APPLICATION

FOR

SOURCE MATERIAL LICENSE

MINERALS EXPLORATION COMPANY

SWEETWATER URANIUM PROJECT

SWEETWATER COUNTY, WYOMING

DOCKET No. 40-8584

REVISED AUGUST 1978

10497

40-8584
w/ ltr
1/24/79

APPLICATION

FOR

SOURCE MATERIAL LICENSE

MINERALS EXPLORATION COMPANY

SWEETWATER URANIUM PROJECT

SWEETWATER COUNTY, WYOMING

DOCKET NO. 40-8584

REVISED JANUARY 1979

TABLE OF CONTENTS

3.0 FACILITY DESIGN AND CONSTRUCTION

3.1 MILL PROCESS

Ore from the open pit mines will be hauled by truck to a probe tower where its uranium oxide content will be determined. If the ore contains more than 0.029 percent uranium oxide, it will be trucked to the mill stockpile. Material below the cut-off grade of 0.029 percent and above 0.010 percent U_3O_8 will be piled on pads for possible heap leaching. A front end loader will feed the ore grade material through a grizzly into the grinding circuit.

The proposed uranium mill will process an average of 3000 tons of ore per day, 365 days per year. Based on a 0.048 percent average grade of ore and a 91.7 percent recovery, the mill will produce approximately 2650 pounds of concentrate per day.

It will be necessary to employ a series of operations in the mill to extract the uranium oxide from the ore. The sandstone ore will first be processed through a semi-autogenous mill circuit to reduce its size. The fine ore will then be mixed with an acid solution in agitator tanks to dissolve the uranium minerals. The discharge from the leaching circuit will be pumped to a countercurrent decantation system where the uranium-rich (pregnant) solution will be separated from the tailings in multiple stages of thickeners and filters. The tailings will be pumped to a subsurface impoundment. The pregnant solution will be clarified and then pumped to a solvent extraction system. In this system, the pregnant liquor passes through a series of stages in which the dissolved uranium is transferred from the aqueous phase to an organic phase and then stripped, purified and concentrated. Anhydrous ammonia will be added to the uranium-rich (loaded) strip solution to precipitate the uranium. Finally, precipitates of uranium will be dryed, packaged and shipped to customers.

Operations will generally be in accordance with the block flow diagram shown in Figure 3.1-1A.

A simplified flow chart is presented in Figure 3.1-1.

Ore Receiving and Grinding

A front end loader will load stockpiled ore into a hopper. Oversize material is removed with a stationary grizzly with 18" square openings. An apron feeder regulates the withdrawal of ore

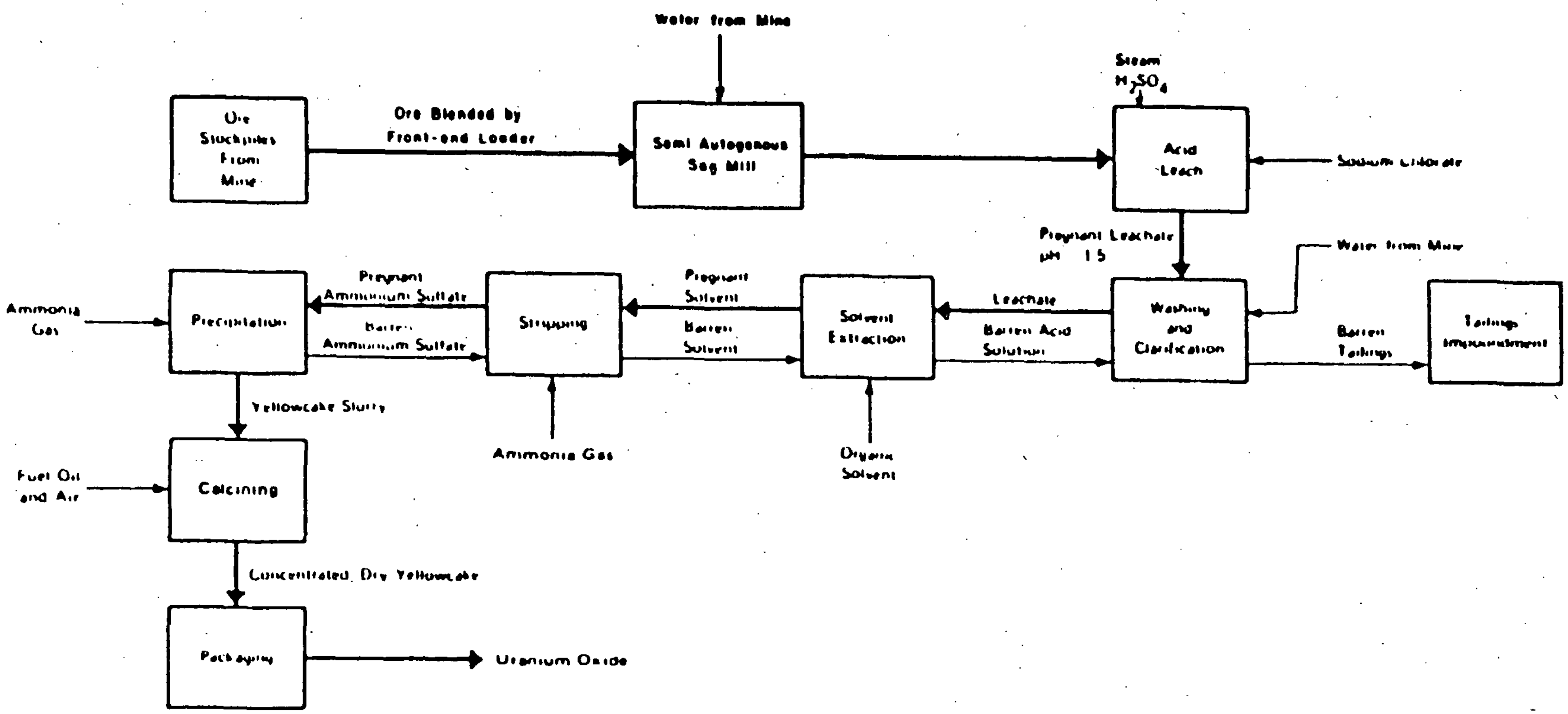

Figure 3.1-1A. Generalized Block Flow Diagram of Mill Operations.

The pulp from precipitation enters the yellowcake thickener. Effluent from wet scrubbing makes up the bulk of the wash water. The thickener overflow is collected in the barren liquor surge tank and is further processed in a sand filter prior to recycling to the barren stripping solution tank in the solvent extraction circuit. The washed and thickened yellowcake slurry is withdrawn by pump and advanced to a centrifuge for a final wash and mechanical dewatering.

A pump takes the thick mud-like centrifuge cake and feeds it to the multi-hearth drying furnace. The furnace discharge product passes through a crusher for reduction to minus 1/4". The final product is then packaged into steel drums. After sampling, the barrels are stacked for storage until a lot or shipment quota has been reached.

Figure 3.1-3 shows the ventilation equipment locations for the drying and packaging areas. Yellowcake packaging is confined to one room to maximize control and minimize emissions by limiting the number of handling operations and exposure points. This room will be kept at negative pressure. Yellowcake crushing will also be contained by ducting and the enclosure will be under negative pressure.

3.2 MAJOR EQUIPMENT

A list of the major equipment is shown in Table 3.2-1. The number, description and approximate specifications are also included. Minor modifications may be necessary due to design changes.

Table 3.2-1

MAJOR EQUIPMENT

Equipment	Qty.	Description	Approximate Specification
Grizzly Ore Receiving	(1)	18" Stationary Grizzly and Steel Hopper	55 ton capacity
Conveyor	(1)	Rubber covered conveyor belt to transport the ore to the semi-autogenous mill	48 inches wide x 180 feet long
Semi-autogenous Mill	(1)	Cylindrical steel grinding mill	18 ft. dia. x 7 ft. long
Leach Tanks	(10)	Cylindrical, rubber-lined steel c/w mechanical agitators	22.5' dia. x 22' hi. and 75 HP agitators
Countercurrent Decantation Tanks	(6)	Open, rubber-lined steel tanks with a mechanical raking mechanism	32' dia. 7.5 HP motor

Table 3.2-1 (cont.)

Equipment	Qty.	Description	Approximate Specification
Clarifier	(1)	Open, lined steel with concrete bottom fitted with a mechanical raking mechanism	75' dia. x 24' hi. 3HP motor
Clarifying Filters	(4)	Cylindrical steel pressure filters containing garnet and sand filter beds	9' dia.
Clarified Solution Storage Tank	(1)	Open, lined steel	50' dia. x 32'
Barren Organic Storage Tank	(1)	Closed, lined steel	16' dia. x 16'
Solvent Extraction Mixer-Settlers	(4)	Two compartment open concrete tanks, one compartment fitted with agitator	32' wide x 86' long 30HP agitator
Raffinate Storage Tank	(1)	Open, lined steel tank	65' dia. x 12'
Pregnant Storage Tank	(1)	Closed, lined steel	16' dia x 16' hi.
Solvent Stripping Mixer-Settlers	(5)	Two compartment open concrete tanks, one compartment fitted with agitator	7' wide x 30' long 5 @ 3HP
Filtered Barren Strip Storage Tank	(1)	Open, lined steel	8' dia. x 8' high
Organic Sludge Holding Tank	(1)	Closed, lined steel with agitator	16' dia. x 16' high 5HP agitator
Precipitation Tanks	(2)	Covered, FRP with agitators	6' dia. x 6' hi. 5HP agitators

Table 3.2-1 (cont.)

Equipment	Qty.	Description	Approximate Specification
Yellowcake Thickener	(1)	Covered, lined steel conical tank with raking mechanism	17' dia. 2 HP drive
Unfiltered Barren Strip Storage Tank	(1)	Open, FRP with agitator	8' dia. x 8' hi. 5 HP agitator
Centrifuge	(1)	Rotating, solid bowl with scroll	9" dia. 15 HP
Yellowcake Dryer	(1)	Oil-fired, four hearth with raking arms	6' dia.
Dryer Wet Scrubber and Exhaust Cooler	(1)	Water scrubbed dryer exhaust	760 ACFM @ 800°F in; 580 ACFM @ 161°F out;
Yellowcake drumming bin and Feeder	(1)	Closed, steel bin and rolls crusher	5000 lbs. U_3O_8 capacity
Drumming Scrubber	(1)	Water scrubbed dryer exhaust	600 CFM
Sulfuric Acid Storage Tanks	(2)	Closed, steel	31' dia. x 24'
Kerosene Storage Tank	(1)	Closed, steel	14' dia x 14' hi.
Sodium Chlorate Storage Tank	(1)	Closed, steel	20' dia. x 18'
Sodium Chlorate Mix Tank	(1)	Closed, steel with agitator	16' dia. x 16'hi.
Flocculant Stock Tank	(1)	Open, steel	14' dia. x 14'
Flocculant Mix Tank	(1)	Open, steel with agitator	13' dia. x 12'hi.

Table 3.2-1 (cont.)

Equipment	Qty.	Description	Approximate Specification
Glue Stock Tank	(1)	Closed, steel	9' dia. x 9'
Filter Backwash Holding Tank	(1)	Closed, lined steel	16' dia. x 14'
Ammonia Storage Tank	(1)	Pressurized, cylindrical steel	12,000 gals.
Wet Scrubber SAG Mill Feed	(1)	Water scrubbed	6,000 CFM
Leach Tank	(1)	Water scrubbed	5,000 CFM
Wet Scrubber Laboratory Hoods	(1)	Water scrubbed	8,000 CFM
Wet Scrubber Y-C Precip., Y-C Thickener, Y-C Centrifuge	(1)	Water scrubbed	1,800 CFM

3.3 INSTRUMENTATION

Process plant instrumentation will serve two main functions:

1. To control the process at the optimum operating condition;

2. To alert plant operators to an abnormal condition and initiate corrective action as required.

The process plant is designed to be fail safe in the event of power failure. Emergency power will be made available to equipment and instrumentation needed to maintain operator safety.

e. Yellowcake dryer scrubber exhaust fan. Failure of the water supply to the scrubber will also be alarmed.

f. Yellowcake packaging wet collector fan.

Failure indication time in all cases is less than five seconds. Scrubber circuits from the concentrate drying and packaging areas will be checked every hour and documented. Manometer readings will be recorded once per shift and such reading will be documented to ensure proper operation.

3.3.3 Reagent Control in Power Failure

The following automatic valves controlling reagents and utility supplies to the circuit will fail shut in the event of a power failure.

a. Sulfuric acid to the leach circuit.

b. Sodium chlorate to the leach circuit.

c. Ammonia to the stripping circuit mixer settler.

d. Sulfuric acid to the extraction settler.

e. Steam to the organic heat exchanger.

f. Steam to the pregnant strip heat exchanger.

g. Ammonia to the precipitation tanks.

Response time in all cases is less than five seconds.

3.3.4 Fire Protection

The mill is designed to minimize the occurrence of fires. Heat sensors will be strategically located to detect fires and approved fire extinguishers will be available. Selected employees will be trained in fire control techniques. A fire protection arrangement is found on Figure 3.3-1.

A light water system will be installed in the solvent extraction building. The system consists of necessary tanks, proportioners, piping, and individual sprinklers strategically placed. Activation will be via heat sensors.

The response time of the heat sensors will depend on the intensity of the fire. The response time of the water valves will be immediate.

In the event of a power failure, all drives associated with the roaster-dryer, including the scrubber fan, will be restarted.

Fire water pressure will be maintained during power failure by an emergency d.esel pump.

Fire pump can operate approximately 4 hours with no replenishment of source water, and approximately 4.5 hours with replenishment.

3.3.5 Conveyor

The conveyor is equipped with safety shut down cable switches. Response time is immediate.

3.3.6 Radiation Protection Instrumentation and Specifications

Beta-gamma and alpha survey meters will be used to monitor the mill, the workers and the environment. Radiation surveys will be made on a routine basis and exposure kept "ALARA".* Laboratory instruments will also be available to measure radiation.

Radiation monitoring and sampling equipment will be calibrated after repair and at least semi-annually or at the manufacturer's suggested interval, whichever is sooner.

1. Beta-gamma survey meters shall have the following minimum specifications:

Range: The lowest range not to exceed 0.2 mR/hr full scale. The highest range to measure 200 mR/hr.

Response time: Adjustable.

Battery operated and portable.

Calibration potentiometers for each range (scale).

Adaptable to use either thin walled GM tubes or "pancake" GM tubes.

Environmental capabilities: Must operate satisfactorily in the temperature range -40 F to 120 F.

---

* "ALARA" - As Low As Reasonably Achievable

Examples of satisfactory beta-gamma survey meters include:

Eberline Instrument Corporation
E-520, E-530, Probes: HP-240, HP-177C

Ludlum Measurements, Inc.
Model 3, Model 5 Geiger Counter;
Probes: Model 44-6, 44-9

2. Alpha survey meters shall have, as a minimum, the following specifications:

Range: The lowest range not to exceed 500 dpm full scale. The highest range to measure 50,000 dpm. Readings should be in dpm.

Battery operated and portable.

Calibration potentiometers for each range (scale).

Adaptable to use of scintillation and gas-proportional types of alpha probes.

Environmental capabilities: Must operate properly in the range -40 F to 120 F.

Examples of satisfactory alpha survey meters include:

Eberline Instrument Corporation
PAC-4G, PS-2, Probes: AC-21, AC-21B, TP-1

Ludlum Measurements, Inc.
Model 12 (CRM); Probes: 43-2, 43-5

3. Laboratory counters for contamination smear samples and air sample filters shall have the following minimum requirements:

Scaler: Counting capacity of at least 999,999.

Timer: Presettable count times.

Threshold and window: Adjustable.

Regulated, adjustable power supply.

Minimum dpm alpha detection: 4-6 dpm per 10 minute count time.

Adaptable to GM, proportional and scintillation detectors, for detection of alpha, beta and gamma.

Shielded detector and counting stage.

Examples of satisfactory laboratory counters are:

Eberline Instrument Corporation
Scaler, Model MS-2
Gas flow counter, Model FC-2, alpha, beta and gamma
Shielded and window counter, Model RD-15, HP-190
GM probe; beta, gamma
Alpha scintillation counter, Model SAC-4
Ludlum Measurements, Inc.
Scaler Model 2000, Model 2200

3.3.7 Spillage

Spillage of solids, slurry and solutions within the process plant will be minimized by level controllers and high level alarms on all major tanks and sumps. In the event of spillage, the material will be contained by curbs and will drain or be washed to sump pumps controlled by automatic level switches.

The floor sump pumps are located in all sections of the process plant and will discharge back to the circuit.

All floor sumps are six-foot cubes except for a double length sump in the CCD pumphouse. The sump pump starts at a liquid level of 12" from the top and stops at a liquid level of 6" from the bottom.

3.3.8 Spill Prevention and Containment

Tanks will be equipped with high level alarms to reduce the possibility of spillage due to tank overflow. High level alarms will generally be set to operate at 90% of tank or sump volume. The high point of level controllers will be set at a slightly lower level. Dikes and/or curbs will be constructed around all process and storage tanks (excluding the water, ammonia, and sulfuric acid tanks) to confine the material in the event of tank spill. In the event of an ammonia tank spill, the material would quickly evaporate. In the event of a sulfuric acid tank spill, design and topography are such that the material would flow to the catchment basin where it would be fully contained and subsequently cleaned up.

Minor piping leaks may occur in the mill circuit. The mill circuit is completely self-contained. Spills will be channeled to and collected in sumps where it then can be returned to process. An entrapment basin is provided to further preclude loss of liquid spills to unrestricted areas in the event of major spills.

As discussed, the tailings discharge line is pressurized and located on a prepared bed designed to minimize leakage or loss of tailings to unrestricted areas. Further, the tailings dam and pipeline will be checked once each shift during operations.

B. Dust collector (vapors):

Wet scrubber, efficiency 99.5 + %

C. Fan:

Same as above

3. Yellowcake Area

A. Pick up Points:

a. Yellowcake precipitation	600 CFM
b. Yellowcake thickeners	600 CFM
Total	1200 CFM

B. Dust collector:

Wet scrubber, efficiency 99.5 + %

C. Fan:

Same as above

4.2 LIQUIDS AND SOLIDS

4.2.1 Tailings

Solid and liquid wastes from the milling process, along with confined spills, will be gathered into a tailings pump box. The combined tailings effluent will be sampled, then pumped through a 10" line to the tailings pond. The tailings will consist of water, waste solids from the ore, minor unrecovered uranium particles and small amounts of chemicals used in the milling process.

1. Tailings Slurry-Physical Characteristics

The tailings slurry consistency will range from 35-40% solids. The solid particles will generally be 100% passing #28 standard sieve size.

2. Slurry Transportation & Distribution

a. The tailings will be transported from the plant area to the pond via a pressurized line placed

TABLE 4.1

STACK AND EMISSION CONTROL EQUIPMENT SUMMARY

Location	Emission Control Equipment
Ore Mill Feed Area	Wet Scrubber
Leach Tanks	Wet Scrubber
Yellowcake Precipitators, Thickeners and Centrifuge*	Wet Scrubber
Yellowcake Dryer*	Wet Scrubber
Yellowcake Product Drumming Area*	Wet Scrubber
Emergency Power Generator	None
Laboratory Hoods (3)	Wet Scrubbers

*NOTE: Y-C precipitator-thickener scrubber, centrifuge scrubber and dryer-product drumming scrubber discharge to a single common stack.

5.0 OPERATIONS

5.0 OPERATIONS

All operations connected with the project will be conducted in conformance with the applicable laws, rules and regulations of the Nuclear Regulatory Commission. In order to ensure compliance and further implement MINERALS' policy of providing a safe work environment with the lowest radiation exposures as reasonably achievable, the following programs will be initiated and maintained.

5.1 PROJECT ORGANIZATION

An organization chart of the personnel for the Sweetwater Project is presented in Figure 5.1-1.

5.1.1 Management Responsibility

1. General Manager: The General Manager of the Sweetwater Uranium Project will have overall responsibility for coordinating and directing the activities of all project persc ıel. The General Manager reports to the Corporate Manager c Operations.

2. Mill Superintendent: The Mill Superintendent will report to the General Manager and will be responsible for mill production, cost and quality control of mill operations, and for meeting production schedules and delivery dates. He will also be responsible for product control, mill safety and metallurgy. The Mill Superintendent will carry out his duties either by direct supervision or by delegation of authority to the Mill General Foreman, the Mill Foreman and Chief Metallurgist.

3. Safety and Environmental Administrator: The Safety and Environmental Administrator is responsible to the General Manager for the Environmental Protection, Radiation, and Industrial Safety programs for the project. He is responsible for all reports and records necessary to comply with regulations and requirements of the NRC, EPA, MSHA, and other government agencies that regulate these aspects of mining and milling. He is responsible for ensuring that monitoring conducted by the Safety and Environmental staff and/or laboratory is conducted in a proper and accurate manner. He will serve as management surveillance and as an advisor to the Maintenance, Mill and Mine Superintendents and direct project security programs.

The Safety and Environmental Administrator or his designate has the authority to cancel, postpone or modify any process, or operation which proves an immediate radiological hazard to employees. His decision is subject to revocation only by the General Manager or his designate after consultation.

5.1.2 Required Approvals

Any training requirements, process changes, unusual maintenance work or equipment modification, requires the approval of the Safety and Environmental Administrator prior to implementation. An operating manual covering each phase of the operation will be written by the appropriate Department staff and made available to each mill and maintenance employee. The Safety and Environmental Administrator will approve the health and safety aspects of the operating procedures. The manual will be updated as necessary to reflect any process or operational changes. The manual will be on file in appropriate work areas.

5.1.3 Safety Administrative Procedures

In addition to the routine safety inspections, the Safety and Environmental Administrator will make monthly inspections of work and storage areas and practices with respect to radiation safety. All monitoring and exposure data will be reviewed monthly to ensure compliance. Any trends or deviations from the "as low as reasonably achievable" (ALARA) philosophy will be addressed. A formal report will be prepared and reviewed by the General Manager and all department heads. The report will address any upward trends, unusual discharges, problem areas, monitoring data, items of regulatory non-compliance, and recommendations for necessary corrective actions. The report will also include an evaluation of the adequacy of the implementation of license conditions.

A semi-annual audit will be conducted by the Corporate Medical Department staff. Operating procedures, exposure records, monthly inspection reports, training programs, safety meeting reports, and the ALARA philosophy will be reviewed. All phases will be evaluated to determine the total programs' effectiveness.

5.1.4 Corporate Review and Assistance

1. Inspections: Corporate management will inspect and review the project, its programs and records on at least an annual basis.

2. Approval: The Corporate Medical Department will inspect, review and approve the project health physics safety programs and records on at least an annual basis.

3. Guidance: Professional guidance and assistance from the Union Oil Company Medical Department, Union Research Center and Corporate Environmental Sciences Department will be provided as needed.

5.2 QUALIFICATIONS

The qualification of management and radiation protection personnel are enumerated below. The qualifications listed are considered minimums.

5.2.1 General Manager

a. Advanced technical training or BS degree or higher, and/or extensive experience in mining or milling (5-10 years).
b. Basic knowledge of radiation and industrial safety.
c. Proven skills in supervisory and management functions.

5.2.2 Mill Superintendent

a. Advanced technical training or a BS degree from a recognized college or university, and/or experience in mining or process operations, preferably within the uranium industry (3-5 years).
b. Training in radiation protection, industrial safety, accident prevention and medical first aid.
c. Training in supervisory and management functions.

5.2.3 Safety and Environmental Administrator

a. BS degree in the physical sciences, mathematics or engineering from an accredited college or university, equivalent experience, or a combination of education and experience. Equivalent experience will be at least four years of relevant radiation safety experience.
b. Specialized training in radiation protection, with at least bi-annual refresher course.
c. Training and experience in management.
d. Have a working knowledge of radiation detection instruments, biological effects of radiation and mathematics of radiation.

5.2.4 Environmental Assistant

a. An associate degree in science or 2 years equivalent work experience, and/or training in radiation protection monitoring of which at least one year is training and/or experience in sampling and analytical procedures.

5.3 TRAINING

MINERALS considers training an important part of any employee's work schedule. All new employees will receive a minimum initial training in Radiation Safety, Industrial Safety and Process Operations. Further specific and periodic refresher training courses will be given for areas of work responsibility. The Safety and Environmental Administrator will administer the safety and radiological training programs.

5.3.1 Employee Radiation Safety Training

Basic indoctrination in radiation protection will be given to all employees prior to being assigned to work in the mill area. Detailed training will be given during the first month of employment. Safety meetings will be conducted monthly with at least 30 minutes devoted to radiation safety. Indoctrination training will include a written examination. These individuals and their respective supervisors will sign a statement that the employee received radiation protection training, successfully completed testing of that training, and the date the training was received. The signed statement and the examination will be kept in the employee's personnel folder. Retraining, covering the basic indoctrination material, will be given to employees at least every 2 years. Retraining will be documented. The basic employee indoctrination training will include:

1. Principles of radiation protection

   a. Definition and explanation of radiation and radioactive contamination, including physical forms and sources within the mill.
   b. Biological effect of radiation.
   c. ALARA Philosophy.

2. Radiation Measurement

   a. Units of measurement.
   b. Detection methods and instruments.
   c. Applicable limits.

3. Radiation measurement

   a. Detector types and operation
   b. Personnel monitoring methods
   c. Survey techniques and methods
   d. Quantitative and qualitative measurements

4. Control of radiation sources

   a. Source geometry and shielding, distance and time methods
   b. Contamination control
   c. Protective clothing and respiratory protection
   d. First-aid relative to radiation protection

5. ALARA philosophy

6. Audit techniques with respect to conformance with radiation practices and procedures by plant employees.

7. Decontamination

   a. Contamination limits
   b. Preparation prior to work to minimize decontamination
   c. Decontamination methods for personnel, tools and areas

8. Regulations

   a. 10 CFR 19
   b. 10 CFR 20
   c. 10 CFR 21
   d. 40 CFR 172, radioactive shipments
   e. Regulatory Guides
   f. Internal (administrative control) guides
   g. License conditions

Technician on-the-job training and demonstration will be conducted by the Safety and Environmental Administrator, and other qualified persons. Oral and demonstration tests will be given to evaluate the technician's job performance. Documentation of training will be placed in the employee's personnel file.

with 10 CFR 20.203. Parking facilities for employee and visitor vehicles will be outside this fenced area. A gate adjacent to the office will provide access for personnel reporting on and off shifts.

The mill will operate 24 hours per day, 365 days per year and all personnel will be instructed to report immediately any unauthorized persons observed on the premises to their supervisors.

All visitors will be required to register at the office and will not be permitted inside the plant area without proper authorization from appropriate supervisory personnel. Each visitor will be escorted while within the secured area.

Contractors having work assignments, such as equipment repair personnel, will be given security, safety and radiation protection orientation and subsequently allowed to perform their duties without escort.

Smoking will be prohibited in the mill except in designated areas. Designated areas will include control rooms, offices, lunch areas and specially designated areas considered non-hazardous and generally free of ore or yellowcake dust.

5.5 RADIATION SAFETY

In order to comply with limits established in 10 CFR 20 and to keep exposures as low as reasonably achievable, MINERALS has established an employee radiation monitoring and protection program described in this Section 5.5.

5.5.1 Occupational Exposure, External

External exposure to ionizing radiation will be determined from known dose rates and exposure times or from dosimeter results.

1. Personnel Monitors: All mill and maintenance employees will be issued thermoluminescence dosimeters (TLD'S) or film badges and will wear them while working in the mill complex. The TLD'S or film badges will be exchanged on a monthly basis and will be furnished and analyzed by a reliable laboratory such as Eberline Personnel Dosimetry Section, P. O. Box 2108, Santa Fe, New Mexico. In addition, stationary badges or dosimeters will be placed in selected locations and read quarterly. Locations will be determined under actual operating conditions.

2. Exposure Control Limits-Action Levels: If an employee receives a dose in excess of 25 percent of the limits

U.S. government (MIL-Q-9859). Additional assurance is gained through audits conducted internally. Laboratories used will meet or exceed these requirements.

5.5.2 External Radiation Control (Beta Gamma Surveys)

1. Surveys: Direct Beta-Gamma radiation surveys will be performed quarterly at locations established. After mill operations commences, these locations will be evaluated for effectiveness and changed or added to as necessary. Special emphasis will be given to potential high radiation areas such as around sealed sources, the x-ray unit, or in the concentrate areas. Additional surveys will be conducted whenever an area is suspect and during non-routine maintenance or spills.

2. Instruments: A list of instrumentation is found in Section 3.3.6. The survey instruments will be checked with a standard prior to each survey. The instruments will be sent to a reputable vendor for calibration semi-annually.

   Additional equipment to be utilized in external radiation control monitoring will include:

   a. Thermoluminescence dosimeters or film badges.

   b. Geiger-Mueller counter or scintillometer with sensitivities of 0-10 MR/Hr with multiples up to 100X. This equipment will be calibrated in accordance with manufacturer specifications, or quarterly.

3. Radiation monitoring and sampling equipment will be calibrated after repair, and at least semi-annually or at the manufacturer's suggested interval, whichever is sooner.

5.5.3 Occupational Exposure Internal

Exposure to internal radiation will be determined from known exposure times and concentrations of airborne radionuclides.

1. Time-Exposure Records

   A time study of all mill and maintenance employees will be conducted to determine the amount of time spent in each area. This information, along with the area airborne concentration, will be used to calculate exposure. The sampling methods and schedules are outlined in Appendix C. Time cards, work logs, process reports and maintenance work orders will be used to verify the employee work locations.

   A computer program or equivalent method will be used to determine weekly and quarterly exposure. The hours worked and airborne concentrations will be used to determine exposure. Any abnormal exposures will be included in the exposure calculation and records.

2. Air Sampling

   On a periodic basis, portable sampling pumps will be attached to employees during the shift in order to determine time-weighted averages. High volume pumps will also be used to sample work locations. Portable air samples will be conducted on:

   a. Representative employees of the yellowcake area.

   b. Employees during maintenance of yellowcake equipment. (In lieu of portable air samples, special hi-vol air samples may be taken during work period.)

c. Additional representative employees in selected work locations in the process area where airborne uranium dust is suspected.

Fixed location sampling will be performed in work areas such as yellowcake and selected process areas.

Filters will be analyzed by a reliable laboratory for total uranium. Semi-annually, filters samples collected in representative areas will also be analyzed for Ra-226 and Th-230.

Radon daughter monitoring will be performed monthly in selected process areas. Sampling and analysis will be performed with a standard procedure such as the Kusnetz method.

3. Extraordinary Procedures

Time records will be kept during a non-routine maintenance or spill in accordance with the procedures outlined in this Section to maintain a close accounting of individuals' exposure. Up-to-date work exposure histories will be maintained, including such non-routine exposures, to reduce the possibility of over-exposure.

4. Exposure Control Limits - Action Levels

If an employee reaches an action level of 25 percent of TWE, the Safety and Environmental Administrator will institute an investigation of their work record and exposure history to identify any problem areas. If any problem areas are noted, they will be studied and necessary corrective measures taken to ensure that the exposure are as low as reasonably achievable.

5.5.4 Bio-Assay

1. Routine Testing

A urine specimen will be routinely collected from all regular mill workers and all personnel directly involved in maintenance tasks in which yellowcake dust is produced. The samples will be collected monthly, as close as is reasonably possible, after 48 hours and before 96 hours of last exposure. The minimum detection limit will be 2 µg/1. Any results exceeding 15 µg/1 will be reported to the Safety and Environmental Administrator within 10 days of sampling.

2. Special Tests

Any special urinalysis or lung count will be scheduled by the Safety and Environmental Administrator.

3. Exposure Control - Action Levels

A. Urine

If 15 to 30 µg/1 of uranium is found in the urine, the following actions will be taken:

1. Re-analyze the sample.
2. Review exposure history for possible causes.

If over 30 µg/1 of uranium is detected in the urine, the following actions will be taken:

1. Repeat the requirements stated above.
2. Obtain and analyze new sample.

If levels are still above 30 µg/1, the following apply:

3. Determine why air samples were not representative and did not warn of excessive concentrations of airborne uranium. Make corrections.
4. Identify the cause of airborne uranium and initiate additional control measures.

f. Employees working in areas which require respiratory protection will be clean-shaven (no interfering facial hair) so proper fit can be achieved.

g. Each employee working in the yellowcake concentrate area under upset or non-routine situations shall shower and change into clean coveralls/clothes after each work period and/or prior to eating.

3. Cleaning, Storage, Inspection

Respirators will be cleaned and disinfected as often as necessary to ensure that proper protection is provided to the user.

After cleaning and after each use, the respirator is inspected to be sure it is functioning properly. Worn or deteriorated parts are replaced as soon as detected, using only approved parts for that particular device. The cleaned respirator will be stored in plastic bags to avoid contamination.

Instructions on the proper care and use of respirators will be posted in the yellowcake area and/or other potential use areas.

A possible list of respirators are:

MSA Custom Comfo II
Welsh 7580
Welsh 7580M
MSA Ultravine
MSA Ultravine (Air powered)

4. Exposure Records

In computing employee exposure, credit for respirators will be taken as outlined in Appendix D.

5.5.6 Decontamination Procedures

1. Employee cleanup

All employees who work in the yellowcake area (dryer and package room) and those involved in upset or yellowcake maintenance activities will be issued coveralls and will shower and change clothes before leaving the property.

2. Contaminated clothing

All contaminated clothing will be laundered on the property. No contaminated clothing or personnel will be allowed to leave the property.

3. Contaminant Surveys

a. Employees receiving direct body contamination will be surveyed for contaminants after showering. They will not be allowed to leave the restricted area without authorization of the Safety and Environmental Department (see Appendix 5-B).

b. Quarterly surveys of selected employees will be made to ensure other mill employees are not contaminated. This will be accomplished using a portable alpha survey instrument as the employees are leaving at the end of the shift. This instrument will be available always.

4. Changeroom Facilities

All mill personnel will be provided with change facilities so that they may leave their work clothes at the mill. The change facilities will include showers and will be designed to encourage their use, thus enabling supervisors to control decontamination of personnel. A washer and dryer will be provided and all coveralls contaminated with yellowcake will be washed on the property.

5. Responsibility

a. Each employee is responsible for safety and quality in his work and for adherence to safety and radiation protection rules as a condition of employment.

b. The shift supervisor or Safety and Environmental Department will ensure that the above rules are enforced.

6. Facilities and Equipment

Decontamination of facilities and equipment will be accomplished in accordance with the guidelines and limits set forth in USNRC Annex C dated November 1976. If contamination levels in the lunch areas, shower rooms, changerooms, or offices exceed the values in Annex C, the area will be decontaminated and a study performed to determine the cause of build-up and corrective measures taken to prevent recurrence.

APPENDIX A

FORM # EXP-1

DATE: ______________________________

EMPLOYEE NAME: ______________________________

EXPOSURE ____________________ PERIOD OF EXPOSURE ______________

JOB CLASSIFICATION/TYPE ______________________________

ACTION TAKEN ______________________________

____

____

____

SIGNED: ______________________________
Safety & Environmental Department

NOTE: SAMPLE only, may be revised or modified without prior notice.

APPENDIX B*

PERSONNEL DECONTAMINATION PROCEDURE

NOTE: Decontamination work will be done in the showers and sinks provided.

a. Wash contaminated portion of body thoroughly and completely with mild soap for two or three minutes. Pay particular attention to finger nails and between fingers, similarly pay attention to all body folds, hair and ears.

b. Rinse completely, dry and monitor. Repeat three times, if necessary.

c. If contamination remains after three washings, wash as before but use a soft bristle brush (surgeon's brush) provided. Wash for five minutes and rinse. Take care not to abrade the skin. Do not use brush on face.

d. If contamination still exists, apply 3% citric acid solution with cotton swabs, then soap and water. Wipe always in a direction away from the eyes, ears, nose, mouth, and other body openings.

e. The following are the permissible limits for remaining fixed contamination on body surfaces.

Beta-Gamma = 0.05 m Rem/hr at 1 inch (G-M probe)

Alpha = 50 d/m/100 cm^2

NOTE: If contamination cannot be removed to these levels, or if initial contamination is extensive or received as a result of an accident, contact the Safety & Environmental Department.

f. Wound decontamination must receive immediate attention. The wound should be allowed to bleed freely for a brief period to remove contamination from the wound itself and the area around the wound should be wiped with sterile swabs. Wipe away from wound, discard swab, and use another, etc. Radiation protection personnel will monitor the wound.

NOTE: In case of severe injury, decontamination shall NOT interfere with or take precedence over proper medical or surgical care. First aid treatment shall be given priority and safety and environmental personnel shall accompany injured person to the doctor or hospital, taking precautions to prevent spread of contamination.

*Procedure presented is example of typical procedure only and may be modified to correspond to specific conditions without prior notice.

APPENDIX C

MONITORING PROGRAMS

The following Tables and Figures show monitoring type, frequency and location for all in-plant and environmental monitoring. The number of samples, locations of monitoring points, type of sampling, etc., have been derived based on experience and metallurgical activity of the area. All areas where radiation, dust or other hazards may exist have been covered in the in-plant monitoring program. The locations for in-plant monitoring shown in Figure C-1 are typical. Exact locations will be determined during construction and prior to operations. If any problem areas develop, the monitoring program will be intensified in those areas and modifications made as necessary to adhere to the ALARA philosophy.

Environmental monitoring locations, types and sample frequencies have been designed so as to determine incremental changes in ambient background concentrations. Meteorological conditions, groundwater movement, site boundaries, etc., were factors considered in establishing the sites. Further, where possible, sites were located so as to coincide with sites utilized for baseline monitoring. Stack monitoring programs were designed to comply with State and Federal regulations and where potential radionuclide emissions may occur.

The following are some of the specific areas given consideration in determining the monitoring program:

1. Areas which may produce dust, vapors, mists, gases or radiation.
2. Available water sources.
3. Area of most likely migration.
4. Average meteorological conditions.
5. Prevailing wind direction.
6. Site boundaries.
7. Baseline data.
8. Nearest residence.
9. Areas of maximum radioactivity.
10. High traffic areas.

TABLE C-1

IN PLANT AMBIENT AIR MONITORING PROGRAM

SAMPLE LOCATION	SAMPLE DESCRIPTION	FREQUENCY	SAMPLE TYPE	TOTAL-U	Rn-222 (B)
Ore Pad	Traversing Pad	Monthly	(1)	X	X
Sag Mill	Traversing Area Around Sag Mill	Monthly	(1)	X	X
Leach Area	Traversing Area Around Leach Tanks	Monthly	(1)	X	X
Leach Operator	Personnel Sampler	Quarterly	(2)	X	
C.C.D.	Traversing Upper Level	Monthly	(1)	X	X
C.C.D. Operator	Personnel Sampler	Quarterly	(2)	X	
Solvent Extraction	Traversing SX Area	Monthly	(1)	X	X
Solvent Extraction Operator	Personnel Sample	Quarterly	(2)	X	
Two Lunch Areas	Traversing Area	Monthly	(1)	X	X

TABLE C-1 (cont'd)

IN PLANT AMBIENT AIR MONITORING PROGRAM

SAMPLE LOCATION (A)	SAMPLE DESCRIPTION	FREQUENCY	SAMPLE TYPE	TOTAL-U	Rn-222 (B)
Precipitation	Traversing Precipitation Area	Monthly	(1)	X	X
Yellowcake Dryer	Traversing Upper Level	Monthly	(1)	X	X
Yellowcake Dryer	Traversing Middle Level	Monthly	(1)	X	X
Yellowcake Packaging	Traversing Lower Level	Monthly	(1)	X	X
Yellowcake Operator	Personnel Sample	Quarterly	(2)	X	
Maintenance Operator	Personnel Sample	Quarterly	(2)	X	
Laboratory	Traversing Laboratory	Monthly	(1)	X	X
Lube & Tire Shop	Traversing Area	Quarterly	(1)	X	X
Administration Building	Traversing Area	Quarterly (C)	(1)	X	X
Garage & Shop	Traversing Area	Quarterly (C)	(1)	X	X
Warehouse	Traversing Area	Quarterly (C)	(1)	X	X
Change Room	Traversing Area	Monthly	(1)	X	X

SAMPLE TYPES

(1) HIGH VOLUME (1-5 minutes)
(2) PERSONNEL BREATHING ZONE SAMPLES (2-8 hours)

(A) See Figure C-1 for locations.
(B) Radon will be sampled using the standard Kusnetz method. Ref. U.S. Bureau of Mines.
(C) Annually after 1st year's quarterly data.

TABLE C-2

OTHER INPLANT MONITORING

SAMPLE LOCATION	ENVIRONMENTAL PARAMETER	SAMPLE FREQUENCY	MEASUREMENT
Mill & Maintenance Employees	Beta Gamma (TLD)	Monthly	Beta Gamma
22 Air Sample Locations (See Table C-1)	Beta Gamma (Survey Meter)	Semi-annually after 1st year's quarterly data	Beta Gamma
Ore area composite Leach and CCD composite Yellowcake area composite	Air	Semi-annually	Uranium Ra-226 Th-230

TABLE C-3

ENVIRONMENTAL MONITORING PROGRAM

ENVIRONMENTAL PARAMETER	SAMPLE LOCATION	SAMPLE FREQUENCY	MEASUREMENT
Tailings Impoundment Liquid	1 Location (Fig. C-3)	Annually	Pb-210, Po-210 Ra-226, Th-230 U, Chemicals* Water level
Unusual water discharge (Spill)		As necessary	NPDES parameters, Th-230
Groundwater	6 Locations near tailing impoundment w/ at least one control up-gradient	Quarterly following 1st year's monthly data	Ra-226, U, Th-230 Pb-210, Po-210 Chemicals* pH
Groundwater	Potable water supply	Quarterly	Ra-226, U, Th-230 Pb-210, Po-210 Chemicals* pH
Air	5 Locations (Fig. C-2)	(2) 24-hr/6 days Quarterly composite (1 downwind)	Ra-226, U Th-230, Pb-210
		(1) Background at Wamsutter	Ra-226, Th-230 U, Pb-210
		(2) Continuous (1 downwind)	U, Ra-226 Th-230, Pb-210
Air	5 Locations (Fig. C-2)	One week per month	Rn-222

TABLE C-3. Environmental Monitoring Program (cont.)

ENVIRONMENTAL PARAMETER	SAMPLE LOCATION	SAMPLE FREQUENCY	MEASUREMENT
Meteorological	Mill site (Fig. C-3)	Continuous	Wind Speed, Wind direction, Temperature,
Beta Gamma	5 Air Monitor Locations (Fig. C-3)	Continuous (Read quarterly)	Beta, Gamma
Soils	5 Locations (Fig. C-2)	Annually	U, Ra-226 Pb-210
Sediment	Battle Spring Draw, one upstream and one below mill site	"	"
Vegetation	3 Soil Sample Locations (Fig. C-2)	Annually (October)	Ra-226, Pb-210

*Parameters included in Chemical Analysis are listed below:

Temperature	Zinc	Nitrate (as N)	Mercury
Total Dissolved Solids	Manganese	Arsenic	Selenium
Total Suspended Solids	Nickel	Boron	Potassium
Alkalinity	Chromium	Phosphorus	Copper
Hardness	Chloride	Fluoride	Cadmium
Sulfate	Iron (Dissolved)	Aluminum	Vanadium
Iron (Total)	Calcium	Molybdenum	Sodium
Lead	COD	Redox Potential	Silica
Dissolved Oxygen			

TABLE C-4

STACK MONITORING PROGRAM

STACK DESCRIPTION	FREQUENCY	PARAMETERS: PARTICULATES	U (nat)	Ra-226	Pb-210	Th-230	H_2SO_4 MIST	NH_3	HYDROCARBONS (TOTAL)
1. YELLOWCAKE * PRECIPITATOR, CENTRIFUGE, DRYER, PACKAGING ROOM (ISOKINETIC)	3		X	X	X	X			
2. ORE RECEIVING (GRAB)	1	X	X						
3. LEACH TANK (GRAB)	1	X	X						
4. SOLVENT EXTRACTION (GRAB)	2							X	X

FREQUENCIES

1. Semi-annual sampling
2. Annually
3. Quarterly for U(nat); semi-annually for Ra-226, Pb-210 and Th-230 **

* Flow rate will be determined and recorded semi-annually.

** A typical analysis of yellowcake may be substituted for analysis of the retained stack sample for determining concentrations of Ra, Pb and Th.

TABLE C-5

ANALYTICAL SENSITIVITY
OF
RADIOLOGICAL PARAMETERS

MEDIUM	PARAMETER	SENSITIVITY	APPROXIMATE SAMPLE SIZE Inplant	Environmental
Water	Ra-226	.05 p Ci/l	4 liters	4 liters
	Th-230	.01 p Ci/l	4 liters	4 liters
	U	5 µg/l	4 liters	4 liters
Air	Ra-226	9×10^{-5} p Ci/M^3	300 m^3	300 m^3
	Th-230	5×10^{-5} p Ci/M^3	300 m^3	300 m^3
	U	6×10^{-5} p Ci/M^3	> 1 m^3	300 m^3
	Rn-222	.02 p Ci/l*	10 liters	50 liters
Soils	Ra-226	.05 p Ci/g (dry)	--	2000 g
Vegetation	Th-230	.01 p Ci/g (dry)	--	2000 g
	U	.05 µg/g (dry)	--	2000 g

* Kusnetz Method .5 p Ci/l

SAMPLING METHODS

WATER - The samples will be taken at a site which is representative of the water being sampled. Care will be taken to avoid sample contamination. The samples will be stored in a manner that ensures that the characteristics to be analyzed are not altered. In some instances, refrigeration will be necessary. Each sample will be labeled with the following information:

a. Designation or location
b. Date and time of collection
c. Sample type (grab etc.)

In addition to this information, a sample data sheet will be filled out. The sample data sheet will contain the following information:

a. Sample designation or location
b. Sample date and time of collection
c. Sampled by
d. Analysis required
e. Date sent to laboratory
f. Weather data (wind speed, direction, temp., etc.)
g. Comments

AIR - A high volume air sampler will be used to collect airborne particulates on a filter paper at a high sampling rate (500 - 2200 liters per minute). Sampling time will be 24 hours for environmental samples. The filter paper will be pre-weighed and then weighed again after sampling is complete. The particulate concentration will be calculated from the weight gain (after 24 to 48 hours in a desiccator) divided by the sample volume. The filter will be dissolved and analyzed using an approved method.

The low volume sampler will be a light weight, battery-operated unit that will be attached to an employee's clothing and operated for 4 to 8 hours. The filter head is attached to the employee's lapel or collar and closely approximates the breathing zone. The sampling rate will be 1-20 liters per minute. The filter will be dissolved and analyzed using an approved method. Good industrial hygiene methodology will be employed throughout the sampling period.

For environmental samples, the same type of sample data sheet that is used for water will be used.

Radon samples taken in the mill will be collected and analyzed using the standard Kusnetz method. This method is described in Volume 2,

Appendix 3, page 137 of the book "Controlling Employee Exposure to Alpha Radiation in Underground Uranium Mines" by Robert L. Rock. Environmental radon samples will be collected in a plastic or nylon bag with a pump using a sampling rate of 0.5 to 2 liters per minute. The sample duration will be approximately 48 hours. Radon will be analyzed using a scintillation cell. This method is described in "Standard Methods" 14th Edition, 1975.

SOIL - A composite soil sample will be collected on 10-foot centers from an area of approximately 900 square feet. The surface sample will be cleaned of roots and rocks, dried, pulverized, blended and analyzed using an accepted method.

VEGETATION - Vegetation samples will be collected in the same areas sampled for soil. The vegetation which is in abundance and the vegetation that plays an important role in the food chain will be sampled. A larger sampling area may be necessary to ensure adequate sample size.

APPENDIX D *

NON-ROUTINE MAINTENANCE OR SPILL

1. Management Direction

In the event of an upset or non-routine maintenance or operating condition involving radioactive material or process chemicals, the supervisor on duty will advise the General Manager, Safety and Environmental Department and the appropriate Department Superintendent before any work is started. The Safety and Environmental Department will then evaluate the conditions and issue the proper safety procedures and instructions and authorize the work. A non-routine operation is defined as an upset, spill or non-routine maintenance that involved radioactive material classes or exposure that are of short duration and adequate limitation of exposure by engineering controls is not practicable.

The Department Superintendent or his designate and the Safety and Environmental Department shall be responsible for the supervision of and verification that the work was completed in accordance with the safety procedures established.

2. Employee Restrictions

a. Yellowcake Areas: No employee shall be permitted to work in a yellowcake area during an upset or non-routine maintenance condition without permission of the Safety and Environmental Administrator or his delegate. Respiratory protection is required in the drying and packaging areas. The Safety and Environmental Administrator, or his delegate, will evaluate the condition(s) and ensure that proper procedures are followed in accordance with the operating guide for upset or non-routine maintenance conditions.

b. Employees involved in upset or yellowcake maintenance activities will be issued coveralls and will shower and change clothes

* Procedures outlined are typical only and may be modified to correspond to specific conditions as needed and without prior notice.

YELLOWCAKE MAINTENANCE FORM

Date ______________________ Authorized by ______________________

Description of work: ______________________

____

____

Protective measures required: ______________________

____

____

Respirator required:

Air purifying ______________________

Air supplying ______________________

Employee	Exposure Time	Employe	Exposure Time

Sample #	Sample Time	Sample Results uCi/ml x 10^{-9}

______________________ Supervisor

______________________ Safety & Environmental Department

NOTE: Form is SAMPLE only and may be revised or modified without prior notice.

c. As far as can be determined, any fire in the solvent extraction system would most likely be caused by human carelessness rather than by spontaneous or process-related incidents. To avoid these kinds of accidental fires, the following precautions will be taken:

1. Smoking by personnel will not be permitted.
2. Welding will be allowed only by special authorization.
3. No open fires will be permitted.
4. Hazard warnings will be posted.
5. Maintenance will be performed only after the responsible supervisor certifies that it can be done safely.

d. The estimated maximum probability of such an occurrence is one fire per 200 years of operation. The probability that a fire would produce a significant environmental impact is negligible. There have been two fires of this type in other mills, both of which were caused by maintenance errors and could have been prevented with proper planning.

2. Storage Areas

Fires originating in these areas are unlikely to cause significant radiological hazards unless allowed to propagate and spread.

a. Mill storage areas for reagents are segregated and are enclosed in diked areas where spillage and subsequent flame propagation are predictable and contained.

b. Outside storage of flammable materials are segregated and pose no abnormal hazards. Fires here would have negligible environmental impact.

6.1.2 Process Leaks

1. Piping

Minor leaks may occur in the mill circuit as part of daily operations. The mill circuit is completely self-contained and the possibility of liquid loss from the plant confines is highly unlikely. A leak in exposed piping would be quickly detected and corrected. Any spilled process liquids would be promptly cleaned up to minimize the environmental impact of the spill.

2. Tanks

a. All tanks (except ammonia, sulfuric acid, and water), sump wells, pump boxes, and thickeners in the plant are contained within diked or enclosed areas to preclude discharge to unrestricted areas. Leakage from these facilities would be detected in the normal process and repairs made as needed. Ammonia would quickly evaporate in the event of a spill. In the event of a sulfuric acid tank spill, the material would flow to the catchment basin where it would be contained.

b. Massive rupture of any tankage would cause local plant damage and/or contamination which would have to be cleaned up and decontaminated in accordance with procedures established in Section 5.

c. Outside storage facilities are also enclosed in diked areas which minimized the impact of accidental discharge of fluids.

6.1.3 Tailings Release

1. Dam Failure

The probable accidents relating to a tailings dam failure are discussed in detail in the "Final Report on Design of Tailings Retention Basin-Sweetwater Uranium Project" Dames & Moore, March 16, 1977, and the supplemental report regarding the subsurface disposal plan dated July 1978.

2. Pipe Line Failure

As discussed in Section 4, the tailings discharge line is pressurized and located upon a prepared bed designed to minimize leakage or loss from the restricted areas. Further, the tailings dam and pipe line will be checked once each shift during operations.

6.1.4 Utility Loss

1. Equipment Shutdown

a. Temporary loss of water or power to the mill could cause a scrubber or ventilation failure. The yellowcake package room scrubber system will have a water-power interlock system that will shut down the dryer and minimize the amount of emissions in the event of water or power loss.

A prolonged loss of electrical power is considered unlikely since diesel generators will supply emergency power to mill. Failure of the standby generators during a prolonged power outage would leave the mill without power but is considered extremely unlikely.

A prolonged water loss is also considered unlikely as the water is available from a number of sources on the property.

b. Loss of ventilation for a prolonged period of time would require evacuation and/or special work procedures to be implemented in the areas affected.

2. Process Overflows

Loss of power would cause some pump boxes, and under worst conditions, portions of the leach, CCD and SX circuits to overfl   Since all of these areas are contained within diked areas, clea   nd/or decontamination would proceed on a routine basis when pow   turns.

.5 Scrubber Failure

1. Partial Failure

a. The failure of various mechanical components of the scrubber assembly could result in less than ~~maximum~~ efficiency in operation.

b. Failures would be detected through process instrumentation, direct observation, ammonia fumes and heat buildup.

c. Corrective action would be partly automatic through the instrumentation interlock system which shuts down the dryer and mechanical repair to the defective machinery.

d. Additional monitoring surveys would be taken to assess the extent of the impact upon the plant and general area environment. The measurable effects of a scrubber failure are expected to be limited and well below permissible emission standards.

2. Complete Failure

The same analysis holds true for complete failure. However, failure of the interlock devices would extend the period of emissions until the operator took corrective action. Extensive monitoring and cleanup might be required depending on conditions prevalent at the time of failure.

6.1.6 Boiler Explosion

The principal hazards connected with a boiler explosion would be subsequent fires and rupture of piping or tanks. The consequences of these are discussed in Sections 6.1.1 and 6.1.2.

6.1.7 Natural Disasters

1. Winds

a. Strong winds and severe storms are noted in the area. Severe winds would cause wave action within the tailings dam,

1. All reagents, except ammonia, are stored within diked or curbed areas to fully contain them on site in the event of a spill.

2. With the exception of ammonia, all spills of stored chemicals would be absorbed in the soils or contained in the immediate vicinity of the storage tank.

3. Spilled liquids could be pumped to the process or to the tailings pond. However, a portion of the chemical may be absorbed in the soil and require cleanup. Spillage in the mill will be washed down and pumped back into the mill circuit.

6.3.2 Ammonia Releases

An ammonia spill or tank rupture would result in ammonia vapor dispersal to the environment. However, concentrations would be quite low and offsite consequences would be negligible.

6.3.3 Operator Error

1. Errors in judgment and mistakes in execution are an inherent aspect of any human endeavor. To ameliorate the effects of human fallibility, control instrumentation has been provided wherever possible to detect or correct process malfunction. Additionally, extensive training programs and standard operating instruction will be devised and used.

2. The effects of operator error may vary over a wide range of severity. Close supervision by experienced personnel will, in most cases, limit the effects of such errors to local impact.

6.3.4 Industrial Accidents (Personnel Injury)

Injuries to personnel and damage to equipment are recognized hazards in any industrial endeavor. These hazards are of major concern to management and continuous-positive steps will be taken to limit their occurrence. A comprehensive and strongly enforced safety program and accident prevention training course will be part of the general employment criteria for all employees.

The effects of any industrial accident can encompass the full range of severity listed in Table 6.0.1.

6.3.5 Impact

The environmental effects of these types of accidents will be confined to the plant site, and the probability of the accidents having any significant effect on the offsite environment is negligible due to the facility's isolated location.

6.4 EMERGENCY ACTIONS

The Safety & Environmental Administrator will establish emergency procedures for the project. A detailed SPCC (Spill Prevention Countermeasure and Control) plan will be prepared and will be available to all supervisory personnel. As the project develops, a complete and detailed Emergency Action Plan will be developed.

6.4.1 Responsibility

1. The Safety & Environmental Administrator is responsible for:

   a. Developing emergency procedures.
   b. Procuring and periodically testing emergency equipment.
   c. Emergency training programs.
   d. Assessing onsite and offsite safety and environmental conditions.
   e. Coordinating assessment of the cause and effectiveness of corrective actions following emergencies.
   f. Notifying corporate and regulatory personnel as required.

2. The Mill Superintendent is responsible for:

   a. Insuring that mill personnel receive the Emergency Training as provided through management.
   b. Keeping a current file of Emergency Procedures for use by supervisors and personnel.

3. The Maintenance Superintendent is responsible for:

   a. Insuring that maintenance personnel received the Emergency Training as provided through management.
   b. Keeping a current file of Emergency Procedures for use by supervisors and personnel.
   c. Assigning work crews for emergency situations.
   d. Repairing and/or maintaining emergency equipment.

7.0 QUALITY ASSURANCE

The quality assurance program will cover mill design, construction and operation to assure safety, reliability and economy of operation. Qualified personnel from MINERALS will review all phases of construction and will insure compliance to the quality assurance program discussed below.

7.1 DESIGN

During design, the General Manager, or his delegate, will be responsible for:

1. Reviewing and approving all specifications for all equipment, construction materials and construction procedures.
2. Final implementation of controls to insure proper criteria are used.
3. Insuring that design criteria complies with OSHA, MESA or other applicable standards or codes.

7.2 CONSTRUCTION

During construction, the General Manager, or his delegate, will be responsible for:

1. Preparing procedures and material specifications.
2. Reviewing and approving specifications.
3. Reviewing and approving procurement documents that conform to specifications.
4. Reviewing, approving and documenting design changes.
5. Implementing a receiving inspection system to assure that materials and components are inspected for conformance to specifications.
6. Making frequent inspections to insure all construction is within design specifications.

7.3 ACCEPTANCE TESTS

The Mill Superintendent will verify:

1. Proper operation of level indicators and alarms.
2. Leaktightness of process piping systems.
3. Separation of sanitary and process water systems.
4. Mill circuit is self-contained.
5. Operability of automatic systems.
6. Proper function of the ventilation systems and air cleaning equipment.

7. Annually review safety records and radiation records for adherence to ALARA philosophy.
8. Written procedures for quality assurance will be developed for all analytical work, monitoring, sample preservation, and data reduction.

7.5.2

The Corporate Medical Department will:

1. Participate in the development and implementation of a radiation monitoring program.
2. Review and approve radiation sampling and surveying procedures and equipment.
3. Review all radiation monitoring results.
4. Review methods, equipment and results of in-house and consulting laboratories relative to radiation.
5. Participate in the development and implementation of an overall radiation protection and training program for appropriate employees.
6. Review content of training courses, literature and aids.
7. Participate in the selection of radiation protection instruments.
8. Review radiation protection procedures, equipment and records and approve as necessary.

The uranium oxide extracted during acid leaching can be concentrated by using either solvent extraction or resin ion-exchange. MINERALS will use both methods: solvent extraction for the high-grade ore, and resin ion-exchange for the leachate from low-grade material. Yellowcake packaging is confined to one room to maximize control and minimize emissions by limiting the number of handling operations and exposure points. This completely closed system was determined to be best for exposure control and is consistent in keeping with the goal of "as low as reasonably achievable". The room will be kept at negative pressure. Yellowcake crushing will also be contained by ducting and the enclosure will be under negative pressure.

Selling and shipping wet slurry was also considered in lieu of yellowcake processing but was discounted due to a lack of market.

8.1.2 Mill Siting

Within the economic hauling distance from the mine, biological communities are relatively uniform. There are variations in species composition and productivity over the area; however, these variations are largely in response to small microclimatic and edaphic changes and are, therefore, relatively minor. There are no unique habitats within the area that are more likely to support protected, threatened or endangered species than other areas. Consequently, the placement of the mill within this area could not be made on the basis of biological considerations, since the impact would be essentially the same for any location within it.

This statement is also true for other environmental considerations. Air quality, water quality, socioeconomics, and cultural resources will be affected in essentially the same manner regardless of the location of the mill within the area.

Due to prevailing southwesterly winds, placement of the mill in most locations to the west of the ore deposits would expose mining personnel to radiation from the mill complex. In addition, preliminary investigations indicate that there is a potential for the discovery of further uranium deposits west of the ore to be mined. For these two reasons, placement of the mill west of the ore deposits was rejected.

Since locations within this area cannot be differentiated on the basis of environmental or safety considerations, the mill was sited on the basis of economics. The mill was placed as close to the ore body as possible in order to provide the shortest ore haulage distance and create the least amount of surface disturbance. The mill