APPLICATION FOR SOURCE MATERIAL LICENSE

REVISED

JULY 16, 1979

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ENERGY FUELS NUCLEAR, INC.
1515 Arapahoe
Denver, CO 80202

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(Rev. 7/79a)

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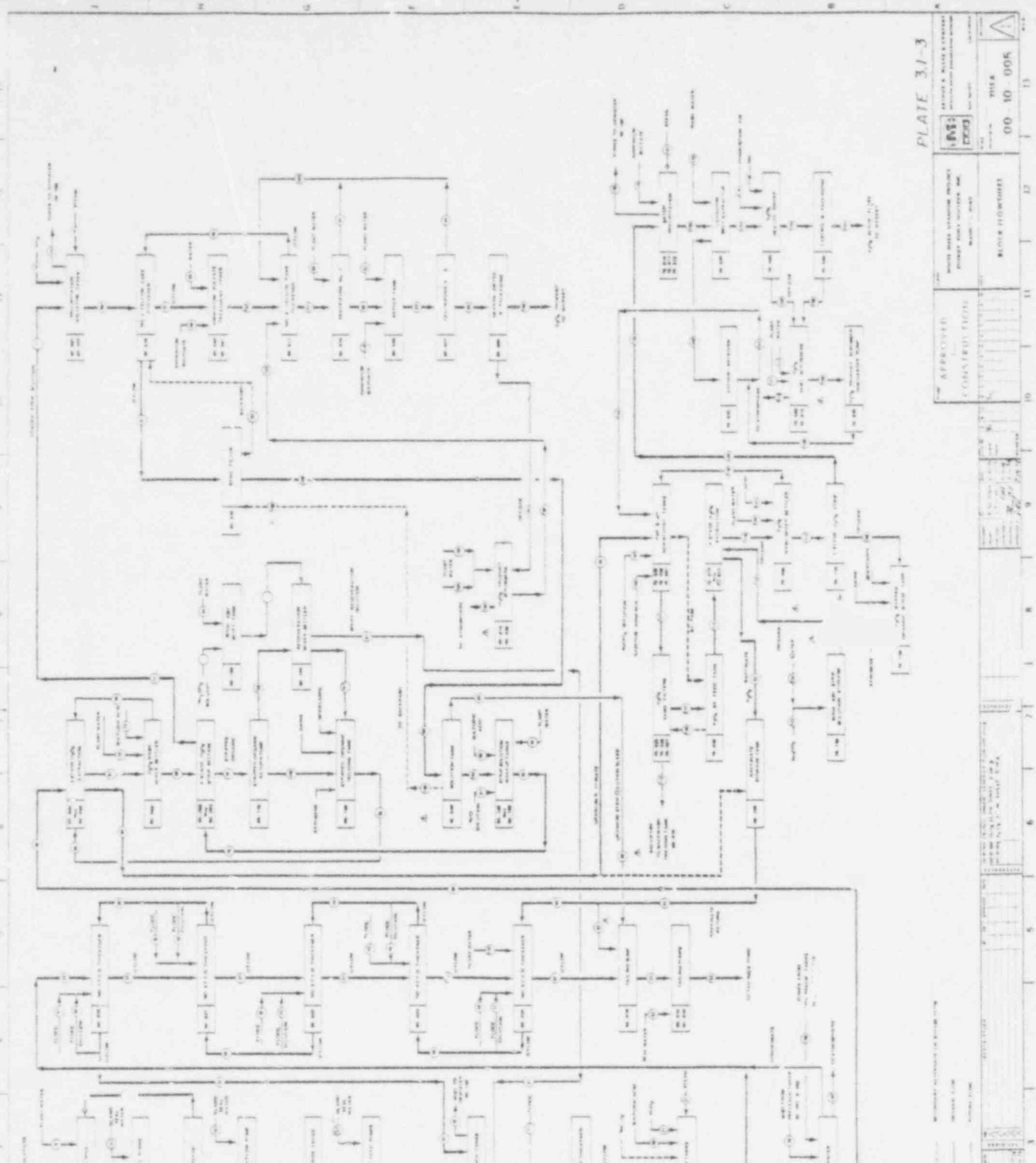

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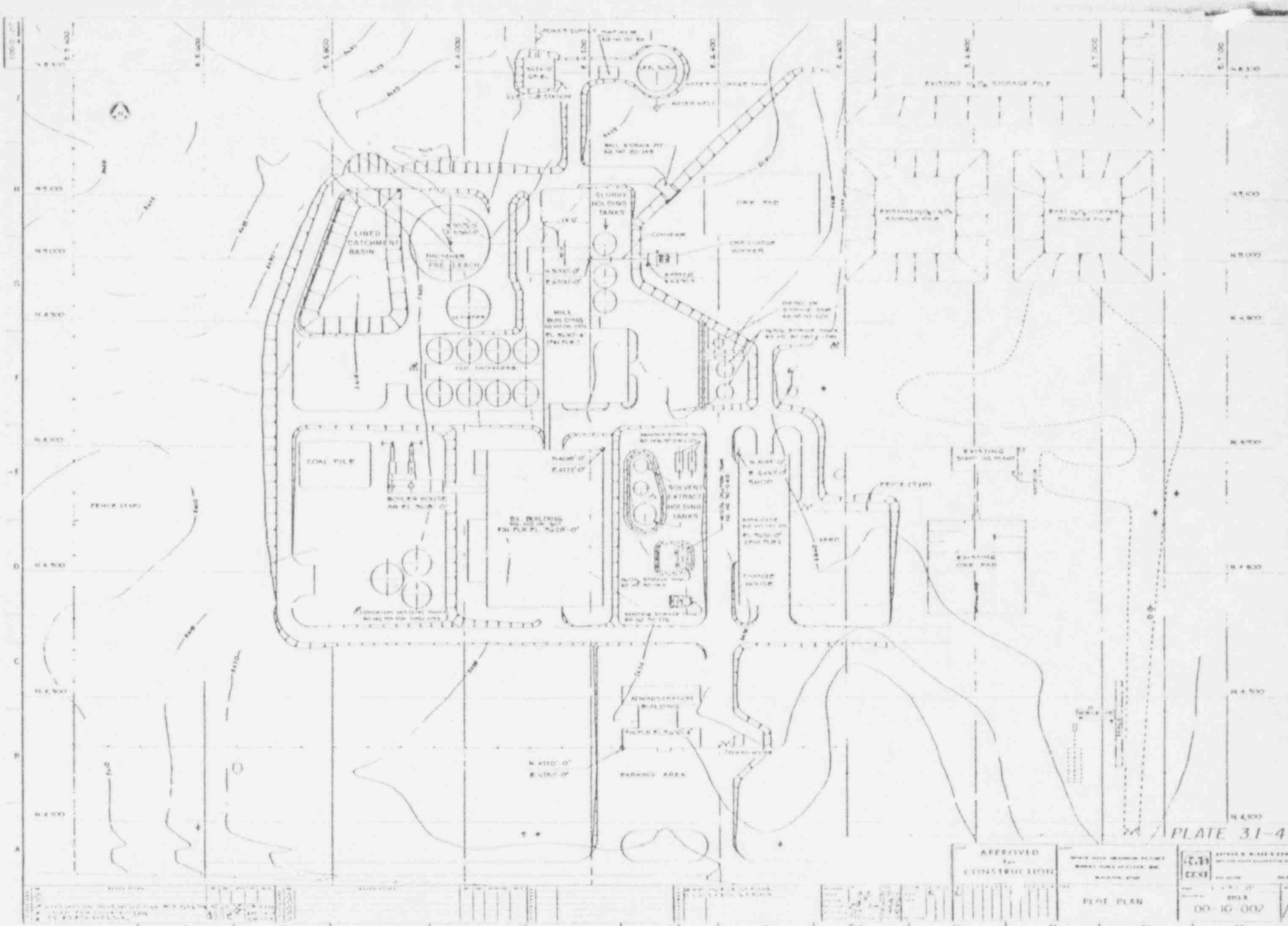
TABLE 3.1-3

COMPOSITION OF LIQUID IN PLANT TAILING SLURRY
BASED ON LABORATORY TEST WORK

Parameter	Amount
Composition (g/liter)	
V	0.24
U	0.0025
Na	4.90
NH_3	0.065
Cl	3.05
SO_4	82.2
Cu	1.62
Ca	0.48
Mg	4.06
Al	4.26
Mn	4.58
Zn	0.09
Mo	0.007
Organics	0.2[a]
pH	1.8-2.0
As	0.052
Ba	0.0003
Cd	0.0017
Cr	0.0060
Pb	0.001
Hg	0.000001
Se	0.00056
Ag	0.00006
F	0.0014
Si	0.30
Radiochemical assay (pCi/liter)	
Gross alpha emissions	2.5×10^5
Gross beta emissions	2.3×10^5
Th-230	1.3×10^5
Ra-226	2.3×10^2
Pb-210	2.8×10^2

[a]Measured in gallons per 1000 gal.



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with screens. The underflow from the screens (-28 mesh) will be pumped to the three 35' diameter mechanically agitated wet slurry storage tanks.

Dikes will be constructed around the perimeter of the slurry holding tanks. In the event of a tank failure the contents would be contained within these dikes.

In order to minimize the risk of a tank overflow, an audible signal will sound before the slurry overflows the top of the tank. If the tank audible system fails or is not detected, an overflow system will discharge into the mill grind sump where it can be pumped into the appropriate circuit. a

3.6.2 Leaching

Leaching at the White Mesa mill will be designed for vanadium as well as uranium extraction. A two-stage acid leach having a total retention time of 24 hours is required in order to maximize recoveries.

The two stage leach step will consist of separating the strong acid leach liquor from the leached residue in the No. 1 counter-current decantation system thickener and mixing it with fresh ore in the first stage leach. The first stage leach will discharge to the Pre-Leach thickener and the pregnant liquor overflow after clarification will be pumped to the solvent extraction circuit. The function of the first stage leach is to utilize the residual acidity from the second stage leach by reacting it with the alkaline constituents of the freshly ground ore, thereby achieving chemical economies and reducing the acidity of the tailing effluent.

Concrete curbs will be constructed around the leach area to contain spillage from the leach circuit. This catchment area will hold sufficient volume to contain the entire contents of any one of the leach tanks. The concrete floors will be sloped toward floor sumps where spills can easily be washed and recycled back into the circuit.

In the event of an overflow each leach tank will be constructed with an overflow pipe line down the side of the tank and directed toward the floor sump. a

The thickened underflow from the Pre-Leaching thickener will be pumped to the second stage leach circuit. Two tanks, approximately 22' x 24' wood stave, will be used in the first leach stage and seven similar steel, rubber-lined tanks will be used in the second stage of leaching. The tanks will be equipped with rubber covered turbine type agitators. Sulfuric acid and manganese dioxide or an equivalent oxidant will be added to the leach tanks in the second stage to dissolve the uranium and vanadium.

Approximately 200 to 300 pounds of H_2SO_4 per ton of ore will be used, resulting in a free acid concentration of about 75 grams/liter. Oxidant equivalent to approximately 10 pounds of MnO_2 per ton of ore will also be required. the temperature of the secondary leach circuit will be elevated to approximately 70°C by the injection of steam.

3.6.3 Counter-Current Decantation (C.C.D.) Washing Circuit

Separation of the strong acid liquor and washing of the leached residue, will be accomplished in a multi-stage counter-current thickener arrangement using 125 ft. diameter conventional thickeners, or 40 ft. diameter high capacity type thickeners. The barren raffinate will be added to the final thickener for washing, drastically reducing fresh water requirements. This internal recycle is equivalent to approximately 2.5 tons of solution for each ton of ore processed, or conservation of 833 gpm of water.

During each C.C.D. thickening stage, solid particles settle to the bottom and the uranium bearing solution reports to the overflow launder. Polymeric flocculants will be utilized to increase the settling rates of the solids in each stage of thickening. The underflow slurry from the last thickener, will be sampled and pumped to the tailing retention area.

As mentioned above, the solution from the No. 1 thickener is utilized in the first stage leach circuit before reporting to the Pre-Leach thickener. Overflow from the Pre-Leach thickener (pregnant solution) is transferred to clarification and filtration prior to solvent extraction.

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The thickener tanks are situated on a concrete slab with a curb around the perimeter. Any overflow or spillage from this area will be contained within the perimeter unless several thickener tanks would fail or collapse at once. In this event, the contents would flow into the lined catchment basement west of the mill area, as shown in the plot plan (Plate 3.1-4).

The pre-leach thickener and clarifier tank have overflow pipe lines, flowing to overflow sumps. The overflow floor sump pump will start automatically when the sump becomes full and divert the material to the appropriate circuit. In the event the pre-leach tank or clarifier tank would collapse, the contents would flow into the lined catchment basin where it would be contained and pumped back into the mill circuit. a

3.6.4 Solvent Extraction, Precipitation, Dewatering and Drying

Solvent extraction will be used to concentrate and purify the uranium contained in the overflow solution. The solvent extraction process is carried out in a series of mixer and

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settling vessels using a amine-type compound carried in kerosene (organic) which selectively absorbs the dissolved uranyl ions from the aqueous leach solution. The organic and aqueous solutions will be agitated by mechanical means and ... allowed to separate into organic and aqueous phases in the settling tank having an area of about 1,400 square feet.

This procedure will be performed in four stages using a counterflow principle where the organic flow is introduced to the preceding stage and the aqueous flow (drawn from the bottom) feeds the following stage. It is estimated that, after four stages, the organic phase will contain about two grams of U_3O_8 per liter and the depleted aqueous phase (raffinate) about 5 milligrams per liter. The raffinate will be recycled to the counter-current decantation step previously described or further processed for the recovery of vanadium as discussed in Section 3.1.5. The organic phase will be washed with acidified water and then stripped of uranium by contact with an acidified sodium chloride solution in mixer-settler vessels. The barren organic solution will be returned to the solvent extraction circuit and the enriched strip solution containing about 20 grams of U_3O_8 per liter will be neutralized with ammonia to precipitate ammonium diuranate ("yellow cake"). The yellow cake will be settled in two 20-ft. diameter thickeners in series and the overflow solution from the first filtered, conditioned, and recycled to the stripping stage.

Feed tanks as well as the raffinate holding tank for the solvent extraction circuit will be situated inside catchment basin adequate in size to contain the contents of any one of the tanks.

Overflow lines will also be installed in each tank flowing into a common sump. This sump pump will start automatically and advance the solution into the appropriate circuit in the event the tanks overflow.

Solvent extraction settling tanks (inside the solvent extraction building) will be constructed with an overflow near the top. In the event of a tank overflow or collapse the content will flow into the concrete sumps on the west edge of the solvent extraction building. Sump pumps will be installed in the sumps to transfer the collected material to the appropriate tank. a

The thickened yellow cake slurry will be dewatered and washed in a two stage centrifuge circuit. This slurry is then pumped to a 6 ft. diameter oil fired multiple-hearth dryer (calciner) operating at approximately 650°C (1200°F). The dried uranium concentrate (about 90% U_3O_8) will be passed through a hammer mill to produce a product of less than 1/4 inch size. The dried concentrate, which is the final production of the plant, is then packaged in 55-gallon drums for shipment.

The uranium concentrate drying, crushing and packaging operation, will be conducted in an isolated, enclosed building with a negative ventilation pressure to contain and collected (by wet scrubbing) all airborne particles. A description of the scrubber is given in Section 4.0.

A concrete curb will be constructed around the yellowcake holding and thickening tanks. Spillage from any of these tanks will be contained by this curb. Sumps will be situated inside the curbs and floors will slope to these sumps so yellowcake spills can easily be cleaned up.

Radiation monitoring equipment is all portable and the location is described under items 5.5.1 and 5.5.2. a

3.6.5 By-Product Vanadium Recovery

Vanadium is present in some of the ores and will be soluable to a major degree along with the uranium during leaching. The solubilized vanadium will report with the uranium raffinate. Depending on the vanadium content of the uranium raffinate, it will either be recycled to the counter-current decantation step (3.1.3) or further processed by solvent extraction for recovery of the vanadium before recycling.

The vanadium recovery process will consist of a separate solvent extraction section to treat the uranium raffinate and precipitate the vanadium from the strip solution. Plate 3.1-1 illustrates the process. Referring to Plate 3.1-1, the uranium raffinate will be pumped to three 12' X 16' agitated wood tanks and three 44' X 20' wood holding tanks where the EMF (oxidation potential) will be adjusted to -700 mv with sodium chlorate or peroxide and the pH raised to 1.8-2.0. The solution may possess some turbidity after this step and will be filtered prior to passing to a 3-stage solvent extraction circuit. The vanadium solvent extraction section is essentially of the same design and size as utilized for the uranium. An amine type compound carried in kerosene (same as used for uranium) will selectively absorb the vanadium ions for the uranium raffinate solution. The organic is then stripped of vanadium with a soda ash solution. The barren organic solution will be returned to the solvent extraction circuit and vanadium will be precipitated from the enriched strip solution with ammonium sulfate.

Dikes will be constructed around the perimeter of the oxidation tank to contain large spills such as tank failures. Also, overflow lines from each tank will flow into floor sumps. In case the regular pump fails, an automatic starting sump pump will pump the material to the appropriate circuit or holding tank. a

The vanadium precipitate (ammonium metavanadate) will be filtered and dried. The dried precipitate will be subjected to a fusion step at approximately 800°C to produce V_2O_5 (black flake). Packaging will be in 55-gallon drums. The vanadium is not radioactive. The drying and fusion steps along with packaging will be conducted in an enclosed area with a negative ventilation pressure to collect (by wet scrubbing) all airborne dust and vapors.

Dikes or curbs will be constructed around all chemical holding tanks with the exception of the water storage tanks. Large water leaks would flow into the catchment basin west of the pre-leach thickener.

The catchment basin around the chemical tanks would hold the contents of any one of the tanks within the perimeter, with the exception of the sulfuric acid tanks. The catchment basin around the sulfuric acid tanks would be large enough to hold the contents of both tanks.

The sulfuric acid tanks will be equipped with overflows near the tops of the tanks in addition to automatic audible signals which will sound before the tanks overflow.

In case of a large spill in the mill, CCD or pre-leach thickener area, such as several tanks collapsing, a lined catchment basin will be utilized to contain the spills. This catchment basin will hold approximately 1.5 million gallons which will hold all of the contents from the pre-leach thickener or the contents of several of the CCD thickeners tanks.

3.7 Instrumentation

Automatic or semi-automatic instruments will be util-

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ized where applicable in the mill circuit for safety, quality control, and process efficiency.

3.7.1 Grinding Circuit and Wet Ore Storage

The rate the ore will be fed to the grinding circuit will be determined by belt scales. The ore feed rate will be controlled by the operator. Feed to the grinding circuit will be shut down by electric circuit interlocks in the event of equipment failure, including the bag house.

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3.7.2 Leach Circuit

Sulfuric acid and an oxidant, such as manganese dioxide, will be added to the leach slurry to dissolve the uranium. the acid content will be measured by pH or conductivity. Control will be manual adjustment of acid addition as indicated by an in-line flowmeter. Oxidation potential will be determined in the leach slurry from individual samples. Oxidant will be added as a slurry or solution and controlled manually through an in-line flowmeter.

Steam will be injected into the leach slurry to elevate the temperature to approximately 70°C. The slurry temperature will be monitored by tank thermometers and controlled by manual adjustment of steam addition.

3.7.6 Drying and Packaging

The partially dewatered yellow cake slurry will be dried in a multi-hearth dryer at about 650°C. The temperature of the dryer will be recorded and controlled automatically by automatic thermal controller. An audible signal will indicate excess temperature in the dryer. In addition, the yellow cake feed pump to the dryer will be interlocked with the scrubber fan and water circulating pump. This feed pump, as well as the discharge scrubber fan, will "shut down" if the scrubber water supply fails. A flow meter will be installed on the scrubber water supply line and checked twice per shift. a.

Manometer readings of the yellow cake dryer off gases will be checked twice each shift and recorded. Hearth and stack temperatures will be recorded on a continuous basis.

The dried yellow cake will be stored in a 20,000 pound hopper and discharged into 55-gallon drums by means of a rotary valve and prepared for shipment.

3.7.7 Radiation Safety and Monitoring Instruments

The various types of radiation and monitoring instruments used to conduct the radiation safety program are discussed in this section. Survey meters will be calibrated after repair, and as recommended by manufacturer, or semiannually, whichever is more frequent. Check sources will be employed prior to instrument use. a

3.7.7.1 Application and Specifications for Determining External Radiation

1. Film Badges: Used for personnel radiation exposure monitoring. Contract services for film badges will be provided by R. S. Landauer, Jr., or an equally competent supplier. Evaluation and calibration is part of the contract services. Badges will be monitored by supplier on a monthly basis.

Badges will be capable of beta-gamma detection with a sensitivity of 10 millirems x-ray or gamma and 40 millirems hard beta.

2. Beta-gamma monitoring will be done with the Eberline E-5 30 survey meter (or equivalent) with an Eberline HP270 probe. The sensitivity of this combination is 1200 cpm/mr, with a lower range of 0 to 0.2 mr/hr. a

3.7.7.2 Application and Specifications for Determining Airborne Radiation

1. Low Volume Air Samplers: Used for taking air samples in non-restricted areas. Must have a capacity up to 20 Liters/min. with built-in air flow indicators for calibration. Equivalent to Eberline RAS-1 air sampler.

2. Low Volume Air Samplers: Used for taking air samples in the mill area to determine airborne Radiation concentrations. Equivalent to sampler manufactured by Scientific Industries, Inc. H25004. Capacity up to 20 liters per minute. Built-in air flow indicator for calibration.

3. Personal Breathing Zone Samplers for Individual Exposure to Airborne Radiation: Sample rate of less than 1 liter per minute, built-in air flow indicator, with remote filter holder attaching to lapel separate from pump. Equivalent to MSA Model S Montaire sampler.

4. Radon Daughter Monitoring - The sample is collected on prescribed filters with an MSA Model S sampler, then counted with an Eberline Mini-scaler Model MS-3. By using procedures prescribed in ANSI 13.8-1973 and the formula for low count rate, a 95% confidence level is assured. The pump and filter train are calibrated monthly. a

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5. G-M Counter - Professional Model 107-C, or equivalent, used for beta-gamma measurements. Will be calibrated with a known radiation source prior to each use.

3.7 7.3 Applications and Specifications for Miscellaneous Monitoring Equipment

1. Galvanek-Morrison Fluorometer, Jarrel Ash Model J. A. 26000 or equal, used for determination of U (nat) present in air samples. Sensitivity of the flourometer will be consistent with NRC-recommended lower limits of detection.

2. pH Meter - Beckman 96 Zeromatic or equivalent. Used to determine pH of liquid effluents; sensitivity of ± .1 pH. Calibrated with buffer solutions of known pH values.

3. Nuclear density gauges will be used for process controls on each of the thickener underflow streams. This will be equivalent to Ohmart Sealed Source Model A2102 of 100 millicuries each. License will be obtained as required under provisions of 10 CFR Part 30, "Rules of General Applicability to Licensing of By-Product Material."

4. An alpha laboratory counter will be used for alpha radiation determination on wipe samples from various equipment surfaces and nuclear density gauges. Unit to have a sensitivity of less than 10 dpm and is calibrated with manufacturer supplied alpha source. Equivalent to Nuclear Chicago Alpha Survey Meter, Model 2672. Lowest range not to exceed 500 cpm. Highest range up to 50,000 cpm, readings in dpm.

5. For personnel scanning, an Eberline RM-19 counter with AC-3 Alpha scintillation probe (or equivalent) will be used. Sensitivity of this combination is 5.9 cpm per disintegrations/min/cm^2.

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4.0 WASTE MANAGEMENT SYSTEM

The methods used for the control of gaseous emissions, vapors, and dust are discussed below.

4.1 Gaseous - Ore Buying Station

Dust generated during crushing and handling of the ore in the Blanding ore buying station is collected in three automatic reverse jet bag houses. The collected dust is recombined with the ore at appropriate points so as to not influence the grade of ore. See Plate 3.1-1 showing the dust pickup points. Baghouse negative pressure checks will be made and logged every two hours.

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4.1.2 Airborne Dust Control - Ore Buying Station

All feeders, chutes and crusher transfer points in the Ore Buying Station are enclosed in hoods connected to a system of ducts under negative pressure. The ducts discharge to their respective bag houses shown on Plate 3.1-2. The design parameters for the bag house collectors are summarized in Table 4.1-1.

The ducts are sized for air velocities of 3,500 to 5,000 feet per minute and equipped with appropriate blast gates.

At times when exceedingly dry or dusty ores are encountered, (usually less than four percent moisture) the ore is sprayed with water before it is fed to the sampling plant. This practice, which is the responsibility of the sampling plant foreman, reduces the dust potential and results in adequate control of dust within the plant.

Control of dust in the sample preparation room is accomplished by two wall-mounted hoods over the sample grinders. These hoods are connected by duct work and discharge to the System 3 bag collector listed in Table 4.1-1.

Table 4.1-1
GAS-FUME-DUST GENERATION AREAS

AREA NO.	DESCRIPTION	GENERATION	CONFINEMENT METHOD	DESCRIPTION AND SPECIFICATION	%EFFICIENCY
1	Ore Buying Station	Dust	Bag House	9750 CFM	99.6
2	Ore Buying Station	Dust	Bag House	3000 CFM	99.6
3	Ore Buying Station	Dust	Bag House	3250 CFM	99.6
4	Ore from Stockpile to SAG Mill-Ore reclaim hopper	Dust	Baghouse dust collectors (3060 sq. feet)	Torit Model T-D 3060F^2-Air to Cloth ratio 1.6:1	99.9
5	Pre-leach Agitators and Final Leach Agitators	Fumes	Covered tanks, and demister exhaust fans to atmosphere	16,875 CFM	
6	Boiler, Coal Fired Boiler, Coal Fired	Coal Dust Flue Dust	Wet Scrubber Centrifuged Cyclone	Ducon 66"UW4 12,000 ACFM Multitype-Dry Cyclone	99.5 92.8
7	Boiler, Oil Fired	Flue Gas	None		
8	Uranium & Vanadium Extraction	Fume	Forced Air Building Ventilation	Up to 6-changes per hour	
9	Yellow Cake Drying and Packaging	Fume-Dust	West Fan Scrubbers (2)	Ducon UW4-1600 CFM	99.5
10	Vanadium Drying-Fusion	Fume-Dust	West Venturi Scrubber	Sly Wet Venturi Scubber 12,000 CFM	99.5
11	Vanadium Fugitive Dust	Dust	West Venturi Scrubber	Sly Venturi Scrubber 6,980 CFM	99.5

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SIZE	% RETAINED
2"	2.6
1"	40.3
½"	61.7
¼"	70.9
4 mesh	72.4
6	74.0
8	75.1
10	76.2
14	77.2
20	78.5
28	79.9
35	81.4
48	83.3
65	85.7
100	88.7
150	91.0
200	92.3
270	93.1
325	93.7
400	93.9

4.2 Gaseous - Mill

Table 4.1-1 summarizes the ventilation, confinement, filtration, and dust collection system with regard to emission sources in the mill.

4.2.2 Airborne Dust Control - Mill

Dust generated in the ore hopper area will be collected in a reverse jet bag house dust collecting system. Bag house negative pressure checks will be made and logged every two hours. In addition, a dust suppression spray system will be installed in the mill feeding system and used when exceedingly dry ores are being fed to the SAG mill. Water added for these purposes will remain with the ore and go to process. a

Yellow cake particles carried in flue gases from the uranium dryer and packaging area will pass through wet fan scrubbers (one on the dryer and one on the packaging process) operating at an equivalent venturi scrubber pressure of 20" W.G. The solution and particulates collected from the scrubbers will be recycled to the No. 1 yellow cake thickener. Specification for the fan type scrubber shows the efficiency to be greater than 99 percent. Plate 4.1-2 illustrates the fan type scrubber presently planned for this

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application. It is expected that the emission release rate for particulate matter will be less than 0.03 grains per cubic foot, thus resulting in an estimated emission rate of 0.041 lbs/hr U_3O_8. The anticipated air flow for each scrubber will be 1600 cfm. Scrubber discharges will be combined into one stack. The stack is planned to be approximately 30" in diameter and about 80 feet above ground level. Safety aspects of the yellowcake dryer are discussed in Section 3.7.6.

Two wet dust collectors also will be installed to collect and recycle dust generated from the vanadium drying operation. An isolated portion of the building is planned for precipitation, drying, and packaging of the vanadium. Since the uranium is removed prior to vanadium recovery, no release of radioactivity is expected in the vanadium drying and fusion step.

At the proposed mill, the processing buildings and equipment will be provided with ventilation fans, hoods and ducting to control the concentration of gaseous effluents (See Table 4.1-1). A forced air ventilation system designed for the entire solvent extraction and stripping buildings will remove kerosene vapors. The ventilation fan will be checked visually for proper operation on a daily basis. In addition, the fan will be equipped with "running light" so that a malfunction will be readily apparent. All solution tanks are equipped with overflows that transfer overflowed material to sumps where it will be diverted to the appropriate tanks or vessel. a

Coal will be used to fire boilers needed to produce steam for heating the leach pulp and other process requirements. A maximum of 60 tons of coal per day will be required for this at a heat input of approximately 50 million BTU's per hour. As a result of the boiler combustion, stack a gases released to the atmosphere will include carbon dioxide, water vapor, sulfur dioxide and nitrogen oxides.

State and national emission standards are not applicable to a steam generating boiler of this small size. However, state and national ambient air quality standards will apply to the resultant ambient concentrations. The combustion of 60 tons per day of 0.3 percent sulfur coal would generate approximately 720 pounds of sulfur dioxide per day and approximately one-half this amount (360) pounds of NO_x. A scrubber will be utilized to control these emissions.

Table 4.1-2 summarizes information regarding the mill discharge stacks and effluents.

The mill facility will be complemented with an analytical laboratory which will routinely assay products of ore, process streams and final products to assure adequate quality control and plant operating efficiency. The laboratory fume hoods will collect air and mixed chemical fumes for venting to the atmosphere. These gases will contain non-radioactive chemicals, including HCl and NO_2. The volume of gaseous fumes emitted from the laboratory operations will be small and free of dust as samples processed in the analytical laboratory will be wet.

Dust is controlled in the small sample preparation room utilizing dust collector systems over the pulverizer and crusher. Two ISSCO .003 dust Collectors with 100 sq ft filter bags are used to control dust. (Model No. PB-12 with 825 cfm).

4.3 Liquids and Solids

The design of the mill is to be such that any leaks or spills will be collected and recycled to the appropriate

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part of the process, thus eliminating any product loss, hazard to personnel, or contamination of the surrounding area. These collection systems are described in detail in Section 3.0 under the specific equipment headings.

Most process liquids will be recycled in the mill; however, about one ton of liquid (water) for every one ton of tailing solids will be discharged to the impoundment area. The water (analysis given in Table 3.1-3) will be required to transport the solid tailing. In addition, the elimination of some process water in this manner will avoid a build-up in chemical ions that could be harmful to the milling process. No liquid or solid effluent will cross the property boundary, other than possible wind blown dust.

4.3.1 Tailing Retention Area

The tailings from the milling operation will be discharged by a slurry pipeline to impoundment southwest of the mill. The impoundment will consist of a series of cells, with a total capacity to hold the quantity of mill tailings produced from a 15-year operating period at a rate of 2,000 TPD. The cells will be lined to provide containment of solids and liquids.

To prevent damage to the tailings cell liner, solid waste materials (e.g., discarded or scrap metal, wood, etc.) will not be placed in the tailings disposal area. Instead, contaminated solid waste will be disposed of in designated zones, per 10 CFR, and other waste will be placed in a landfill or handled by off-site contract disposal.

Appendices A, A-A, and A-B correspond to the information requested in Regulatory Guide 3.11, "Design, Construction and Inspection of Embankment Retention Systems for Uranium Mills." See Appendix A-B for the detailed tailing retention plans.

4.3.2 Sanitary and Other Mill Solid Wastes

All applicable State of Utah, Division of Health standards will be met in the design and operation of the sanitary facility associated with the mill complex. Sanitary wastes will be disposed of through a septic tank and leach field designed and operated in accordance with applicable regulations.

Trash, rags, wood chips, and other solid debris will be collected and buried in designated areas. Coveralls used in the yellow cake area will be laundered at the mill. Mill personnel will be provided with a change room and laundering facility to allow them to leave their work clothes at the mill. All liquid effluents from the laundry will be routed to the tailings retention system.

The combustion of coal will produce two ash products, fly ash and bottom ash. With a maximum coal usage rate of 60 tons per day, the total ash production would be less than 6 tons per day which will be sent to the tailings pond. These ash products will remain in the tailing, settling with the tailing solids, and will present no additional waste problems.

Stack emissions from the coal-fired boilers will be subject to a precipitator to remove fly ash. It is estimated that less than 190 pounds per day of particulate matter will be released to the atmosphere. Fly ash collected from the scrubber will be sent to the tailing retention system.

Liquid laboratory wastes will be discharged to the tailing retention system.

4.3.3 No effluents are to be released into waters of the United States. Therefore, no request will be made to obtain water quality certification under Section 401 and discharge permits under Section 402 of the Federal Water Pollution Control Act.

4.4 Contaminated Equipment

All equipment contaminated in the mill process will be buried in a designated zone per 10 CFR within the restricted area or decontaminated as specified in Annex C Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use, NRC, November, 1976. All solid waste from the milling process will be buried with overburden material in accordance with 10 CFR 20.304 and 20.401.

5.0 OPERATIONS

5.1 Corporate Organization and Administrative Procedures

5.1.1 Energy Fuels Nuclear, Inc. Organization

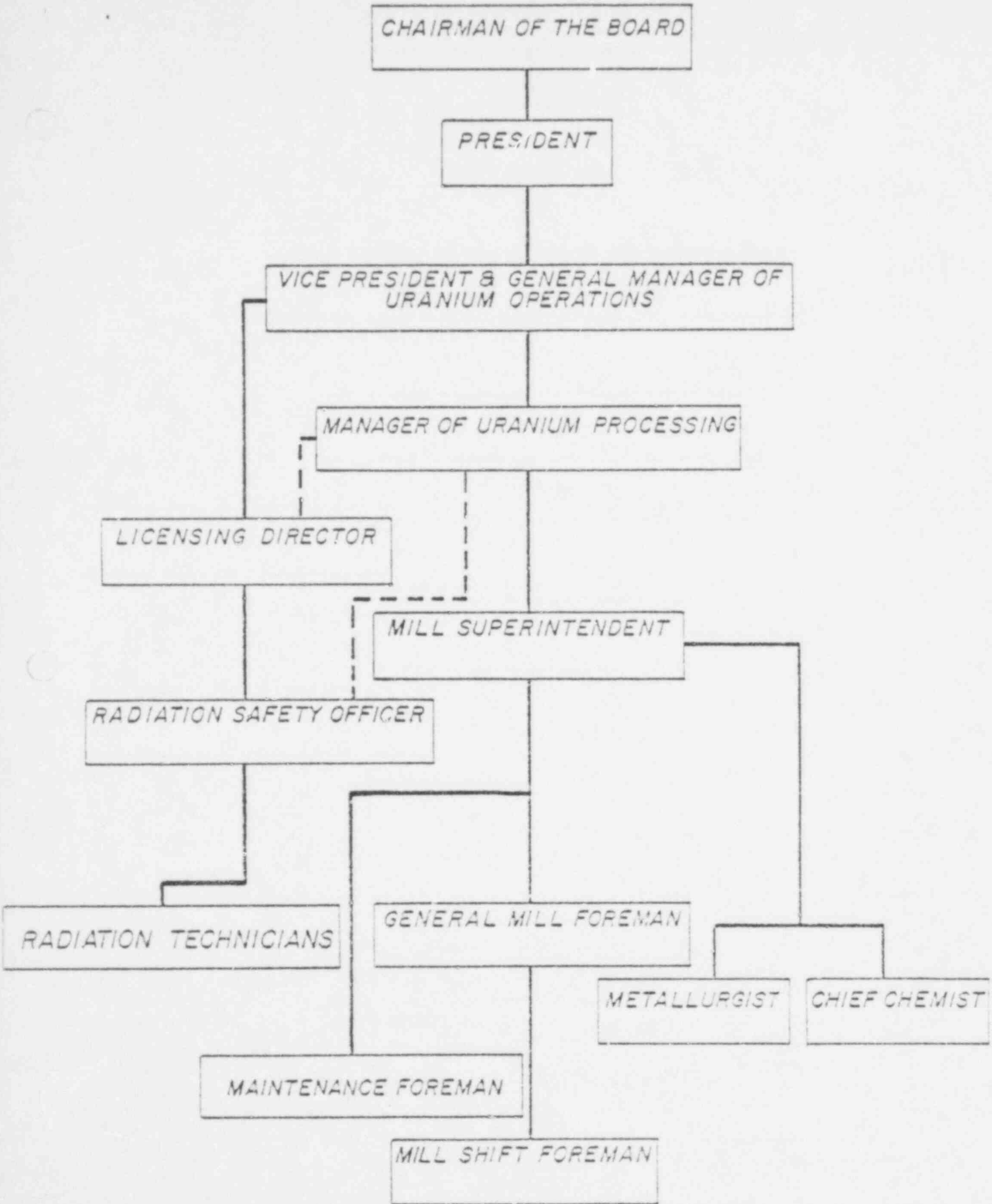
Energy Fuels Nuclear, Inc., is a privately owned company with headquarters in Denver, Colorado. The company's business is the mining and processing of uranium bearing ores to produce uranium concentrate (yellow cake), and by-products. The relevant company organization and the personnel occupying each position are shown in Table 5.1.1-1.

The authority and responsibilities of each level of management as shown in Table 5.1.1-1 are as follows:

The Chairman of the Board is responsible for all of the practices and decisions made by those management personnel reporting to him. He delegates the authority for the decisions in the uranium mining and mill operations to the President and Vice President of Uranium Operations.

The Vice-President (and General Manager) of Uranium Operations reports directly to the President of the Company, and is responsible for uranium mining and milling operations. The Radiation Safety Officer (RSO) reports through the Licensing Director to the Vice President, who is ultimately responsible for all recommended radiation safety programs and any changes to these programs. He will further assure the implementation of such approved program through the line organization. a

The Manager of Uranium Processing is responsible to the Vice President of Uranium Operations for conducting the company's milling operations in a safe and efficient manner. These responsibilities include production operations, maintenance procedures, and overall security practices.



ENERGY FUELS NUCLEAR ORGANIZATION
PROCESSING DEPARTMENT
TABLE 5.1.1-1

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The specific responsibilities for enforcing the company's operational procedures and safety practices at the mill will be those of the Mill Superintendent, who will report directly to the Manager of Uranium Processing. The Mill Superintendent will supervise the mill staff, and be responsible for the day-to-day operating decisions, including changes in operating procedures and equipment.

The Metallurgist will be responsible for the metallurgical control of the plant, which will include mill recovery and reagent usage. He will also be responsible for the metallurgical control of the plant, which will include mill recovery and reagent usage. He will also be responsbile for the metallurgical testing required to insure that optimum conditions are being maintained in the mill and that accurate sampling is being conducted in the mill and sampling plants. He will be responsible for recommending any changes to the processes used in the mill circuitry. He will report directly to the Mill Superintendent, and work closely with the Mill Foreman.

The Chief Chemist will be responsible for the Chemical Laboratory and the analytical work performed in the laboratory, including ore lot assays for ore purchasing and mill control assays. The Chief Chemist will report to the Mill Superintendent and will supervise a staff of chemists and analysts. He will also work closely with the Mill Foreman.

The Radiation Safety Officer, with the assistance and supervision of the Licensing Director and the assistance of his staff of radiation safety techni ians, is responsible for developing, implementing, monitoring, ' reporting functions that assure the plant safety and the radiological protection of plant personne_ and the public. This responsibility includes training of all personnel in radiation and industrial safety; monitoring plant effluents; monitoring, evaluating, and maintaining records of personnel exposures and plant area surveys; posting radiation areas; providing for radiation safety staff surveillance of tasks in higher than routine radiation exposure areas; maintaining plant radiation monitoring equipment; and preparing reports to regulatory agencies. He is also responsible for investigating personnel safety related incidents. He reviews normal plant procedures and equipment for radiological safety. Both the Radiation Safety Officer and the Licensing Director will have sufficient authority to enforce regulations and assure worker health and safety in the mill. They will have the authority to cancel, postpone, or modify any operation or process which poses an immediate radiological hazard. Radiation technicians immediate radiological hazard. Radiation technicians make up the RSO's staff and assist the RSO in implementing the radiological safety program.

The Radiation Technicians will perform the duties of the RSO when the RSO is absent due to sickness, vacation, personal leave, etc. The Radiation Technicians will be assigned virtually full time to radiation protection activities. If they are asked to perform other duties, these will not be in production or in areas where their authority or disposition to perform radiation protection duties is impared.

5.1.2 Management Controls

Activities at the mill involving design, procurement, construction, preoperational checkout, operations and maintenance of safety related equipment will be authorized by written, approved procedures. These procedures will comply with Energy Fuels Safety Standards, the conditions of the operating license, and existing regulatory requirements.

Administrative policies and procedures will be documented to clearly delineate the authorities and responsbilities for each level within the organizational structure with regard to safety related activities.

Written operating procedures shall be maintained specifically for the radiation safety program and the environmental monitoring and control program, and written procedures pertaining to all activities conducted in an area shall be available in each area where radioactive material is processed, handled, or stored, and shall be reviewed at least quarterly. In addition, for any work or maintenance for which there is no effective operating procedure, and for any non-routine maintenance or repair work, a special work permit signed by the radiation safety staff shall be prepared and used for performing these activities.

The results of sampling, analysis, surveys, monitoring, equipment calibration, training, reports on audits and inspections, subsequent reviews, investigations and corrective actions will be documented and maintained for at least five years. a

All radiation protection procedures will be documented within a Health and Safety Manual. The Manual will detail health and safety procedures employed for radiological protection; describe monitoring equipment, and its locations and use; define monitoring and repoting procedures; and describe the use of Special Work Permits as authorization to perform work in areas which might result in exposures greater than 25% of 10 CFR 20, Appendix B limits (hereafter referred to in this context as 10 CFR 20). a

The Radiation Safety Officer and Licensing Director will conduct a quarterly review (audit) of all written operating procedures in conjunction with the other members of the Internal Audit Committee (see Section 5.1.3)

A system of routine preventive maintenance is provided to assure plant reliability. The system provides for a specific schedule of preventative maintenance on safety related equipment to be carried out in accordance with approved procedures. However, where the need for a nonroutine work or maintenance activity arises in areas which could lead to exposures in excess of 25% of 10 CFR 20 limits as determined by the RSO, approved Special Work Permits will be required. The procedures of obtaining a Special Work Permit will be as follows: a

1. The need for the nonroutine activity will be defined and approved, in writing, by the General Mill Foreman or Mill Superintendent. Information on the specific work locations, duration of time at the location, types of work to be performed, and personnel to be utilized, will be included. This information will be provided on the Special Work Permit.

2. The Radiation Safety Staff will review the Permit and, after insuring that the proposed work will not present a health hazard to the employees, approve the Permit in writing. The Permit will stipulate the duration of time a

that the defined personnel shall work in the location and all personnel protective equipment to be supplied. The RSO will provide the necessary surveillance and respiratory equipment.

3. All supervisors will be given training in and copies of, the requirements for using Special Work Permits, and the permits themselves will be kept on file for five years.

5.1.3 Radiation Safety Inspection and Audit Program

5.1.3.1 Inspection Program

A daily documented visual surveillance of all mill areas will be performed by the operating mill foreman to insure proper implementation of good radiation safety practices and a weekly documented inspection by the Radiation Safety Staff of all work and storage areas, with a report to the RSO on any items of non-compliance with operating procedures, license requirements, or safety practices affecting radiological safety. The RSO shall perform a monthly documented walk-thru inspection of all work and storage areas to ensure the radiation safety program is working as required.

5.1.3.2 Audit Program

An Internal Audit Committee, composed of the Radiation Safety Officer, Licensing Director, Mill Superintendent, Chief Chemist and the Manager of Uranium Processing, will be formed. The Audit Committee will:

--Perform a quarterly review/audit of the radiation safety program including procedures, exposure records, and data, records from radiation safety staff reviews (including the results of the monthly review by the RSO of exposure records) and for the inspection, equipment calibration, and training programs. A written report to the Vice President of Uranium Operations, describing the results of the audit, results of follow-up actions, and recommendations of the Committee concerning the radiological safety program will be provided. Particular emphasis will be placed on operating anomalies and records of violations of procedures.

The Vice President will be responsible for taking action concerning these recommendations. Copies of reports will go to the RSO, Licensing Director, and Manager of Uranium ocessing. a

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--Perform follow-up inspections to determine if violations have been corrected, and anomalies either eliminated or satisfactorily explained.

--Investigate immediately any abnormal occurrences relating to personnel radiological safety, and assure that corrective actions are taken to correct the situation. The Committee must approve any corrective actions taken.

--Perform unannounced, unscheduled inspections of phases of the plant operations, reviews of exposure records and examination of required logs. a

--Note trends and deviations with respect to the ALARA Concept (Section 5.1.4), and report same to higher management levels.

The committee will insure that the plant safety program is maintained at the highest level of performance, and in compliance with all governmental regulations.

5.1.4 Program to Insure As Low As Reasonable Achievable Exposure and Releases.

The program that Energy Fuels Nuclear, Inc., has developed to insure that employee exposures and effluent releases are "as low as is reasonably achievable" (ALARA) is the sum total of all the design barriers, operating procedures, management controls, and personnel experience and expertise built into the plant.

The plant design, (see Sections 3.0, 4.0, and 5.5.10) including the equipment to control and prevent effluent releases and to sample and monitor the working environment, reflects the most advanced proven technology currently available. Potential releases, both in the plant and to the environment, will be held within the performance capability

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of the control equipment through regular inspection and maintenance of the equipment.

Members of the committee will establish operating procedures and training programs (see Sections 5.1.3 and 5.3) and audit them frequently to assure that routine operating conditions provide the maximum protection to workers against exposure.

Extensive programs to monitor both the work environment and the releases for the plant will be conducted. These will include:

--Monitoring of the work environment (Section 5.5.1.1)

--Personnel monitoring programs (Sections 5.5.1.2 and 5.5.3)

--Mill area monitoring programs (Section 5.5.2.2) including external radiation surveys and airborne radionuclide monitoring.

--Bioassay programs (Sections 5.5.4)

--Contamination control programs (Section 5.5.5)

--Effluent and environmental monitoring programs (5.5.6 and 5.5.7)

In addition to the mechanical and operational controls, a major factor in the overall program to achieve ALARA exposures and releases is the qualifications of the staff (see Section 5.2). All management personnel involved with plant safety have extensive experience in similar positions, and are trained to use state-of-the-art technology. a

5.2 Qualifications

Guidelines have been establihsed to provide the minimum experience in radiation safety and contamination control at a nuclear facility. He must have demonstrated experience in the performance and/or management of radiation safety, environmental, and occupational health programs, with at least three (3) years experience in these positions.

Radiation Safety Officer:

Must have a B.S. degree in environmental or radiological science, or equivalent relevant experience in radiation safety and contamination control at a nuclear facility. He must have demonstrated experience in the performance of radiation safety, environmental,and occupational health activities with at least two (2) years of experience in these positions.

Radiation Technicians

Perferably will have at least an associate degree in a scientific or technical field, but in any case a high school diploma. They will have had sufficient training and/or experience to allow them to understand and carry out their assigned surveillance, sampling, and analytical duties. In addition, they will receive special training and indoctrination from the RSO regarding the execution of their specific tasks, and what is required to assist the RSO in carrying out his duties.

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Chief Chemist:

Must have a B.S. degree in chemistry or chemical engineering, or equivalent analytical chemistry experience. In addition, he must have at least two (2) years experience as a chemist in mining or related industries.

Metallurgist:

Must have a B.S. degree in Metallurgical Engineering or equivalent metallurgical experience.

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General Mill Foreman:

Must have a B.S. degree in physical science or equivalent relevant experience in the milling industry. He must have a demonstrated competence in the technical aspects of uranium milling processes, knowledge of safety related aspects of milling. A minimum of three (3) years management experience in milling operations, preferably in a uranium mill, is required.

5.3 Training

The purpose of an in-house radiaton safety training program is to place in proper perspective, for the employee, the potential short and long term radiation hazards associated with the job; to acquaint him with the practices instituted by management to keep occupational exposures as low as practicable; and to assure that he has an understanding (both initially and over the duration of his employment) of the radiation safety procedures he should be following.

Each person, upon reporting for employment at the mill, will receive, from the RSO, instruction in mill and personnel safety, including radiological safety procedures. The instruction would include on-the-job demonstrations of proper safety precautions, and measures to be taken to minimize radiation exposure. These instructions and precautions are summarized in the form in Appendix C. Each employee will also be provided a safety manual which covers radiation safety and industrial safety procedures including personal hygiene instructions for use of monitoring and safety equipment, and procedures for handling spills and maintaining clean working conditions. Each employee will be required to pass a written test on his or her understanding of radiation safety and hygiene.

The employee's understanding and retention of proper practices will be validated by the supervisor at the work location through use of periodic checks. If the employee does not exhibit sufficient grasp of the safety procedure he will receive further instruction from his supervisor. This procedure will be repeated until satisfactory retention is demonstrated. On-the-job training and testing will be conducted and the results recorded to assure that each employee understands applicable radiation protection practices.

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In addition, a minimum of one-half hour of the monthly mill safety meeting will be set aside for discussion of radiation safety procedures and, on an annual basis, one of the monthly meetings will be set aside for reindoctrination of the mill staff in radiation safety. Each employee wil be teste. annually by the radiation supervisor on his understanding of radiation protection as it is related to his job. All supervisors will be required to periodically attend specific training courses in radiation and industrial safety, so that they will be better able to provide and evaluate specific job-related training. All personnel will be retrained every two years and records will be kept of the training program

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5.4 Security

The mill and tailings area will be fenced and will be posted with "Restricted Area" signs in accordance with 10 CFR 20.203. Exemption is requested from the requirements of Section 20.203(e) (2) and 20.203(f) (2), 10 CFR 20 for areas and containers within the mill since all entrances to the mill property will be conspicuously posted in accordance with Section 20.203(e) (2) and with the words "Any area or container within this mill may contain radioactive material." Refer to Plate 2.1-2 showing a plot plan of the mill and tailings area delineated with the fence around the Restricted Area.

The plant will usually be operated seven (7) days per week, twenty-four (24) hour per day. All visitors will be required to register at the office and will not be permitted inside the plant restricted area without proper authorization and escort. Access to the restricted area by the public will be strictly controlled by physical barriers and security personnel. Contractors having work assignments will be given security, safety and radiation protection

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orientation prior to performing their duties without escort.

5.5 Radiation Safety

The radiation safety program at the Energy Fuels Nuclear facilities will be conducted at several levels simultaneously.

It will consist of management controls, administrative procedures, and monitoring programs. Management controls and administrative procedures will be designed to assure the existence of, and adherence to, an in-plant program and the implementation of corrective measures if procedures or standards have been violated. Monitoring programs will include monitoring personnel exposures, areas where mill personnel work, mill effluents and the offsite environment. Monitoring of personnel exposures and areas where mill personnel work would assure that exposures are being maintained within the standards established by federal regulations. Monitoring of mill effluents and the offsite environment would assure that man and biota are not being exposed to excessive radiation levels.

5.5.1 Mill Personnel Monitoring Program to External Radiation

The purpose of the personnel monitoring program will be to provide accurate and timely measurements of personnel exposures. This program will provide a means of determining whether these exposures are within allowable limits and will permit action to be taken to bring exposure levels to as low as is reasonably achievable. Areas with levels that would lead to exposures in excess of 25% of limits set by 10 CFR 20 will be given special study for immediate improvement. a

5.5.1.1 Film badges, obtained from R.S. Landauer, Jr., Company; Glenwood, Illinois, or an equally competent supplier, will be utilized to determine individual radiation exposures. Badge specifications are given in Section 3.7.7. Badge recordings will be filed in compliance with 10 CFR 20.101. a

Film badges will be assigned to each new employee permanently assigned to areas where badging is prescribed (Table

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5.5-1) within thirty (30) days of the date of assignment. The cumulative occupational dose of these employees will be filed in accordance with 10 CFR 20.202(a). If total quarterly exposure exceeds 25% of the 10 CFR 20 limits, the personnel involved will be assigned to duties in areas of known lower radioactivity and the area studied. a

5.5.1.2. Mill Area Monitoring Program

Radiation monitoring will be used throughout the mill to protect plant personnel. This program will also assist in detecting abnormal operating conditions through measurements of anomalous radiation levels. A combination of alpha, beta, and gamma radiation measurements will be taken monthly at locations in the restricted area as described in Table 5.5-2. Calibration procedures are outlined in Section 3.7.7.

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5.5.1.3 Sources of radiation other than natural materials will be monitored to detect leaks from sealed sources or inadequate shielding of x-ray equipment. Such monitoring will include the sources used in density measuring devices and analytical x-ray equipment in the laboratory.

5.5.2 Airborne Radionuclide Monitoring

Airborne radionuclide concentrations in dust in the mill area will be determined by monthly analysis of samples taken each month at the locations listed in Table 5.5-3. Sample duration time is 60 minutes. An air sampler equivalent to Scientific Industries, Inc. No. 25004 with built-in air flow indicator will be used to collect airborne dust samples. The sampler will be calibrated prior to each usage. These samples will be analyzed for natural uranium content. Step-by-step procedure for analyses is shown in Appendix D. Analyses will be made semi-annually for thorium-230 and radium-226 levels. A statement regarding quality assurance of analyses is found in Section 7.5. a

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TABLE 5.5-1

PERSONNEL PARTICIPATION IN FILM BADGE PROGRAM

JOB STATUS	ESTIMATED NUMBER OF EMPLOYEES
Loader Operation	3
SAG Mill Operator	3
Leach Operator	4
Washing Circuit (CCD)	4
Yellow Cake Precipitation Drying	4
Yellow Cake Packaging	1
Boiler Operator	4
Solvent Extraction & Filtration Operator	4
Reagent Control Operator	4
Vanadium Precipitation and Drying	8
Helpers	8
Mechanics & Helpers	22
Instrument Mechanic	1
Electricians	2
Yardmen	2
Warehouse	3
Millgrind Operator	3
Mill Superintendent	1
Mill Foreman	1
Maintenance Foreman	1
Shift Foremen	4
Sample Preparation Person	1
Sampling Plant Foreman	1
Sampling Plant Operator	1
Vanadium Plant Supervisor	1
Chief Metallurgist	1
Chief Chemist	1
Chemist	4
Analyst	4
Metallurgist	1
Metallurgical Technician	2
Radiation & Safety	3
TOTAL	107

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TABLE 5.5-3

AIRBORNE RADIATION SAMPLE LOCATIONS

SAMPLE IDENTIFICATION	LOCATION DESCRIPTION
BA-1	SAG Mill Area
BA-2	Leach Tank Area
BA-3	Washing Circuit CCD Thickeners
BA-4	Solvent Extraction Building--Stripping Section
BA-5	Solvent Extraction Building--Extraction Section
BA-6	Yellow Cake Precipitation and Wet Storage Area
BA-7	Yellow Cake Drying and Packaging Area
BA-8	Packaged Yellowcake Storage Room
BA-9	Laboratory Sample Preparation Room
BA-10	Lunch Area
BA-11	Change Room
BA-12	Ore Storage
BA-13	Ore Buying Station Primary Jaw Crusher
BA-14	Ore Buying Station Secondary Jaw Crusher
BA-15	Ore Buying Station Sample Prep Room
BA-16	Ore Buying Station Final Vezin Sample Area
BA-17	Administrative Building

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Mill operating personnel working in processing areas where the potential personnel exposure might exceed 25% of 10 CFR 20 limits will be required to wear individual air samplers during the time worked in these areas. Operating and maintenance personnel working in areas of the mill where exposure from dust inhalation is intermittent will be required to wear air samplers on a periodic basis to establish typical exposures for these individuals.

Individual air samplers will be used to provide approximation of the amount of uranium dust inhaled by the employee carrying the sampler. The samplers (MSA Model S Montaire Sampler, or equivalent) will have built-in air flow indicators for calibration, will be battery powered and have air pumps with the suction orifice of the pump covered by a paper filter; the pump in-take will normally be carried in the lapel area ("breathing zone"). The sampler will be calibrated at least once each eight hours. The dust samples collected on the filter discs will be analyzed for the natural uranium content by fluorometric methods.

The sample areas listed in Table 5.5-3 will also be sampled monthly and reported for radon daughter activity which will be measured using an MSA Air Sampler No. 458475 or equivalent and an Eberline Counter PS-2 with SPA-1 detector head or equivalent. A measurement sensitivity of approximately one picocurie per liter is achievable. The modified Ksnetz method of sampling and analysis will be used, and results will be reported as percentage of working level (% WL).

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5.5.3 Radioactive Materials Intake

When routine work is performed, assessment of an individual's exposure to airborne natural uranium and radon daughters will be calculated using the results of the prescribed sampling in each area and the time spent in each area of exposure as determined by careful observation of the task performed by each individual exposed. Quarterly breathing zone samples using prescribed portable samplers will be taken to assure reliability of this procedure. Individuals wearing samplers will be determined by analysis of routine samples and their likelihood of reaching the action level of 25% MPC.

When non-routine maintenance is performed, accurate time records will be kept to calculate exposure to natural airborne uranium. Dust samples taken while work is being done will be used in this exposure assessment. Periodic breathing zone samples using prescribed portable samplers and approved cyclone attachment, will be taken to assure accurate assessment of exposure during non-routine work assignments.

The observed time spent in each area where routine work is performed, and where exposure beyond the 25% MPC action level is likely, will be recorded and the accuracy of the observation reviewed quarterly, or when major changes are made in job assignments.

If an employee reaches an action level of 25% of MPC based on TWE (time weight exposure) over a period of one quarter, the Radiation Safety Officer 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 is as low as is reasonably achievable.

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5.5.4 Bioassay Program

The bioassay program will conform to the program outlined in Regulatory Guide 8.22. Where the word "should" appears in the Regulatory Guide, it will be interpreted as meaning "shall."

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5.5.5 Contamination Control Program

5.5.5.1 Personnel

All personnel working within the mill area will be provided with change room, shower, and laundry facilities. Employees working in the yellow cake product areas or performing maintenance on equipment from these areas will be provided coveralls and be required to change and shower prior to leaving the mill. All employees will also be required to monitor themselves with a survey meter prior to leaving the mill. Alpha contamination on skin or clothes greater than 1,000 dpm/100 cm^2 shall be cause for additional showering or decontamination and an investigation by radiation safety staff. Spot checks with a survey meter also will be made at least quarterly. Coveralls and contam-

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inated clothing will be laundered on site. A respitatory protection program will include written procedures and personnel training in the use, care and selection of respirators as outlined in ANSI-Z-88.2-1969.

5.5.5.2 Clean Areas

Surface contamination surveys of clean areas, e.g., administration offices, eating areas, change rooms and control rooms, will be conducted on a bi-weekly basis using the "wipe sample" method in accordance with Annex C, "Guidelines for Decontamination of facilities and Equipment Prior to Release for Unrestricted use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material." Areas which have wipe sample activities greater than prescribed by Annex C will be resurveyed and decontaminated, and an investigation to control the source shall be initiated by the RSO.

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5.5.5.3. Materials and Equipment Release

Equipment and/or materials, excluding ore haulage vehicle, will be surveyed prior to leaving the site. The survey will be conducted using an alpha survey meter. Materials with activities greater than prescribed by Annex C will be resurveyed, wipe tested and decontaminated as required. Survey radiation levels will be recorded.

5.5.6 Environmental Surveillance Program

An environmental monitoring program designed to assess the effect of mill operations on the unrestricted environment, will be performed on a regular basis around the mill and tailings area. This program complements the effluent monitoring program (see section 5.5.7). The operational monitoring program is summarized in Appendix G, and the quarterly assurance program is outlined in Section 7.5.

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5.5.7 Effluent Monitoring Program

A pr gram to periodically monitor the airborne effluents from various release points in the mill at Blanding and at the site boundary, and the liquid effluents (if any) from the tailings area will be conducted. Sampling points are shown in Appendix E and the groundwater monitoring program is treated in detail in Appendix A-B. The quality assurance program is outlined in Section 7.5.

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A direct comparison with the background levels of the analyzed radionuclides will be possible, because the preoperational sampling program encompasses the same locations and utilizes the same instrumentation and collection procedures. Thus, the proposed program will assure compliance with 40 CFR 190.

5.5.8 Radiation Safety Program - Radioactive Sources

Sources of radiation from other than natural mat rials will be monitored quarterly to detect leaks from sealed sources or inadequate shielding of x-ray equipment. Sources monitored will incl de the sources used in density measuring devices and analytical x-ray equipment in the laboratory.

5.5.9 Interim Stabilizatin Procedures

Dusting from the tailings disposal area will be controlled by the use of a sprinkling system tht will be utilized as required. Fugitive dust from the ore piles will be controlled by a sprinkling system. Keeping the tailings moist or under water in this manner will prevent wind transport and subsequent saltation.

It should be noted that the tailings management plans (see Section 5.5.12) will require that each cell be reclaimed soon after it is filled, thus minimizing the period of exposure of the tailings.

5.5.10 Mill Ventilation and Dust Collection Systems

The dust collection systems at the White Mesa mill are described in Table 4.1-1, and in Sections 3-7.6, 4.1 and 4.2.

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Uranium drying and packaging operations will be conducted in an enclosed building maintained under negative ventilation. Yellow cake particles in the free gases will pass through a wet fan scrubber. The manufacturer's stated efficiency for this type of scrubber is greater than 99%.

The processing building and equipment will be provided with ventilation fans to control the concentration of gaseous effluents. The solvent extraction building will be equipped with a forced-air ventilation system. These ventilation and dust collection systems will be inspected at least monthly and tested at least quarterly. Other checks and assurances that the ventilation system is working properly are addressed Section 4.2.2.

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5.5.11 Decommissioning Program

Upon termination of milling activities, the facility will be decommissioned and the site reclaimed. Energy Fuels will perform these activities in accordance with regulatory requirements then in existence, using accepted industrial practices and procedures.

It is not possible at this stage to delineate the specific details of the decommissioning and reclamation program because of the lack of prior precedent and regulatory guidance. It is our understanding that regulatory guidance is currently being prepared by the NRC which will be available within the next few months. In addition, Battelle Northwest labora-

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A thickness of 9.0 feet of silt-sand reduces the surface radon flux to less than twice background. A mixture of silt-sand and sand or a cover of sand would require 16 feet or greater than 20 feet, respectively, to achieve the same goal.

Gamma Radiation Attenuation: Theoretically, each foot of packed earth cover will reduce the gamma exposure rate by approximately an order of magnitude. (Gamma Ray attenuation is heavily dependent on atomic electron interactins e.g., Compton collisions, photoelectric absorption, so that the absolute type of material, clay, etc., is irrelevant to this discussion. Thus, considering the worse case, 9.0 feet of cover material, the reduction is of the order of 10^9. This would reduce the gamma dose of 7,736 mrem/year to significantly less than 0.001 mrem/year.

5.5.12.6 Tailing Reclamatin Alternatives

Several tailing reclamation concepts were considered prior to selection of the proposed plan; these are discussed in Section 9.0 and Appendices H & I of the Environmental Report and Appendix A-A of this report.

5.5.12.7 Conclusions & Recommendations:

See Appendices A-A & A-B for the Applicant's Proposed Tailing Management and Reclamation Plan.

5.5.13 Financial Arrangements

Energy Fuels Nuclear, Inc., will bond in accordance with an approved reclamation and decommissioning plan and in accordance with applicable rules and regulations. The NRC will be consulted on any surety arrangements made with the State of Utah. a

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The probability categories in Table 6.1-1 are defined as follows:

1 = Probable - expected to occur during operating life of plant.

2 = Improbable - possible one or two of these events can be expected to occur during the life of the plant.

3 = Highly Improbable - not expected to occur during the life of the project.

6.1.1 Failure of Tailing Retention and Transport System

The tailing retention system has been designed in accordance with Regulation Guide 3.11 to eliminate the possiblity of tailing escaping to the surrounding environment. The operational plan and construction sequence call for a completely constructed, empty cell downstream of each of the first five cells as soon as any tailing sand or solution enters the upstream cell. The final tailings dike will be constructed using 6:1 slopes on the upstream and downstream faces as well as a heavy layer of riprap on the downstream face to prevent erosion. An adequate free board will be maintained to contain the probable maximum flood throughout the the life of the cell. This design should eliminate any breaching of the final tailing dike.

6.1.2 Flood Water Breaching of Retention System

In general, flood water breaching of tailing embankments presents one of the greatest dangers for the sudden release of tailing and impounded water. For this project, however, because of the additional unused downstream cell constructed below the first five cells, and the conservative design on the last dike, this danger is greatly reduced. Within the tailing cells themselves, sufficient volume will be available to store any flood which would occur, including the probable maximum flood. The drainage basin upstream of the tailing retention facility will not contribute water to the impounded area. Flood waters which flow towards the tailing dikes will be stored on the north side of the dike where flood waters will be evaporated over a period of time (See Appendix A).

The possibility of floods in Westwater Creek, Corral Creek or Cottonwood Wash causing damage to the tailing retention facility is extremely remote. This is due to the approximately 200 foot elevational difference between the streambeds of the creeks and the toe of the tailing dikes.

6.1.3 Overflow of Tailing slurry

The operational plan and construction sequences call for a completely constructed, empty cell to be downstream of the first five tailing cells. Therefore, any overflow of tailing from any of the first five cells would flow through a concrete lined overflow into a completely lined tailing cell.

6.1.4 Structural Failure of Tailing Dikes

See Appendix A-B

The final tailing cell has been conservatively designed with 6:1 slopes on the upstream and downstream faces as well as a heavy layer of riprap on the downstream face to prevent erosion. The tailing discharge system will be checked at least once per shift, or every eight hours, so there would be no possible way for the tailing to build up and overflow the final dike. a

6.1.5 Seismic Damage to Transport System

The rupture of the tailing retention slurry pipeline would result in a minor impact on the environment. the tailing retention system pipe, as planned, will be in the same drainage basin as the retention system. any tailing slurry released by a pipe rupture, no matter what the cause, would flow downhill where it would be impounded against the tailing dike. This would prevent any spillage or escape of the tailing slurry (see Appendices A and A-A)

6.1.6 Minor Pipe or Tank Leakage

Minor leaks resulting from loose connections in piping or tanks overflowing, etc., will be collected in sumps designed for this type of spill. Sump pumps will be used to return the material to the circuit and the reason for the spill determined and corrected. No environmental impact would result from this type of occurrence.

6.1.7 Major Pipe or Tank Breakage

All of the mill drainage including large chemical spills from storage tanks will flow into a large catchment basin upstream from the tailing impoundment site. See Section 3.6 for detailed description of tank containment systems.

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6.1.8 Electric Power Failure

Temporary loss of electrical power to various sections within the mill or throughout the entire mill would cause no more than a tank or vessel to overflow temporarily. No impact would result from such an occurrence. Emergency lights will be situated in various parts of the mill that will activate during power failure enabling personnel to take appropriate action.

Electrical, mechanical, or water supply failure to the yellow cake scrubber fan would be noticed very quickly, as the termperature on the yellow cake dryer would elevate rapidly. An audible signal would activate as a result of the increase in temperature and the dryer would be shut down automatically due to the interlock system described in Section 3.7.6. No impact would result from such an occurrence. a

6.1.9 Process Equipment Malfunction and/or Operator Error

Process equipment malfunction and operator error could result in several different types of accidents. However, none of these would result in any environmental impact, with the exception of a yellow cake dryer explosion which is described in Section 6.1.12

6.1.10 Tornado

The most significant environmental impact from a tornado would be transport of tailing from cells or liquids from mill process tanks into the environment. This dispersed material would contain some uranium, radium and thorium. An increase in background radiation could result and, if sufficient quantities are detected and isolated, they would be cleaned up.

6.1.11 Minor Fire

Small fires that might result from welding in the maintenance shop or involving small amounts of combustible material could occur but would be unlikely because of industrial safety precautions. Such a fire would be extinguished rapidly and no environmental impact is expected.

6.1.12 Major Fire

The most likely place a major fire would occur would be in the solvent extraction building or in the yellow cake or vanadium dryers.

A fire protection system will be utilized for the main mill building and solvent extraction building which will consist of an automatically activated sprinkling system capable of delivering 2000 gallons per minute at 100 psig for approximately 2 hours. In the event of a fire in the solvent extraction building, the solvent would be flooded at a rate of 2000 gpm and would overflow the settler tank. The solvent would be carried outside of the building into a catchment basin where additional water could be added, if needed. a

6.2 Transportation Accidents

Concentrates will be shipped in sealed 55-gallon drums built to withstand normal handling and minor accidents. Each drum will contain approximately 900 pounds of yellow cake. A maximum of 60 drums will be shipped in each closed van. The drums will be sealed and marked "Radioactive LSA" (low specific activity), and the trucks will be properly marked. Because most of the radioactive daughter products of uranium are removed in the extraction process and radioactive buildup of daughter products is slow, yellow cake has a very low level of radioactivity and is, therefore, classified by the Department of Transportation as a low specific material.

The environmental impact of a transportation accident involving release of the product would be minimal. Even in a severe accident, drums would likely be breached and, since yellow cake has a high density, it would not easily disperse. More than likely, the drums and any released material would remain within the damaged vehicle or in an area of close proximity of the accident site.

Even if the yellow cake were to spill out of the vehicle, it could be detected by sight and by the use of survey equipment. The yellow cake would be recovered to prevent any significant environmental impact. At most, the cleanup operation would involve removing small amounts of pavement, topsoil and vegetation in the immediate area of the accident.

(Rev. 7/79a)

Proper and safe shipment guidelines for radioactive materials will be the responsibility of the Radiation Safety Officer, with actual shipment being the Shipping Department's responsibility.

Driver or carrier instructions will be given to each driver of each transport leaving the plant site with a load of yellow cake. These instructions will consist of an explanation of the product, preliminary precautions at the accident site, whom to notify and what to do in case of fire. A copy of these instructions is included in this application in Appendix F.

6.2.1 Responsibility for Yellow Cake Transportation Accident Response

Energy Fuels Nuclear, Inc. will contract with a carrier properly trained to handle any yellow cake transport accident. Transportation of the product and response to an accident in route will be in accordance with applicable DOT regulations and guidelines. a

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6.2.2 Spill Countermeasures

In the event of a transportation-related accident on the mill property, immediate containment of the product will be achieved by covering the spill area with a plastic sheeting or equivalent material to prevent wind and water erosion. If sheeting is not available and depending on where the spill occurs, soil from the surrounding area may be used. Perimeter ditching will be used to contain the spill if it should occur in an area where runoff could result from precipitation.

All human and vehicular traffic through the spill area will be restricted. The area would be cordoned off if possible. All persons not participating in the accident response will be restricted to 50 feet from the accident site. Local law enforcement officers will be notified and may be asked to assist in controlling traffic and keeping unauthorized persons out of the spill area.

Covered containers and removal equipment--i.e., large plastic sheeting, radioactive signs, ropes, hoses, shovels, vacuums, axes, stakes, heavy equipment (front-end loaders, graders, etc.), will be available to clean up the yellow cake. If conditions warrant, water will be applied to the spilled yellow cake in a fine spray to assist in dust abatement.

Gloves, protective clothing, and any personal clothing contaminated during cleanup operations will be encased in plastic bags and kept in the plant area for decontamination or disposal. a

Any fire at the site will be controlled by local experienced fire fighting personnel wearing appropriate respiratory protective equipment.

Response team members will have a thorough knowledge in basic first aid and of the physical hazards in inhalation, ingestion, or absorpotion of radionuclides. Team members will adequately protect themselves.

The NRC will be notified promptly of any accident of this type.

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6.3 Emergency Procedures

Emergency procedures will be established by the Radiation Safety Officer for accidents that could occur. Personnel safety, environmental conditions and prompt corrective actions will be taken as well as notification of regulatory officials. Employees will be indoctrinated as to emergency and remedial measures in the event of an accident which poses a health and safety hazard. These will include evacuation procedures, clean-up measures, and follow-up medical examinations if warranted. a a

Tanks which are likely to overflow will be equipped with high level alarms to reduce the possibility of spillage due to tank overflow. Dikes and/or curbs will be constructed around process and storage tanks (excluding the water tank) to confine the material in the event of tank spill. In the event of an ammonia tank spill, the material would be expected to evaporate quickly. A sulfuric acid tank spill would flow via a specially excavated channel to the catchment basin where it would be fully contained and subsequently cleaned up. Tank safety and containment is discussed in detail in Section 3.6.

Due to the design of the tailings disposal system (Appendix A-B), a break or breach in the containment area is not likely. In this event, however, any released material will be contained by the downstream catchment dike. If a break occurred, the pumping system would be shut off, personnel removed from the immediate area, and the NRC notified. The break would be repaired and the affected area cleaned up in the safest and most expeditious manner. The advice and direction of the NRC would be sought and heeded throughout the episode.

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Procedures for responding to other types of emergencies requiring removal or isolation of personnel (e.g., evacuation in case of fire, protection of employees from various spills and pipe breaks, and general first aid) will be developed and documented in writing prior to mill start-up. a

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7.0 QUALITY ASSURANCE

The Quality Assurance Program will be the responsibility of the Vice President of Operations, and will be carried out in accordance with Regulatory Guide 4.15. This program will apply to design, construction, mill start-up and mill operations.

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7.1 Design

It will be the responsibility of the Vice President of Operations to select a competent engineering firm to design the mill and tailings retention system. The Manager of Uranium Processing will be responsible for working with and continually checking the engineering firm's design activities. This will include ascertaining compliance with all local, state and federal codes and regulations. He also will see that qualified personnel review design criteria with regard to safety and radiation control, and will approve all specifications for materials of construction. a

7.2 Construction

The Vice President of Operations will be responsible for selecting a competent firm to construct a safe, economic and efficiently operated plant. the Manager of Uranium Processing shall be responsible for the following:

1. Quality Control of Material and Workmanship during Construction.

2. Selecting a staff qualified to inspect, assist and direct contractors during mill construction.

7.2.1 Tailings Retention System

During construction of the tailing retention system, which will be done in accordance with Regulatory Guide 3.11, the

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6. All safety equipment, such as, machinery guards, warning signals, hand rails, eye wash fountains, and safety fountains will be installed and operating.

7. Nuclear density gauges will be checked for "leaks" after installation.

7.4 Operations

The Manager of Uranium Processing will be directly responsible for the safe, economic and efficient operation of the plant. He will have written procedures for executing the following duties:

1. Be responsible for filling all positions with qualified and competent personnel.

2. See that all employees take part in the radiation training program and understand the radiation hazards involved.

3. See that all equipment in the plant is operating within design specifications.

4. See that all personnel will receive adequate training for assigned duties within the plant.

5. Review the Radiation Safety Officer's training program with the mill staff. See that all staff members work with the radiation safety department to carry out the radiation safety program to all employees.

6. Implement a tailing impoundment inspection program whereby an inspection of the tailings retention system will be made once per shift and data recorded in regard to solution depth, available minimum freeboard, input tonnage, liner condition, and general conditions of the entire system.

7. See that an inspection of all equipment, associated control devices, gauges, and alarms installed to control dust, gases or fumes within the mill is performed and recorded weekly by a member of the radiation safety staff. If any of this equipment is found to be inadequate, the Radiation Safety Officer will be notified immediately and corrections made. A record of the malfunction and follow-up action will be forwarded to the manager of uranium processing. A follow-up inspection will be performed to insure that corrective measures were performed.

8. Establish a procedure system so the Manager of Uranium Processing will be notified in writing if work is required that could result in the exposure of plant personnel or the environs to radioactive materials in excess of established limits.

9. Twice annually approve and conduct periodic reviews of operating procedures and revisions as discussed in Sections 3.0, 4.0, and 5.0.

10. Keep a master file of operating procedures and revisions.

11. Develop and implement a preventive maintenance program based upon manufacturer's recommendations, inspection data, and operating experience.

7.5 Radiation Protection and Environmental Monitoring

The Radiation Safety Officer will be responsible for radiation protection monitoring. He will:

1. Develop and implement a radiation protection orientation and training program for all employees.

2. Establish a program for training the radiation protection technician(s).

3. Perform quarterly reviews of training documentation to verify the adequacy of course content and training records.

4. Review and approve sampling and surveying procedures and their revisions, and document to assure that the provisions of Regulatory Guide 4.15 are properly instituted. a

5. Review and approve sampling and surveying procedures for industrial safety, radiation protection and environmental impact considerations.

6. Review and approve procurement of radiation protection and environmental monitoring instruments and calibration standards.

7. Perform monthly reviews of survey records to insure completeness, detection of abnormal conditions and adequacy of follow-up actions.

8. Quarterly audit of the radiation instrument calibration records and procedures. Calibration procedures will be in accordance with NRC recommendations and manufacturer's specifications, as equipment is received or before use (see Section 3.7.7).

9. Perform and document quarterly audits of jobs which are hazardous with in-house radiation rules. Special attention will be given to adherence to ALARA philosphy. a

10. Monthly review of radiation safety and exposure records (including daily and weekly inspection logs), and radiation survey records for adherence to ALARA philosphy. He also reviews abnormal occurrences and follow-up actions.

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11. Be responsible for seeing that all sampling and analyses are conducted in accordance with the QA program; he will also see that laboratories selected to perf ̣m contract analyses will have QA programs consistent with that for the mill to assure that confidence limits of analyses stipulated by the license and sensitivities stated in the Branch Position for Operational Radiological Environmental Monitoring Programs for Uranium Mills are met.

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* * *

The following plates are attached and complete this report.

Respectfully submitted,

DAMES & MOORE

Larry K. Davidson
Partner

LKD/tlg

Plate	Description
1 a, b, c	Artist's Rendition - DELETED
2	Plot Plan - 6-Cell Tailing Disposal System
3	Section A-A - 6-Cell Tailing Disposal System
4	Section B-B - Transverse Section, Cell 2
5	Typical Dike Section
6	Final Dike Section
7	Typical Drainage Ditch Section
8	Operational Sequence - Figure 1, 2, and 3
9	Operational Sequence - Figure 4, 5, and 6
10	Operational Sequence - Figure 7, 8, and 9
11	Operational Sequence - Figure 10
12	Reclamation Schedule

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DESCRIPTION OF SYSTEM

GENERAL

Major features of the tailing management plan include partially excavated containment cells, compacted sandy clay and silt liners and dikes to control seepage, and sequential construction, operation and reclamation of the cells during the life of the project (see Plate 1 a, * b, c for artist's rendition). Construction and reclamation will preserve existing ridge lines so that impacts on topography will be minimal and long-term stabilization will be facilitated.

Two multiple-cell configurations were evaluated on a preliminary basis at the request of Energy Fuels Nuclear, Inc. One had 5 cells and the other 9 cells. Each had a total capacity for about 23 years of tailing disposal at the expected tailing production rate of 2000 tons per day. The 9-cell system, shown in Plate 2, was chosen over the 5-cell system based on economic, operational and environmental advantages and is described in detail in this report.

Each cell shown in Plate 2 has a capacity of 2.5 years. A 6-cell 15-year tailing disposal plan is presented in this report. This plan comprises Cells 1 through 6 as shown on Plate 2. Potential future expansion to a 22.5 year system is available in Cells 7, 8 and 9. The other features shown on Plate 2 (stockpiles, borrow area, drainage ditches, etc.) correspond to the 15 year plan.

*Plates 1A, 1B, & 1C have been deleted.