be in the operator's area, he or she must know how to shut off each line in case of an emergency.

8. Safe operation of conveyors requires that you shall:
    a. Be sure everyone is clear of all belts and pulleys before starting the conveyors.
    b. Lock out the main drive motor switch before cleaning or repairing head or tail pulleys, idlers, or the belt. If guards must be removed to grease or use belt dressing, the conveyor shall be locked out.
    c. Never ride a conveyor belt.
    d. Cross conveyors only at walkways provided.
    e. Check and record each shift to be sure all emergency stop lines are operative.

Safety Rules – Yellowcake Precipitation, Drying, and Packaging

1. If any part of the dust collecting system for the drying and packaging facility is not working, the operation shall be shut down at once.

2. Operators in this area are required to shower at the end of each shift.

3. All clothing used in the yellowcake area must be washed daily.

4. All spills and dust leaks shall be cleaned up at once and the cause corrected immediately.

    When any non-routine (i.e., maintenance, clean up work) is to be performed in the yellowcake area, the radiation safety office shall be notified as far in advance of doing the work as possible.

SAFE WORK PERMIT

Issued by: ______________________ Date: ________________ Time: __________
For Dept.: ______________________ In area: ______________________________
Task to be performed: ____
Permit good until: ____
Confined space hazard evaluation completed by: _______________________________

REQUIRED	**PRECAUTIONS**	**COMPLETED BY**
__________	Safety Dept. approval for confined space entry	______________
__________	Relieve vac/pressure	______________
__________	Equipment & lines drained, washed out, and ventilated	______________
__________	Atmosphere checked for explosion, toxicity, and oxygen (see Safety Department)	______________
__________	Continuous air monitor	______________
__________	Radiation work permit	______________
__________	Shower and eye wash checked	______________
__________	Drive mechanisms locked out	______________
__________	Chemical and gas inlets locked and blanked	______________
__________	Steam, air, and high volume lines locked and disconnected	______________
__________	Special zero energy considerations	______________
__________	Openings roped off or guarded	______________
__________	Proper ladder tied off	______________
__________	Ground fault interrupter	______________
__________	Disconnect level indicators, etc.	______________
__________	Class 1 Division 1 explosion proof lights	______________
__________	Proper bonding and grounding of equipment and material will be verified for permissible OHMS resistance by a qualified electrician	______________
__________	Fire extinguisher and/or charged hose	______________
__________	Test welding hose for leaks	______________
__________	Qualified safety watch	______________
__________	Stay clear when lifting materials overhead	______________

PERSONAL PROTECTIVE EQUIPMENT

Splash goggles ☐	Face shield ☐	Rubber suit ☐	Latex nitril gloves ☐
Rubber boots ☐	SCBA ☐	F.F. respirator ☐	
Cartridge type ☐	Airline respirator ☐	Safety belt & line ☐	Hearing protection ☐

Other equipment ____
Special instructions
____
____

Job completed: Date ______________________ Supervisor ______________________

Reviewed by: Dept. Head ___________________ Safety Department ________________

RADIATION SAFETY PROCEDURES

These rules do not cover all of the White Mesa Mill Radiation Safety Procedures, but are supplied as a guide to be utilized as a supplement to the training which you have received.

Listed below are the Radiation Safety Procedures for ore receiving and grind which, when followed, will maintain your exposures A.L.A.R.A. Remember, you are the person most responsible for controlling your radiation exposure. If the Radiation Safety Procedures are followed and protective equipment is utilized correctly, your exposure will be maintained A.L.A.R.A.

Yellowcake Precipitation, Drying, and Packaging Safety Procedures

1. A.L.A.R.A. Program Policy Statement

The policy of Denison Mines (USA) Corp. to maintain good radiation protection practices is the expenditure of every reasonable effort to achieve and maintain low levels of contamination and radiation in occupational exposures. By definition, the A.L.A.R.A. program shall result in radiation exposures being maintained to levels far below any applicable limits of the N.R.C. regulations as is reasonable.

This policy and program is to be achieved through systematic employee monitoring and an on-going review process between the radiation protection staff and plant operations management with secondary audits performed by corporate environmental personnel.

Denison Mines (USA) Corp. is committed to maintaining occupational exposures of personnel at White Mesa to levels as reasonably achievable. This commitment is supported by the training program conducted for facility personnel, continuous reviews of radiation, environmental and industrial hygiene protection policies.

It is the policy that occupational exposure records of personnel at the White Mesa Mill are readily available for review when requested. The radiation protection staff will review and discuss any aspect of radiation safety at any time.

2. Radiation Work Permit

The Radiation Work Permit is designed to provide a job procedure plan to prevent unknown or excessive exposure when any non-routine (i.e., maintenance, etc.) work is to be performed in the mill area. The procedure ensures that radiation hazards which cannot be contained will be controlled by the use of protective equipment. An initial assessment of the work environment and associated work tasks as related to potential radiation exposure will be made for those non-routine work activities which may require the issuance of a Radiation Work Permit. If it is determined, by this initial assessment, that there is a potential for elevated radiation exposure, a Radiation Work Permit will be issued.

a. The jobs mentioned below at yellowcake precipitation, drying, and packaging will require a Radiation Work Permit:

b. Before work starts on the job outlined on the work permit, the radiation safety staff must review and approve the permit after being certain there is no health hazard to employees.

c. The permit must be signed by all personnel involved in the work and posted in the work area.

d. After work has been completed, the permit will be sent to the radiation safety office for calculations of exposures and filed for future reference.

e. The jobs mentioned below at yellowcake precipitation, drying and packaging may require a Radiation Work Permit if the initial radiological assessment indicates a potential for elevated radiation exposure:

   1. Entry into thickeners or enclosed tanks.

   2. Entry into the yellowcake dryer or packaging enclosures by anyone other than the Operator unless covered by a written procedure.

   3. Cleaning out the sumps.

   4. Cleaning the yellowcake packaging and dryer scrubber system by personnel other than the Operator. Repairs or cleaning of yellowcake duct work. Repairs or replacement of process lines.

   5. Addition of any clean up materials into the yellowcake sumps

   6. Sandblasting the yellowcake dryer and packaging scrubber fans.

This is not an all-inclusive list of jobs at Yellowcake precipitation, drying and packaging that could require a Radiation Work Permit, but is intended as a guide.

3. **Posting of Specific Areas**

As a part of A.L.A.R.A. practices and controlling your exposures, the following signs could be posted in your work area. It is important that you understand what these signs mean.

CAUTION – AIRBORNE RADIOACTIVE AREA This sign is posted in an area in which airborne uranium or radon daughter concentrations are, or at above 25% of the specified limits for airborne concentrations. Any time this posting is observed, respiratory protection is required to minimize your exposure until conditions can be corrected and airborne concentrations are below 25% D.A.C. The following areas have required that they be posted as an "airborne radioactivity area" requiring the use of full-face respirators due to airborne or radon daughter concentrations above 25% D.A.C.:

a. Airborne uranium concentrations at the yellowcake dryer and packaging enclosure average 300% D.A.C. Full-face respirators and protective clothing are required when entering the yellowcake dryer and packaging enclosures.

CAUTION – RADIATION AREA This sign is posted in an area where beta and gamma radiation levels are at, or above 5 mr/hr. Methods of controlling your exposure to beta or gamma radiation are listed below.

a. Decreasing time of exposure.

b. Increasing distance between you and the source.

c. Increasing shielding.

Our primary means of control for gamma and beta radiation is limiting time spent in the radiation area.

4. **Procedures to Follow Regarding the Use of Respirators**

a. When issued a new respirator, the respirator shall be fit-tested with irritant smoke and logged on the forms provided at the shifters office. After the initial fit-testing, a positive-negative pressure test will be done each time the respirator is donned to ensure a proper fit.

b. If you are using a respirator in a very dusty area, it may be necessary to change the filter after two to three hours. When resistance to breathing becomes uncomfortable, it is a sign that the filters have served their useful life and need to be replaced.

c. At the White Mesa Mill facility, there is only one cartridge used. The cartridge is for nuisance dusts, chemical mist, and radiological dust.

5. **Radiation Safety Procedures**

These are practices that, if you follow, will minimize your radiation exposure while working at the White Mesa Mill:

a. Practice good housekeeping to prevent build up of contamination.

b. Follow good personal hygiene habits.

    1. Wash your hands prior to eating and before leaving the plant.

    2. Change and wash your clothes regularly and bathe regularly.

    3. All mill personnel will be provided with a change room, showers, and laundry facilities so that they may leave their work clothes at the mill. All coveralls and contaminated clothing will be laundered on the property.

    4. Store your lunch box and eat only in a designated eating area.

    5. Scan your clothes, hands, and bottoms of your shoes with the alpha scanner prior to leaving the restricted area.

c. Cooperate with the people making the radiation surveys by doing your job in a normal manner. If you think sampling is being done under abnormal conditions, tell the person doing the surveys.

d. Always wear your dosimetry device when you are assigned one. Put it in the designated area when leaving work.

e. Wear appropriate respiratory protection while in potentially elevated radiation areas. (full-face respirator), if required.

f. Check the equipment utilized to control the radon daughter levels, if applicable. Take necessary precautions to reduce your radiation exposure if there is evidence of excessive dusting and notify your shift foreman of any equipment malfunctions.

g. If you are concerned or have any questions about the amount of radiation you are being exposed to, contact the Radiation Safety Officer.

6. **Urinalysis Sampling**

Routine urinalysis samples for operators at yellowcake areas will be taken every two weeks. Urinalysis samples are utilized to determine the uranium content contained in the urine of the operator. The frequency of sampling is dependent on the airborne concentrations and will be changed if airborne levels exceed 25% of the airborne standards.

To minimize the change of contaminating a urine sample, the following practices should be followed:

a. Urinalysis containers can be picked up at the administration building upon returning from your scheduled days off (two and four days). The sample containers should be filled after washing your hands and prior to changing into your work clothes or reporting to your work location. The samples can then be placed in the bioassay laboratory.

Under unusual circumstances where specimens cannot be collected in this manner, the worker should shower immediately prior to voiding. When a shower is not possible, disposable plastic or rubber gloves should be worn during voiding. Take all necessary precautions to ensure that your urine sample is not contaminated.

OPERATOR'S RESPONSIBILITIES

1. Shift change between operators will be made in assigned circuits. Shift change between operators will not be made in the mill lunchroom or the mill change room. An operator leaving his work station before being relieved will be leaving without permission and will be subject to disciplinary action which could lead to termination.

2. After the shift change has been made, the oncoming operator will read the circuit log book at the beginning of the shift for any operating changes or information pertaining to the circuit since the last log book review. The operator will be required to initial the log book stating he or she understands the information in the log book. If the information concerning your operation is not clearly understood, contact your shift foreman as soon as possible. Review the log book during your shift for any operating changes made during your shift.

3. The first hour of each shift will be spent checking all equipment and conditions of the circuit to determine that the circuit is operating safely and to operating parameters stated in the circuit log book.

4. It will be the responsibility of each operator to:
    a. Operate the circuit in a safe and efficient manner while following all company safety rules.
    b. Operate departments within specified parameters.
    c. No alarms are to be blocked out or otherwise made to be inoperable at any time.
    d. Maintain a proper operating log sheet.
    e. Collect and properly label all mill control samples and avoid sample contamination.

1. If a sample is contaminated, start a new sample and mark "contaminated sample" on the item that was contaminated.

f. Communicate operating conditions in an accurate and timely manner.

g. Maintain and practice good housekeeping.

h. Practice assigned duties on equipment to be repaired by the maintenance department.

   1. Shut down equipment to be repaired.
   2. Close all valves related to equipment to be repaired.
   3. Properly bypass equipment if bypassing facilities are available.
   4. After equipment has been repaired and turned back to operations, the operator will open all equipment-related valves and all bypassed systems and start equipment.

5. All operators will be required to submit bioassay (urine) samples. Normal sampling frequency is every two weeks or monthly depending on your work locations and after performing work requiring a Radiation Work Permit. To minimize contamination, all operators will submit bioassay samples before reporting to their work station. Sample containers will be placed in the administration building and bioassay laboratory.

6. All operators will wear personal sampling equipment when asked to do so by the radiation or safety departments.

7. All operators will be provided with a change room, shower, and laundry facilities so that they may leave their work clothes at the mill. All coveralls and contaminated clothing will be laundered on the property.

   a. Yellowcake precip and yellowcake packaging operators will be required to shower before leaving the mill. These operators will be paid ½ hour of overtime to shower.

8. Prior to leaving the restricted area, all operators will monitor themselves with an alpha radiation survey meter located at the guard house. If the alarm sounds, re-survey. If the alarm sounds again, contact the Shift Foreman, Radiation Safety Officer, or a radiation staff member.

9. Operators of company vehicles must have a valid driver's license.

10. Operators will not operate mobile equipment until trained to operate mobile equipment by a qualified trainer.

11. Mobile equipment is to be checked before use on each shift. A Mobile Equipment Check List will be filled out and turned in to your shift foreman each shift. Any equipment defects must be corrected before equipment is operated.

1.0 Purpose:

The State of Utah Radioactive Materials License (the "License") for the White Mesa uranium mill is a Performance-Based License ("PBL"). The License essentially allows Denison Mines (USA) Corp. ("DUSA") to evaluate and implement certain changes in the licensed operation without applying for and receiving a formal amendment to the License. The following procedure outlines the procedural steps to follow when making changes to the operations pursuant to the License or a Performance-Based License Condition ("PBLC").

2.0 Changes Allowed Under the License or PBLC:

Under Performance-Based Licensing, DUSA may make changes in licensed activities under certain conditions as outlined in the License. Essentially, DUSA may:

(1) Make changes in the facility or process, as presented in the License application,

(2) Make changes in the procedures presented in the application, or

(3) Conduct tests or experiments not presented in the application, without prior approval of the Executive Secretary of the State of Utah Radiation Control Board (the "Executive Secretary"), if DUSA ensures that the following conditions are met:

- The change, test or experiment does not conflict with any requirement specifically stated in the License (excluding material referenced in a PBLC), or impair DUSA's ability to meet all applicable regulations;
- There is no degradation in the essential safety or environmental commitments in the License application, or provided by the approved reclamation plan; and
- The change, test, or experiment is consistent with the conclusions of actions analyzed and selected in the Environmental Assessment (EA) of February 1997.

Otherwise, DUSA is required to submit an application for a license amendment from the Executive Secretary. The determinations whether the above conditions are satisfied for a particular proposed change will be made by a Safety and Environmental Review Panel (SERP), described as follows.

3.0 Safety and Environmental Review Panel (SERP):

DUSA will form a SERP to evaluate each potential change under the License or PBLC. The SERP will be responsible for reviewing the changes, tests, or experiments to determine whether an amendment to the License is required.

The SERP shall consist of a minimum of three individuals. One member of the SERP shall have expertise in management and shall be responsible for managerial and financial approval changes; one member shall have expertise in operations and/or construction and shall have responsibility for implementing any operational changes; and, one member shall be the corporate radiation safety officer (CRSO), or equivalent, with the responsibility of assuring changes conform to radiation safety and environmental requirements. Additional members may be included in the SERP as appropriate, to address technical aspects such as health physics, groundwater hydrology, surface-water hydrology, specific earth sciences, and other technical disciplines. Temporary members or permanent members, other than the three above-specified individuals, may be consultants or other staff members.

4.0 SERP Review Procedure:

In their documented review of whether a potential change, test, or experiment (hereinafter called "the change") is allowed under the License or PBLC, without a License amendment, the SERP shall consider the following:

(1) Current License Requirements: The SERP will conduct a review of the most current License conditions to assess which, if any, conditions will have impact on or be impacted by the potential SERP action. If the SERP action will conflict with a specific License requirement, then a License amendment is necessary prior to initiating the change.

(2) Impacts on regulations: The SERP will determine if the change, test, or experiment conflicts with applicable regulations (example: UAC R313-15 requirements). If the SERP action conflicts with applicable regulations, a license amendment is necessary.

(3) Environmental Assessment: The SERP will review whether the change, test, or experiment is consistent with the conclusions regarding actions analyzed and selected in the Environmental Assessment of February 1997. If the change causes substantive safety or environmental impacts that have not previously been evaluated in the environmental report/assessment, the proposed action must be evaluated to determine if the change would authorize or result in:

- a significant expansion of the Mill site;

- a significant change in the types of effluents;
- a significant increase in the amounts of effluents;
- a significant increase in individual or cumulative occupational radiation exposure; or
- a significant increase in the potential for or consequences from radiological accidents,

in which case an environmental report would be required. If an environmental report is required, a License amendment would be necessary for the proposed action.

(4) Financial Surety: The SERP will review the proposed action to determine if any adjustment to the financial surety arrangement or approved amount is required (Condition No. 9.5 of the License). If the proposed action will require an increase to the existing surety amount, the financial surety instrument must be increased accordingly. The surety estimate must also be updated either through a License amendment or through the course of the annual surety update to the Executive Secretary. The Executive Secretary incorporates the annual surety update by license amendment.

(5) The SERP will assure that there is no degradation in the essential safety or environmental commitment in the License application, or as provided by the approved reclamation plan.

5.0 Documentation of Review Process:

(1) After the SERP conducts the review process for a proposed action, it will document its findings, recommendations and conclusions in a written report format. All members of the SERP shall sign off in concurrence on the final report. If the report concludes that the action meets the appropriate License or PBLC requirements and does not require a License amendment, the proposed action may then be implemented. If the report concludes that a License amendment is necessary prior to implementing the action, the report will document the reasons why, and what course DUSA plans to pursue. The SERP report shall include the following:

- A description of the proposed change, test or experiment (proposed action);
- A listing of all SERP members conducting the review, and their qualifications (if a consultant or other additional member);
- The technical evaluation of the proposed action including all aspects of the SERP review procedures listed above;

- Conclusions and recommendations;
- Signatory approvals of the SERP members; and
- Any attachments such as approved procedures or plans, all applicable technical, environmental or safety evaluations, reports or other relevant information including consultant reports.

(2) All SERP reports and associated records of any changes made pursuant to the License or PBLC shall be maintained through termination of the License.

3) On an annual basis, within sixty (60) days after the calendar year end, DUSA will furnish to the Executive Secretary a report that describes all changes, tests or experiments made pursuant to the License or PBLCs during the calendar year. The report will include a summary of the SERP evaluation of each change. In addition, DUSA will annually submit, as part of such report, any pages of the License renewal application to reflect changes to the August 23, 1991 License Renewal Application, or supplementary information submitted by letters dated December 13, 1991, July 25, October 5 and November 22, 1994, and December 13, 1996.

ALARA PROGRAM

Denison Mines (USA) Corp.

White Mesa Mill

**6425 South Highway 191
Blanding, Utah 84511**

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1. ALARA PHILOSOPHY

1.1. Licensee Management

1.1.1 Management Commitment

Denison Mines (USA) Corp. ("Denison") is committed to maintaining occupational exposures of personnel, contractors and visitors and effluent releases at the White Mesa Mill (the "Mill") as low as is reasonably achievable ("ALARA").

In order to achieve this objective, Denison and its management provide a strong commitment to and continuing support for the development and implementation of the radiation protection and ALARA Programs at the Mill.

The program that Denison utilizes to ensure that worker exposures and effluent releases are ALARA is the sum total of:

- all the design barriers, operating procedures, management controls, and personnel experience and expertise built into the Mill, including the equipment to control and prevent effluent releases and to sample and monitor the working environment. Potential releases, both in the Mill and to the environment, are held within the performance capability of the control equipment through regular inspection and maintenance of the equipment;

- Extensive programs to monitor both the work environment and releases from the Mill are conducted. These include monitoring of the work environment; personnel monitoring programs; and Mill area monitoring programs, which include both external radiation surveys and airborne radionuclide monitoring;

- Bioassay programs;

- Contamination control programs;

- The qualifications of the staff. All management personnel involved with plant radiation protection have extensive experience in similar positions, and are trained to use appropriate technology.

Denison's commitment to this ALARA objective is supported by the training program conducted for facility personnel, continuous reviews of radiation, environmental, and industrial hygiene protection policies and procedures, and the adoption of procedures and equipment that have been demonstrated to reduce occupational exposures and releases to the environment.

This ALARA program is to be achieved through systematic worker monitoring and an on-going review process between the radiation protection staff and plant operation management with secondary audits performed by corporate environmental and health and safety personnel.

1.1.2 ALARA Committee

Denison has established an ALARA Committee to review all matters relating to the ALARA Program. The ALARA Committee meets as required, but generally at least once per quarter. The Mill maintains a complete set of minutes from the ALARA Committee meetings. The ALARA Committee maintains an ALARA Tracking List to ensure that all matters raised by the Committee are dealt with in an appropriate and timely fashion.

The members of the ALARA Committee shall include at least the following:

- The Mill's Radiation Safety Officer ("RSO");
- The Mill Manager;
- Corporate management personnel in charge of Mill operations;
- Corporate management personnel in charge of environmental and regulatory matters.

All Mill matters that impact or could potentially impact public health, safety or the environment are reviewed by the ALARA Committee to ensure that exposures to the public, workers and the environment are as low as reasonably achievable.

1.1.3 Information and Policy Statements

Denison provides information and policy statements to workers, contractors and visitors as necessary. The underlying philosophy that radiation exposure to workers, the public and to the environment will be maintained ALARA is a fundamental practice of all Mill operations, and this concept is clearly explained to all workers and contractor personnel during Mill orientation and worker training sessions.

It is the policy of Denison that occupational exposure records of each worker at the Mill are readily available for review by the worker. The RSO and his staff will review and discuss any aspect of radiation safety at any time.

1.1.4 ALARA Audit

Mill License condition 11.6 requires that Denison, as Licensee, perform an annual ALARA audit of the radiation safety program at the Mill, that reviews procedural and operational efforts to maintain exposures ALARA, in accordance with Regulatory Guide 8.31. This requirement is implemented through Section 2.3.5 of this Program. The ALARA audit is performed each year by a member of the corporate environmental and regulatory compliance management personnel of the Licensee and an external consultant. The results of this annual audit are summarized in the annual ALARA Report that is provided to the ALARA Committee for review, and maintained on file at the Mill for inspection.

1.1.5 Continuing Management Evaluation

Through the ALARA Committee, Denison continually evaluates the Mill's radiation safety (health physics) and environmental protection programs, including their staff and whether or not adequate resources are allocated to the programs. Any issues relating to radiation safety or environmental protection are reviewed by the ALARA Committee as they arise. The ALARA Committee takes a pro-active role in scheduling periodic reviews of various aspects of the Mill's radiation safety program to help ensure that any potential areas of concern are identified and dealt with before a problem can arise.

1.1.6 Briefings and Training in Radiation Safety

Appropriate briefings and training in radiation safety, including ALARA concepts are given to all uranium mill workers, both to new hires and to current Mill employees, as part of their 40-hour training requirements under the Mine Health and Safety Administration ("MSHA") for newly hired employees, and as part of their 8-hour refresher training for all existing employees. In addition, appropriate training is provided to contractors and visitors, as required. See Sections 2.5.8 and 2.5.9 below for further details.

1.2. Radiation Safety Officer

The RSO has primary responsibility for the technical adequacy and correctness of the radiation protection and ALARA program and has continuing responsibility for surveillance and supervisory action in the enforcement of the program. The RSO reports directly to the Mill Manager, but also has the authority to report to the President or to a Vice President, or to the Manager, Environmental Affairs of Denison if he feels the need to do so in fulfilling his responsibilities.

Specifically, the RSO's authority and responsibilities include the following:

- Major responsibility for the development and administration of the radiation protection and ALARA program;

- Sufficient authority to enforce regulations and administrative policies that affect any aspect of the radiological protection program, including the following:

    - the authority to order cessation, postponement or modification of any operation at the Mill that he deems violates the radiation protection program, industrial hygiene or environmental procedures or standards, or the ALARA program. The RSO is directly responsible for developing, implementing, monitoring and reporting activities that ensure that the Mill radiation protection program, industrial hygiene practices and environmental protection program meet applicable standards; and

- o the authority to direct and participate in an investigation of any circumstances of unusual exposures. Such investigation will include recommended remedial action and documentation of corrective action;

- Responsibility to review and approve plans for new equipment, process changes, Mill maintenance work, or changes in operating procedures, whether alone or as a member of the Mill's SERP committee, to ensure that the plans do not adversely affect the radiation protection program, or result in unsafe radiation safety, industrial hygiene or environmental practices; and

- Responsibility to ensure that adequate equipment, supplies and laboratory facilities are available, are well maintained in proper working order, and are used properly in order to monitor relative attainment of the ALARA objective. To the extent the Mill does not have adequate laboratory facilities or it would be preferable to utilize an independent certified laboratory, the RSO has the authority to utilize such an independent certified laboratory.

Demonstration of improvements in radiation safety, or in modifications sought, considered, or implemented where reasonably achievable is the combined responsibility of the RSO, Mill Manager and the ALARA Committee.

1.3. Uranium Recovery Workers

In order to better ensure compliance with the Mill's radiation protection and ALARA program, all workers at the Mill are responsible for the following:

1.3.1 <u>Adhering to all Procedures</u>

Adoption, approval, and adherence to the designated policies and recommendations is the assigned responsibility of Mill management. Mill management is responsible for all aspects of the Mill operation, including the onsite radiation protection program, and is responsible for approval and adherence to procedures for operation of the Mill in reference to the ALARA concept.

Mill workers are responsible for adhering to all rules, notices, and operating procedures for radiation safety established by Denison management and the RSO. All Mill employees are advised of this responsibility during their annual refresher training and during specific training relating to the job tasks associated with the issuance of specific Radiation Work Permits.

1.3.2 Reporting Promptly to the RSO and Mill Management

All workers are required to report promptly to the RSO, or Mill management, equipment malfunctions or violations of standard practices or procedures that could result in increased radiological hazard to any individual. This requirement is specifically delineated in each standard operating procedure for all operating circuits at the Mill and is emphasized in employee training sessions.

In addition, Mill supervisory personnel are responsible for notification to the RSO whenever activities are planned or instigated that may involve a potential significant increase in exposure to airborne radioactivity or significant increase in extended gamma radiation.

1.3.3 Workers are Responsible for Suggesting Improvements

All workers are responsible for suggesting to the RSO or Mill management any improvements for the radiation protection, environmental protection and ALARA programs that arise from performing their jobs.

2. HEALTH PHYSICS ORGANIZATION AND ADMINISTRATIVE PROCEDURES

2.1. Health Physics Authorities and Responsibilities

2.1.1 Health Physics Authorities and Responsibilities

The RSO is responsible for conducting the health physics program and for assisting the Mill Manager in ensuring compliance with applicable regulations and license conditions applicable to worker health protection. The RSO reports directly to the Mill Manager, but also has the authority to report to the President or to a Vice President or the Manager, Environmental Affairs of Denison if he feels the need to do so in fulfilling his responsibilities.

In addition to the responsibilities and authorities delineated in Section 1.2 above, the RSO has the following specific authorities and responsibilities:

- Directly responsible for supervising the health physics technicians, for overseeing the day-to-day operation of the health physics program, and for ensuring that records required by the State of Utah are maintained; and

- The responsibility and authority, through appropriate line management, to suspend, postpone, or modify any work activity that is unsafe or potentially a violation of the State of Utah's regulations or license conditions, including the ALARA program.

The RSO may have other safety related duties, such as responsibility for programs of industrial hygiene and fire and safety, but will have no direct production-related responsibility.

2.2. Operating Procedures

2.2.1 Standard Operating Procedures Established

The Mill is required to maintain written standard operating procedures or Radiation Work Permits ("RWPs") for all activities that involve handling, processing, or storing radioactive materials, as well as health physics monitoring, sampling, analysis and instrument calibration.

All such procedures include consideration of pertinent radiation safety practices, to the extent not covered in the Radiation Protection Manual, Respiratory Protection Manual or Environmental Protection Manual.

2.2.2 Policy-for Eating - Restricted Area

Eating lunches or snacks, or chewing tobacco is not allowed within the Restricted Area of the Mill except for those areas so designated by the RSO. Such noted activity, as observed, results in a supervisory review of employee actions, documentation of the incident, and retraining by the Radiation Safety Staff. Repeated occurrences shall be cause for dismissal. This policy is in effect to ensure that radiation and uranium ingestion exposures to Mill workers are maintained ALARA.

Smoking is not permitted anywhere within the Mill's Restricted Area.

The administrative office building, except for the metallurgical laboratory and sample processing sections, is designated as an eating area.

The Restricted Area designated eating areas, are as designated by the RSO from time to time and may include:

- Scalehouse,
- Warehouse Office,
- Maintenance Office,
- Change Room,
- Maintenance Lunchroom,
- Mill Office Lunchroom,
- Chief Chemist Office,
- Met Lab Office,
- Training Room

The designated areas are routinely monitored for alpha and beta-gamma contamination as provided in the Radiation Protection Manual.

2.2.3 Up-to-Date Copy of All Procedures Kept Accessible

An up-to-date copy of each written procedure, including accident response and radiological fire protection plans, are kept accessible to all workers under the Mill's Document Control System.

2.2.4 Review by RSO and Documentation of Revisions

All written procedures involving radioactive material control have been compiled in a manual (the SOP binders) that allows documentation of each revision and its date. In accordance with the Mill's Radioactive Materials License condition 9.6, all written SOPs for both operational and non-operational activities shall be reviewed and approved in writing by the RSO before implementation and whenever a change in procedure is proposed to ensure that proper radiation protection principles are being applied. In addition, the Mill's Radioactive Materials License requires that the RSO shall perform a documented review of all existing operating procedures at least annually, to ensure the procedures do not violate any newly established radiation protection practices. The Mill Manager also performs a documented review of all existing operating procedures at least annually.

The Mill's Document Control System requires that the Master Control List (MCL) be updated every time an SOP is revised or added. The revision date of the MCL is also updated. A copy of the MCL is included in the front of every SOP book.

2.2.5 Radiation Work Permits

An RWP is designed to provide a job procedure plan to prevent excessive exposure when any non-routine work is performed at the Mill.

When RWP's are issued, the Mill maintains employee exposure ALARA through engineering controls and established management practices or by the use of respiratory protection if no other means of controls are practical. Verification of the effectiveness of these practices is monitored through various radiological samplings, including breathing zone sampling, area airborne sampling, bioassay sampling, etc.

The procedure for issuance of RWPs is set out in Section 5.0 of the Mill's Radiation Protection Manual.

2.3. Surveillance: Audits and Inspections

Daily, weekly, and monthly inspections of worker health protection practices serves to provide management with the information necessary to conduct this ALARA program.

During non-operational periods, radiological monitoring may or may not be reduced in frequency, depending on previous radiological trends or anticipated exposure potential. Often such monitoring is conducted at the same frequency as but at fewer locations than for operational periods.

2.3.1 Daily Inspections

The RSO or designated radiation safety (health physics) technician conducts a daily walk-through (visual) inspection of all work and storage areas of the Mill to ensure proper implementation of good radiation safety procedures, including good housekeeping practices that would minimize unnecessary contamination. The inspection includes observations of housekeeping practices, ventilation equipment conditions, employee observance of radiation protection signs and policies, and maintenance and operating conditions present during the inspection. The inspection will include all work, storage, and lunchroom areas of the facility. These inspections are documented and on file in the Radiation Safety Office. A copy of the Daily Inspection of the Mill form is attached as Appendix A. If not included on the inspection form, a report to the RSO on any items of non-compliance with operating procedures, license requirements, or safety practices affecting radiological safety is also made.

2.3.2 Weekly Inspections

Routine weekly inspections of all areas of the Mill are made by the RSO and Shift Foremen or designees, to observe general radiation control practices and review required changes in procedures and equipment. Particular attention is focused on areas where potential exposures to personnel might exist and in areas of operation or locations where contamination is evident. A copy of the Weekly Mill Inspection Report form is attached as Appendix B.

In addition, the RSO, or his designee, will review the daily shift logs and work orders on a weekly basis to determine that all jobs and operations having a potential to exposing personnel to uranium were evaluated, either through a properly completed RWP or authorized written job operating or maintenance procedure, or were approved by the RSO, his staff, or designee prior to initiation of the work.

2.3.3 Documentation of Problems and Violations

Problems observed during all inspections are noted in writing in an inspection logbook, inspection forms, or other retrievable record format. The entries are dated, signed, and maintained on file for at least one year.

The RSO reviews all violations of radiation safety procedures or other potentially hazardous problems with the Mill Manager or other Mill workers who have authority to correct the problem.

2.3.4 Monthly Reports

At least monthly the RSO reviews the results of daily and weekly inspections, including a review of all monitoring and exposure data for the month and provides to the Mill Manager, and any other Mill department heads designated by the Mill Manager, for their review a monthly report containing a written summary of the month's significant worker protection activities. The Monthly Report should contain, at a minimum, the following information:

- a summary of the most recent personnel exposure data, including bioassays and time-weighted calculations;
- a summary of all pertinent radiation survey records;
- a discussion of any trends or deviations from the radiation protection and ALARA program, including an evaluation of the adequacy of the implementation of license conditions regarding radiation protection and ALARA; and
- a description of unresolved problems and the proposed corrective measures.

Emphasis is placed upon maintaining activities ALARA.

These monthly reports are maintained on file and readily accessible for at least five years.

The RSO performs an unannounced monthly documented walk-through inspection of all work and storage areas to ensure the radiation safety program is working as required.

Appropriate actions are taken promptly by the RSO to correct any problems or deficiencies noted during inspections by the RSO and his designees. When unusual exposures have occurred, the RSO will direct and participate in an investigation to determine the cause, and the remedial actions necessary. Mill operations management will decide on action to be taken, and the RSO will document the resultant action for later review. These are reviewed by Mill operations management on a monthly basis.

2.3.5 Radiation Protection and ALARA Program Audit

An annual audit of the radiation protection, environmental protection and ALARA program is performed, and a written report on the audit is submitted to the ALARA Committee for review and action, if warranted.

All members of the ALARA audit team should be knowledgeable concerning the radiation protection program at the Mill. In addition, one member of the team should be experienced in the operational aspects of the Mill's radiation protection practices. One or more of the audit team will be independent specialists. An example of an audit team is a member of corporate environmental health and safety together with an independent expert in radiation safety practices at uranium mills. The RSO should accompany the team but should not be a member.

a) Radiation Protection Component of ALARA Audit

The audit report should summarize the following data relating to radiation protection at the Mill:

(i) Worker exposure records (external and time-weighted calculations);

(ii) Bioassay results;

(iii) Inspection log entries and summary reports of daily, weekly, and monthly inspections;

(iv) Documented training program activities;

(v) Radiation safety meeting reports;

(vi) Radiological survey and sampling data;

(vii) Reports on overexposure of workers submitted to the Executive Secretary or MSHA; and

(viii) Operating procedures that were reviewed during this time period.

The audit report should specifically discuss the following:

- Trends in personnel exposures for identifiable categories of workers and types of operational activities;

- Whether equipment for exposure control is being properly used, maintained, and inspected; and

- Recommendations on ways to further reduce personnel exposures from uranium and its daughters.

b) Environmental Component of ALARA Audit

Utah Administrative Code R313-15-101 (2) provides that the Licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. As a result, in addition to occupational data, the annual ALARA audit also addresses all environmental monitoring data for the year.

The audit committee will review and document in the annual ALARA report the following items relating to environmental matters at the Mill:

(i) Documented inspection reports;

(ii) Environmental radiological effluent and monitoring data, including quality assurance data as necessary; and

(iii) Reviews of operating and monitoring procedures completed during this time period.

(iv) The audit specifically addresses:

- Trends in environmental radiological effluent and monitoring data;
- Performance of effluent control equipment; and.
- Administrative controls and policies and ALARA management of retention systems and release.

c) *Timing of ALARA Audit and Review of Audit Report*

The ALARA audit for a particular calendar year will be performed as soon as reasonably practicable in the following calendar year as all of the monitoring data and dose calculations for the subject calendar year become available, and will be performed generally in the first quarter of the next calendar year. The Audit Report will be completed by April 30 of each year.

The ALARA report is reviewed by the ALARA Committee. The ALARA Committee will make a determination whether or not any recommendations in the ALARA audit report require follow-up or further actions. It will be the responsibility of the Mill Manager to ensure that the decisions of the ALARA Committee are implemented.

The ALARA audit reports are maintained on file at the Mill.

2.4. Technical Qualifications of Health Physics Staff

2.4.1 Radiation Safety Officer

The RSO should have the level of education, training and experience recommended in NRC Reg. Guide 8.31.

2.4.2 Radiation Safety Technicians

When the Mill is in full-scale operations, in addition to the RSO, there should be a minimum of one full-time radiation safety (health physics) technician. The radiation safety technician(s) should have the level of education, training and experience recommended in NRC Reg. Guide 8.31. The radiation safety technician(s) should demonstrate a working knowledge of the proper operation of health physics instruments used in the Mill, surveying and sampling techniques, and personnel dosimetry requirements.

2.5. Radiation Safety Training

2.5.1 Periodic Radiation Training for the RSO

The RSO is required to have refresher training once every two years.

2.5.2 Radiation Training for New Employees

All new workers are trained by means of an established course on the inherent risks of exposure to radiation and the fundamentals of protection against exposure to uranium and its daughters before beginning their jobs. This training program, which is set out in the Mill's Training Program, takes 24 hours for inexperienced personnel, of which approximately 8 hours is devoted to radiation safety training, and 8 hours for experienced personnel, of which approximately 3 hours is devoted to radiation safety training. The topics listed in 2.5(1) to (6) of Reg Guide 8.31 are included in the Mill's Training Program. In all cases, the training will be commensurate with the risks and hazards of the task.

A written or oral test with questions directly relevant to the principles of radiation safety and health protection in uranium milling is covered in the training course given to each worker.

The instructor reviews the test results with each worker; workers who fail the test are retested after items of confusion are discussed. The tests and results are maintained on file.

2.5.3 Hazard Training for New Employees

All new workers receive hazard training in accordance with the Mill's Mine Safety and Health Administration ("MSHA") training plan for new hires. This training takes 24 hours, which includes the 8 hour radiation training referred to in section 2.5.2 above.

2.5.4 Radiation Safety Refresher Training

All Mill workers receive eight-hour refresher training in accordance with the Mill's MSHA training plan each year. This training includes annual radiation safety training, including relevant information that has become available during the past year, a review of safety problems that have arisen during the year, changes in regulations and license conditions, exposure trends and other current topics. Some of these topics are discussed at various radiation safety meetings that are held during the year. The radiation refresher training is set out in the Mill's Training Program. As part of this training, all workers are required to retake the written test required of new hires.

A list of all workers who completed the retraining and copies of the written tests are maintained on file at the Mill.

2.5.5 Radiation Safety Meetings

In addition to the 8-hour refresher training, relevant information that has become available, a review of safety problems that have arisen and changes in regulations and license conditions are discussed as they arise during radiation safety meetings. These meetings are generally held once per month when the Mill is operating, and once per quarter when the Mill is not operating.

2.5.6 Specialized Instruction

All new workers, including supervisors, are given specialized instruction on the health and radiation safety aspect of the specific job they will perform. All workers receive the 24-hour initial radiation and safety training when first employed. In addition, when the employees get to their jobs, their supervisor gives them specific on-the-job training. This training typically does not cover radiation protection, to the extent it is already covered in the initial training. If specific radiation protection issues exist for any particular job, or new job (such as may result from a new alternate feed material), such issues would typically be addressed in a new procedure, RWP or Safe Work Permit ("SWP"). The RSO will determine any new procedures or actions that are required in order to ensure radiation protection is ALARA. If the job is a one-time type of job, then an RWP or SWP will typically be employed. If the job is to be a recurring job, then a new procedure may be adopted, or an RWP will initially be adopted, followed by a new procedure. Specific radiation protection training is given on any new procedure or permit either at a regularly scheduled radiation and safety meeting or at a radiation and safety meeting held for the affected employees.

2.5.7 Acknowledgement of Training

All employees sign an attendance sheet for each training session. This sheet is dated and is co-signed by the instructor.

2.5.8 Contractors

Contractors having work assignments in the Mill are given appropriate training and safety instruction. Contractor workers who will perform work on heavily contaminated equipment will receive the same training and radiation safety instruction normally required of all permanent workers. Only job-specific radiation safety instruction is given for contract workers who have previously received full training on prior work assignments at the Mill or have evidence of recent and relevant radiation safety training elsewhere. Basic radiation training is given verbally, unless more specific training is required, which would be addressed on a case-by-case basis. Contractors are provided with an instructional packet and are required to acknowledge their acceptance thereof.

2.5.9 Visitors

All visitors who have not received training are escorted by someone properly trained and knowledgeable about the hazards of the Mill, or have received instructions specifically on what they should do to avoid possible radiological and non-radiological hazards in the areas of the Mill they will be visiting. Typically, all visitors are escorted by trained personnel. In addition, the RSO or a member of his staff will also provide a short safety briefing about possible hazards that exist at the Mill before any visitor, who is accompanied by trained personnel, is permitted to enter the Mill's restricted area.

2.6. Surveys

2.6.1 Responsibility to Perform

The RSO and radiation safety office staff are responsible for performing all routine and special radiation surveys as required by license conditions and by R313-15, in accordance with NRC Regulatory Guide 8.30 (Health Physics Surveys in Uranium Mills). Under certain SOPs (for example the *Intermodal Container Acceptance, Handling & Release*, No. PBL-2 Rev. No. R-3 and *End Dump Trailer Acceptance, Handling & Release*, PBL-9, Rev. No R-0), the RSO is given authority to delegate release surveys to other qualified Mill personnel.

Radiological surveys are performed as set out in the Mill's Radiation Protection Manual and Environmental Protection Manual.

2.7. Respiratory Protection

2.7.1 Responsibility for the Respiratory Protection Program

The RSO is responsible for the implementation and direct control of the respiratory protection program. This program is set out in the Mill's Respiratory Protection Program.

2.7.2 Adequate Supplies of Respiratory Devices

It is the responsibility of the RSO to ensure that the Mill maintains adequate supplies of respiratory devices to enable issuing a device to each individual who enters an airborne radioactivity area, and that additional respiratory protection devices are located near access points or airborne radioactivity areas.

2.7.3 Controlled Access

All airborne radioactivity areas have controlled access. The controlled access is marked with warning signs and is either a separate room that can only be entered through a door or is a roped or taped off area that one must knowingly cross over.

2.7.4 Medical Evaluations

The RPP provides that medical qualification will be required of each employee that might be using a respirator in their normal work duties.

2.7.5 RPP Complies with Regulatory Requirements

The Mill's RPP must meet, at a minimum, the requirements of NRC Reg. Guide 8.15.

2.8. Bioassay Procedures

The RSO is responsible for implementing a bioassay program. The Mill performs bioassays in accordance with U.S. NRC Regulatory Guide 8.22, "Bioassays at Uranium Mills", which states that frequent bioassays are to be performed for employees that are routinely exposed to yellowcake dust, uranium ore dust, or involved in maintenance tasks in which potential yellowcake exposure may occur. Urinalysis measurements are performed in accordance with the recommendations contained in Regulatory Guide 8.22. The recommendations in Reg. Guide 8.22 provide corrective actions based on urinary uranium concentrations. This program is set out in the Mill's Radiation Protection Manual.

3. FACILITY AND EQUIPMENT DESIGN

3.1. Space Layout

As the Mill was licensed and constructed in 1980, it was designed to incorporate the ALARA standards prevailing at that time, which generally are reflected in Reg Guide 8.31 (which was published in 1983). As a result, the space layout, access control, ventilation systems, fire control, laboratory design features, ore and product storage and general equipment considerations requirements specified in Section 3 of Reg. Guide 8.31 have been incorporated into the design of the Mill. Any new construction at the Mill should observe these design features and considerations set out in Reg Guide 8.31.

3.1.1 Change Rooms and Shower Facilities

The Mill maintains change rooms and shower facilities so that all workers can remove any possible radioactive contamination before leaving.

3.1.2 Dispersion Control on Radioactive Materials

The Mill has dispersion control on radioactive materials moving from contamination areas (e.g., grinding mill) to relatively contamination-free areas (e.g., grinding control room). Lower contamination areas are isolated from higher contamination areas by self-closing doors, and air flows are maintained from lower contamination areas into higher contamination areas.

3.1.3 Access to Airborne Radioactivity Levels Controlled

Access to airborne radioactivity areas are controlled or restricted by the use of caution signs and operational procedures, or security locks when permitted by fire regulations. In particular access to the yellowcake drying area is restricted by the radiation staff. Access to the drying and packaging areas are restricted by padlock on the doors.

3.2. Fire Control

The Mill maintains adequate firefighting equipment. Mill workers are trained in the proper use of fire control equipment. This training is provided annually under the MSHA-approved training plan and is also addressed biannually during an unannounced fire drill.

As per MSHA requirements, fire detection systems are checked quarterly and fire extinguishers are checked monthly.

3.3. Laboratory Design Features

Metallurgical. Bioassay and assay analyses are performed at the Mill site. In order to prevent cross contamination of uranium from metallurgical analysis, there are different laboratory facilities for metallurgical, bioassay and assay analyses.

Laboratory surfaces used for the preparation of bioassay samples are decontaminated to levels as close to background as practicable but less than 200 dpm/100cm2. The results of these surveys are recorded on a log sheet that is kept in the bioassay lab.

3.4. Ore and Product Storage

Ore and yellowcake will be stored in areas so that the material does not cause unnecessary exposure to workers and so that the material is not dispersed by wind and rain.

Adequate space will be provided in the yellowcake storage and packaging areas to conduct initial surveys and spot smear tests of yellowcake packages and to enable decontamination of drums to avoid transporting a contaminated package through other Mill areas

Yellowcake storage and shipping areas will be located to minimize the handling time required prior to shipment.

4. CONTROL OF AIRBORNE URANIUM AND ITS DAUGHTERS

4.1. Ore Storage, Handling, and Crushing Areas

Where ore is handled in the open the ALARA objective is to minimize blowing of dust. The Mill's Utah Air Quality Approval Order specifies the steps the Mill must take for fugitive dust management. Additional provisions are required under the Mill's license.

A weekly inspection of the ore piles for dust conditions will dictate if dust suppression measures are necessary. This inspection is documented by the Radiation Safety Staff and filed with the Radiation Safety Department. If dusty conditions are present, the roadways and ore stockpiles will be sprayed with water or stabilizers to minimize dusting.

4.2. Precipitation, Drying, and Packaging Areas

4.2.1 Scrubber System on the Concentrate Drying and Packaging Area

Drying and packaging of yellowcake is performed in an enclosure that is separated from other areas of the Mill. Also, the drying and packaging enclosure is maintained under negative pressure. An automatic malfunction alarm and interlock system has been installed on the scrubber system for the yellowcake drying and packaging system scrubber, to ensure that the yellowcake dryer will not operate unless the scrubber is also operating. No modification to the system will be allowed to bypass the interlock system. Operation of the yellow cake calciner will not be allowed to proceed without proper scrubber operation.

Manometer readings or operation and instrument checks are recorded once per shift when the system is operating and recorded in log books and operational data sheets

4.3. Interim Stabilization of Tailinqs

The active tailing retention system, when observed to be in a condition causing fugitive tailing dust generation, will be treated using process liquor or other chemical dust suppressant methods or engineering solutions to minimize tailing dust generation (See Section 3.1 of the Mill's Environmental Protection Manual).

DAILY MILL INSPECTION

Date:________________

AREAS INSPECTED	ROOF VENTS	AREAS POSTED	Maintenance Activity Required/Safety and Radiation Concerns	COMMENTS
GRIND				
LEACH				
MILL LUNCH ROOM				
CCD				
YELLOWCAKE PRECIP & PKG				
SX				
BOILER				
VANADIUM	NA			
SCALEHOUSE	NA			
MAINTENANCE				
CHANGE ROOM	NA			
MILL YARD	NA			
STOCKPILES	NA			
ADMINISTRATION/LAB				

If an item is not checked off, the problem needs to be listed in the comments section. Items to be inspected for and written in the comments section include housekeeping and cleanup, operating conditions, safety concerns, employee observation of radiation policies and information pertaining to radiation safety.

INSPECTORS SIGNATURE ____

Weekly Mill Inspection

To : Denison Mines Supervisors

From :

Date :

For the week of:

The following areas of the White Mesa Mill were inspected. A description of the potential safety hazards, housekeeping, operational and radiological conditions are described. The color code breakdown is for those departments I feel are responsible, but not limited to for repair of said items:

Red – Maintenance Green – Safety Blue – Operations/Labor Crew

If an item is underlined, that item must be corrected immediately.

Leach Tank Area:

CCD Area:

Control Room and Lunch Area:

Administration Building:

Soda Ash:

Labor Change Room:

SAG Mill:

Vanadium Circuit:

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Weekly Mill Inspection

Ore Storage:

Tailings:

SX Building:

Warehouse/Maintenance:

Miscellaneous/Comments: