MORTON RANCH URANIUM MILL LICENSE APPLICATION

1.0 PROPOSED ACTIVITIES

United Nuclear Corporation's Mining and Milling Division, the Applicant, with division offices in Albuquerque, New Mexico and corporate headquarters in Falls Church, Virginia, proposes to construct and operate a uranium mill on the Morton Ranch in Converse County in eastern Wyoming. This Application provides the informational content outlined in Regulatory Guide 3.5, Guide to the Contents of Applications for Uranium Milling Licenses, and is submitted to allow the Nuclear Regulatory Commission to assure that issuance of a Source Material License for the proposed mill will not result in undue risk to the health and safety of the public. Further, Applicant's Environmental Report, in compliance with paragraph 40.31 (f) of 10 CFR Part 40, accompanies this Application.

ACTIVITY SUMMARY

Mine

Draft and final Environmental Statements have been prepared by the Tennessee Valley Authority (TVA) for joint mining activities by Applicant and TVA covering the Morton Ranch uranium mining. Applicant will operate both the mill and mine. Construction of surface and underground mining facilities has begun and ore is being produced.

To date exploration activities have demonstrated that a minimum of 14,000,000 tons of uranium ore containing 25,200,000 pounds of uranium oxide (U_3O_8) is located on the Morton Ranch property. A production rate of 660,000 tons of ore per year from mining activities is anticipated. Thus, mining is expected to continue until 1998 when existing reserves would be exhausted. Should expected additional reserves be discovered, the mining production rate may be increased and the length of operations may be extended to 2001 or beyond.

Mill

Mill operation is expected to begin in January, 1980, and during the first month, 800 tons of ore per day (TPD) will be processed. Thereafter, the mill will gradually increase process throughput until it reaches 3,000 TPD.

The mill will employ the conventional acid leach, solvent extraction process in concentrate uranium from the average 0.10 percent U_3O_8 in the ore to the 95 or more percent U_3O_8 in the final product, yellowcake.

During the life of the mill, an estimated 14,000,000 tons of uranium ore will be crushed and chemically processed to yield an estimated 12,500 tons of U_3O_8 as yellowcake. The yellowcake, after further processing steps, will be available as fuel for nuclear reactors to produce electricity.

The crushed ore, after the uranium has been removed, forms coarse and fine wastes commonly called mill tailings. These tailings will be pumped as a slurry into a tailings pond or ponds, behind a dam or in clay lined mined-out pits.

Liquid will evaporate from the tailings pond. At the close of operation, after all liquid has evaporated, the tailings, containing process chemicals and radionuclides, will be graded and covered with soil. The soil will be planted with acceptable vegetation, and the terminated tailings pond will become a long-term storage site for the contained radionuclides.

Most radionuclides, except uranium, entering the mill will be retained in the tailings pond. Some gaseous radionuclide releases are expected although these will be controlled to as low as practicable by the best technology currently available and will comply with applicable regulations.

Boiler combustion products and trace quantities of process chemicals will be released to the atmosphere from mill activities. Natural uranium, Th-230, Ra-226 and Rn-222 will be released to the atmosphere from mill ore pad, unprocessed ore stockpiles, milling activities, and from mill tailings.

3.0 FACILILITY DESIGN AND CONSTRUCTION

This section described the process for Applicant's proposed mill, the major equipment used in the process, and analysis of the radiological aspects of the process, and the instrumentation planned for use in monitoring the mill process, plant personnel and the environment.

3.1 MILL PROCESS

The design capacity of the proposed mill is 2000 tons per day of ore. To accomodate any expansion during the life of the project, flow rate feed rates and environmental releases have been presented for a 3000 ton per day mill. The mill will contain eight operating sections as illustrated in the simplified flow chart presented in Figure 3.1-1. Major items of process equipment are shown in Figure 3.1-2. Quantitative mill input and output estimates are presented in Figure 3.1-3. The projected material balance is listed in Table 3.1-1, Incoming Material, and Table 3.1-2, Outgoing Material.

The quantified material balance, input, and output values, found in Figure 3.1-3 and Tables 3.1-1 and 3.1-2, represent best estimates for current design. When the mill begins operation, these estimated values may change due to operational adjustments to minimize chemical consumption and to maximize yellowcake production.

Uranium will be extracted from the Morton Ranch ores by the following generalized process. The mill will grind the ore in water to form a slurry. The slurry will be routed through surge tanks to leaching tanks and mixed with sulfuric acid and sodium chlorate to dissolve the uranium. The resultant mixture of ground ore, acid and water will be transferred from the leaching tanks to the countercurrent decantation section. Here the uranium bearing liquid will be separated from the waste ore solids that will be pumped to the tailings pond. The uranium bearing liquid will be clarified and filtered to remove remaining solids and routed to the solvent extraction section. In the solvent extraction section, the uranium bearing water solution will be brought into contact with an organic solution composed of solvent extraction diluent, an organic amine, and isodecanol. The amine will form a chemical complex with the uranium, holding it in the organic solution. This organic solution will then be routed to the stripping section. The water solution, called raffinate, will be routed to the countercurrent decantation section to recycle.

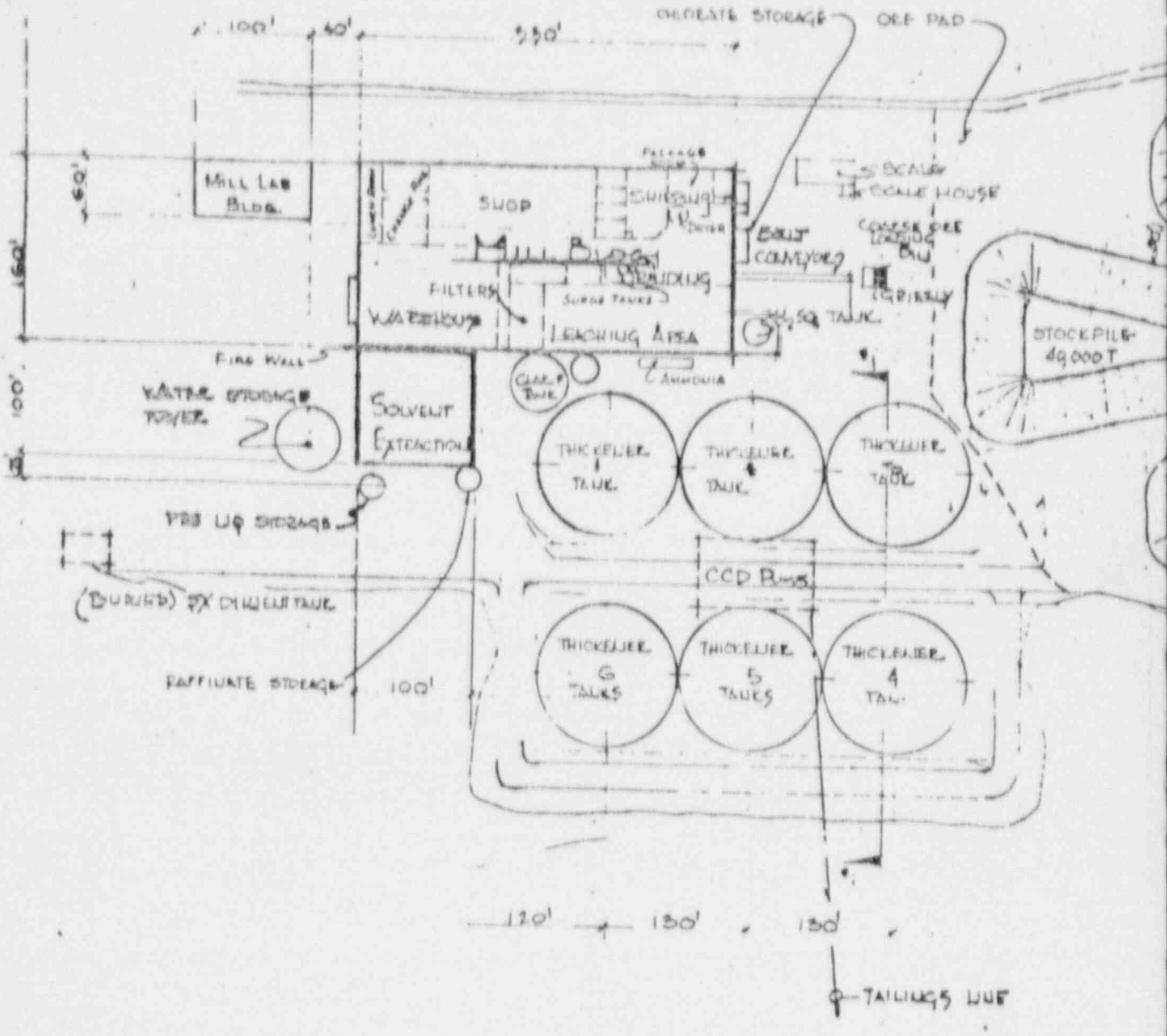
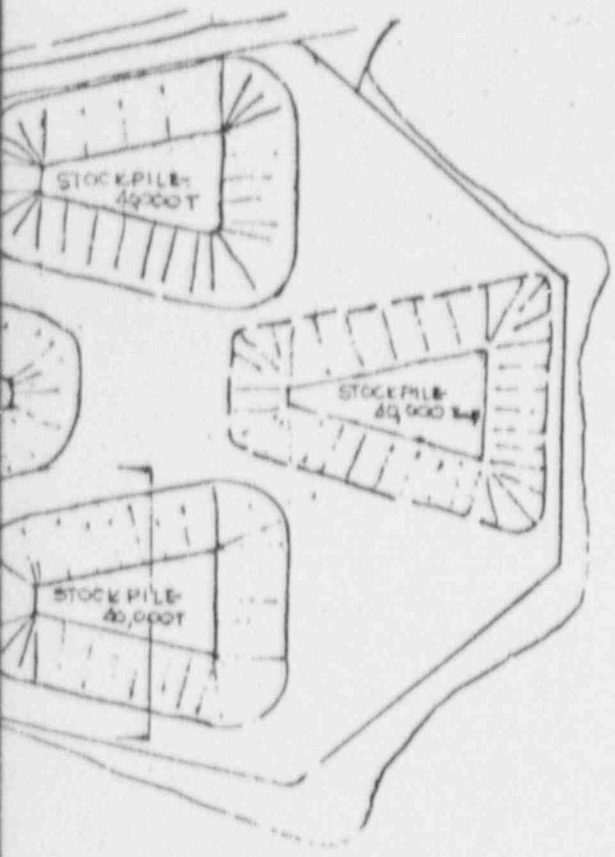
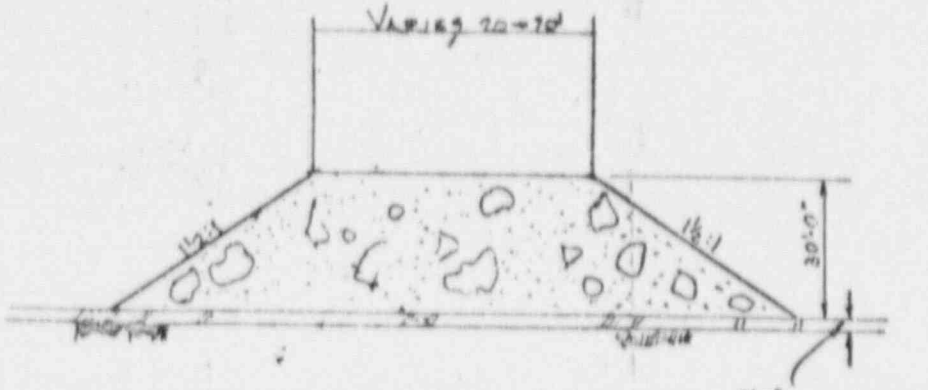


FIGURE 3.1-1 REV. 11





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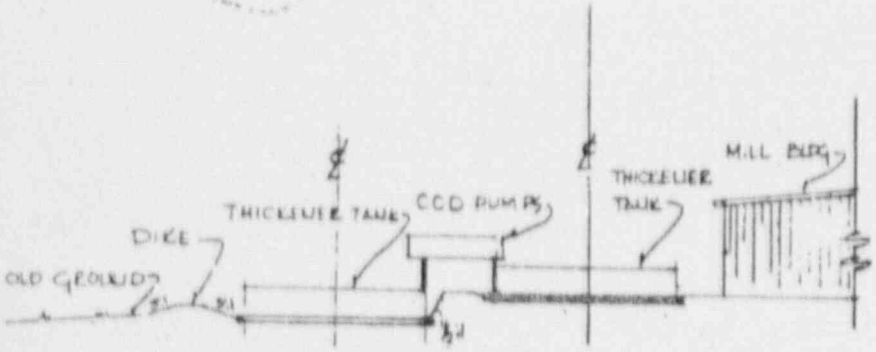

SECTION No "1
SCALE 1" = 100'

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PROPOSED GEN. ARRANGEMENT

SYM	DATE	DESCRIPTION	BY

UNITED NUCLEAR CORPORATION
CASPER, WYOMING 82601

MILL LAYOUT
PROP. GEN. ARRANGEMENT

CONVERSE COUNTY, WYOMING
DATE 8/29/77 SCALE 1" = 100 DRAWN BY CW EB

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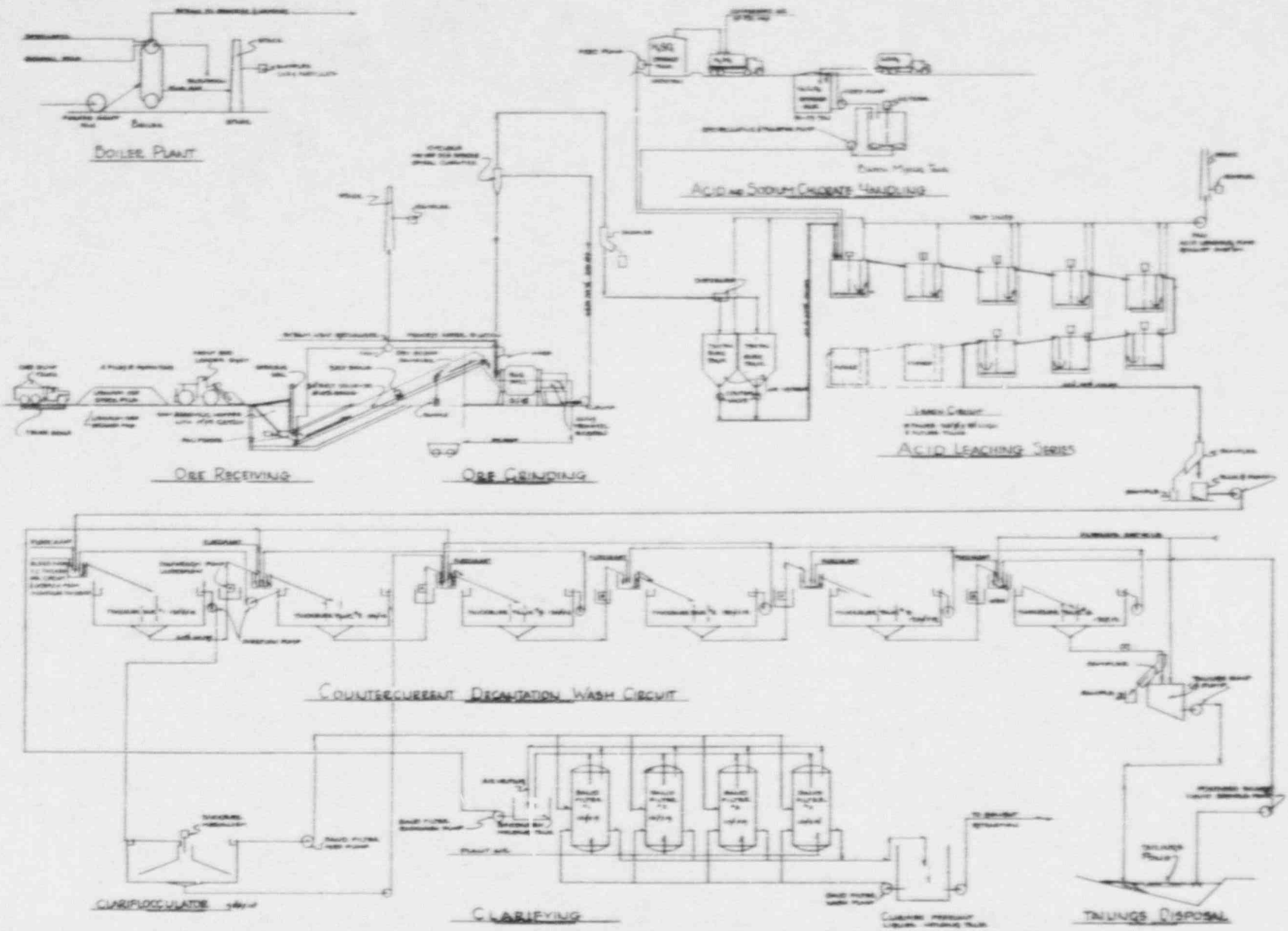

General Flowsheet

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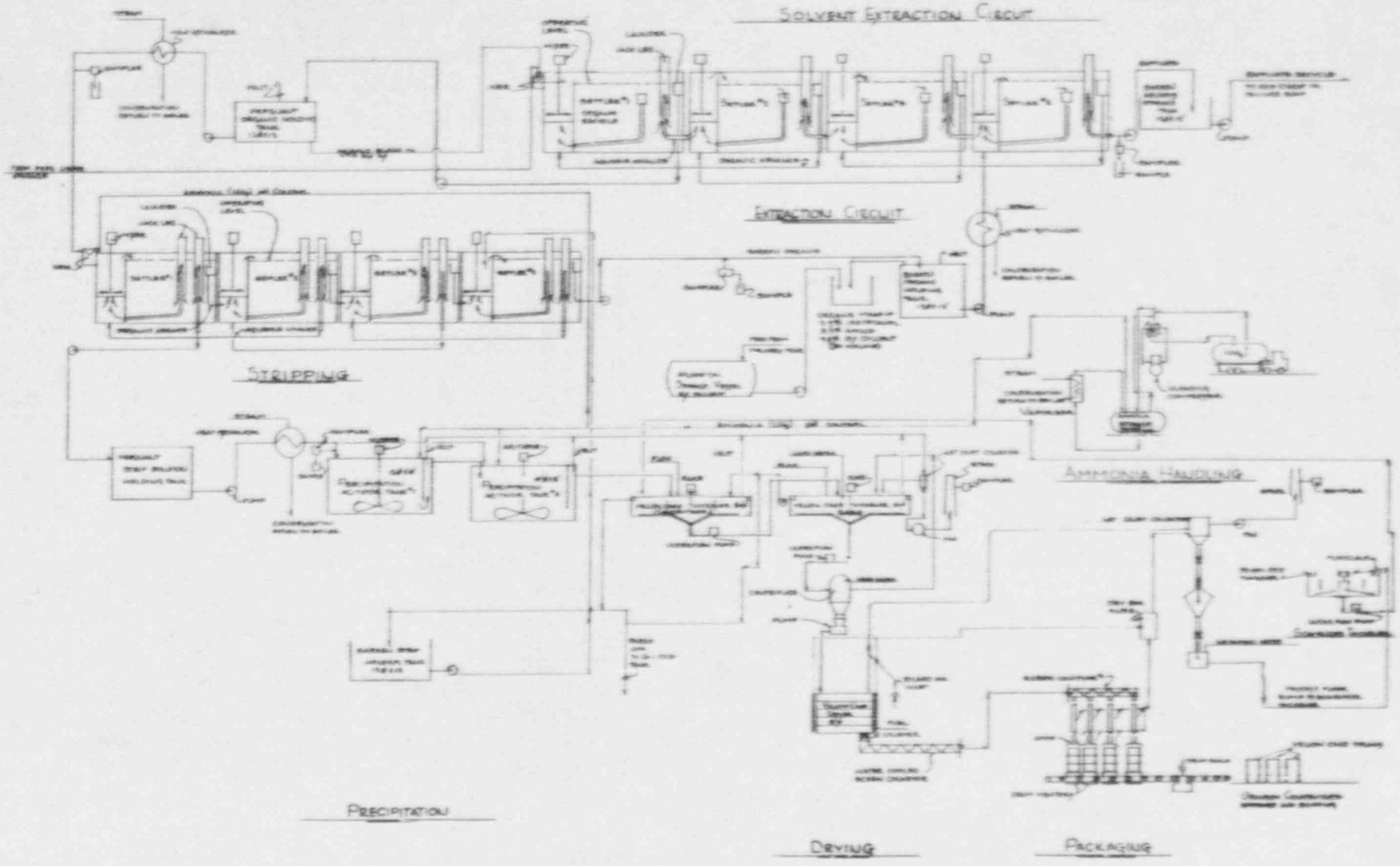

General Flowsheet

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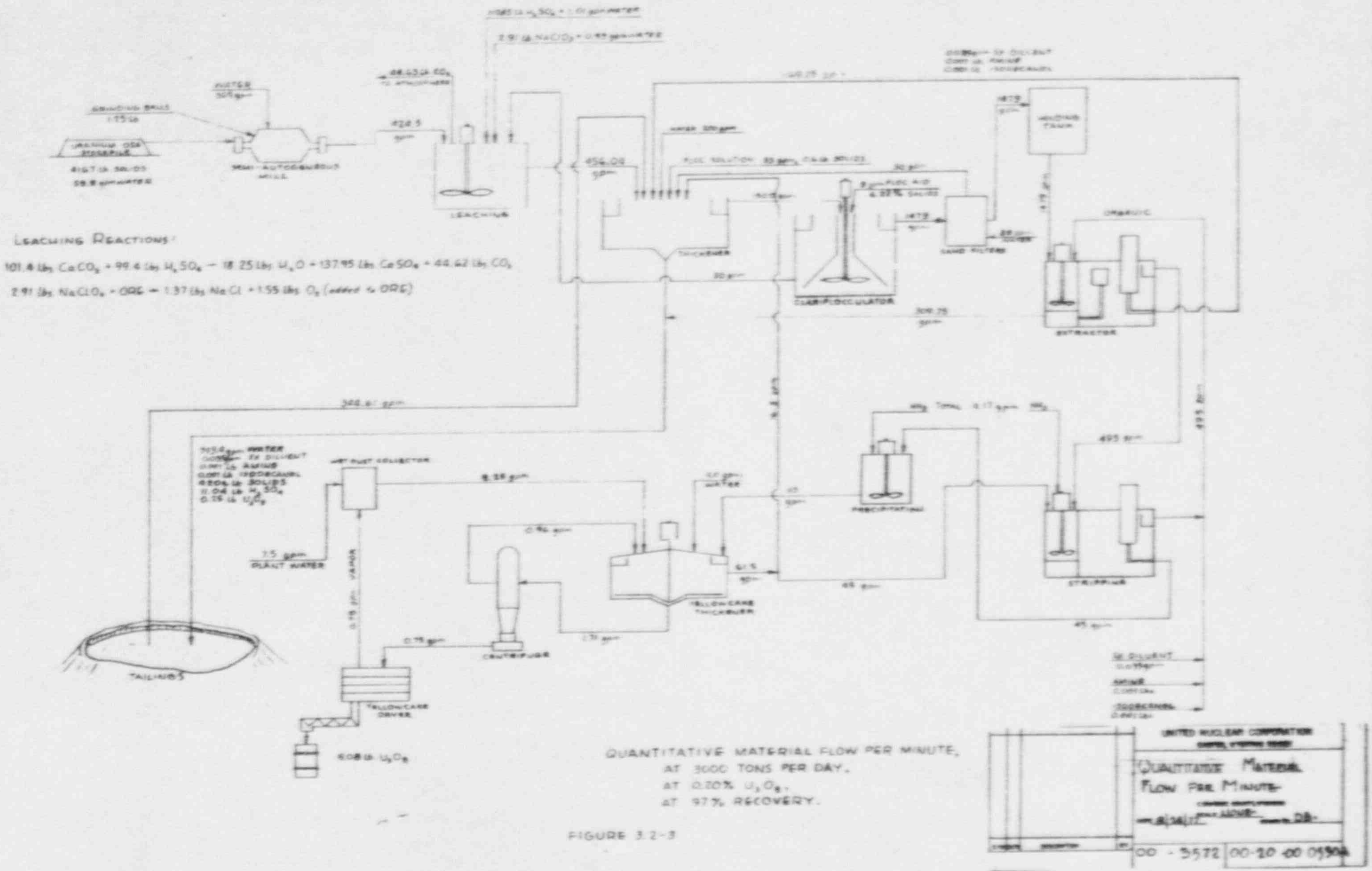

QUANTITATIVE MATERIAL FLOW PER MINUTE,
AT 3000 TONS PER DAY,
AT 0.20% U_3O_8,
AT 97% RECOVERY.

FIGURE 3.2-3

MILL CIRCUIT - INCOMING MATERIAL
(Average per minute values)

Mill Component	Material Added	Composition	
Ore Pad	Ore	8.33	lb. U_3O_8
		55.5	gal. water
		101.4	lb. $CaCO_3$
		4056.9	lb. inert material
Grinder	Grinding Balls	1.25	lb. inert material
	Water	369.00	gal. water
Leaching section			
	Sulfuric acid	110.45	lb. H_2SO_4
		1.01	gal. water
	Sodium chlorate	2.91	lb. $NaClO_2$
		0.53	gal. water
	Flocculant	0.60	lb. coagulant aid
		33.00	gal. water
Clarifloculator	Flocculant	0.15	lb. coagulant aid
		8.85	gal. water
Sand Filter	Water	30.00	gal. water
CCD Weir	Water	200.00	gal. water
	Tailings return	344.61	gal. water
Solvent extraction section	SX Diluent	0.035	gal. SX Diluent
	Amine	0.001	lb. amine
	Isodecanol	0.001	lb. isodecanol
Stripping section	Ammonia > Total	4.17	lb. NH_3
Precipitation	Ammonia > Total		
Yellowcake Thickener	Water	9.00	gal. water
Dust collector	Water	7.50	gal. water

Based on 3000 TPD @ 0.20% U_3O_8 at a 97% recovery.

MILL CIRCUIT- OUTGOING MATERIAL
(Average per minute values)

Mill Component	Material Leaving		Composition
Leaching Circuit	Offgas	44.93	lb. CO_2 (a)
CCD	Tailings	749.4	gal.water
		4206	lb. inert material
		0.035	gal. SX Diluent
		0.001	lb. amine
		0.001	lb. isodecanol
		0.25	lb. U_3O_8
Dryer	Product	8.08	lb. U_3O_8

(a) Based on a 10% excess of sulfuric acid.

The stripping solution will be composed of water containing ammonium ions. Here the uranium will be re-extracted from the organic solution into water and routed to the precipitation section where ammonia will be added to precipitate the uranium as ammonium diurnate (ADU). The ADU will be heated in a dryer to vaporize the water and traces of ammonia to form yellowcake, the final product. The yellowcake will then be packaged and shipped offsite for further processing into nuclear reactor fuel.

A more detailed description of each major mill circuit is presented below.

Ore Handling and Storage

Loaded ore trucks from the mines will be first weighed and then the ore dumped onto a 160,000 ton capacity ore pad. A front end loader will transfer the ore to a receiving hopper equipped with a pan feeder and a grating (grizzly). A conveyor belt will transfer the ore from the hopper to the grinding section.

Grinding Section

The grinding mill will be a semiautogenous mill 28 feet in diameter by 6 feet long. A total of 369 gallons per minute of well and mine water will be added to the ore in the grinding section. The semiautogenous mill discharge will be directed to a cyclone separator from which the denser material will be returned to the grinder and the slurry, containing 60 to 62 percent finely ground solids, will be routed through surge tanks to the leaching section.

Leaching Section

The leaching section, composed of eight 26 foot diameter by 28 foot high tanks, will combine the slurry from the cyclone with sulfuric acid (H_2SO_4) and sodium chlorate ($NaClO_3$) to dissolve the uranium from the ore. The solution conductivity, which is a measure of the acidity, and the oxidation potential will be monitored automatically. Sulfuric acid will be used to adjust the conductivity and sodium chlorate will be used to adjust the oxidation potential via an automated system. Periodic grab samples will be taken for pH measurement and subsequent system adjustment.

Complete dissolution of the uranium in 1 ton of ore is expected to require 57 pounds of sulfuric acid and between 1.0 and 1.5 pounds of sodium chlorate. The slurry will flow by gravity from one tank to another, each tank slightly lower than the one preceding it. The expected retention time in the tanks will be approximately 10 hours. The discharge from the section, containing 58-60 percent solids with a pH of about 1.2, will be pumped to the countercurrent decantation (CCD) section.

Countercurrent Decantation (CCD Section

The term countercurrent describes two phases that pass through a process in opposite directions. In the CCD section, solids from the leaching section, along with some liquid, will enter the No. 1 thickener tank. These solids will be pumped to each of the thickener tanks serially and will be disposed of as tailings from the No. 6 thickener. In contrast, raffinate, a byproduct from the solvent extraction section, mine water and solution returned from the tailings impoundment will be introduced at the No. 6 thickener and will pass through the CCD section to the No. 1 thickener to wash the uranium bearing solution from the solid particles. This flow pattern assures that solids sent to tailings are given a final wash with a solution that is relatively free of uranium. Raffinate and recycled tailings pond water are used instead of mine water to conserve water and reduce the volume of waste generated. CCD tanks will be 120 feet in diameter and twelve feet high except for the number one thickener which will be 14 feet high to provide surge capacity.

The tailings will contain approximately 2 to 6 percent of the uranium originally present in the ore and essentially all of the radium and thorium. The only chemical addition in the CCD section will be a coagulant aid used to accelerate solid settling. The anticipated use is 0.07 pound per ton of ore.

The overflow from the No. 1 thickener is the uranium bearing product from the CCD section. This solution will pass through a clarifier-flocculator where solids will be removed and returned to the [illegible]

thickener. The partially clarified liquid will then pass through three of four sand filters for further solid removal prior to uranium extraction in the solvent extraction section. The sand filters will be sparged with air and backwashed with a 600 gallon per minute stream. The backwash will be collected and returned to the No. 1 thickener at a constant rate of about 20 gallons per minute. Three sand filters will operate while one is removed from service for backwash.

Solvent Extraction and Stripping Sections

The solvent extraction (SX) section will receive the "clarified pregnant" aqueous solution from the CCD section. The uranium will first be extracted into an organic phase consisting of SX diluent, a petroleum distillate, 3.5 percent organic amine and 2.5% isodecanol. This uranium bearing organic solution will then be pumped to the stripping section where the uranium will be re-extracted into water containing ammonium sulfate. These two processes will use liquid ion exchange to provide uranium in a water solution free of other minerals in the ore. Extraction into and later out of the organic phase is a function of the acidity in the aqueous phase. Both the solvent extraction and stripping sections will use multiple tanks and countercurrent flow.

The solvent extraction section will consist of four mixer-settler units. The settlers will be lined concrete basins, each providing approximately 1,000 square feet of settling area.

The filtered effluent, from the CCD circuit, carrying approximately 0.55 grams per liter U_3O_8, will be pumped to the first mixer-settler unit. This solution will mix with the organic solution in the first mixer. After settling, the aqueous solution will be pumped to the second water. By the time the aqueous solution leaves the No. 4 settler, the U_3O_8 concentration will be reduced to 0.001 grams per liter or less. This acidic, aqueous solution, called raffinate, will be recycled to the CCD section. About 1,000 gallons per minute of the organic solution from each settler will be recycled through the mixer portion of the unit. The organic solution will advance through the section at approximately 330 gallons per minute and will

extract uranium to a final concentration between 1.6 and 2.5 grams per liter U_3O_8. The uranium bearing organic solution will then be pumped to the stripping section, consisting of four mixer-settler units. Each unit will provide a settling area of about 300 square feet. The strip solution will contain about 130 grams per liter of ammonium sulfate in water and will flow at 30 gallons per minute. The flow rate difference between the aqueous and organic solutions will result in an 11 fold concentration of uranium to between 18 and 27 grams U_3O_8 per liter in the aqueous strip solution. The barren organic solution from the stripping sections will be recycled to the extraction section. Before the solution is reused, sx diluent, amine, and isodecanol may be added to replace the amount lost. The uranium bearing strip solution will be routed to a holding tank, and then to the precipitation section.

Precipitation and Washing Sections

The uranium bearing strip solution will be heated to between 140°and 160° F. and routed to the two stage precipitation section where gaseous ammonia will be added. The uranium will precipitate as ADU, which is primarily a mixture of uranium hydroxides and ammonium diurnate. The precipitation process will be monitored by automated pH control.

The ADU will be separated from the water and impurities in the two stage yellowcake thickener section. Slurry from the precipitators will be pumped to a primary thickener approximately 30 feet in diameter. The underflow, containing about 30 percent solids, will be mixed with wash water and transferred to the second thickener, approximately 20 feet in diameter. The underflow from the second thickener will be transferred to a cyclone separator or centrifuge for further dewatering. The slurry from the centrifuge will contain about 60 percent solids and will be routed to the dryer. The overflow of the second, or washing, thickener will be pumped to the first thickener. The overflow of the first, or primary, thickener will be recycled to the stripping section. Any excess will be directed to the CCD circuit to reclaim the uranium.

Drying Section

An 8 foot diameter multihearth dryer will be fired by natural gas and/or propane to approximately 1,000° F. The drying process will remove the remaining ammonia and most of the water to convert the ADU to uranium concentrate, called yellowcake. The yellowcake will be crushed and transferred by screw conveyors to packaging drums. The 55 gallon packaging drums will be vibrated to insure complete filling. Filled drums will be sampled, weighed, and sent to the yellowcake storage area until shipped. Dust from the yellowcake handling and drying operations will be collected by a wet scrubber and returned to the process. Based on 3,000 tons per day of ore containing 0.2% U_3O_8, the mill will produce about 12,200 pounds of yellowcake containing 11,600 pounds of U_3O_8 per day.

Tailings Disposal System

Due to the nature of the uranium ore deposit, about 99.8 weight percent of the ore removed from the mines becomes a waste product. In addition, the use of chemicals in the extraction and purification of the uranium will add chemicals to the liquid wastes. These wastes will be collected in a tailings pond. See Section 4.0.

About 750 gallons per minute of water and about 4,200 pounds per minute solids will be pumped from the mill to the tailings pond. Three hundred forty-five (345) gallons per minute will be returned for use in the mill. Most of the waste leaves the mill circuit from the CCD section, and the recycled water is used in the same section.

Plant Layout

Figure 3.1-4 shows the plant layout. The plant has been designed to protect the offsite environment not only during routine operation but during postulated accidents. The placement of thickeners, chemical storage tanks and tailings lines is an example of this design consideration. The tanks and pipelines have been designed such that they drain into holding basins from which water or chemicals can be reclaimed.

The tailings pond and ore piles are located so that they are normally upwind from the mill to minimize, to as low as reasonably achievable, the exposure of plant personnel to airborne dust and radon-222 from these sources.

Radiological Analysis

This radiological analysis covers storage and handling of uranium ore at the mill, processing of ore to form yellowcake, and disposal of the waste materials into the tailings pond. The proposed mill has been designed to process 2000 tons of uranium ore per day. However, for purposes of this analysis, 3000 tons per day are assumed. The nature of mill operations, the nature and design of the process and the safeguards planned will minimize the occupational exposure to "as low as reasonably achievable."

Storage and Handling of Ore

The uranium ore will be stored on an earthen pad and moved from the pads via front end loaders to the conveyor loading hopper which feeds to the grinder. Most of the radionuclides contained in the ore are alpha emitters and, consequently, whole body dose rates will be a small fraction of 1 mrem per hour at the ore surface. Since ore loading is accomplished without direct contact whole body dose rates will not be measurably different from natural background rates.

Both stored ore and handled ore will release small amounts of radon-222. Table 4.1-1 shows the expected annual release of radon-222 from stored and handled ore. The exposure from radon released in ore storage and handling will be small. The expected maximum of 160,000 tons of ore on the pad and in the mill will release approximately 156 Ci of radon-222 per year compared to 730 Ci per year from the tailings. See also Environmental Report Section 5.0.

The major potential of occupational exposure from stored and handled ore is dust. Ore from the mines will be damp and will not generate significant dust until it dries. Every effort will be made to process the stored ore with the greatest dust potential first to avoid dust. During the warmer months when the ore is not frozen chemical stabilization or water sprinkling of dried ore will be done if necessary to minimize dust generation. Sprinkling will be minimized to avoid leaching. During the fall and winter months, the wet ore will freeze, thus retarding dust generation and radon emission.

Ore Processing

Ore will be ground wet to eliminate the potential for relatively high occupational exposure from both dust and radon-222. The ventilation system will prevent buildup of radionuclides in breathing air within the grinding operations area. However, since the grinding area depends upon wet operations and ventilation to minimize personnel exposure, air samples will be used to insure the effectiveness of these controls. Additional air sampling is outlined in Section 5.5. Initial sampling and monitoring of the grinding area will be frequent to insure that the expected low concentrations of radionuclides in breathing air are maintained.(see Section 5.5) Whole body dose rates are also expected to be low in the grinding area and will be evaluated by station dosimeters and by personnel dosimeters as outlined in Section 5.5. The remaining process steps up to drying and packaging of yellowcake are all in solution and either are ventilated or are performed outside (e.g.CCD). Thus, the nature of these processes occupational exposure during

proper operation of ventilation and water flow systems. Applicant's program to monitor both airborne activity and whole body dose rates is outlined in Section 5.5.

Drying and packaging of yellowcake will be accomplished in an isolated area equipped with two high capacity ventilation systems equipped with scrubbers. Personnel entering this area will be equipped with dosimeters to measure whole body dose rates, and required respiratory protection as outlined in Section 5.5. Since this area will concentrate the final product, low but measurable surface dose rates are expected. A station dosimeter will be used in this area during the initial sampling program to determine occupational dose rates. Work in the drying and packaging area will require, at a minimum, use of protective clothing, personnel washing and personnel surveillance. Urine analysis and invivo lung counts will be used to insure that safeguards and monitoring techniques are adequate.

Storage of sealed yellowcake drums provide little hazard from airborne radioactive materials unless a drum is breached. Routine surveys will insure no airborne activity or yellowcake spread results from storage areas. When large quantities of yellowcake are stored, there is a potential for whole body dose rates up to a few mrem per hour. Dose rates will be assessed by portable monitoring instruments and/or station dosimeters. Personnel access will be limited to that required for work.

Waste Product Storage

All process wastes will be routed to the tailings pond (s). A measurable increase in dose rates in the immediate vicinity of the tailings pond is expected. However, the liquids associated with the tailings sands will shield the radionuclides stored in the pond. The largest radionuclide emission from the tailings pond is expected to be radon-222, 2.0 curies per day (see Tables 3.1-3 and 4.1-1). Since all other radionuclides will either be stored under solution or kept wet by sprinkling. (if tailings sands are

TABLE 3.1-4
GASEOUS EMISSIONS

Location	Potential Airborne Contaminant	Safeguards(a)
Ore conveyor belts and grinding equipment	. Dust containing radionuclides . Radon-222 gas	. Water spray chemical stabilization high volume ventilation system equipped with wet scrubber
Leaching area	. Chlorine and chlorine dioxide gases . Sulfuric acid mist . Radon-222 gas	. Ventilation from tank surfaces-periodic chemical surveys
Outdoor thickener tanks and clariflocculator	. Radon-222 gas	. Outdoor facility
Solvent extraction and stripping	. Petroleum distillate . Ammonia gas	. Enclosed isolated facility . Separate vent to atmosphere . Periodic chemical surveys
Dryer Storage bin Yellowcake packaging area	. Ammonia . Yellowcake dust	. Separate ventilation systems with wet scrubbers and bag filter

(a) All areas are surveyed routinely for airborne contamination and whole body dose rates as described in Section 5.5.

TABLE 3.2-1 (Page 1 of 2)

Equipment	Description	Approximate Specifications
Loading hopper	200 ton,with sides sloped at or above the angle of repose (3 sides sloped, 1 vert.)	1' thick reinforced concrete sidewall wild mild steel liner.
Conveyor	Continuous rubber-covered conveyor belt, with emergency stop chord.	36" wide, 20° trougher, idler with headend drive & gravity takeup at tailend, 300' long.
Grinding Mill	Semi-autogeneous mill with trunnion overflow screen and replaceable baffle plates.	18' diameter x 72" in length.
Cyclone Separator	Rubber-lined mild steel	Cyclone 1500 gpm. (solids and liquids.
8 Leach Tanks	Wood-staved or steel with fiberglass lining, with mechanical agitators.	26' diameter x 28'high
6 C.C.D. Thickeners	Concrete mild steel or wood staved tank, or acid resistant plastic lining, stainless steel rakes, centerwell and discharge cone.	(1) 120' diameter x 14'high (5) 120' diameter x 12 high.
Clarifiocculator	Wood-staved or steel with fiberglass lining, tank. Mechanical agitator and stainless steel discharge cone	50' diameter x 16 high.
4 Filters	Carbon steel, fiberglass lined, pressure sand filters; air sparged.	10' diameter x 15' high. 15,000 gpm capacity.
Backwash Holding Tank	Fiberglass	1,800 gallons capacity
Clarified Pregnant Liquor Holding Tank	Wood-staved or mild steel with fiberglass lining. Covered tank.	30' diameter x 12 high.
4 Settlers (Extraction Circuit)	Concrete,acid-protected with fire resistant plastic.	80'x 20' x 6' high.
Barren Organic Holding Tank	Fiberglass	12' diameter x 12' high 12' diameter high

TABLE 3.2-1 (Page 2 of 2)

Equipment	Description	Approximate Specifications
Pregnant Organic Holding Tank	Fiberglass	12' diameter x 12' high
Barren Strip Holding Tank	Fiberglass	12' diameter x 12' high
4 Settler (Stripping Circuit)	Concrete, acid protected with fire resistant plastic.	80' x 20' x 6' high.
Raffinate Holding Tank	Wood-staved	50' diameter x 12 ' high.
2 Precipitators	Wood-staved or fiberglass, mechanical agitator and ammonia addition lines.	6' diameter x 8' high.
2 Yellowcake Thickeners 1.) Concentrator 2.) Wash	Fire resistant plastic lined steel with steel rakes.	1.) 30'diameter x 12' high. 2.) 20' diameter x 12' high.
Centrifuge	Rubber-lined steel	Accept 30% solids, remove 50% of the water with less than 10% solids.
Yellowcake Dryer and Wet Scrubber	Natural gas fired, multi-hearth type.	Dry to less than 1% water. Uranium emission concentration less than M.P.C. specified in 10CFR20 for controlled areas
Screw Conveyor	Mild steel,totally enclosed.	0' 10" diameter x 30' in length
Standard Packaging Equipment	Minimum dust in surrounding environment	12,000 lbs/day.
Wet scrubber and Fan	4,000 cfm	Minimum 95% efficiency

3.3 INSTRUMENTATION

The most effective instrumentation available will be used to monitor the milling process, plant personnel and the environment. Automated safety instrumentation will be used in areas of the mill where conditions warrant. An example of such instrumentation is the fire protection system in the solvent extraction area.

The radiation safety, industrial safety and fire protection and process control instrumentation are discussed below.

3.3.1 Radiation Safety Instrumentation

Various types of radiation detection instruments will be used to monitor the plant, workers and the environs. This section describes Applicant's plans for such monitors.

3.3.1.1 Application

Portable radiation survey instruments will be used to monitor work areas, personnel and equipment. Beta-gamma, Geiger-Muller survey meters will be used for the detection of radioactivity where uranium daughter products are expected to be present as in the ore and tailings. Alpha survey meters will be used for the detection of uranium in the absence of concentrated daughter products, as in the ADU and yellowcake.

Whole body dose rates for working areas will be established using portable ionization chamber type instruments. Airborne contamination levels will be monitored by either fixed or portable air samplers. Fixed samplers will be used in areas where there is the greatest potential for airborne contamination.

Air samples will be taken periodically in areas not serviced by fixed samplers. High volume samplers will be used for short duration samples. Filter paper samples will be analyzed on a laboratory counter fitted with a gas flow proportional or scintillation detector. Certain samples may be sent offsite to an independent laboratory for verification or isotopic analysis.

3.3.1.2 Availability

Except for the laboratory counter and fixed area monitors, a sufficient number of instruments of each type used will be provided to insure that operable instruments will always be available for both routine and emergency situations.

Should the laboratory counter be temporarily out of service, air sample filters will be checked using appropriate portable instrumentation and retained for counting when the instrument is again in service.

3.3.1.3 Specifications for Radiation Protection Instrumentation

1. Beta-gamma survey meters shall have the following minimum specifications:
   - Range: The lowest range not to exceed 0.5 mR/hr (or 700 cpm) full scale. The highest range to measure 50 mR/hr (or 70,000 cpm). Readings in cpm and/or 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 -20 F to 120 F.

Examples for satisfactory laboratory counters are:

Eberline Instrument Corporation

Scaler, Model MS-2

Gas flow counter, Model FC-2,alpha, beta and gamma

Shielded end window counter, Model RD-15, HP-190, GM probe; beta, gamma

Alpha scintillation counter, Model SAC-4

4. Dose-rate meters shall have the following minimum requirements:
   - Range: The lowest range not to exceed 5 mR/hr full scale. The highest range to detect, 1R/hr.
   - Response time: 10 seconds to final reading.
   - Environmental capabilities: Must operate properly in the temperature range of -20 F to 120 F.
   - Calibration potentiometers for each range (scale).
   - Battery operated and portable.
   - Detector: Ionization chamber vented to atmosphere with a minimum active volume of 200 cc and an energy response to gamma or x-rays of ±15% in the range 20 KeV to 1 MeV.

Examples of satisfactory dose-rate meters include:

Eberline Instrument Corporation

Model RO-3

Victoreen Instrument Division

Model 470A

5. Portable high volume air samplers will have, as a minium, the following specifications:

   . Sample rate: 10 cfm and/or 1 m^3 in 5 minutes.
   . Filters: Sample head must prevent filter rupture and accept 4" diameter or larger filters.
   . Portable: Equipped with air flow meter accurate to $\pm$5%.

   Examples of satisfactory high volume air samplers include:
   Radeco, Inc.
   Model H-809
   Eberline Instrument Corporation
   Model 08-600

3.3.2 Industrial Safety and Fire Protection Instrumentation

Chemical Detection

The use of chemicals in the proposed mill presents a potential risk to plant personnel. To assure ammonia, chlorine, chlorine dioxide and hyd[illegible]on fumes do not exceed TLV values in breathing air, a gas sampler with disposable detector tubes will be available for monitoring.

Typical specifications are as follows:

Sample pump volume: Variable 50 or 100 cc.

4.0 WASTE MANAGEMENT SYSTEMS

Effluents released from the proposed mill will be minimized to the extent reasonably achievable. The "better features of current practice," as stated by the Environmental Protection Agency, (1) are incorporated in the design of the mill and tailings dam. The control methods used on the various gaseous effluents streams as well as the plans for solid and liquid waste retention are discussed below.

4.1 AIRBORNE EFFLUENT CONTROL

The ore stockpile and ore handling conveyors will be sprayed with water as necessary to minimize dust. Since the grinding operation could generate considerable dust, mine water will be added to the ore in the grinding process. All stacks from the proposed mill will be provided with ports for air sampling. Table 4.1-1 enumerates the gaseous effluent release points, anticipated flow rates, controls and potential contaminants.

The ore transfer and grinding and the yellow cake precipitators and thickeners and yellowcake dryer will be ventilated through separate wet venturi-type scrubber. These high efficiency wet scrubbers will consist of a series of impingement baffle plates wetted from above. The air drawn in from the bottom of the scrubber will be accelerated as it passes through holes in the plates, imparting kenetic energy to both the particulates and scrubber solution. This process will separate the water into tiny droplets to more efficiently capture particulates in the air. The air and water stream will then impinge on small plates mounted above holes in the baffles. By coalescing the droplets, the impingement will provide efficient dissolution of soluble gases as well. A fixed blade moisture eliminator will be mounted at the top of the scrubber at the cleaned air exit.

(1) EPA-520-9-73-3-B. pg. 2, 24, 25.

TABLE 4.1-1

GASEOUS EFFLUENTS

Release Location	Anticipated Height Above Ground (Feet)	Anticipated Flow Rate ft^3/min	Equipment Serviced	Control Employed	Anticipated Efficiency	Potential Contaminate	Annual Quantity (a)
Stack 1	20	10000	Grinding Circuit	Wet scrubber & wet grinder	95% for particulates	Nuisance dust	< 0.5 tons
Stack 2	20	6000	Leach Circuit & surge tanks	non-wet process	95% for particulates	ClO_2 Cl_2	trace trace
Stack 3	30	4500	Yellowcake thickeners Precipitation tanks	Wet scrubber	95% for particulates	U_3O_8 NH_3	< 0.01 Ci trace
Stack 4	30	4000	Yellowcake dryer & packaging	Wet scrubber & bag dust collector as shown	99.8% for 1 to 2 μ particulates	U_3O_8	< 0.11 Ci
#1 laboratory hood	20	3000	Chemical laboratory	Wet scrubber UnKnown		Perchloric acid fumes	trace
#2 laboratory hood	20	2000	Chemical laboratory	HEPA filter	99.93%	Misc. chemicals	trace
Ore pile	Ground	Not Applicable	Ore storage			Nuisance dust Ra-226 (b) Th-230 Rn-222 Natural U Pb-210	40 tons 0.01 Ci 0.01 Ci 156. Ci 0.01 Ci 0.01 Ci
Tailings Pond	Ground	Not Applicable	Solid and liquid waste storage	Keep wet	50% for Th-230 and Ra-226	Nuisance Dust Ra-226 Th-230 Rn-222 Sx Diluent	trace 0.02 Ci 0.02 Ci 730 Ci 55 tons
8 mine vent shafts	Ground level	Total 2.9 $m^3/sec.$	Underground mine	None	Not applicable	Rn-222	37 Ci
						Totals	
						Natural U Ra-226 Th-230 Rn-222	0.13 Ci 0.03 Ci 0.03 887 Ci

(a) Radionuclide estimates assume 3000 tons per day of 0.20% uranium ore.
(b) Based on NUREG-0129 values adapted for 0.2% U_3O_8 in Ore.

4.2.1 Tailings

Solid and liquid waste from the mill process will be pumped in a slurry from the CCD section of the mill to the tailings pond. A flow proportional sampler will be provided downstream of all effluent sources that empty into the clay lined tailings pond.

The tailings slurry will consist of water, solids from the ore, and relatively small amounts of chemicals from the mill process. The slurry will carry particles ranging in size from very fine slimes to coarse sands. The solids will settle, adding to the clay liner. The liquid will evaporate. Some of the liquid will be recycled to the mill process.

The chemicals in the tailings pond liquid will originate from the mill process. The anticipated quantities are listed in Section 3, Table 3.1-2.

Two alternate tailings disposal systems are being considered. If proven technically feasible and environmentally sound, applicant will dispose of mill tailings in mined out open pits which have been sealed with compacted clay. Alternately tailings may be impounded behind an earthen dam in a natural drainage south of the millsite.

Tailings disposal pits will be mined completely to isolate them from mineable ore. The pit will then be backfilled above the watertable with overburden. The last two feet of fill will be selected clay which will be wetted during compacation with sheeps foot rollers to provide an impermeable barrier to downward seepage. Areas of the pit walls with exposed sands which might provide a pathway for tailings solution to reach the uncontrolled environment will be sealed. The method of sealing is still under investigation.

The most satisfactory sealant is expected to be compacted clay. This will not be effected by radiation or chemicals from the tailings and has a very low seepage rate.

If tailings are impounded behind a dam, one of two locations will be used. A starter dam sufficient for the first five years of operation will be constructed within a water shed tributary to the south fork of Box Creek to form a retention pond with a capacity adequate for five years of mill operation. If the site lying north of the millsite is used the dam design is shown on page 4-5 and a Geological Cross section beneath the dam is shown on page 4-6. A site south of the millsite is presently under study and if it is used these drawings will be revised. The initial dam design provides for additional storage capacity by raising the height of the starter dam to increase the tailings pond area.

The strata beneath the starter dam and pond is part of the Wasatch Formation and is comprised principally of claystones and siltstones, with some thin interbedded sands. From the lowest point in the stream channel, these subsoils extend to a depth of 50 feet to the top of the ore sand. A geologic cross section will be constructed from test boring data along the length of the dam.

The starter dam will be constructed using the modified centerline method. Unclassified overburden removed during mining will form the main structure. A keyway of selected clays will form the core of the starter dam and will extend threw the upper soil layers. Tailings will not be used for dam construction and a drainage blanket and seepage collection ditch will collect any seepage thru the dam so that is can be returned to the pond. The dam will be constructed with the dam base the final width. The clay core will be extended straight up with the unclassified overburden used on both sides. As shown in figure 3.4.2.-1.

All dam construction will be compacted. Construction will not be done during cold weather when frozen ground would prevent adequate compaction. The starter dam will have a crest elevation of 5,240 feet, and will have a top width of 30 feet. Total length of the starter dam will be approximately 3,900 feet.

Consideration is being given to constructing the entire dam at one time rather than in 5 year increments.

In either case, seepage would be minimized by use of an impermeable clay blanket or core and a compacted clay key. An internal drain of coarse material would collect any seepage through the dam and route it to the seepage collection ditch and insure that the dam does not become saturated.

The entire pond area will be stripped of topsoil and the topsoil stockpiled for use in site vegetation. The existing clays will then be compacted in place. In areas where permeable subsoils are exposed they will be covered with approximately 2 feet of selected clay which will be compacted in place.

Diversion ditches will be constructed upstream of the tailings pond to avoid collecting and contaminating runoff water from up valley.

A water collection dam, constructed similarly to the tailings dam, will be provided downstream from the tailings dam. The collection dam will collect runoff water from the downstream face of the tailings dam and impound the water for use in the mill or for return to the tailings pond. The water may be released to the downstream drainage if discharge permit requirements are met. Monitor wells will be provided down gradient to detect any seepage from the tailings pond or seepage collection ditches.

A continuing program of monitoring stability and seepage of the tailings pond and dam will be instituted. Movement points will be installed along the crest of the starter dam and surveyed to determine any subsidence or creep. Monitoring wells will be drilled below the dam and at locations surrounding the pond to monitor for seepage. Section 5.5 describes Applicant's operational monitoring program.

4.2.2 Other Process Liquids

Water used to launder protective clothing worn for yellowcake handling operations will be returned to the process for uranium reclamation or discharged to the tailings pond.

The small volume of wastes containing small amounts of laboratory reagents from the supporting chemical laboratory will be discharged into the tailings pond upstream of the sampler.

4.2.3 Sanitary Wastes

Sanitary wastes from the proposed mill will be treated by digestion in an underground anaerobic septic tank. Treated waste will then be discharged to a sewage lagoon. The sanitary systems will be sized for the maximum workers expected at each location. The construction of sewage treatment facilities in Wyoming is subject to approval by the Department of Environmental Quality. A permit will be obtained for the sewage treatment facility prior to construction.

4.2.4 Noncontaminated Solid Wastes

Solid wastes such as construction debris, office and lunchroom wastes, and packaging materials will be disposed of in an approved sanitary landfill near the proposed site.

4.2.5 Storm Water Runoff

Rainwater runoff at the mill will be allowed to enter the natural water shed except for the small quantity trapped within tank impoundments or routed to the tailings dam. Impounded water will either evaporate or percolate into the ground.

4.3 CONTAMINATED EQUIPMENT

Before unsalvageable process machinery is discarded in the sanitary landfill, the machinery will be acid cleaned to remove radioactive material and surveyed. The acid used in cleaning will be recycled to the mill process.

A controlled outdoor equipment storage yard will be provided for interim storage. Storm water runoff from this area will be impounded and directed to the process or the tailings pond.

Equipment and material contaminated with radionuclides from the ore, that cannot be released for burial in a sanitary landfill, will be shipped according to DOT regulations to an NRC licensed burial site.

5.0

RADIATION SAFETY PROGRAM

This section defines Applicant's operational radiation safety program. Design and planning aspects are covered in Sections 3.0 and 4.0. Instrumentation and measurements are covered in Section 3.3 and audits and evaluation are covered in Section 7.0. Section 5.0 is organized as follows:

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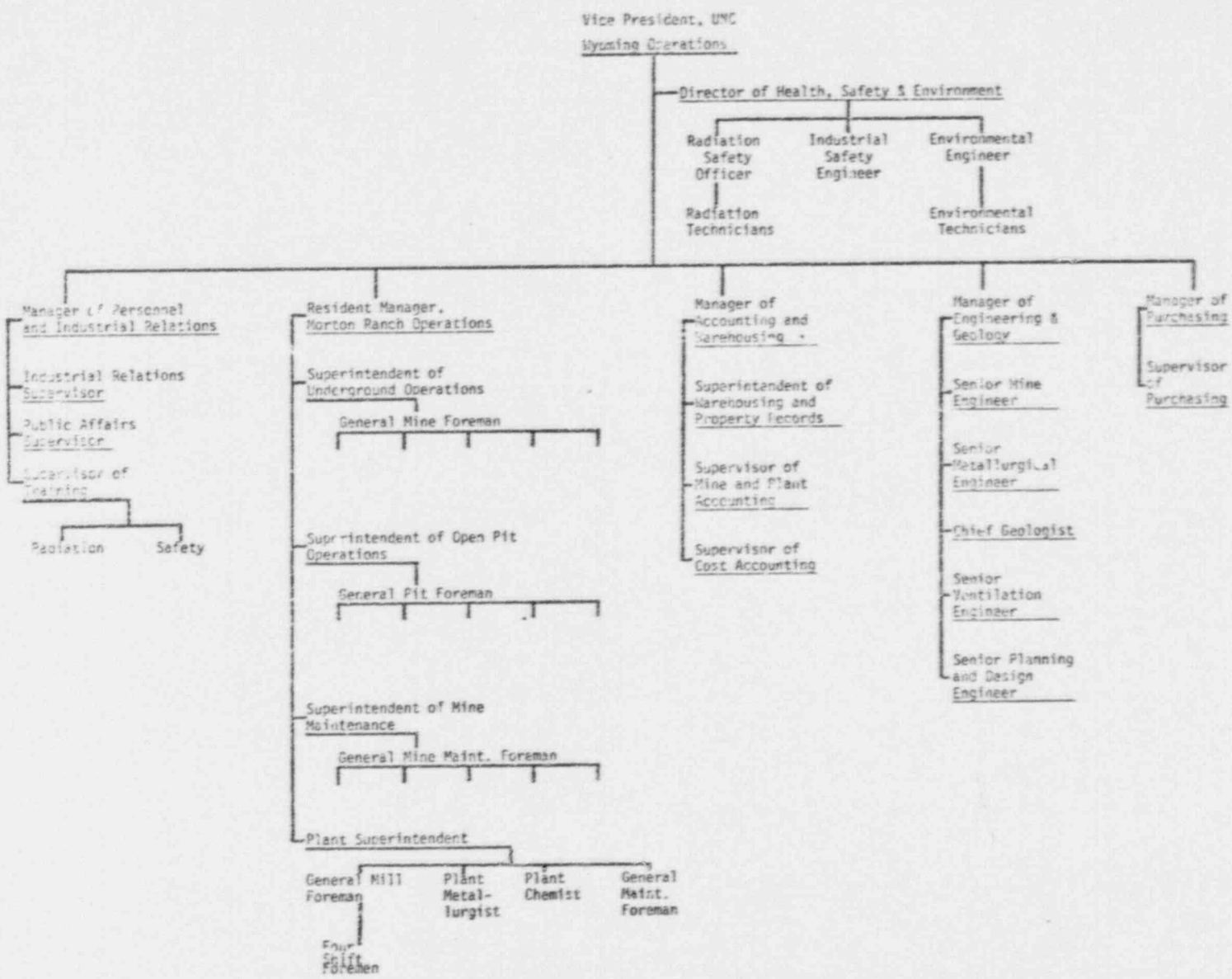
ADDENDUM

FIGURE 5.1-1. CORPORATE ORGANIZATION



UNITED NUCLEAR CORPORATION

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DOCUMENT UNC LA-2

PROGRAM BASES

Operation of the proposed mill will conform to the standards set forth in Title 10 Code of Federal Regulations Part 20 (10 CFR 20), "Standards for Protection Against Radiation". Radiation protection policies and procedures will be based upon appropriate Regulatory Guides, recommendations of the International Commission on Radiation Protection (ICRP), the National Council on Radiation Protection (NCRP), American National Standards Institute (ANSI), other applicable guides and recommendations, and good practices common to the uranium industry. It is the intent of the Applicant upon acceptance by the NRC of the attached proposal to fully implement the radiation safety program in future operations. NRC Form 3 "Notice to Employee "will be posted in accordance with Title 10 CFR 19.

The Radiation Safety Program entered herein basically consists of instructions, methods, reporting procedures and forms, and uses of various types of equipment of instruments. This program will be used as criteria for the future.

5.1 ORGANIZATION

This section defines Applicant's policy, organization for implementing policy and personnel qualifications.

5.1.1 Policy and Responsibilities

It is United Nuclear Corporation's policy to maintain occupational and non-occupational radiation exposures at the lowest level reasonably achievable during performance of work related to operation of its mining and milling operations. This policy is to be implemented via documented procedures developed by qualified personnel who have specifically assigned responsibilities.

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

Applicant's mines and proposed mill will be separate but interdependent operating units, with the Resident Manager having responsibility and authority for all operational phases of mining and milling. The Resident Manager reports to the Vice President of the Mining and Milling Division, Wyoming Operations. The Plant Superintendent will assume the responsibility for insuring the Radiation Safety Program is adhered to in all aspects. The Plant Superintendent reports directly to the Resident Manager. The Director of Health, Safety and Environment, reporting to the Vice President of Wyoming Operations, will serve in an advisory capacity to the Plant and Mine Superintendents and other personnel. That person will be responsible for:

1. Performance, documentation and review of a program of environmental and work area surveillance.
2. Maintenance of personnel exposure records.
3. Procurement and maintenance of radiation monitoring instruments.
4. Development of emergency procedures.
5. Managing an ongoing safety and emergency preparedness training program; mantaining training records.
6. Reviewing and approving maintenance and operating procedures to assure radiation safety, industrial safety and industrial hygiene practices.
7. Investigating accidents and notifying state and federal agencies as necessary.
8. Training and supervising the routine radiation protection activities of the Radiation Safety Officer.
9. Auditing conformance to procedural requirements dealing with health, safety and radiation protection.

5.2 QUALIFICATIONS

The qualifications of radiation protection personnel are enumerated below.

5.2.1 Director of Health, Safety and Environment

Qualifications of the Director HSE are:

1. BS degree or higher in a technical or scientific field, with specialized on-the-job training;
2. Training or experience in management;
3. Training or experience in mine and mill safety;
4. Experience in conducting training courses, preferably in radiation protection;
5. Good communicative skills to prepare both written and oral reports;
6. Demonstrated concern for the health and safety of employees;
7. Must have capability to exercise good judgment in dealing with emergency situations;
8. Experience in underground mining and/or milling operations.

5.2.2 Radiation Safety Officer

Qualifications of the Radiation Safety Officer are:

1. BS degree in a scientific or technical field, or equivalent work experience;
2. A minimum of two years radiation safety experience is required;
3. Training and/or experience in radiation protection;
4. Able to effectively communicate with all levels of management;
5. Demonstrated concern for the safety of personnel;
6. Demonstrated ability to perform assigned duties promptly and accurately and ability to use good judgment in emergency situations.

5.2.3 Industrial Safety Engineer

Qualifications of the Industrial Safety Engineer are:

1. BS degree in a scientific or technical field, or equivalent work experence;
2. Experience in underground and open pit mining and/or milling operations and industrial hygiene;
3. Required to communicate with all levels of supervision;

4. Demonstrated concern for the safety of personnel;

5. Capable to perform assigned duties promptly and accurately;

6. Exercise professional judgment in emergencies to protect life and property.

5.3 TRAINING

The programs to be used by United Nuclear Corporation for employee and supervisory radiation safety training will be based on the Nuclear Regulatory Commissions Guide 8.10 "Operating Philosophy for Maintaining Occupational Radiation Exposure as low as is Reasonably Achievable."

The following United Nuclear Corporation policy has been established to provide instructional programs aimed towards 1) an understanding of basic safety and health precautions associated with problems of radiation exposure, 2) the personnel protective devices for controlling radiation exposure and 3) reporting procedures for both employees and supervisors to comply with 10 CFR, part 19 and 10 CFR, part 20.

The RSO will be responsible for establishing and administering the radiation protection training program. This responsibility will include the development of, training materials and review of training documentation. United Nuclear Industries, Inc. of Richland, Washington, or equivalent facilities, if necessary, will provide health physics assistance in program development and administration and, if requested, conduct as needed evaluations of health physics practices at the Applicant's operation.

5.3.1 Policy

The primary objective of the mill radiation program is to keep personnel exposures to as low a level as can reasonably be achieved. This will be accomplished through process, administrative controls, engineering and surveillance of radiation and contamination levels, including airborne radioactivity and individual monitoring. Training in health and safety precautions associated with radiation and the use of

personnel protective devices will also be provided.

5.3.2 Employee Radiation Protection Training and Indoctrination

Basic indoctrination in radiation protection will be given to all plant employees before starting work. The basic indoctrination training will include:

1. Principles of radiation protection
   a. Definition and explanation of radiation and radioactive material;
   b. Biological effect of radiation.
      "As low as reasonably achievable" (ALARA) philosophy.
2. Radiation measurement
   a. Units of measurement;
   b. Detection methods and instruments;
   c. Applicable limits.
3. Methods of radiation control
   a. Radiation area work rules, including good housekeeping, proper handling of contaminated materials, external and internal contamination control (an example of typical radiation area rules is given in the addendum to this section);
   b. Protective clothing - proper use (demonstrations) and areas where worn;
   c. Respiratory protection - proper use; mask fitting and experience wearing a respirator (as covered in Section 5..4.1)
   d. Instrumentation and monitoring at the mill.
4. Radiation sources
   a. When and where to expect radiation and radioactive contamination;
   b. Potential hazards;
   c. Methods of identification for positive control.
5. Limits and guides
   a. Allowable exposure based on 10 CFR 20 and internal control (administrative) guides;
   b. Guides for maintaining exposure ALARA:

c. Posting required notices.

6. Radiation control and job performance

a. Consequences of rule violation

b. Exposure reduction through job planning

5.3.2.a New Employee Indoctrination, Orientation and Follow-Up

All new employees will be oriented in radiological safety procedures as established by the Applicant. For their protection, employees working in the final product areas are furnished protective clothing which can be laundered or serviced within the restricted areas. Emergency eye, face baths and showers will be located strategically throughout the plant. Caution signs, labels and signals will be displayed prominently as required. Employees who operate the drying and packaging circuits will be required to shower before going off duty. Bathing towels and soap will be provided by the Applicant and daily shower records will be retained in the Radiation files. (see 5.5.A).

All new employees must provide to Applicant a slip authorizing the Applicant to request previous occupational exposure to ionizing radiation.(See 5.5A). This report is to be obtained from the former employer if possible. This therefore becomes a permanent part of the employees Radiation Exposure Record in the Applicant's files and can be kept current available at all times.

Training will be mandatory for all new employees in order for them to understand the potential problems of radiation exposure, and their own personal responsibility to adhere to all Radiation Safety Rules for their own protection as well as others. Workers will be made knowledgeable of the procedures for making suggestions for better radiation protection and the importance of working together in order to lower radiation exposure.

New employees for their own safety will be made aware of the origin, location, and operation of job categories that require the strictest possible compliance with the Radiation Safety Program.

New employees will be schooled in allaspects of Radiation Protection Safety. This will ensure that all personnel can apply correctly Radiation Safety Protection as it relates to their primary duties and to temporary placement in the Plant area.

A follow-up safety session is to be conducted with each new employee and a written record maintained during the first three months of employment. Thereafter an annual test by the RSO of each employee's understanding of the Radiation Safety Program will be conducted and a record maintained in the Radiation files.

New employees will be furnished a list of all Radiological Safety Rules and Regulations. They must also sign an acknoledgement that they have received, read and understand those Rules and Regulations. (see 5.3A)

5.3.3 Supervisory Training

Additional training will be given to supervisors so they will be able to prcvide specific job-related training and evaluate their subordinates' performance. Supervisory training will include:

1. Radiation levels expected, normal and abnormal values;
2. Applicable standards and plant control limits, ALARA philosophy implementation;
3. Importance of training workers in radiation protection;
4. Planning and procedure review;
5. Methods for controlling radiation exposure;
    a. Protective clothing and respiratory equipment
    b. Radiation control areas (RCs) and posting requirements
    c. Traffic and material movement control
    d. Personnel monitoring
    e. Work practices

6. Methods for controlling radiation dose:

   a. Personnel dosimetry;
   b. Radiation control areas and posting requirements;
   c. Work practices.

7. Personnel and area clean-up methods.

Supervisor training will be documented in the same manner as indoctrination training, with retraining required annually.

Plant employees will receive on-the-job training from supervisors. Plant employees' job performance with respect to radiation protection will be appraised annually by his supervisor to determine if retraining is necessary. A training evaluation sheet, signed by the supervisor, will be placed in the employee's personnel file. Training given the employee will be documented with the date and type of training. This documentation shall be signed by the person providing training and the employee and will be placed in the employee's personnel file. The supervisor is responsible for continual evaluation and on-the-job training as necessary to insure the employee's exposure is maintained "as low as reasonably achievable."

5.3.4 Radiation Safety Officer (RSO) Training

A minimum of two years radiation safety experience plus related short course training in radiation safety is required to perform the duties of the RSO. Training should include:

1) Radiation measurement:

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

2) Biological effects;

3) ALARA philosophy;

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

5. Rules and Regulations

a) 10 CFR 19

b) 10 CFR 20

c) Regulatory guides

d) Internal (administrative control) guides

e) License conditions

The RSO will exercise supervision over the respective Radiation Techinicians as required to accomplish those goals established in this program.

5.3.5 Radiation Technicians

To qualify for the job of Radiation Technician, an applicant should have a high school diploma or equivalent with a science background. At least one year's experience in a chemical laboratory would be desirable. Technician on-the-job training and demonstration will be conducted by the RSO and other qualified persons. Oral and demonstration tests will be given to evaluate the technician's job performance. Documentation of training, test results and evaluation will be by written statement, signed by the technician and retained in his personnel file. Retraining and/or re-testing is required every two years and will be documented. Training documentation will be accomplished by use of forms similar to those found in 5.3A, Training Addendum.

5.4 SECURITY

The Morton Ranch is enclosed with a cattle-and sheep-tight fence with cattle guards at road entries. Similar fencing will be erected around the underground mine, the sewage lagoon and the tailings pond.

Appropriate signs will be posted at road entries and where necessary to control ingress and egress.

A fence will be placed around the mill area with gates for visitors and employees

at the administration building and for trucks and other heavy equipment. Both gates will be closed except for normal daytime business hours and periods of heavy traffic such as employee shift change. Supervisory personnel will be provided building keys.

Visitors to the Plant will be admitted only by permission of the Manager, Plant Superintendent, General Foreman or Safety Department. Each visitor will be checked in and out on a visitor's register and will be escorted by a qualified guide while within any secured area. Visitors having work assignments, such as an equipment manufacturer repair man, may be given security, safety and radiation protection orientation and subsequently allowed to perform their duties without escort. A sample Unescorted Visitor Orientation Record form is included in 5.4A.

The mill and tailings pond fences will be checked daily by RSO or other responsible employees to insure integrity of the fence and the results logged.

5.5 PLANT RADIATION COLLECTION AND SAMPLING PROGRAM

Applicant has developed a comprehensive radiation safety program to assure worker safety and adherence to applicable regulations. This section describes the radiation control and sampling practices applicant will employ to achieve this end.

5.5.1 Ventilation and Dust Collection System

The following ventilation and dust collection system will be installed in the plant to control the presence of radioactive particles in the atmosphere.

1) a wet dust collection system in the grind circuit;
2) a forced air ventilation system for leach agitator fumes;
3) a dry-wet dust collection system for the yellowcake drying and packaging areas;

4) a dry dust collection system for the ore sample preparation room;

5) gravity ventilators throughout mill buildings in ares not controlled by collection systems;

5.5.2 Personnel Sampling Program

To comply with the radiation exposure limits established in 10 CFR 20 and to assure that exposures will be maintained ALARA, Applicant has established a personnel sampling program, radiation measurement procedures and methods to safeguard employees from inhalation and ingestion of radioactive materials.

5.5.2.1 Limits

Occupational exposure to radiation will be limited to the values in Table 5.5.3

Exposure to minors will not exceed 1/10th of the Table 5.5.3 values.

5.5.2.2 Exposure to Airborne Radioactivity

Dust surveys will be conducted to yield data from which a monthly average exposure can be computed. Employees working in the same operation are expected to be subjected to approximately identical exposures. The sequence is repetitive on a daily basis. The daily or weekly averages, therefore, can be calculated from the monthly sample data.

The survey will consist of the collection of both Breathing Zone (BZ) and General Area (GA) air samples taken at designated stations throughout the plant area. Refer to Table 5.5-5 for stations locations.

BZ samples will be taken within twelve inches of the operators mouth and nose during operations.

GA samples will be collected from fixed locations in areas normally occupied by employees for significant periods of time. These samples will cover process areas, lunch rooms, mill offices, change rooms and restrooms. Collection points will be from three to ten feet from the floor and clear of any air obstructions, so that

5.5.1

CONVERSION FACTORS and REPORTING UNITS
Based on Part 20, Amended July 29, 1974

Airborne natural uranium in restricted area - ore dust or yellowcake:

$$\frac{\mu gU}{\text{liters of sample} \times 10^3 ml/L \times 1.5\ gU/\mu Ci \times 10^6\ \mu g/g} =$$

$$\frac{\mu g}{\text{liters} \times 1.5 \times 10^9} = \text{uCiU/ml}$$

Report in $\mu CiU \times 10^{-11}/ml$

Airborne natural uranium in unrestricted area - ore dust or yellowcake:

Conversion from ugU to uCiU is same as above

5.5-2

MAXIMUM PERMISSIBLE CONCENTRATIONS IN AIR AND WATER

From Part 20 Amended - Effective July 29, 1974

RESTRICTED AREAS

Airborne natural uranium in ore dust:	uc/ml
40-hour week basis	5×10^{-11}
42-hour week basis	4.8×10^{-11}
48-hour week basis	4.2×10^{-11}
56-hour week basis	3.6×10^{-11}

Airborne natural uranium in yellowcake:	
40-hour week basis	1×10^{-10}
42-hour week basis	9.5×10^{-11}
48-hour week basis	8.3×10^{-11}
56-hour week basis	7.1×10^{-11}

UNRESTRICTED AREAS

Airborne natural uranium in ore dust:	
Based on 100% occupancy	2×10^{-12}

Airborne natural uranium in yellowcake (little application; only applicable to area immediately adjacent to yellow cake areas and where there would be essentially no exposure to ore dust):	
Based on 100% occupancy	5×10^{-12}

Liquid effluents	
Radium-226	3×10^{-8}
Thorium-230	2×10^{-6}
Uranium-natural	3×10^{-5}

$$\frac{\text{conc. Ra-226}}{3 \times 10^{-3}} \quad \frac{\text{conc. Th-230}}{2 \times 10^{-6}} \quad \frac{\text{conc. U-nat.}}{3 \times 10^{-5}} \leq 1$$

a normal concentration can be measured.

In order to compute the average daily exposure of an employee, both BZ and GA samples will be obtained.

All samples will be analyzed by the approved procedure for such determinations. If any employee exceeds 25% Maximum Permissable Concentrations (MPC), a film badge will be provided for his protection.

Special airborne dust samples will be taken during non-routine maintenance of yellowcake processing equipment. Individual exposure will be computed on a Special Maintenance Job Evaluation form (see Addendum 5.5A).

Additional samples will be taken and surveys conducted as frequently as is deemed necessary to comply with 10 CFR 20.

TABLE 5.5-3

EXPOSURE LIMITS and CONTROL POINTS

Type of Exposure	Exposure Period	Exposure Limit Dose Equivalent	Control Point
Whole body, head and trunk, active blood forming organs, lens of eyes, or gonads	Year Quarter	5 rem 1 1/4 rem(a)	3 rem/yr 1 rem/qtr
Hands and forearms, feet and ankle	Year Quarter	75 18-3/4	--- ---
Skin of whole body	Year Quarter	30 7 1/2	--- ---
Concentrations of radioactive(b) materials	7 consecutive days	40 MPC hours(c)	20 MPC hours

(a) An individual may receive a dose to the whole body greater than 1 1/4 rem per quarter provided:

(1) During any calendar quarter, the dose to the whole body from radioactive material and other sources of radiation in the licensee's possession shall not exceed 3 rems; and

(2) The dose to the whole body, when added to the accumulated dose to the whole body, shall not exceed 5 (N-18) rems where "N" equals the individual's age in years at his last birthday; and

(3) The individual's accumulated occupational dose to the whole body has been calculated on Form NRC-4, or on a clear and legible record containing all the information required in that form; and has otherwise complied with the requirements of 20.102, paragraph (b), of Title 10 Code of Federal Regulations.

(b) "Expose" means that the individual is present in an airborne concentration. No allowance will be made for the use of protective clothing or equipment or particle size except as authorized by the Nuclear Regulatory Commission.

(c) MPC values are as specified in Appendix B, Table 1, Part 20, Title 10, Code of Federal Regulations.

5.5.2.3 Gamma Radiation

Gamma radiation rates will be measured. Records will be kept of all surveys made.

General area surveys will be made in the following areas at monthly intervals.

1) grinding circuits

2) coarse ore bins

3) sample preparation rooms

4) final product areas

5) main exit from the mill (provided for individual self monitoring).

A gamma survey instrument will be utilized at the main exit from the mill for individual self-monitoring of radiation exposure to insure that individuals do not carry radioactive material to a non-restriced area.

5.5.2.4 Film Badge Program

Film Badges will be worn by selected employees on each shift and processed at the end of each month, unless it is suspected that an individual has equaled or exceeded a control point. Any employee that may be expected to reach 25% MPC will be badged on a permanent basis. Control Badges will be used at each operator's post to establish a base line. Instruction will be given to all employees on care and wearing of Film Badges. The results received from the badge will be entered

in each employee's radiation record.

An individual receiving overexposure in any area or areas will be removed from this area until his calendar MPC record indicates he is below normal exposure levels.

5.5.2.5 Bioassay and In vivo Measuring

Pursuant to the current provisions of NRC Regulatory Guide 8.11 "Applications of Bioassay for Uranium" a program will be established to assure that the doses received from radioactive materials deposited in the body fall within applicable limits.

A bioassay program will be conducted for uranium, radium and thorium. This program will consist of pre-placement and annual tests, unless airborne radiation surveys indicate a greater frequency is required. Both in vivo measurements and urinanalysis will be utilized. A certified testing laboratory service will be employed for these measurements.

All bioassay results will be evaluated by the RSO. Results will be reported to the employee and his or her supervisor as soon as practicable. Explanation of results will be provided upon request.

5.5.3 Source Control

The control of radioactive materials is one of the methods Applicant will use to limit exposure to radioactive materials. This section describes (1) the labeling of radioactive materials and areas where radioactive materials are present, (2) the rules and procedures system to safeguard personnel in areas where radioactive materials may be present, and (3) the radiation survey program to detect and measure radiation sources within the mill.

5.5.3.1 Radiation Work Area Designation and Labeling

Areas containing radioactive material are designated radiation work areas if any of the following conditions are present:

1. Dose rates in excess of 1 mrem/hr;
2. Airborne radioactive materials are present in concentrations above 25% of the value specified in 10 CFR 20, Table 1.

All radiation control areas will be properly marked with the appropriate sign identifying both the presence of and type of radioactive material present.

No items will be removed from contaminated or airborne radioactivity areas without monitoring to assure contamination does not exceed limits. Approved handling, storage and control of contaminated items are the responsibility of the radiation protection staff.

Packaged radiation sources such as yellowcake drums will be marked with the standard radiation symbol in accordance with 10 CFR 20.

5.5.3.2 Radiological Safety Rules

Control of work, traffic and movement of materials will be by radiation area rules (see Section 5.5A), radiation protection requirements, monitoring requirements, and establishment of boundaries with specific entry and exit points.

Radiation Protection Rules will be prepared by the radiation protection staff and posted in change rooms and at the entrance to radiation control areas. They will include the following provisions: (See 5.5A)

1) Film Badge requirement;
2) Protective clothing requirements;
3) Monitoring requirements;
4) Respiratory protection requirements;
5) Self survey requirements;
6) Other applicable instructions.

5.5.3.3 Radiation Sampling Procedures

Airborne Dust Sampling: General Area (GA) and Breathing Zone (BZ) samp'es will be collected routinely on a monthly schedule from sample stations (Table 5.5-2) along the operational circuits of the plant. Special airborne dust samples will be collected during all non-routine maintenance on yellowcake processing equipment. These samples will be analyzed and used to compile individual exposure records.

During evaluation of similar uranium processing plants, the area where the final product (yellowcake) is processed, has been found to have the highest exposure to radioactive particles in the respirable air. This area will be enclosed and entry restricted to aughorized personnel who will be required to wear National Institute of Occupational Safety (NIOSH) approved respirators during all operations and clean up. (See Section 5.5.4.1)

General Area (GA) samples are taken at a five-foot elevation from a fixed platform at a rate of 17.5 liters/minute for ten minutes. Breathing Zone (BZ) samples will be taken at a rate of 17.5 liters/minute for ten minutes within twelve inches of the operators mouth and nose during operations. Sample filters are placed in celluloid envelopes and are delivered to the analytical laboratory for analysis

utilizing a chemical fluorimetric procedure for U_3O_8 determination. Refer to Section 3.3 for equipment used.

Time studies will be made on a time-weight average based on United Nuclear Corporation's computerized payroll system.

5.5.3.4 Gamma Radiation

The gamma survey will be taken monthly in each circuit of the mill. The probe will be held waist high and physically exposed to areas being used by personnel in the performance of their work. Records will be kept of all readings. If an employee or area exceeds 25% of MPC further monitoring by use of a Film Badge will commence.

5.5.3.5 Instrumentation

Surveillance will be accomplished using radiation detection instrumentation described in Section 3.3.

1) Radiation surveillance
   - Alpha survey meters
   - Beta-gamma dose rate meters
   - Film Badges
2) Airborne radioactive surveillance - air sampling method
   - High volume air samplers
   - Low volume air samplers

5.5.3.6 Plant Monitoring Stations

The plant processing area is divided into distinct areas of process operations and job functions. Each area is assigned one or more monitoring stations depending upon routine employee exposure to potential sources of radiation or radioactive materials.

Table 5.5-5 lists each job function area and its corresponding monitoring station.

TABLE 5.5-4

INTERNAL AIRBORNE SAMPLING STATIONS

Job Function Area		Monitoring Station Designation and Location
Grind Area - A	●	A-1 Ore Pad
	●	A-2 Loader Operator
	◆ ◀ ●	A-3 Pan Feeder
	◆ ◀ ●	A-4 Magnet
	◆ ◀ ●	A-5 Feed to Mill
	◆ ◀ ●	A-6 Discharge from Mill
	◆ ◀ ●	A-7 Operators Post
	◆ ◀ ●	A-8 Cyclone Deck
	◆ ◀ ●	A-9 Floor (during clean-up)
Sample Preparation - B	◆ ◀ ●	B-1 Pulverizer
	◆ ◀ ●	B-2 Weigh and Packaging
Leach - C	◆ ◀ ●	C-1 #1 surge tank
	◆ ◀ ●	C-2 #2 surge tank
	◆ ◀ ●	C-3 Operators Post
	◆ ◀ ●	C-4 Floor between tanks
CCD Circuit - D	◆ ◀	D-1 Operator's post
	◆ ◀	D-2 Access from Mill
	◆ ◀	D-3 #1 Thickener
	◆ ◀	D-4 #6 Thickener
	◆ ◀	D-5 Tunnel to #1 Thickener
	◆ ◀	D-6 Tunnel to #6 Thickener
	◆ ◀	D-7 Floor (during clean-up)
Solvent Extraction - E	◆ ◀	E-1 Operator's Post
	◆ ◀	E-2 #1 settler tank
	◆ ◀	E-3 #4 settler tank
Precipitation - F	◆ ◀	F-1 Operator's Post
	◆ ◀	F-2 Between precipitation tanks
	◆ ◀	F-3 Over #1 Thickener
	◆ ◀	F-4 Over #2 Thickener
	◆ ◀	F-5 Floor (during clean-up)
Drying - G	◆ ◀	G-1 Yellowcake Dryer
	◆ ◀	G-2 Hammermill
	◆ ◀	G-3 Scrubber
	◆ ◀	G-4 Centrifuge
	◆ ◀	G-5 Operator's Post
	◆ ◀	G-6 Dryer (at start up)
	◆ ◀	G-7 Dryer (at shut down)
	◆ ◀	G-8 Dryer (during clean up)

LEGEND:

Airborne Dust ◆
Gamma ◀
Radon 222 ●

TABLE 5.5-4

(concluded)

Packaging - H	H-1	Yellowcake Sample Preparation
	H-2	General area (during packaging)
	H-3	General area (during clean-up)
General - I	I-1	Yellowcake personnel clean-up room
	I-2	Mill change room - men
	I-3	Mill change room - women
	I-4	Lunch Room
	I-5	Shift Office
	I-6	Main Electrical Control Center
	I-7	Storage Area

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Monitoring procedures carried out at these stations include air sampling for Natural Uranium, surveys for gamma radiation and Radon 222. All monitoring areas listed will be sampled on a monthly basis except for Radon 222. Monitoring for Radon 222 will be done in accordance with Division 8 Regulatory Guides, Occupational Health.

5.5.4. Personal Protective Equipment

5.5.4.1. Respiratory Protection

Applicant will utilize the control for personnel radiation exposure outlined in Sections 5.2, 5.3 and 5.4 to achieve the lowest level reasonable. When such engineering controls, including process, containment, and ventilation are not feasible, the use of respiratory protective devices consistent with Title 10 CFR 20, Part 20, "Standards for Respiratory Protection Against Radiation", Regulatory Guide 8.15 "Acceptable Procedures for Respiratory Protection" ANSI 88.2 - 1969 "Practices for Respiratory Devices", and NUREG-0041 "Manual of Respiratory Protection Against Airborne Radioactive Materials" may be employed as a control measure.

Respiratory protection may be required for employees working in certain areas or performing certain jobs for any one of three reasons:

a) Airborne activity levels exceed or are likely to exceed 25% of the levels specified in 10 CFR 20, Appendix B, Table 1, Column 1;

b) Work of a non-routine or emergency nature being done that could cause the level specified in a) above to be reached;

c) To control inhalation of airborne radionuclides to the lowest level reasonably achievable.

Respiratory protection equipment will be used whenver airborne radioactivity is

$\geq$ 200,000 dpm/100 cm^2 beta gamma or

$\geq$ 20,000 dpm/100 cm^2 alpha

TABLE 5.5-5

PROTECTION FACTORS FOR RESPIRATORS[a]

DESCRIPTION[b]	MODES	PROTECTION FACTORS PARTICULATES ONLY	SELECTION OF TESTED & CERTIFIED EQUIPMENT BUREAU OF MINES/NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH APPROVALS
1. AIR PURIFYING RESPIRATORS			
Facepiece, half mask[c]	Negatitive Pressure	10	
Facepiece, full	Negatitive Pressure	50	30 CFR Part 11 Subpart K
Facepiece, half mask, full or hood	Positive Pressure	100	

a. For use in the selection of respiratory protective devices to be used where the the contaminant has been identified and the concentration (or possible concentration is known.

b. Only for shaven faces and where nothing interferes with the seal of tight-fitting facepieces against the skin. (Hoods and suits are excepted.)

c. Under-chin type only. This type of respirator is not satisfactory for use where it might be possible (e.g., if an accident or emergency were to occur) for the ambient airborne concentration to reach instantaneous values greater than 10 times the pertinent values in Table I, Column 1 of Appendix B to 10 CFR Part 20, "Standards for Protection Against Radiation." This type of respirator is not suitable for protection against plutonium or other high-toxicity materials. The mask is to be tested for fit with irritant smoke, prior to use, each time it is conned.

The applicant shall designate the RSO as the person responsible for an adequate respirator program. The minimum program shall include:

a) Air sampling and other surveys sufficient to identify the hazard, to evaluate individual exposure, and to permit proper selection of the respiratory protective equipment;

b) Procedures to assure proper selection, supervision and adequate training of personnel using such protective equipment;

c) Procedures to assure the adequate fitting of respirators and the testing of equipment for operability.

d) Procedures for maintenance to assure full effectiveness of respiratory protective equipment, including issuance, cleaning and decontamination, inspection, repair, and storage;

e) Records sufficient to permit periodic evaluation of the adequacy of the respiratory protective program. (see 5.5 A)

The selection and use of respirators will be governed by NIOSH certification in accordance with U.S. Bureau of Mines tests as specified in Title 30 CFR Part 11 "Respiratory Protective Devices; Tests for Permissibility; Fees" dated March 23, 1972. These protection factors were obtained from the "Manual of Respiratory Protection Against Airborne Radioactive Material" NUREG-0041 published in October, 1976. (Table 5.5-4)

5.5.4.2 PROTECTIVE CLOTHING

Protective clothing will be provided by applicant to all employees working in yellowcake areas. Laundry and shower facilities will be supplied adjacent to yellowcake area.

5.6 ENVIRONMENTAL SAMPLING and CONTROL PROGRAM

Applicant will monitor effluents from the mill and take radionuclide measurements in the environment according to the program outlined in Table 5.6-1.

5.6.1 Mill Monitoring

A study period of three months duration will be established upon mill startup. Intermittent emission sampling on bi-weekly basis will be performed on the yellow-

cake dryer for approximately one hour during operation. Isotopic Analysis will be performed for Natural U, Ra226, and Th230 on at least one sample each month. A grab sample will be taken on all other plant stacks semi-monthly. Isotopic analyses will be performed bi-weekly for Natural Uranium, Ra226, Th230 and Radon 222 on at least one sample each month. If minimums are met, thereafter, samples will be taken at monthly intervals. Applicant will measure the flow rates and isokinetically sample the exhaust stack air as outlined in Table 5.6-1. Other airborne radionuclides released to the environment by the proposed mill will be evaluated in the environmental sampling program.

Sample sizes specified in Table 5.6-1 provide detection levels for stack air well below the MPC values for unrestricted areas.

Should the concentration of radionuclides in air or water effluents exceed federal or state limitations, corrective action will be taken by Applicant to bring the effluent concentrations back within prescribed limits. The corrective actions would involve determining the cause of the excess concentration, halting the process in question, and repairing or modifying the faulty equipment.

All liquid effluents from the proposed mill will be discharged to the tailings pond. Numerous samples will be taken in the mill in addition to composite samples from the tailings samples. Composite samples will be used to establish the inventory of radionuclides discharged to the tailings pond.

5.6.2 Environmental Radiological Monitoring

The operational environmental radiological monitoring program outlined in Table 5.6-1 is an extension of the pre-operational environmental monitoring program.

5-31-32

TABLE 5.6-1 (Page 1 of 2)

OPERATIONAL EFFLUENT AND ENVIRONMENTAL MONITORING PROGRAM

Medium	Sampling Location	Parameter Measured	Lower Limit of Detection**	Sampling Frequency	Sample Size or Type
MILL EFFLUENT SAMPLING					
Air	Ore grinder and leachtank stack	Nat U	3×10^{-13} µCi/ml	Semi-annually	Filter 2 cfm for minimum of 6 hours
		Ra-226	2×10^{-13} µCi/ml		
		Th-230	5×10^{-13} µCi/ml		
Air	Yellowcake dryer stack, and yellowcake packaging stack	Nat U	3×10^{-13} µCi/ml	Monthly	Filter 2 cfm for minimum of 6 hours
		Th-230*	5×10^{-15} µCi/ml	Monthly	
		Ra-226*	2×10^{-12} µCi/ml	Monthly	
		Flow rate	± 15%	Semi-annually	Air Velocity Meter
Water	Discharge to tailings pond, 1 site	pH	.02	Monthly	Grab Composite Sample
		NatU	3×10^{-5} µCi/ml	Monthly	Grab Composite Sample
		Th-230	2×10^{-6} µCi/ml	Monthly	Grab Composite Sample
		Ra-226	3×10^{-8} µCi/ml	Monthly	Grab Composite Sample
Water	If water is discharged from final mine water settling pond or treatment facility, sampling would be conducted as required by the applicable NPDES Permit.				
WITHIN MILL SAMPLING					
Air	Work locations within proposed mill, various sites	Gross alpha	3×10^{-13} µCi/ml	Monthly on each shift	Filter 6 hour sample at at 2 cfm
		Gross beta	1×10^{-11} µCi/ml		
		Rn+daughters	0.1 WL		Filter 5 min sample at 2 cfm
		External gamma	5 mR/hr		Portable Instrument
Air	Work location in mine, various sites	Rn+daughters	.0.1 WL	Quarterly on each shift	Filter 5 min sample at 2 cfm

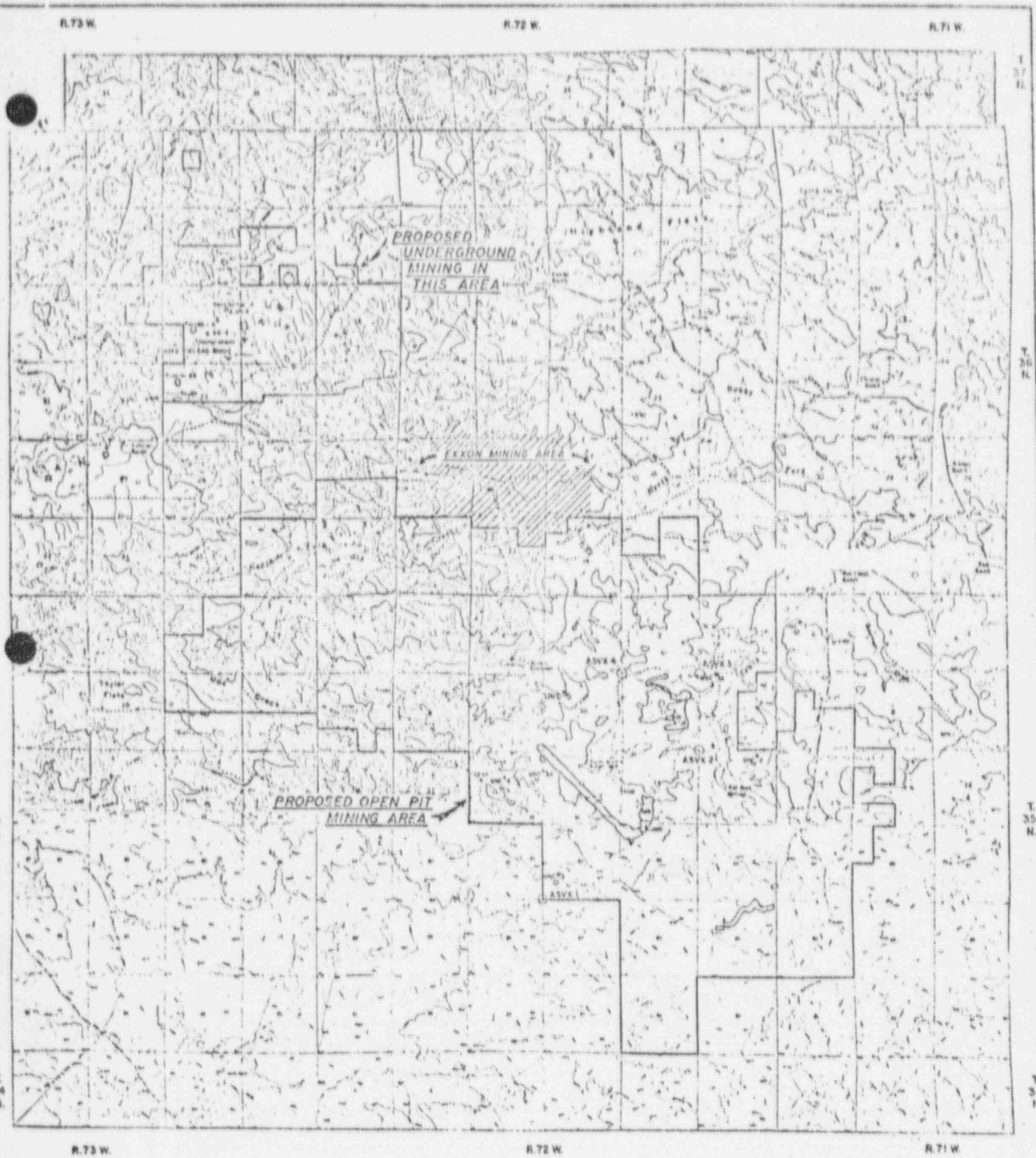
*Composite product samples will be collected and analyzed semi-annually for Th-230 and Ra-226. Results of these analyses will be used to determine the uranium, thorium and radium ratio and therefore the radium and thorium concentration.

**Based on NRC Regulatory Guide 4.14 Measuring, Evaluating and Reporting Radioactivity in Releases of Radioactive Materials in Liquid and Airborne Effluents from Uranium Mills (for comment only).

TABLE 5.6-1 (Page 2 of 2)

Medium	Sampling Location	Parameter Measured	Lower Limit of Detection*	Sampling Frequency	Sample Size or Type
ENVIRONMENTAL SAMPLING AND MONITORING	Same as preoperational environmental sampling program. See Table 6.0-1.				
Drinking water obtained from Applicant's site	Applicant's site	Gross alpha Gross beta Th-230 Ra-226 Nat U	1×10^{-10} µCi/ml 1×10^{-8} µCi/ml 2×10^{-10} µCi/ml 3×10^{-7} µCi/ml 3×10^{-7} µCi/ml	Semi-annually	2 gallons
Air	See Fig 6.2-1 4 sites	Gross alpha Gross beta Th-230 Ra-226 Natural uranium Pb-210	5×10^{-15} µCi/ml 5×10^{-15} µCi/ml 8×10^{-17} µCi/ml 2×10^{-15} µCi/ml 3×10^{-15} µCi/ml 4×10^{-15} µCi/ml	Quarterly	Continuous sample collection for one week every quarter.
Air	2 locations	Particulates	4 µg/m^3	Bi-weekly	Filter approximately 2000m^3 of air and weigh filter
Air	4 sites	Ra-222	3×10^{-11} µCi/ml	Monthly	Continuous sample collection for 1 week samples every 48 hours
Meteorology	Mill site	Wind speed Wind direction Temperature	0.5 mph 22.5° at 1 mph -25 F to 125 F	Continuous	
Soils	See Fig 6.2-1; 4 sites	Gross alpha Gross Beta Th-230 Ra-226 Nat U	0.1 pCi/g(dry) 0.05 pCi/g(dry) 0.01 pCi/g(dry) 0.01 pCi/g(dry) 0.1 µg/g(dry)	Semi-annually	1000 g for each soil layer: 0-2 inch 2-4 inch
Vegetation	See Fig 6.2-1; 4 sites	Gross alpha Gross beta Th-230 Ra-226 Nat U	0.1 pCi/g(dry) 0.05 pCi/g(dry) 0.1 pCi/g(dry) 0.1 pCi/g(dry) 0.1 µg/g(dry)	Semi-annually	2 liter compressed grasses + leaves from plants used for feed by antelope, cattle or sheep. Green vegetation preferred
Environmental radiation	See fig 6.2-1; 4 sites	Environmental gamma dose rates	9 mrem over 90 day exposure	Semi-annually	3-LiF dosimeters

*Based on NRC Regulatory Guide 4.14 Measuring, Evaluating, and Reporting Radioactivity in Releases of Radioactive Materials in Liquid and Airborne Effluents from Uranium Mills (for comment only).



Air, Soil and Vegetation Map

8/19/77

REVISED BY	DATE
	8-19-77
	8/19/77

UNITED NUCLEAR CORPORATION

ENVIROMENTAL MAP

Air, Soil, and Vegetation Map

3000- 00 00 0000- 35- 00 MAP

The environmental sampling program for water, air, soils, vegetation and environmental gamma radiation will be conducted semi-annually as specified in Table 5.5-6. Measurements of gross alpha, gross beta, Th-230, Ra-226 and natural uranium will be performed by United Nuclear Laboratory or outside certified Laboratory.

5.7 ALARA COMMITTEE (As Low As Reasonably Achievable)

United Nuclear Corporation has always considered safety as a primary objective in every phase of its operations. Applicant has the same concern for occupational radiation exposures to employees as it does to other occupational hazards.

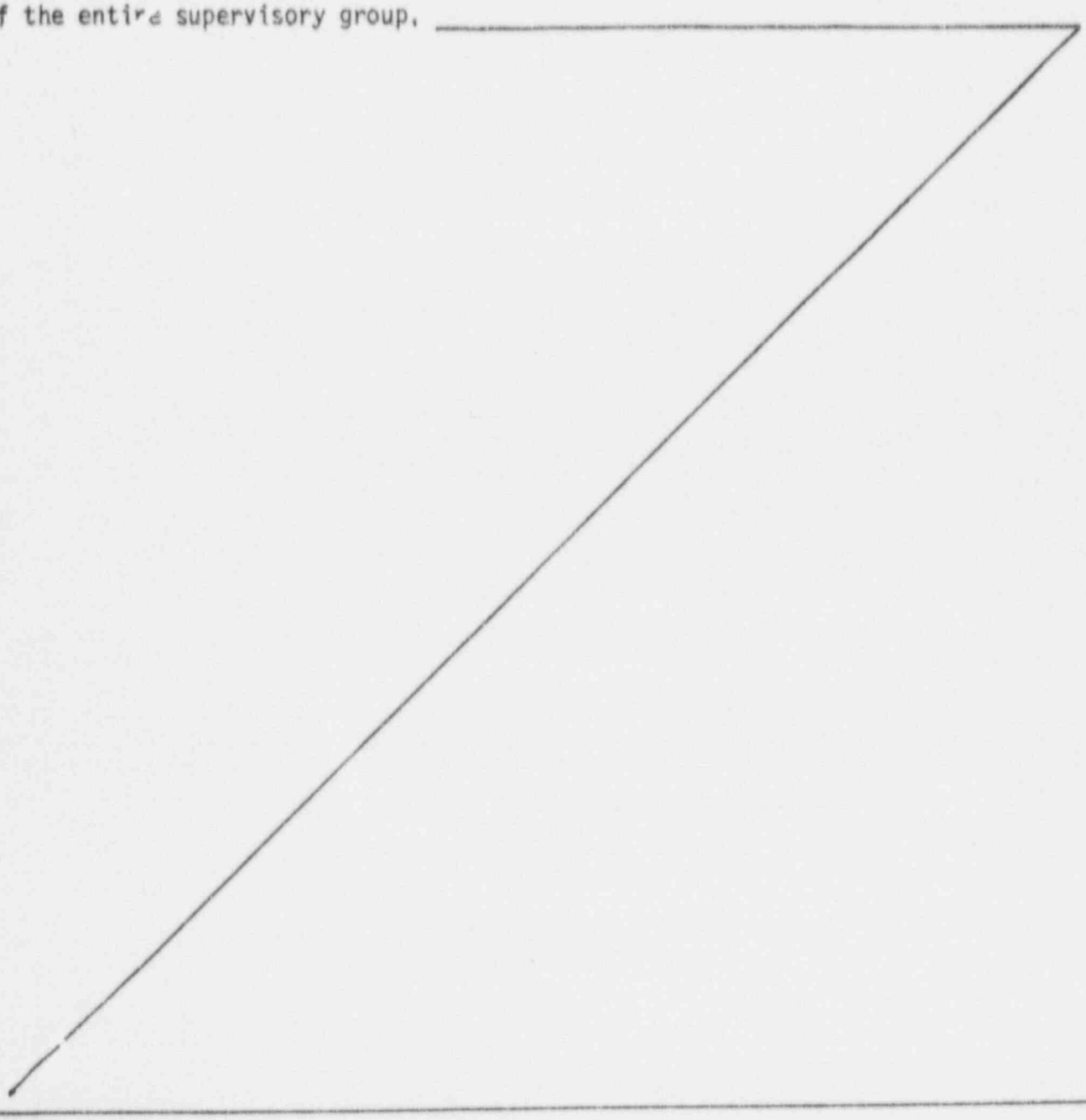
All levels of management will be required to take active roles in matters of safety including occupational and non-occupational radiation exposure. Corporate safety personnel, safety advisors of insurers and other qualified persons may make periodic tours and inspections of the operations. Lectures, films, displays and meetings will be provided by appropriate staff and management personnel. For matters requiring technical expertise pertaining to radiation, the applicant can also call upon United Nuclear Industries, Inc., Richland, Washington, or equivalant facilities, for assistance and guidance.

An auditing program will be established to evaluate on a continuing basis the exposure levels as determined by sampling and analysis of work areas. Operating procedures and exposure records will be reviewed with the goal of minimizing exposures.

The Radiation Safety Officer (RSO), Shift Supervisors, and the Superintendent, HSE and Safety Engineer, with the direct assistance of the Plant Superintendent, constitute a safety group. On start up of the milling facility an expanded group of this nature will form the ALARA Committee.

The ALARA Committee will be given the responsibility to determine locations where potential radiation exposure may or could exist or develop. The main areas of concern would initially include the ore stockpile, grinding circuit, coarse ore storage, leaching, yellowcake preciptation, concentrate centrifuge room, concentrate drying and packaging and tailings disposal.

The Radiation Safety Officer (RSO) and the ALARA Committee will have primary responsibility for all aspects of radiological safety with full cooperation of the entire supervisory group.



The RSO's responsibilities and authority are expressed in the respective Job Duties and Work Practices. However, to further clarify his position, the RSO has the authority to halt unsafe practices at all times in any department subject to radiation hazards. In the event shutting down a section of the mill is indicated, consultations with higher authority (Plant Superintendent) is prudent. Action must be taken as deemed necessary to correct the problem.

Orientation of newly-hired personnel by the Radiation Safety Officer, Safety Engineer and Supervisors and the required observance of all established in-plant radiation rules and regulations will be required.

The authority vested in the ALARA Committee will be similar to other like operations, i.e., the Committee will be granted the authority to stop or secure any person or persons, equipment or areas wherein a violation of governing regulations has been discovered. Further, the Committee will request a meeting of the mill staff or those staff members involved, at the earliest convenience in order that a systematic method can be established to correct any urgent problem. In all cases, immediate notification to the Plant Superintendent is mandatory.

Recommendations by operating and maintenance personnel will be evaluated and incorporated into procedures and or equipment modification. Supervisory and engineering personnel will also evaluate all data available from technical and individual sources to further substantially reduce radiation exposures.

Frequency of the ALARA Committee inspections are to be quarterly. The regulatory position to be taken by the ALARA Committee must be one of strict adherence to instructions governing radiological safety.

The Committee should particularly observe those areas of greatest potential source

of radiation exposure, i.e., crushers and final product areas. All areas of the operation will come under scrutiny, however.

Evaluation of available technical data and other methods to reduce exposure is required. Investigation of problem areas or malfunctioning equipment is a prerequisite to recommendations of correction.

The ALARA Committee is anticipated to be as follows:

Reporting direct to the Superintendent HSE:

1) Committee Head- Radiation Safety Officer
2) Plant Superintendent
3) Maintenance Foreman
4) General Operations Foreman
5) Shift Foreman
6) One - Hourly Maintenance Person
7) One - Hourly Operations Person
8) Industrial Safety Engineer

Reports of all ALARA Committee activities will be furnished to the Plant Superintendent, Resident Manager and Vice President, Wyoming Operations. Since the ALARA Committee meets on a quarterly frequency, the written reports are to be filed at the same frequency, and will include review of those areas of the greatest potential source of radiation exposure, i.e., grinding and final product areas, any corrective action taken in the respective departments, any closure of a particular part of the operations and reasons explaining the necessity of these actions. Record reviews of operating procedures and past exposure evaluation. Review and record evaluation of employees suggestions relative to radiation safety protection. Any new methods or operating procedures as approved by this committee will

be included in the reports.

5.7.1 ALARA ANNUAL ANALYSIS

An annual review of the ALARA Committee's inspections, findings, recommendations and corrective actions, is to be conducted at mid-year. Personnel participating in this review should include certain managerial personnel or their representatives. In attendance should be the following:

Vice President, Wyoming Operations
Health, Safety & Environmental Superintendent
Resident Manager
Plant Superintendent
Radiation Safety Officer

and the remainder of the ALARA Committee.

5.7.2 RECOMMENDATIONS FOR LOWERING EXPOSURE

1) Management annually will make a formal audit to determine how exposure might be lowered;

2) This audit will include reviews of operating procedures and past exposure records. It is the intent of the Applicant to conduct regular inspections, and to consult with the Radiation Safety Officer as well as outside consultants, with the primary purpose of lowering the exposure to radiation.

3) Procedures for receiving and evaluating suggestions relating to radiation safety protection from employees will be established. Employees upon their initial indoctrination, will be advised as to how this is to be accomplished, and whom to notify in the event they have a suggestion of merit.

4) Each employee will be made aware of the need for constant surveillance in jobs associated with radiation exposure, and his own responsibility in determining the cause and action that should be taken.

5) The Radiation Safety Officer will be vigilant in keeping abreast of all new innovations and improved equipment in the area of radiation safety.

6) A written report of the annual formal audit of the ALARA Committee will be distributed to those personnel participating in the ALARA annual analysis and it will be the responsibility of the Vice President, Wyoming Operations, to review and to take any necessary corrective action.

The Applicant has a commitment to its personnel to keep the occupational exposures as low as reasonably achievable. Workers will be made familiar with this policy upon employment. They will be told what radiation exposure means, and why they are required to implement Radiation Safety Rules and Regulations at all times on

their jobs. Employees will be made aware of the importance and responsibility of their own actions in lowering the radiation exposure for all people they come into contact with on a daily basis.

5.3A TRAINING ADDENDUM

TYPICAL RADIATION AREA RULES

CLASS TRAINING RECORD

PERFORMANCE EVALUATION FORM

(Example Form)

UNITED NUCLEAR CORPORATION

Wyoming Operations

PERFORMANCE EVALUATION

NAME_____ JOB TITLE_____

JOB RESPONSIBILITY (Application to Radiation Work)	EVALUATION OF PERFORMANCE
ADDITIONAL TRAINING REQUIRED	

Employee's Signature _____

Supervisor's Signature _____

Date_____

(Example Form)

CLASS TRAINING RECORD

NAME & PAYROLL NO. _____ JOB TITLE _____

Training Subject	Employee Initials	Instructor Initials	Date	Exam Grade
A. All Employees 1. Principles of radiation protection 2. Radiation measurement 3. Methods of radiation control 4. Radiation sources 5. Limits and guides 6. Radiation protection relative to job performance 7. Housekeeping methods				
B. Supervisors 1. Radiation levels 2. Standards and limits 3. Importance of radiation protection training 4. Planning and procedure review 5. ALARA philosophy and implementation 6. Contamination control 7. Work practices 8. Controlling radiation dose				
C. Radiation protection technicians 1. Biological effects of radiation 2. Radiation measurement 3. Control of radiation sources 4. ALARA philosophy implementation 5. Audit techniques 6. Housekeeping methods 7. Regulations and guides				

Supervisor's Signature

Radiation Safety Officer's Signature

NEW EMPLOYEE INDOCTRINATION,
ORIENTATION AND FOLLOW-UP

A copy of the current DIRECTIVE to be issued to each new employee is as follows:

D I R E C T I V E

TO: ALL UNITED NUCLEAR CORPORATION EMPLOYEES, WYOMING OPERATIONS

FROM: PLANT SUPERINTENDENT

SUBJECT: RADIOLOGICAL SAFETY RULES

Following are instructions that set forth provisions for personal hygiene, including washing prior to eating or leaving the Plant, instructions for wearing respirators, wearing of protective clothing and film badges and desired methods for cleaning up dust whithin the plant.

These instructions are presented in the interest of your health and supplement previous verbal and written instructions governing radiological safety.

If you do not understand the instructions, check with your supervisor. Also, report any deficiencies or unusual conditions to him.

Disregard or abuse by an employee of the following directive will cause that employee to be subject to disciplinary action or dismissal.

Attachment:

UNITED NUCLEAR CORPORATION		PAGE
DATE ISSUED September 1, 1977	SUPERCEDES ISSUE DATED January 1, 1977	DOCUMENT UNC-LA-2

RADIATION AREA RULES

1) Prior to entry: (a) inspect and don required protective clothing; (b) if respiratory protection is required, assure proper condition and fit of mask.
2) Contact the radiation protection staff if you have a skin break.
3) Wear required film badge.
4) If you are injured or if required respirator ceases to function properly, leave the zone immediately.
5) If injured, tell your supervisor immediately.
6) No eating, smoking, or drinking in radiation control zones.
7) Contamination survey of tools and equipment required prior to removing them from a radiation control zone.
8) A personal visual check for yellowcake particles is required when leaving a contaminated area.
9) Remove protective clothing at radiation control zone exit. Exercise care while undressing to prevent contamination of skin or personal clothing.
10) Yellowcake operating personnel must shower at least at the end of each shift. A shower record must be filed.
11) Maintenance personnel must shower upon completion of job. A shower record must be filed.

5.4A SECURITY ADDENDUM

UNESCORTED VISITOR ORIENTATION RECORD

(Example Form)

UNESCORTED VISITOR ORIENTATION RECORD

	Visitor Initial	Instructor Initial
SECURITY		
Gate locations		
Sign-in procedures		
Alcohol and firearms prohibition, no-smoking rules		
Prohibition against sample removal		
SAFETY		
Hard hat; respiratory, eye, feet and hearing protection requirements		
RADIATION CONTROL		
Zone labeling		
Protective equipment		
Survey requirements		
Film badge requirements		

I certify that I have received the above training and a copy of United Nuclear Corporation's safety and radiation area rules. I agree to obey established security, safety and radiation rules while on the property.

_____ _____(signed)
Date Visitor

_____ _____(signed)
Date Instructor

Badge Issued _____ Date
Returned _____ Date _____
Recorded Exposure

5.5-A RADIATION SAFETY ADDENDUM

5.5-A RADIATION SAFETY ADDENDUM

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Request for Radiation Exposure Record	1
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Personal Hygiene	3
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Mask Maintenance Record	6
Special Maintenance Job Evaluation	7
Radiation Detection Instrument Calibration Record	8
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Special Notification to Employees of Radiation Exposure	13
NRC Form 4	14
NRC Form 5	15

(Example Form)

Date: _____

SUBJECT: Request for Occupational Ionizing Radiation Exposure Record

TO: UNITED NUCLEAR CORPORATION
P. O. Box 2996
Casper, Wyoming 82601

FROM: _____

_____

_____

In accordance with provisions of the United States Nuclear Regulatory Commission Regulations, 10 CFR 19.13 (b) and (c), please provide a report of the occupational ionzing radiation exposure received by:

NAME	SOC. SEC. NO.	BIRTH DATE
_____	_____	_____

while employed at UNITED NUCLEAR CORPORATION, Wyoming Operations, from _____ to _____.

_____
Signature

_____
Title

Encl: (1) Employee's Authorization
(If Required)

(Example Form)

Date: _____

SUBJECT: Endorsement To
Release Records

TO: _____

_____

_____

FROM: UNITED NUCLEAR CORPORATION
P. O. Box 2996
Casper, Wyoming 82601

In accordance with provisions of the United State Nuclear Regulatory Commission Regulations, 10 CFR 19.13 (b) and (c) I hereby authorize you to release my occupational ionizing exposure records to the above named United Nuclear Corporation.

NAME	SOC. SEC. NO.	BIRTH DATE
_____	_____	_____

Very truly yours,

_____
Employee's Signature

(Example Form)

UNITED NUCLEAR CORPORATION
Wyoming Operations

PERSONAL HYGIENE

1. All personnel are required not to eat, smoke or drink while cleaning the centrifuge. Designated protective clothing is to be worn during the cleaning operation. Coffee cups, pop bottles and lunch containers must be stored outside of this area and the concentrate dryer enclosure.

2. All personnel will shower after working in the yellowcake area. Soap and towel will be furnished.

3. Personnel must not enter the office building, laboratory, or go home with visible traces of yellowcake on articles of clothing and/or footwear. Likewise, all clothing and footwear must be cleaned as soon as possible and absolutely no articles which have obvious shows of yellowcake are to be taken home or sent to commercial launderies for cleaning.

4. Operating personnel are to wear dust respirators when they enter the concentrate dryer enclosure. This door is to be kept closed. Dryer should be inspected as often as required to prevent plugging resulting in unnecessary dust discharges. Maintenance on equipment within the dryer enclosure should be initiated only after a thorough cleanup in the area of repair. Cleanup must be accomplished with water, damp rags or vacuum. Absolutely no air hoses are to be used for any type of cleanup or maintenance activity.

5. Any employee who should happen to spill concentrate on footwear while working in the centrifuge area, yellowcake slurry tank area or dryer area must wash off same and not track the material around the mill.

6. Film badges are changed at the end of each month. It is mandatory that each operator wear his assigned badge, report its loss or contamination to his supervisor and return the badge to the designated storage rack daily.

7. Dust respirators are to be worn in the yellowcake dryer enclosure and packaging room. Respirator filters should be replaced and the complete assembly cleaned as required.

8. All personnel should wash thoroughly before eating after having worked in yellowcake areas.

9. Report all problems relative to radiological safety to your supervisor immediately.

(Example Form)

UNITED NUCLEAR CORPORATION
Wyoming Operations

EMPLOYEE SHOWER RECORD 5.5A

DEPARTMENT_____ MONTH_____ YEAR_____

DATE	NAME	JOB TITLE	SHOWER YES	SHOWER NO	FOREMAN	REMARKS

CRITERIA

1) This form will be required for NRC Compliance Officer.

2) Employee MUST complete the date, name, job title and Yes and No column. Shift Foreman will follow through that information is correct and sign in FOREMAN column.

3) Remarks column to be completed as applicable.

4) Showers are required for ALL MAJOR REPAIRS made in the YELLOWCAKE sections.

5) Completed report to be turned in to the Radiologist at the end of every month.

6) Department to indicate Operations or Maintenance.

(Example Form)

Respiratory Protection Record

Name _____ Payroll No. _____

Does the employee have any of the following: ☐ Yes ☐ No

1) Perforated eardrums
2) Respiratory ailment
3) Other health problems

(Explain on reverse side)

Date		Initials	
		Trainer	Employee
	Initial training and experience wearing filter mask		
	Mask fitting Type (s) giving good fit _____		
	Were glasses worn ☐ Yes ☐ No Facial hair present (specify) _____ Dentures ☐ Yes ☐ No		
	Method of check Smoke test Other (specify) _____		
	Training with SCBA, experience wearing and leak test		
	The following type (s) gave good fit _____ _____		
	Additional training and refitting		

(Example Form)

MASK MAINTENANCE RECORD

TYPE _____

MANUFACTURE _____

MODEL _____

IDENTIFICATION NUMBER _____

DATE RECEIVED _____

DATE	INSPECTION, ISSUE, SURVEY, OR REPAIR	PERSON RESPONSIBLE
	Initial Inspection	
	Leak Check	

(Example Form)

United Nuclear Corporation
Wyoming Operations

SPECIAL MAINTENANCE JOB EVALUATION

Survey Period _____

Building _____ Process Area _____

Operator Special Maintenance men/shift _____ shift/day _____

Operation or Operating Area	Time Per Oper.	Oper. Per Shift	Time Per Shift (T)	Sample No.	Concentration ucU x 10^{-11}/ml High	Low	Avg.	(C)	TXC

(7)

Σ (T) _____ Σ (TXC) _____

$\frac{\Sigma(TXC)}{(T)}$ = _____ = [ ] MPC / MPC (Norm)

Frequency: As Required

5.5A

(Example Form)

RADIATION DETECTION INSTRUMENT CALIBRATION and REPAIR RECORD

Type: _____

Manufacturer: _____

Model No: _____

Serial No: _____

Date Received: _____

Monthly Checks:

Date	Source Used	Working Properly Yes or No	Initials of Checker and Payroll No. If UNC Employee	Followup or Repair Required

(Example Form)

AIR SAMPLE COLLECTION LOG

PLANT STATUS:

AIR SAMPLES:	Time On	Time Off	Flow	% MPC

Example Form

UNITED NUCLEAR
Wyoming Operations

RADIATION PROTECTION RECORDS

AIR SAMPLE MEASUREMENT RECORD

LOG NO.

BUILDING | ROOM

RADIONUCLIDE INVOLVED | SAMPLE TYPE | FLOW RATE | β FACTOR | α FACTOR | LOCATION | PERIOD COVERED TO

NO.	ON DATE	ON TIME	OFF DATE	OFF TIME	CU. FT.	COUNTED DATE	COUNTED TIME	COUNT PERIOD	α COUNT	α c/m	$\alpha\mu$c/cc	β COUNT	βc/m	$\beta\mu$c/cc	CALCULATED BY

REMARKS

UNITED NUCLEAR CORPORATION
MINING AND MILLING DIVISION
WYOMING OPERATIONS

RADIOLOGICAL SAFETY RULES

PERSONAL HYGIENE

1. All employees working any of the Yellowcake Areas shall endeavor to prevent Yellowcake from entering the body. This will be accomplished by following all rules and practicing good personal hygiene at all times.

2. All employees working in yellow[illegible]e areas and any dusty areas will be provided with respirat[illegible]s.

3. All employees working in the coarse grinding Ore Bin or Yellowcake Areas shall wash their hands thoroughly before eating, drinking, smoking or chewing, and at the end of each shift before leaving the plant area.

4. Eating, drinking, smoking or chewing, shall be prohibited in the Yellowcake Area.

5. Lunch pails, food, drinks, tobacco and smoking material are not to be taken into the Yellowcake Area.

6. Men working in the coarse Ore Bin and Yellowcake Areas shall store their lunches and eat them in a designated area.

7. All skin eruptions, cuts, open wounds and abrasions shall be covered with sterile bandage before personnel enter, or while working in any Yellowcake Area.

8. Operators and maintenance men cleaning or working on any of the equipment in the Yellowcake Area, which involves direct handling of Yellowcake, shall wear the protective clothing provided. In no case shall clothing, which is contaminated with Yellowcake, be worn outside the designated Yellowcake Area. The aforementioned personnel will be required to cleanse footwear and to use monitoring devices provided to ensure that no radioactive materials are carried outside the area. In lieu of the above program, United Nuclear Corporation may provide footwear protection to ensure that no radioactive materials are carried outside the area.

9. The Yellowcake operators shall change company furnished coveralls as is necessary and wash the soiled clothing as soon as possible in the laundering machines provided.

RESPIRATORS

1. All employees required to work in a dusty or the Yellowcake Area shall wear an approved type respirator.

2. Filters in respirators shall be changed as often as necessary, to give maximum filtering effect to the wearer. Any time visible dust has collected on the filter, the filter shall be changed.

3. Respirators must be kept clean at all times by disassembly and washing with soap and warm water. Respirators must be cleaned at the end of each shift. Individuals using respirators will be responsible for the upkeep and cleanliness of respirator equipment each shift that it is used.

4. In no case shall a respirator that has been stored in a location where it may have been contaminated with dust be used before it is thoroughly cleaned.

5. The wearing of respirators in designated areas and on specific jobs shall be rigidly enforced by all supervisors. Supervisors shall inspect respirators regularly.

6. The wearing of respirators in any but the proper position over the hose and mouth shall be considered a violation of safety rules.

DUST CLEANUP

1. Water, damp rags, sponges and vacuum will be used for dust cleanup.

2. All areas must be kept as clean as possible at all times.

3. Dust suppression equipment and additional water sprays must be used when crushing.

4. All dust collection fans must be in operation and blast gates must be properly adjusted at all times while crushing, sampling, cleaning up, preparing samples, or any other operation liable to produce dust.

5. All areas in coarse grinding Yellowcake Ore Bins and Sample Preparation must be kept clean.

FILM BADGES

1. Film badges are worn by selected individuals in each of the specified job classifications.

2. Care shall be taken to follow the below listed rules or a false exposure reading will be recorded on the film.

   a. Wear the badge face-out, with no obstruction before the face of the badge.

   b. Keep the badge clean at all times. If the badge comes in contact with contamination of any kind, clean it immediately.

   c. Report to the foreman anything unusual that may cause the film to be contaminated.

   d. Report a lost badge to the foreman immediately.

   e. Do not allow the badge to face a welding area at close range.

   f. Do not subject the badge to extreme heat of any kind.

3. False readings will be returned if the film is subjected to unusual heating, light, pressure, partial shielding or wetting with mill solutions.

4. A storage rack will be provided where the film badge shall be placed when the individual goes off shift.

DEFINITIONS

Yellowcake Area: This area shall include the Centrifuge Room; the Yellowcake Slurry tank, the Yellowcake dryer, the Yellowcake packaging, weighing, sampling and storage areas, the Precipitation tanks, and any other area which contains exposed Yellowcake.

Grinding Circuit: This area shall include the ore pad and stockpiles, the coarse ore bin, the pan feeder, the conveyor system, and the semi-autogenous mill.

Yellowcake: The common name used to identify the product made by uranium mills.

DEFINITIONS (Cont'd)

Radiation: Any of all of the following: Alpha rays, Beta rays, gamma rays, X-rays, neutrons, high-speed electrons, high-speed protons and other atomic particles, but not sound or radio waves, or visible infra-red or ultraviolet light.

Radioactive Air-Borne Material: Any radioactive material disbursed in the air in the form of dusts, fumes, mists, vapors or gases.

Maximum Permissable Concentration: The radiation limit established by the NRC and published in the Federal Register, Title 10, Part 19 and 20. It is believed that the standards incorporated in the regulations provide, in accordance with present knowledge, a very substantial margin of safety for exposed individuals.

Respirator Filter (Cartridge): It is that part of respirator which cleans the air being inhaled by the wearer.

Film Badge: A device designated to be worn or carried by an individual for the purpose of measuring external radiation exposure.

UNITED NUCLEAR CORPORATION
Wyoming Operations

RADIOLOGICAL SAFETY RULES

RADIATION SAFETY INSTRUCTIONS FOR YELLOWCAKE AREAS

The following rules have been established for the protection of all employees working in yellowcake areas.

1. Protective clothing - coveralls, respirators, safety glasses and safety shoes shall be worn at all times when working in a designated area.
2. Avoid breathing visible dust.
3. Smoking, chewing, eating or drinking is prohibited in the designated area.
4. Skin eruptions, cuts, open wounds or abrasions shall be covered with a sterile bandage before entering or working in a designated area.
5. Company furnished coveralls will be washed as soon as possible after each use.
6. Contaminated clothing shall not be worn outside of the designated area.
7. Use extreme caution in removing drum lids, drums from stations and in drum sampling.
8. Keep the floors wet down when working in a designated area.
9. Upon leaving a designated area, showers are provided and must be used.
10. Report malfunctions or incidents to the Shift Foreman immediately.

UNITED NUCLEAR CORPORATION
Wyoming Operations

RADIOLOGICAL SAFETY RULES

RADIOLOGICAL SAFETY INSTRUCTION IN FINAL PRODUCT PACKAGING

1. CHANGING DRUMS

   a. Before a barrel is topped off for changing, the new barrel should be completely ready, with filler lid on, and setting ready to be immediately placed under filling chute when filling barrel is full. This should eliminate any dust trickle coming from filler valve in case any time is lost.

   b. If any dust is observed coming from filler valve or rubber sleeve while topping off full barrel, walk away for a few minutes and give it a chance to settle.

   c. Before rubber sleeve is pulled from filler spout, wipe all dust from lid, barrel and filler chute system with a wet sponge. This action will keep settled dust from being disturbed around the operator while making change.

   d. Pull rubber sleeve carefully and slowly. If any clouding dust is observed at this point, again walk away and give it a chance to settle. Clean any excessive settlement with a wet sponge again.

   e. Remove barrel and replace empty as quickly as possible. Do not jar full barrel when setting it down, as this will usually blow dust through the open sleeve from concussion. Make certain that sleeve on filler spout from new barrel is tight and does not leak dust when filler valve is opened.

   f. When removing filler lid from full barrel, do not break lid away from the barrel suddenly. This will create a vacuum which will swirl dust from top of the barrel. It is a good idea at this point to set filler lid down and leave the drum for a few seconds, whether dust is seen or not. It will most likely be there.

   g. Carefully place new lid on barrel. Do not fan lid across the top of the product suddenly.

* This system may be improved upon, dependent on designed drum filling system when the new mill is completed.

RADIOLOGICAL SAFETY RULES and REGULATIONS

RADIOLOGICAL SAFETY INSTRUCTION IN FINAL PRODUCT PACKAGING (continued)

II. SAMPLING DRUMS

a. Place full barrel gently on sampling platform. A sudden jar will stir the concentrate up inside drum and possibly create dust when sample bung is removed.

b. Unscrew sample bung in lid and slowly lift lid off.

c. When sampler is being driven into barrel, be sure that plexiglas shield is in place. If any dust is observed coming out of the drum or sampler, leave the area until dust has cleared, clean up and resume sampling where you left off.

d. Remove sample jar slowly. Pulling it away from its holder rapidly may cause a vacuum swirl of dust.

e. Avoid excessive contact with sampler parts which have made contact with the concentrate.

f. Replace bung as soon as possible.

g. Throughout sampling of a drum, the operator should stand as far from the operation as possible and still be able to handle his controls.

III. CLEAN UP

a. All clean up possible in the packaging room should be done with a wet sponge or hose. Any other method creates dust. Large spills may be handled with the vacuum hose.

b. Clean up on drums at filler station should not be confined to periods of drum changes only. Cleaning of this area should be done immediately with a wet sponge, any time the operator is in the area and observes settled concentrate dust. Wiping the filler lids, drum ridges and vibrator platform should be done each time prior to starting the vibrator.

IV. GENERAL

a. Any time a lid, cover or connection is made where concentrate dust may be present, make certain that it is tight and will not leak.

b. Avoid physical contact as much as possible.

c. Keep all settled concentrate dust washed down from overhead structures.

RADIOLOGICAL SAFETY RULES and REGULATIONS

RADIOLOGICAL SAFETY INSTRUCTION IN FINAL PRODUCT PACKAGING (continued)

IV. GENERAL (continued)

d. Keep all operating pieces of equipment such as the fork lift, sampler, scale clean.

e. Keep hands away from your face during operations in the packaging area. Also try to avoid wiping sweat from your face with coverall sleeves.

f. Keep respirator, film badge and coveralls clean. Clean shoes or boots thoroughly with damp brush after session in packaging room.

g. For extended personal protection, take a shower, scrubbing hands and face thoroughly after each operating period in packaging area.

h. Report any leaks or trouble spots to your immediate supervisor, at once.

(Example Form)

UNITED NUCLEAR CORPORATION
Wyoming Operations

RADIOLOGICAL SAFETY RULES
ACKNOWLEDGEMENT

I have received a copy of United Nuclear Corporation's, Mining and Milling Division, Plant Radiation Safety Rules. I have read these rules, they have been reviewed with my Superintendent, I understand them and I agree to abide by them.

(Example Form)

UNITED NUCLEAR CORPORATION
Wyoming Operations
P. O. Box 2996
Casper, Wyoming 82602

Special Notification To Employees of
Radiation Exposure

Mr. John Doe
2028 Torilane
Anywhere, U. S. A.

Dear Mr. Doe:

This report is furnished to you under the provisions of the Nuclear Regulatory Commission Regulations entitled. "Standards for Protection Against Radiation", (10 CFR, Part 20). You should preserve this report for future reference.

During the period of _____(date)_____ to _____(date)_____ while you were working as a _____(job description)_____ on the _____(job location)_____ for United Nuclear Corporation, you were exposed to an airborne Natural Uranium (U_3O_8) concentration of _____ $\mu cu \times 10^{-11}/ml$. which is equivalent to _____ times MPC.

The respirator which you wore at all times during the exposure reduces the amount considerably. The exact amount depends on respirator fit and efficiency of the filter.

Yours very truly,

UNITED NUCLEAR CORPORATION

By _____
Radiation Safety Officer

INSTRUCTIONS FOR PREPARATION OF NRC FORM 4

This form or a clear and legible record containing all the information required on this form must be prepared by each licensee of the Nuclear Regulatory Commission who, pursuant to Section 20.101, proposes to expose an individual to a radiation dose in excess of the amounts specified in Paragraph 20.101(a) of the regulations in Part 20, "Standards for Protection Against Radiation," 10 CFR. The requirement for completion of this form is contained in Section 20.102 of that regulation. The information contained in this form is used for estimating the external accumulated occupational dose of the individual for whom the form is completed. A separate Form NRC-4 shall be completed for each individual to be exposed to a radiation dose in excess of the limits specified in Paragraph 20.101(a) of Part 20 of the Commission's regulations.* Listed below by item are instructions and additional information directly pertinent to completing this form:

Identification

Item 1. Self-explanatory.
Item 2. Self-explanatory except that, if individual has no social security number, the word "none" shall be inserted.
Item 3. Self-explanatory.
Item 4. Enter the age in full years. This is called "N" when used in calculating the Permissible Dose. N is equal to the number of years of age of the individual on his last birthday.

Occupational Exposure

Item 5. List the name and address of each previous employer and the address of employment. Start with the most recent employer and work back.

Include only those periods of employment since the eighteenth birthday involving occupational exposure to radiation. For periods of self-employment, insert the word "self-employed."

Item 6. Give the dates of each employment listed in Item 5.
Item 7. List periods during which occupational exposure to radiation occurred.
Item 8. List the dose recorded for each period of exposure from the records of previous occupational exposure of the individual as calculated under Section 20.102. Dose is to be given in rem.

"Dose to the whole body" shall be deemed to include any dose to the whole body, gonads, active blood forming organs, head and trunk, or lens of eye.

Item 9. After each entry in Item 8 indicate in Item 9 whether dose is obtained from records or calculated in accordance with Section 20.102.
Item 10. Self-explanatory.

Total Accumulated Occupational Dose (Whole Body)

Item 11. The total for the whole body is obtained by summation of all values in Item 8.

Certification

Item 12. Upon completion of the report, the employee must certify that the information in Columns 5, 6, and 7 is accurate and complete to the best of his knowledge. The date is the date of his signature.

Calculations

Item 13. The lifetime accumulated occupational dose for each individual and the permissible dose under Paragraph 20.101(b) are obtained by carrying out the following steps: The value for N should be taken from Item 4. Subtract 18 from N and multiply the difference by 5 rem. (For example, John Smith, age 32; N = 32, PAD = 5(32-18) = 70 rem.) Enter total exposure to date from Item 11. Subtract (b) from (a) and enter the difference under (c). The value in (c) represents the unused part of the permissible accumulated dose. This value for permissible dose is to be carried forward to Form NRC-5, "Current Occupational External Radiation Exposure (Whole Body)."

Item 14. Self-explanatory.

*This form requires the signature of the employee concerned.

PRIVACY ACT STATEMENT

Pursuant to 5 U.S.C. 552a(e) (3), enacted into law by section 3 of the Privacy Act of 1974 (Public Law 93-579), the following statement is furnished to individuals who supply information to the Nuclear Regulatory Commission on Form NRC-4. This information is maintained in a system of records designated as NRC-27 and described at 40 Federal Register 45344 (October 1, 1975).

1. AUTHORITY Sections 53, 63, 65, 81, 103, 104, 161(b), and 161(o) of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2073, 2093, 2095, 2111, 2133, 2134, 2201(b), and 2201(o)). The authority for soliciting the social security number is 10 CFR Part 20.

2. PRINCIPAL PURPOSE(S) The information is used by the NRC in its evaluation of the risk of radiation exposure associated with the licensed activity and in exercising its statutory responsibility to monitor and regulate the safety and health practices of its licensees. The data permits a meaningful comparison of both current and long-term exposure experience among types of licensees and among licensees within each type. Data on your exposure to radiation is available to you upon request.

3. ROUTINE USES The information may be used to provide data to other Federal and State agencies involved in monitoring and/or evaluating radiation exposure received by individuals employed as radiation workers on a permanent or temporary basis and exposure received by monitored visitors. The information may also be disclosed to an appropriate Federal, State, or local agency in the event the information indicates a violation or potential violation of law and in the course of an administrative or judicial proceeding.

4. WHETHER DISCLOSURE IS MANDATORY OR VOLUNTARY AND EFFECT ON INDIVIDUAL OF NOT PROVIDING INFORMATION It is voluntary that you furnish the requested information, including social security number; however, the licensee must have a completed Form NRC-4 on each individual whom the licensee proposes to expose to a radiation dose in excess of the amounts specified in 10 CFR 20.101(a). Failure to obtain the requested information before permitting such exposure may subject the licensee to enforcement action in accordance with 10 CFR 20.601. The social security number is used to assure that NRC has an accurate identifier not subject to the coincidence of similar names or birthdates among the large number of persons on whom data is maintained.

5. SYSTEM MANAGER(S) AND ADDRESS Director, Office of Management Information and Program Control
U.S. Nuclear Regulatory Commission, Washington, D.C. 20555

Form NRC-4
(2-75)
10 CFR 20

U. S. NUCLEAR REGULATORY COMMISSION

Approved by GAO
B-180225 (R0043)
Expires - 4-30-77

OCCUPATIONAL EXTERNAL RADIATION EXPOSURE HISTORY

See Instructions on the Back

IDENTIFICATION

1. NAME (PRINT – LAST, FIRST, AND MIDDLE)	2. SOCIAL SECURITY NO.
3. DATE OF BIRTH (MONTH, DAY, YEAR)	4. AGE IN FULL YEARS (N)

OCCUPATIONAL EXPOSURE – PREVIOUS HISTORY

5. PREVIOUS EMPLOYMENTS INVOLVING RADIATION EXPOSURE – LIST NAME AND ADDRESS OF EMPLOYER	6. DATES OF EMPLOYMENT (FROM–TO)	7. PERIODS OF EXPOSURE	8. WHOLE BODY (REM)	9. RECORD OR CALCULATED (INSERT ONE)

10. REMARKS	11. ACCUMULATED OCCUPATIONAL DOSE – TOTAL	

13. CALCULATIONS – PERMISSIBLE DOSE WHOLE BODY:

(A) PERMISSIBLE ACCUMULATED DOSE = 5(N–18) = _____ REM

(B) TOTAL EXPOSURE TO DATE (FROM ITEM 11) = _____ REM

(C) UNUSED PART OF PERMISSIBLE ACCUMULATED DOSE (A–B) = _____ REM

12. CERTIFICATION: I CERTIFY THAT THE EXPOSURE HISTORY LISTED IN COLUMNS 5, 6, AND 7 IS CORRECT AND COMPLETE TO THE BEST OF MY KNOWLEDGE AND BELIEF.

EMPLOYEE'S SIGNATURE DATE

14. NAME OF LICENSEE

INSTRUCTIONS FOR PREPARATION OF FORM NRC-5

The preparation and safekeeping of this form or a clear and legible record containing all the information required on this form is required pursuant to Section 20.401 of "Standards for Protection Against Radiation," 10 CFR 20, as a current record of occupational external radiation exposures. Such a record must be maintained for each individual for whom personnel monitoring is required under Section 20.202. Note that a separate Form NRC-5 is to be used for recording external exposure to (1) the whole body; (2) skin of whole body; (3) hands and forearms; or (4) feet and ankles, as provided by Item 5 below.

Listed below by item are instructions and additional information directly pertinent to completing this form.

Identification

Item 1. Self-explanatory.
Item 2. Self-explanatory except that, if individual has no social security number, the word "none" shall be inserted.
Item 3. Self-explanatory.
Item 4. Self-explanatory.

Occupational Exposure

Item 5. "Dose to the whole body" shall be deemed to include any dose to the whole body, gonads, active blood-forming organs, head and trunk, or lens of eye. Unless the lenses of the eyes are protected with eye shields, dose recorded as whole body dose should include the dose delivered through a tissue equivalent absorber having a thickness of 300 mg/cm^2 or less. When the lenses of the eyes are protected with eye shields having a tissue equivalent thickness of at least 700 mg/cm^2, dose recorded as whole body dose should include the dose delivered through a tissue equivalent absorber having a thickness of 1,000 mg/cm^2 or less.

Dose recorded as dose to the skin of the whole body, hands and forearms, or feet and ankles should include the dose delivered through a tissue equivalent absorber having a thickness of 7 mg/cm^2 or less. The dose to the skin of the whole body, hands and forearms, or feet and ankles should be recorded on separate forms unless the dose to those parts of the body has been included as dose to the whole body on a form maintained for recording whole body exposure.

Item 6. This item need be completed only when the sheet is used to record whole body exposures and the licensee is exposing the individual under the provisions of Paragraph 20.101(b) which allows up to 3 rems per quarter to the whole body. Enter in this item the unused part of permissible accumulated dose taken from previous records of exposure, i.e., Item 18 of the preceding Form AEC-5 or NRC-5 or Item 13 of Form AEC-4 or NRC-4 if the individuals's exposure during employment with the licensee begins with this record.

Item 7. Indicate the method used for monitoring the individual's exposure to each type of radiation to which he is exposed in the course of his duties. Abbreviations may be used.

Item 8. Doses received over a period of less than a calendar quarter need not be separately entered on the form provided that the licensee maintains a current record of the doses received by the individual which have not as yet been entered on the form. The period of exposure should specify the day the measurement of that exposure was initiated and the day on which it was terminated. For example, if only quarterly doses are entered, the period of exposure for the first calendar quarter of 1962 might be taken as running from Monday, January 1, 1962, through Friday, March 30, 1962, and would be indicated in this item as Jan. 1, 1962-Mar. 30, 1962. If weekly doses are entered, a film badge issued Monday morning, January 1, 1962, and picked up Friday, January 5, 1962, would be indicated as Jan. 1, 1962-Jan. 5, 1962.

Items 9, 10 and 11. Self-explanatory. The values are to be given in rem. All measurements are to be interpreted in the best method known and in accordance with Paragraph 20.4(c). Where calculations are made to determine dose, a copy of such calculations is to be maintained in conjunction with this record. In any case where the dose for a calendar quarter is less than 10% of the value specified in Paragraph 20.101(a), the phrase "less than 10%" may be entered in lieu of a numerical value.

Item 12. Add the values under Items 9, 10 and 11 for each period of exposure and record the total. In calculating the "Total" any entry "less than 10%" may be disregarded.

Item 13. The running total is to be maintained on the basis of calendar quarters. Paragraph 20.3(a) (4) defines calendar quarter. No entry need be made in this item if only calendar quarter radiation doses are recorded in Items 9, 10, 11 and 12.

Lifetime Accumulated Dose (Whole Body)

NOTE: If the licensee chooses to keep the individual's exposure below that permitted in Paragraph 20.101(a), Items 14 through 18 need not be completed. However, in that case the total whole body dose for each calendar quarter recorded in Item 13 (or Item 12 if quarterly doses are entered in Item 12) should not exceed 1 1/4 rem.

If an individual is exposed under the provisions of Paragraph 20.101 (b), complete Items 14 through 18 at the end of each calendar quarter and when the sheet is filled. Values in Item 13, when in the middle of a calendar quarter, and values in Item 18, must be brought forward to next sheet for each individual.

Item 14. Enter the previous total accumulated dose from previous dose records for the individual (e.g., from Item 16 of Form AEC-5 or NRC-5 or Item 11 of Form AEC-4 or NRC-4). The total occupational radiation dose received by the individual must be entered in this item, including any occupational dose received from sources of radiation not licensed by the Commission. If the individual was exposed to sources of radiation not licensed by the Commission during any calendar quarter after completing Form AEC-4 or NRC-4 and personnel monitoring equipment was not worn by the individual, it should be assumed that the individual received a dose of 1 1/4 rems during each such calendar quarter.

Item 15. Enter the total calendar quarter dose from Item 13 (or from Item 12 if quarterly doses are entered in Item 12) and the date designating the end of the calendar quarter in which the dose was received (e.g., March 30, 1962).

Item 16. Add Item 14 and Item 15 and enter that sum.

Item 17. Obtain the Permissible Accumulated Dose (PAD) in rem for the WHOLE BODY. "N" is equal to the number of years of age of the individual on his last birthday. Subtract 18 from N and multiply the difference by 5 rem (e.g., John Smith, age 32; N = 32, PAD = 5(32-18) = 70 rem.)

Item 18. Determine the unused part of the PAD by subtracting Item 16 from Item 17. The unused part of the PAD is that portion of the Lifetime Accumulated Dose for the individual remaining at the end of the period covered by this sheet.

PRIVACY ACT STATEMENT

Pursuant to 5 U.S.C. 552a(e) (3), enacted into law by section 3 of the Privacy Act of 1974 (Public Law 93-579), the following statement is furnished to individuals who supply information to the Nuclear Regulatory Commission on Form NRC-5. This information is maintained in a system of records designated as NRC-27 and described at 40 Federal Register 45344 (October 1, 1975).

1. AUTHORITY Sections 53, 63, 65, 81, 103, 104, 161(b), and 161(o) of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2073, 2093, 2095, 2111, 2133, 2134, 2201(b), and 2201(o)). The authority for soliciting the social security number is 10 CFR Part 20.

2. PRINCIPAL PURPOSE(S) The information is used by the NRC in its evaluation of the risk of radiation exposure associated with the licensed activity and in exercising its statutory responsibility to monitor and regulate the safety and health practices of its licensees. The data permits a meaningful comparison of both current and long-term exposure experience among types of licensees and among licensees within each type. Data on your exposure to radiation is available to you upon your request.

3. ROUTINE USES The information may be used to provide data to other Federal and State agencies involved in monitoring and/or evaluating radiation exposure received by individuals employed as radiation workers on a permanent or temporary basis and exposure received by monitored visitors. The information may also be disclosed to an appropriate Federal, State, or local agency in the event the information indicates a violation or potential violation of law and in the course of an administrative or judicial proceeding.

4. WHETHER DISCLOSURE IS MANDATORY OR VOLUNTARY AND EFFECT ON INDIVIDUAL OF NOT PROVIDING INFORMATION It is voluntary that you furnish the requested information, including social security number; however, the licensee must complete Form NRC-5 on each individual for whom personnel monitoring is required under 10 CFR 20.202. Failure to do so may subject the licensee to enforcement action in accordance with 10 CFR 20.601. The social security number is used to assure that NRC has an accurate identifier not subject to the coincidence of similar names or birthdates among the large number of persons on whom data is maintained.

5. SYSTEM MANAGER(S) AND ADDRESS Director, Office of Management Information and Program Control, U.S. Nuclear Regulatory Commission,

Form NRC-5
(6-76)
10 CFR 20

U. S. NUCLEAR REGULATORY COMMISSION

Approved by GAO
B-180225 (R004)
Expires - 4-30-77

CURRENT OCCUPATIONAL EXTERNAL RADIATION EXPOSURE

See Instructions on Back

IDENTIFICATION

1. NAME (PRINT – Last, first, and middle)	2. SOCIAL SECURITY NO.
3. DATE OF BIRTH (Month, day, year)	4. NAME OF LICENSEE

5. DOSE RECORDED FOR (Specify: Whole body; skin of whole body; or hands and forearms, feet and ankles.)	6. WHOLE BODY DOSE STATUS (rem)	7. METHOD OF MONITORING (e.g., Film Badge – FB; Pocket Chamber – PC; Calculation – Calc.) X OR GAMMA _____ , BETA _____ NEUTRONS _____

8. PERIOD OF EXPOSURE (From – To)	DOSE FOR THE PERIOD (rem)				13. RUNNING TOTAL FOR CALENDAR QUARTER (rem)
	9. X OR GAMMA	10. BETA	11. NEUTRON	12. TOTAL	

LIFETIME ACCUMULATED DOSE

14. PREVIOUS TOTAL (rem)	15. TOTAL QUARTERLY DOSE date rem	16. TOTAL ACCUMULATED DOSE (rem)	17. PERM. ACC. DOSE 5(N-18) (rem)	18. UNUSED PART OF PERMISSIBLE ACCUMULATED DOSE (rem)

TABLE 6.3.-1

CHEMICAL STORAGE

Chemical and Form	Storage Capacity	Maximum Daily Use Rate (1)	Environmental or Toxicological Data
Ammonia (liquified)	30,000 gal.	4.00 lb.	TLV (threshold limit value); 25 ppm in cir (3)
SX Diluent (liquid)	40,000 gal.	54 gal.	LD50 rabbits (lethal dose to 50% of rabbit pop.) 28,350 mg/kg(5). Moderate fire hazard. (6)
Sodium chlorate (solution)	50.75 ton (concentrate) 2000 gal. (dilute)	4500 lb.	Local irritation May form highly flammable compounds with organic materials.
Sulfuric acid (liquid)	1000 ton	85.5 tons	TLV 1 mg/m^3 (4).
Natural gas	NA	5.4x10^6 ft.^{3}	Moderate fire and/or explosion hazard
Chlorine, for water treatment (gas)	200 lb.	0.4 lb.	TLV 1 ppm air; 3 mg/m^3 air (4)
Diesel oil, stored in day tanks near points of use.	2000 gal. (4 tanks)	0 (a)	LD50 rabbits 28.350 mg/kg(5). Moderate fire hazard (6).
Water Gel(solid)	10,000 lb. (b)	500 lb.	Moderate fire hazard; low to moderate general explosion hazard.

(1) Based on 3000 TPD
(3) Manufacturing Chemist Data Sheet SD 8.
(4) American Conference of Governmental and Industrial Hygienists, 1975
(5) Merck Index, 1968. (for kerosene).
(6) Sax, 1968.
(a) Diesel oil is intended for backup heating and heavy equipment.
(b) Estimated value.

2. Annually review training documentation to verify adequacy of course content and training records.
3. Establish a procedure system for work that could result in the exposure of plant personnel or the environs to radioactive materials in excess of established limits.
4. Review and approve operating procedures and their revisions.
5. Institute a document control program to insure that operating documents and their revisions are issued only after they are properly reviewed and approved.
6. Keep a master file of operating procedures and revisions.
7. Review and approve procurement of items or materials critical to the safety of plant personnel, or the public.
8. Develop and implement a preventive maintenance program based upon manufacturer's recommendations, inspection data and operating experience.
9. Establish a calibration program for measuring and testing equipment critical to the safety of plant personnel, or the public.

7.5 RADIATION PROTECTION AND ENVIRONMENTAL MONITORING

The Radiation Safety Officer will be responsible for radiation protection and environmental 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 annual 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.

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