70-1257
#30893

SIEMENS

July 30, 1996
JBE:96:068

U.S. Nuclear Regulatory Commission
Attn: Mr. Robert C. Pierson, Chief
Licensing Branch
Division of Fuel Cycle Safety and Safeguards, NMSS
Washington DC 20555

License No. SNM-1227
Docket No. 70-1257

Dear Mr. Pierson:

Re: Letter, JB Edgar to RC Pierson, dated December 20, 1995

In the referenced letter Siemens Power Corporation (SPC) described the initial phase of its lagoon inventory reduction program as the enclosure of the lagoon uranium recovery (LUR) process equipment in a building which provides HEPA filtration and isokinetic sampling of the effluent air. The purpose of this letter is to describe recent changes made to the planned LUR enclosure and the LUR/solids processing facility (SPF) HVAC system; to describe the SPF addition and process; to apply for a license amendment to add the SPF as an authorized location for uranium recovery; and to supply Part II license application information on both LUR and SPF.

The second phase of the lagoon inventory reduction program is an addition to the south side of the LUR building to house the SPF equipment. The construction of the enclosure for the LUR process was originally scheduled to begin in April 1996 and be completed in June 1996. The construction of the SPF addition was scheduled for March and April 1997. The construction schedules have been revised so that both will be constructed in November and December 1996. Operational testing at LUR is scheduled to begin in July 1997 with beneficial use by January 1998. Equipment installation at SPF is scheduled to begin in July 1997; testing in January 1998; and beneficial use in July 1998. As mentioned earlier, the original building layout has been changed somewhat as has the design of the HVAC system. The LUR process is unchanged.

Background

The lagoon inventory reduction program will provide the facilities and processes to recover uranium from both the liquids and solids currently stored in the lagoons and will result in waste that can be disposed of as low level radioactive waste (LLRW). Uranium will be recovered from the lagoon liquids and solids at LUR/SPF; effluent from the LUR/SPF process will be routed to the Ammonia Recovery Facility (ARF) for recovery of

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ammonia; and the ARF liquid effluent will then be discharged to sewer as allowed by the State Waste Discharge Permit. Once emptied, the lagoons will be taken out of service as required by a consent decree between SPC and the Washington State Department of Ecology (WDOE). An enforceable provision of that consent decree requires that LUR and SPF be operational by January 1998 and July 1998, respectively. The modifications made in restoring LUR to service will bring that facility into compliance with NRC requirements.

Process Description

In the SPF process a small dredge will be used to retrieve solids and liquids from the bottom of the lagoons as a slurry which will be pumped to the SPF. The slurry will be screened to remove rocks and large debris, processed through an in-line grinder to shred the remaining solid debris, and stored in a 12,000 gallon slurry feed tank at the SPF. The slurry will be homogenized in the feed tank with a mixer and heated with steam from a recirculation loop. Chemical additives (mild oxidizing agents such as sodium hypochloride or sodium nitrite) will be pumped into the slurry as needed to assist in the dissolution of uranium. A filter aid will also be added to prepare the slurry for dewatering. The slurry will be pumped to the filter press for dewatering, resulting in a solid filter cake and separate liquid filtrates. The filter cake will consist of insoluble sands, filter aid, fine materials, debris, and residual moisture and uranium. The filter cake will be packaged into 55-gallon drums for disposal as LLRW. The filtrates will be pumped thorough a polishing filter and collected in the filtrate tank. The filtrates will be processed at LUR for uranium recovery. See Figures II-10.31 in the existing license and renewal application for a schematic diagram of the LUR/SPF processes.

Building Enclosure

The LUR enclosure described in the referenced letter has been changed slightly. What was the existing office is now a break room. The previously described change room and airlock have been slightly reduced in size and the mechanical room, containing the supply fan, heating equipment and filter, has been relocated between the change room and airlock.

The SPF consists of a 60 x 65 foot addition to the south side of the LUR building to be built concurrently with the LUR building. One building will therefore enclose both the existing LUR process and the SPF equipment. The overall building size will be approximately 110 feet x 65 feet. A foundation will be laid around LUR and to the south of LUR, and structural steel will be erected. Insulated wall panels and roofing will be mechanically attached, as described in the referenced letter. A single sloped roof will enclose all LUR and most SPF equipment, 32 ft. high on the east to 18 ft high on the west. An airlock for forktruck access will be provided on the west side as will access to the chemical and mechanical equipment rooms. Access doors will be provided for the steam generator room on the south side. A lagoon access personnel airlock will also be provided on the east side. See Figures II-10.30 in the existing license and renewal application for a building/equipment layout diagram.

Building HVAC System

As described in the referenced letter, the HVAC system is sized to accommodate both the LUR building and the SPF addition. The significant change to the HVAC system from that described previously is the provision for recirculating facility air.

The building air supply and heating system will consist of a pad, ductwork, prefilters, an air-conditioner, electric heater, instrumentation and an air supply fan. The supply fan will supply 1,500 cfm of outside air and recirculate approximately 8,800 cfm of building air. The recirculated air passes through a roughing filter and a HEPA filter and is continuously monitored for airborne radioactivity. The building air filtration and exhaust system will consist of a pad, ductwork, a HEPA air filtration unit, a 2,000 cfm exhaust fan, a 50 foot exhaust stack, an isokinetic stack gas sampler, instrumentation and room air monitoring equipment. A flowsheet for the building HVAC system is shown on Figures II-10.27a in the existing license or II-10.27b in the renewal application.

Safety Considerations/Management System

The criticality safety, radiation protection, fire protection, environmental impact considerations of the LUR and SPF operations as well as the management system directing such operations are as described in the referenced letter. The LUR/SPC will be equipped with a fire suppression sprinkler system. Chemicals used in the LUR and SPF will be handled and stored under the auspices of SPC's industrial safety and industrial hygiene programs described SPC's Safety Manual.

Enclosed in support of this request and as committed to in the referenced letter are six copies each of revised pages 1-9, 10-40b and 10-40c, 10-45b and 10-45c, 10-52, 10-79a, 10-81b, 10-83a and 15-18 through 15-20 of the existing license and pages 1-11, 10-41a, 10-41b, 10-41c, 10-41d, 10-46, 10-47, 10-47a, 10-55c, 10-84a, 10-88, 10-89a, and 15-122 through 15-124 of the renewal application. You will also note that some minor changes to the Chapter 15 pages describing the lagoons and safety conditions have been made for clarification.

If you require additional information, please call me at (509) 375-8663.

Very truly yours,

J.B.E.

James B. Edgar
Staff Engineer, Licensing

JBE/cf

Enclosures

TABLE I-1.1 Specific Locations of Authorized Activities (Cont.d)

Location	SNM	Authorized Activity
Packaged Fuel Storage Areas	UO_2 (up to 19.99 wt% U-235)	Outside storage of fuel packed for shipment; the transport containers are closed, sealed and properly labeled for shipment.
Packaged Waste Storage Areas	Uranium Compounds (up to 19.99 wt% U-235)	Outside storage of contaminated materials (including low level waste and incinerator ash) which are packaged, sealed, labeled and externally free of contamination.
Process Chemical Waste Storage Lagoon System	Uranium Compounds (up to 5 wt% U-235)	Transfer, mixing, sampling, storage and solar evaporation of contaminated liquid wastes.
Retention Tanks	Uranium Compounds (up to 5 wt% U-235)	Interim storage of potentially contaminated liquid wastes.
High Uranium Solids Pond	Uranium Compounds (up to 5 wt% U-235)	Transfer of uranium bearing solids, leaching for uranium recovery.
Solids Trench	Uranium Compounds (up to 5 wt% U-235)	Transfer and storage of contaminated solids awaiting leaching or burial.
Lagoon Uranium Recovery/Solids Processing Facility	Uranium Compounds (up to 5 wt% U-235)	Recovery of uranium from lagoon liquids and solids.
Ammonia Recovery Facility	Uranium Compounds (up to 5 wt% U-235)	Removal and recovery of ammonia from uranium contaminated liquid wastes.
Lagoon 5A IX Process-ARF Bldg.	Uranium Liquid Wastes (up to 5 wt% U-235 and less than 140 gU/ℓ concentrations in filters and resins)	Filtration and ion exchange of uranium liquid wastes.

10.3.10.4 HEPA Filter Bank

The final HEPA filters are enclosed in a sheet metal housing that, in turn, is mounted on structural steel legs fastened to a concrete slab. The HEPA filters are rated at 1000 ft^3/min at 1-inch H_2O pressure drop and are mounted in welded steel frames. Continuous air samplers are installed downstream of the filter bank. Visual indicators for reading the pressure drop across the filters are permanently installed, and means are provided for in-place DOP/DOS testing.

The HEPA filter medium is 100% moisture-resistant fiberglass, pleated over corrugated separators and sealed in fire-resistant plywood frames. The individual filters are certified to remove 99.97% of 0.3 micron particles and meet or exceed Military Specification MIL-F-51079.

10.3.11 LUR/SPF HVAC System

The general features of the LUR/SPF HVAC system include a combination of a once-through airflow and recirculation supply system (K64) and a double HEPA filtered exhaust system (K65). A simplified schematic diagram of the HVAC system is shown in Figure II-10.27a.

10.3.11.1 K64 Air Supply and Recirculation System

The K64 air supply and recirculation system supplies approximately 1500 ft^3/min. of outside air and also recirculates approximately 8800 ft^3/min of building air. Recirculated air is passed through a roughing filter and a single HEPA filter with an installed efficiency of 99.95% for 0.8 micron DOS cold-generated aerosol. Provision is made in the K64 recirculation system for continuous alpha radiation monitoring of recirculated air upstream of the HEPA filter bank. The alpha air monitor is set to alarm and annunciate when alpha activity exceeds 8 MPC-hr.

10.3.11.2 K65 Air Exhaust System

Air supplied to the LUR/SPF, plus infiltration, is exhausted through the K65 exhaust system. The double HEPA filter arrangement in this system consists of the final HEPA filter bank and upstream primary HEPA filter bank plus individual prefilters located in the exhaust ducts of the two areas serviced.

The K65 system exhaust air (approximately 2000 ft^3/min.) passes from the two stage HEPA filter bank through the main exhaust fan, past a duct air monitor (measures airflow quantities) and is discharged from a stack extending 50 feet above ground on the south side of the building. The K65 exhaust system has one fan which is connected to normal power. All final HEPA filters are in-place tested to be 99.95% (minimum) efficient for 0.8 micron DOS cold aerosol.

10.3.11.3 System Controls

The HVAC systems are controlled with temperature, pressure and flow sensor actuating valving and damper positions to hold temperatures, pressures, and pressure differentials constant in the various building areas. The K64 supply air system is interlocked with the K65 exhaust system to prevent operation of the K64 supply air system without the K65 exhaust system operating. Pressure sensors are provided to maintain a minimum negative differential pressure of 0.05 inch water gauge in the building relative to the atmosphere.

The K64 supply fan is interlocked so that a loss of exhaust duct flow (exhaust fan failure) or a signal from the exhaust duct heat detector will shut down the K64 air supply system.

An automatic visual alarm is activated when the recirculation system is inoperable.

10.3.11.4 HEPA Filter Bank

The final HEPA filters are enclosed in a sheet metal housing that, in turn, is mounted on structural steel legs fastened to a concrete slab. The HEPA filters are rated at 1000 ft^3/min. at one-inch water gauge pressure drop and are mounted in welded steel frames. Continuous air samplers are installed downstream of the filter bank. Visual indicators for reading the pressure drop across the filters are permanently installed, and means are provided for in-place DOS testing.

The HEPA filter medium is 100% moisture-resistant fiberglass, pleated over corrugated separators and sealed in fire-resistant plywood frames. The individual filters are certified to remove 99.97% of 0.3 micron particles and meet or exceed Military Specification MIL-F-51079.

10.4 Radioactive Waste Handling

The facilities and processes which are involved in the handling of radioactive and chemical wastes produced by Advanced Nuclear Fuels in Richland, Washington are described in the following sections.

effluents or increases in the quantities of radioactive waste generated. All underground transfer lines entering and leaving the new facility are completely double-encased (inner pipe surrounded by a sealed secondary plastic containment shell), with electronic leak detection systems that alarm locally and in the Line 2 control room. The primary pipes are tested hydrostatically annually and the secondary pipes biennially. The process generates small quantities of additional chemical wastes, but this is more than offset by the positive environmental impact of reducing the quantities of uranium discharged to the Richland city landfill.

10.4.4 Lagoon Uranium Recovery (LUR) and Solids Processing Facility (SPF) Description

10.4.4.1 LUR

The LUR Facility is provided to recover LEU from stored high uranium content liquid chemical wastes (see Section 10.4.1). Following uranium recovery, the waste is treated for ammonia removal (see Section 10.4.2), then disposed to the municipal sewer.

The LUR Facility is located adjacent to Lagoon 4 as shown on Figure II-10.1. The equipment consists of six process vessels, one chemical makeup vessel and associated pumps, piping and filters. A brief description of the major equipment is given in Table II-10.2 and the equipment layout is depicted in Figure II-10.30. The process equipment is housed in the LUR building which includes a HEPA-filtered, isokinetically-sampled HVAC system.

A process flow diagram for the uranium recovery system is presented in Figure II-10.31a. Approximately 5000 gallons of high uranium content waste is pumped into each of the two precipitators. The uranium is precipitated from solution by addition of sodium hydrosulfite and allowed to settle. At the end of the settling period, the low uranium content liquid is decanted and pumped to lagoon storage and the solids filtered out. The uranium precipitate is transferred to plastic 55-gallon drums where they are dissolved using aluminum nitrate. The resulting solutions are processed at the ELO Building where the uranium is further recovered by solvent extraction.

10.4.4.2 SPF

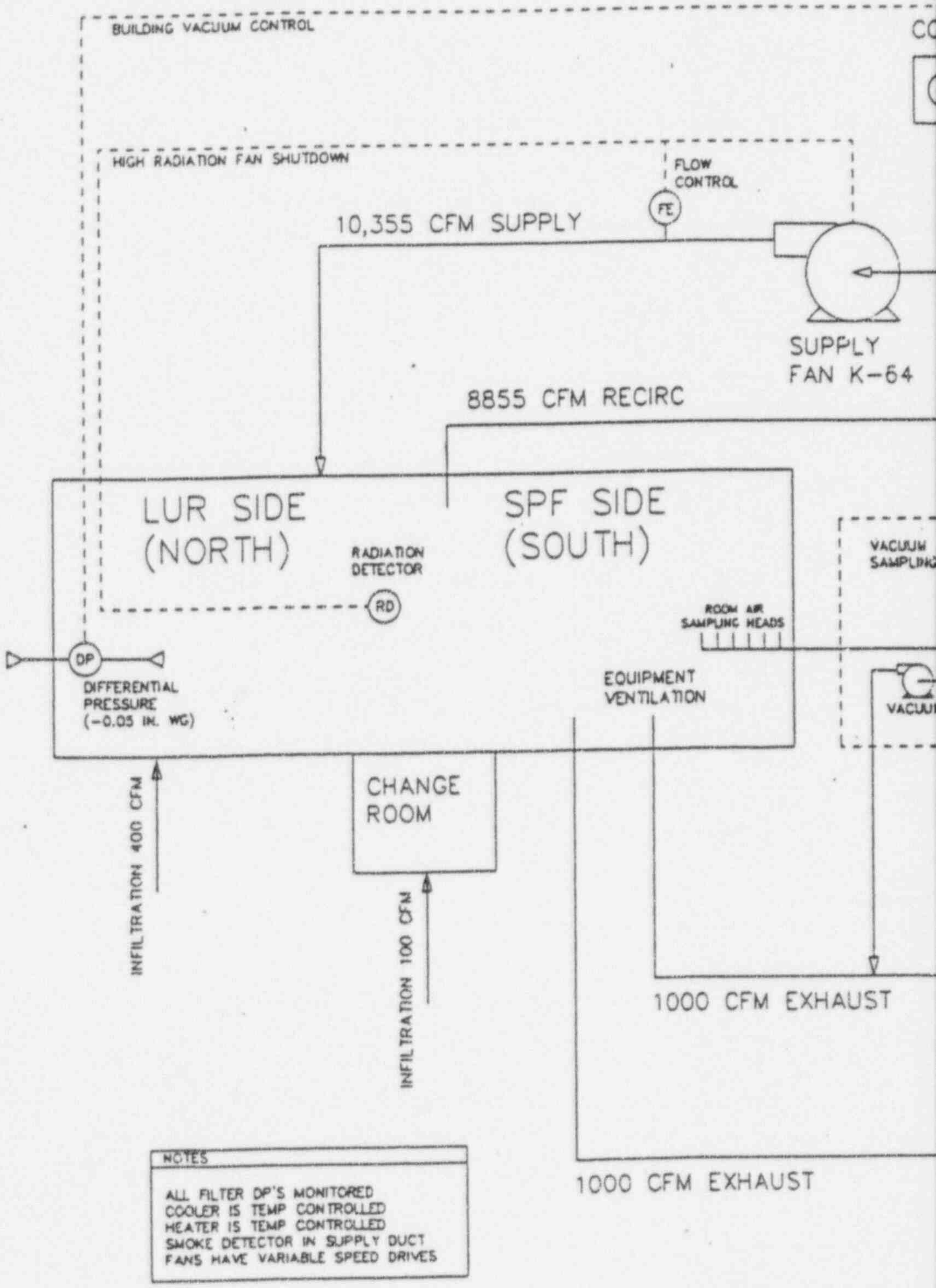
The SPF is provided to recover LEU entrained in the solids in the bottoms of the lagoons and put the uranium into solution to be fed to LUR. The SPF process equipment is located in the south end of the building that encloses LUR. LUR and SPF share the same HVAC system. The SPF process equipment consists of two feed and product tanks, two additive makeup tanks, a filter press, and associated filters, pumps, piping and a steam generator. A brief description of the major SPF equipment is included in Table II-10.2 and the equipment layout is included in Figure II-10.30.

A small manned dredge retrieves solids from the bottom of the lagoons as a slurry and pumps them to the SPF. The slurry is screened, processed through a grinder, screened again, and pumped to a 12,000 gallon feed tank. The slurry is then mixed and heated to the required leaching temperature with steam provided by two 50 Hp boilers. A leach chemical tank and pump system injects additives into the feed tank which assist the dissolution of uranium. A body feed/precoat tank and pumps inject filter aids to the slurry to prevent blinding of the filter cloths with slimes. When the leaching is complete, the slurry is dewatered by a filter press. Residual insoluble sands, body feed, fines, debris and other solids from the lagoons collected in the filter press cake are packaged into 55-gallon drums for disposal as low level waste. Filtrates from the filter press pass through a polishing filter and are collected in a filtrate tank for sampling prior to pumping directly to LUR or to Lagoon 3 for eventual processing at LUR. A process flow diagram for the SPF is shown in Figure II-10.31.

Table II-10.2

LUR Major Process Equipment		SPF Major Process Equipment	
TANKS			
T-650	Precipitator #1 (6,000 gallons)		
T-651	Precipitator #2 (6,000 gallons)	T-670	Feed Tank (12,000 gallons)
T-652	Precipitator Washer #1 (350 gallons)	T-671	Precoat Tank (1,000 gallons)
T-653	Precipitator Washer #2 (350 gallons)	T-672	Filter Aid Tank (1,500 gallons)
T-654	Filter Wash Tank #1 (70 gallons)	T-673	Additive Tank (250 gallons)
T-655	Filter Wash Tank #2 ([illegible]0 gallons)	T-674	Filtrate Tank (12,000 gallons)
T-656	Precipitation Agent Mix Tank (50 gallons)		
T-660.1	Dissolver Vessel (100 gallons)		
T-660.2	Dissolver Vessel (100 gallons)		
T-660.3	Dissolver Vessel (100 gallons)		
T-660.4	Dissolver Vessel (100 gallons)		
PUMPS			
P-650	Precipitator #1 Slurry Pump		
P-651	Precipitator #2 Slurry Pump	P-670	Slurry Feed Pump
P-652	Precipitator Washer Decant Pump	P-671	Precoat Pump
P-653.1	Decant Product Pump (portable)	P-672	Filter Aid Pump
P-653.2	ANN Pump (portable)	P-673	Additive Pump
P-654	Filter Wash Pump #1	P-674	Filtrate Pump
P-655	Filter Wash Pump #2	P-675	Dredge Pump
P-656	Precipitation Agent Makeup Pump	P-676	Recirc Pump
P-657	Precipitation Decant Pump		
P-658	Lagoon Waste Feed Pump		
P-659	LUR Waste Transfer Pump		
FILTERS			
F-652	Washer Decant Filter (25-30 micron)	F-670	Filter Press
F-657.1	Precipitation Decant Filter (5-10 micron)	F-674	Filtrate Filters (10 micron)
F-657.2	Precipitation Decant Filter (5-10 micron)	F-675	Dredge Strainers (¼", ½")
F-657.3	Precipitation Decant Filter (1-3 micron)		
F-657.4	Precipitation Decant Filter (1-3 micron)		
F-658	Lagoon Feed Filter (200 mesh)		
AGITATORS			
A-650	Precipitator #1 Agitator		
A-651	Precipitator #2 Agitator	A-670	Feed Tank Agitator
A-652	Precipitator Washer #1 Agitator	A-671	Precoat Agitator
A-653	Precipitator Washer #2 Agitator	A-672	Filter Aid Agitator
A-654	Filter Washer #1 Agitator		
A-655	Filter Washer #2 Agitator		
A-656	Mix Tank Agitator		

LAGOON URANIUM RECOVE
VENTILATION SY



RY/SOLIDS PROCESSING FACILITY
YSTEM FLOW DIAGRAM

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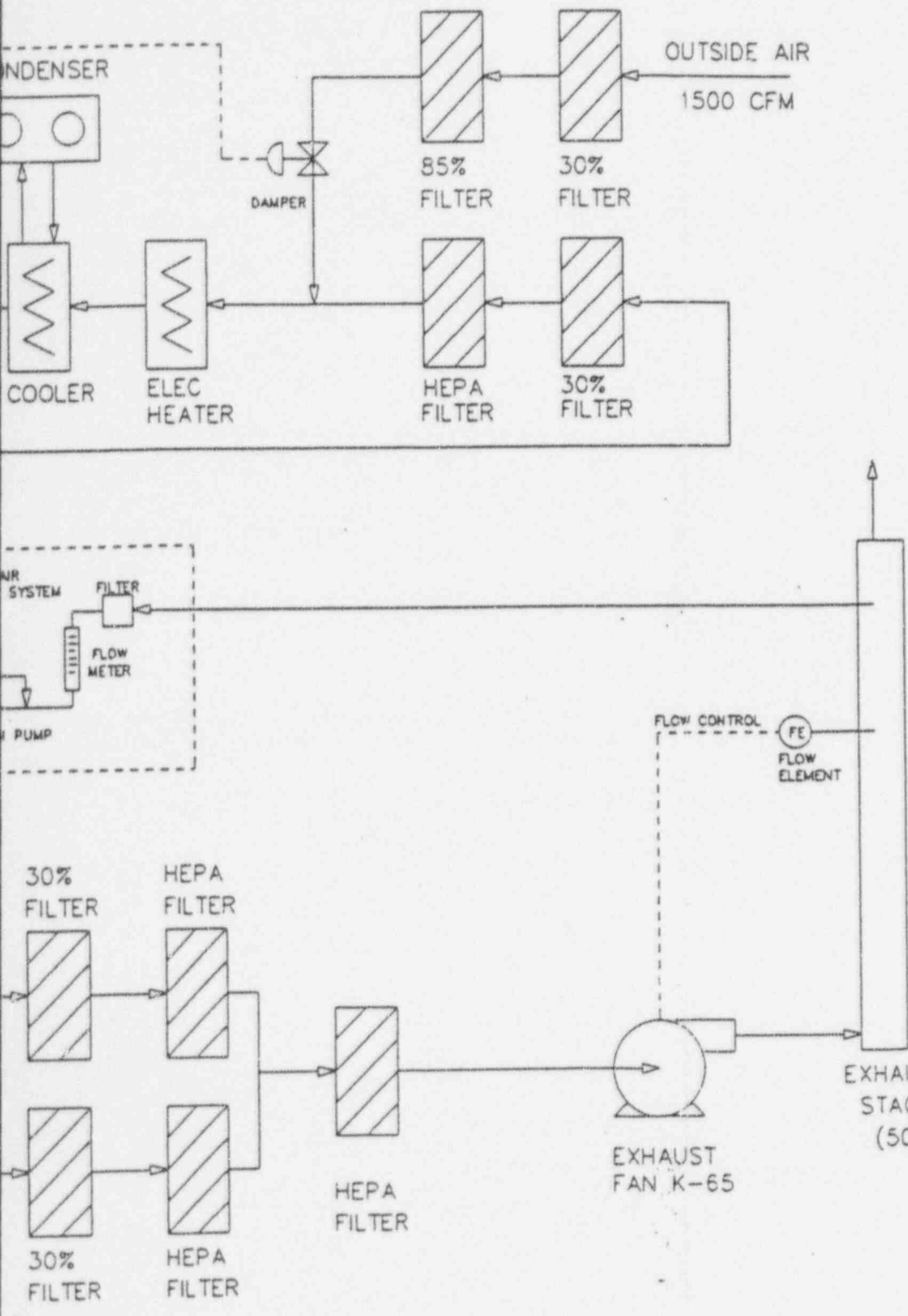

ANSTEC APERTURE CARD

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FIGURE II-10.27a

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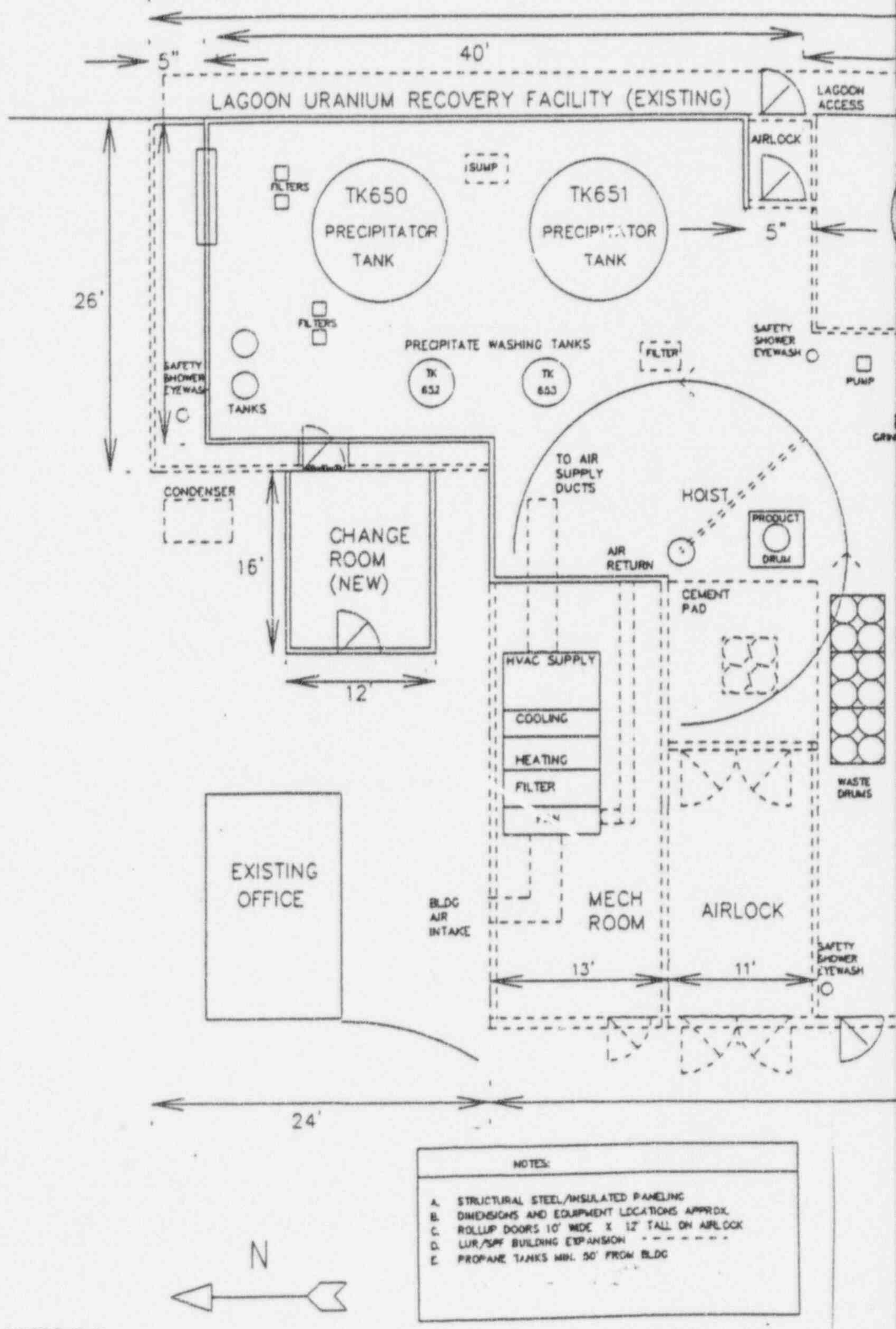
LAGOON URANIUM RECOVERY/SC
GENERAL BUILDING/E



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LIDS PROCESSING FACILITY
QUIPMENT LAYOUT

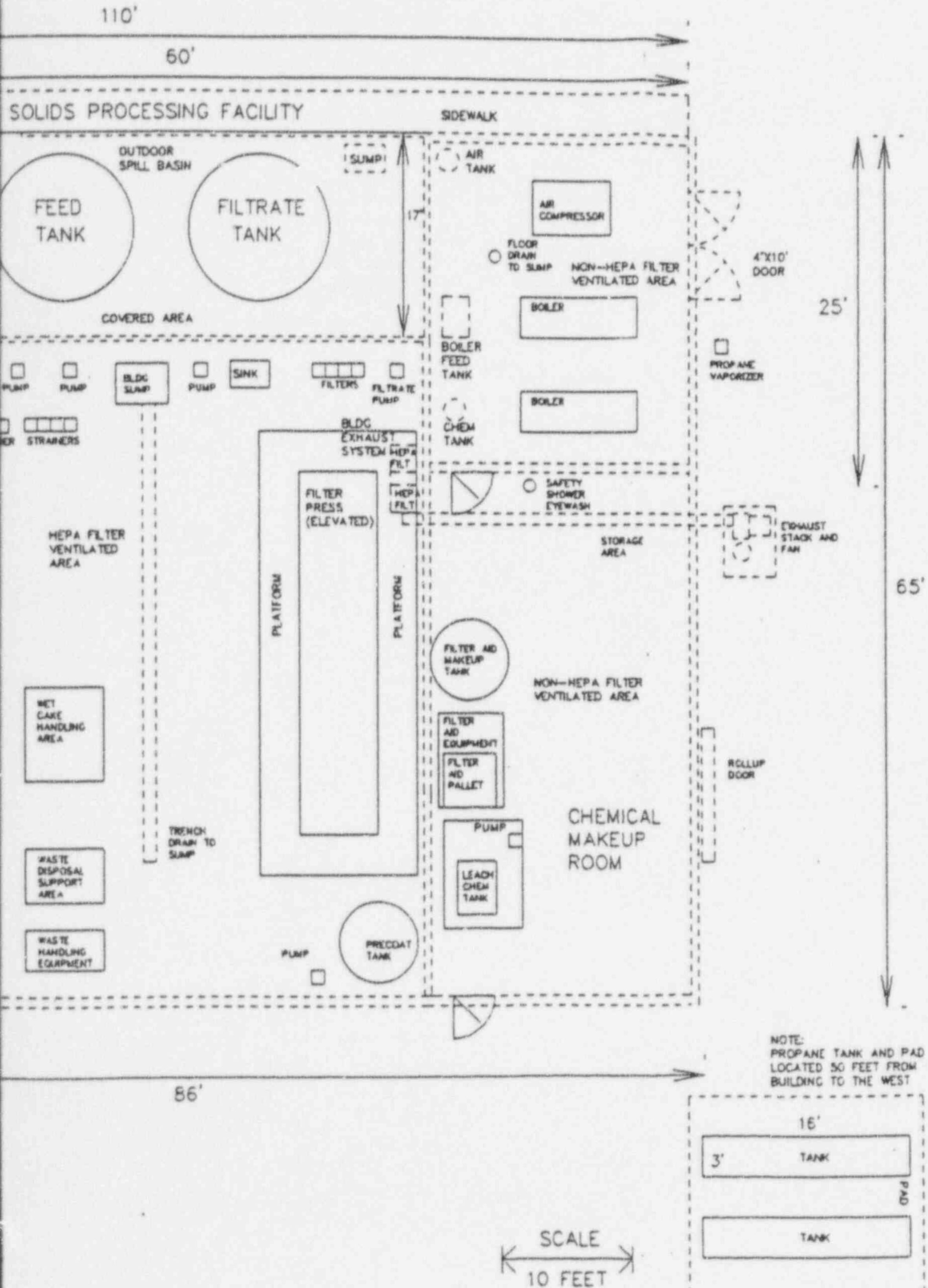

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FIGURE II-10.30

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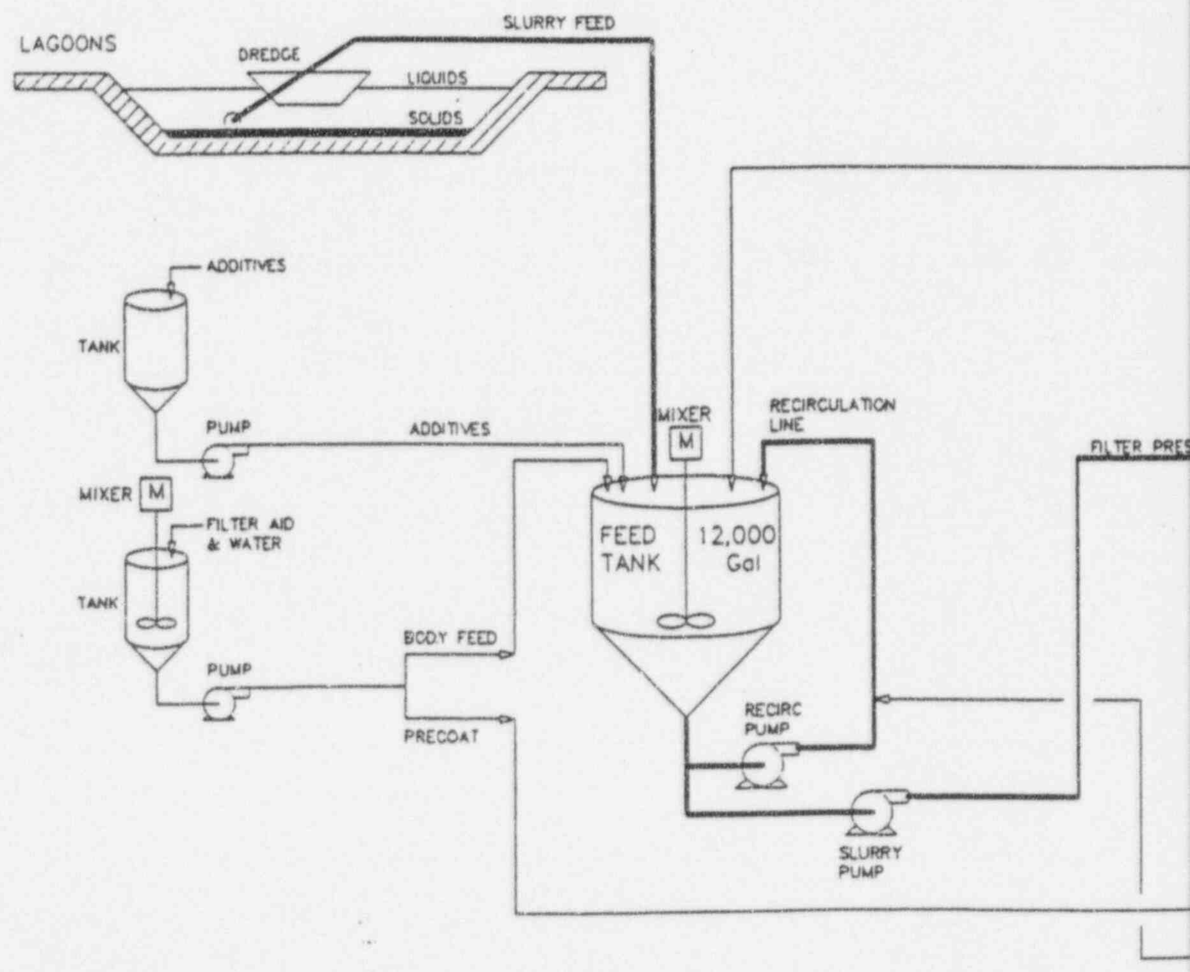
LAGOON UR
SOLIDS P
PRO



ANIUM RECOVERY (LUR)
ROCESSING FACILITY
CESS FLOW DIAGRAM

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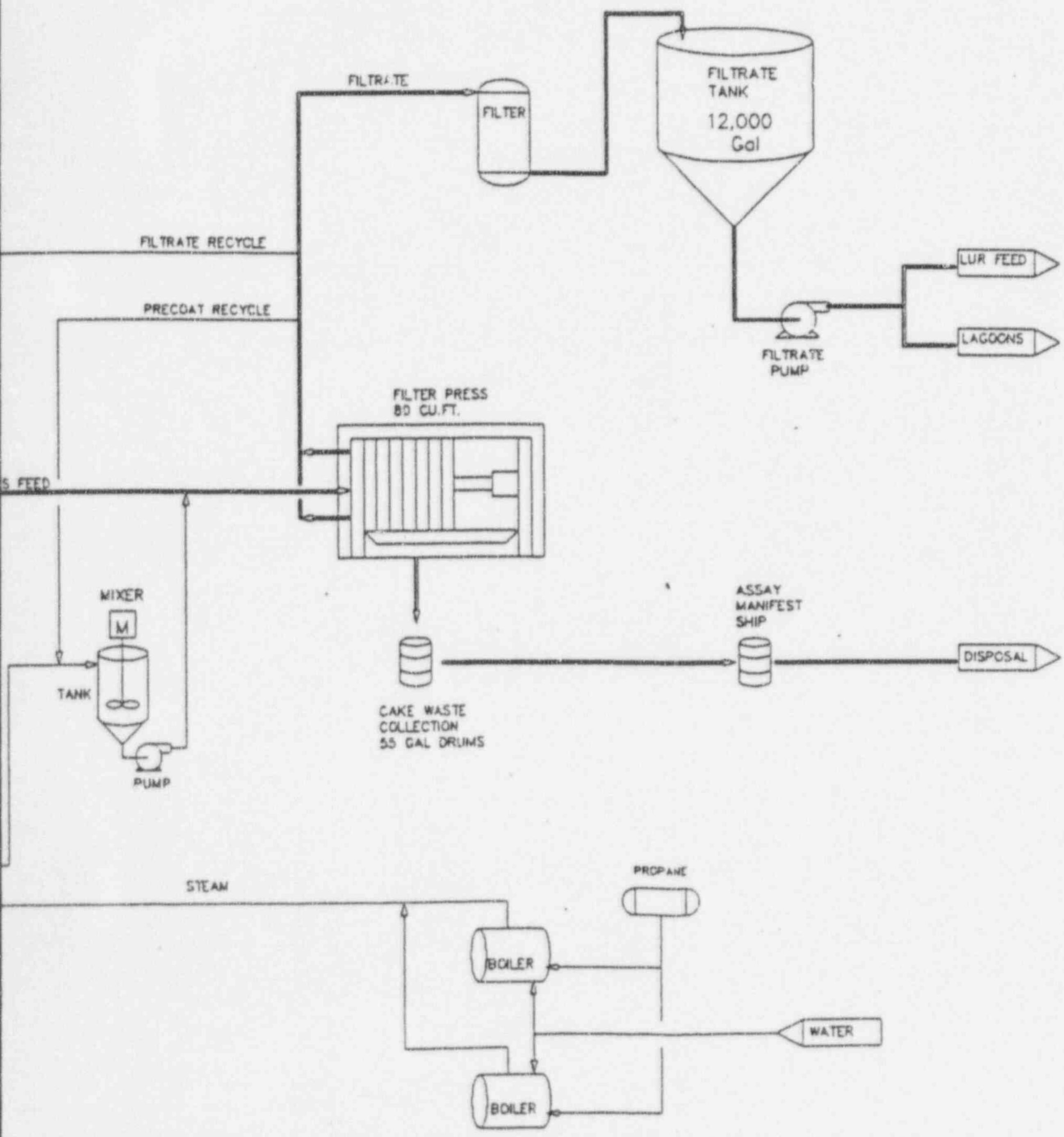

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FIGURE II-10.31

SPFNRC.SKD

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15.12 Lagoons and Lagoon Systems

15.12.1 General Safety Conditions

There are six lagoons, the sand trench, and the leach pit plus two uranium recovery systems, LUR/SPF and the Lagoon 5A IX constituting the lagoon system, where SNM in varying concentrations is stored and recovered. The safety conditions of these areas are discussed collectively.

Lagoons - There are six lagoons in the lagoon system. Each lagoon is equipped with multiple liners (minimum of two) of either Hypalon, high density polyethylene (HDPE), or a combination thereof. Two of the lagoons have an HDPE covering. Each of the lagoons is equipped with an inter-liner leachate detection/collection system. The lagoons accept waste from various chemical operations. The wastes are segregated according to their source and chemical content for reprocessing to reclaim usable constituents. After recovery, the waste is then prepared for sewering to the Richland public sewer system under the conditions of a State Waste Discharge permit. Fences have been erected around the lagoons and appropriate radiological warning signs exist.

Sand Trench - The sand trench can receive sand which is removed from various lagoons during the mid 1970's. The sand is washed with water to remove most of the chemical and radiological contaminants and screened. The fines and water go to Lagoon 3 and the solids go to the leach pit.

Leach Pit - The leach pit collects washed sand from the sand trench operations. Any liquid which drains from the sand is pumped to Lagoon 3. The sand is used as backfill in the commercial radioactive burial facility at Hanford, Washington.

Lagoon Uranium Recovery/Solids Processing Facility (LUR/SPF) System - In the LUR process, Lagoon 3 solution is pumped to tanks in the LUR facility. Sodium hydrosulfite is then added to precipitate the uranium. (Other metals as impurities also precipitate.) The liquid is decanted and pumped to Lagoon 4 and the solids are centrifuged. The centrate is pumped to Lagoon 4 and the solids are placed into a drum where they are dissolved using aluminum nitrate. Once the solids are dissolved, the uranium is recovered by solvent extraction at the ELO Building.

In the SPF process a small manned dredge retrieves solids from the bottom of the lagoons as a slurry and pumps it to the SPF where it is screened, processed through a grinder, and pumped to a feed tank. The slurry is then mixed and heated to the required leaching temperature. Additives are injected into the feed tank to assist the dissolution of uranium. When the leaching is complete, the slurry is dewatered by a filter press. Filtrates from the filter press are collected in a filtrate tank for sampling prior to pumping to LUR for uranium recovery.

Lagoon 5A Ion Exchange (IX) System - Effluent from Lagoon 5A is fed to the Lagoon 5A IX column to remove residual uranium before the effluent is sent to the Richland public sewer system. The effluent is normally less than 2 ppm uranium as it is fed to the IX column and less than 0.1 ppm uranium as it leaves the IX column. Optimum uranium removal is obtained at $8<pH<12$. When the IX resin is loaded, elution and regeneration are performed and all liquid streams are sent to Lagoon 3.

15.12.1.1 Criticality Safety

Criticality safety is assured for the lagoons, sand trench and leach pit by uranium concentration control. Inputs to the lagoons are monitored and the concentrations are limited to 1000 ppm U. Lagoon 3 is the only one of these areas that approaches this limit. The lagoons, both solution and sludge, are sampled semiannually and the samples analyzed for U concentration. Precipitating agents are controlled in Lagoon 3 to keep the U in solution and pH is controlled in all lagoons.

The Lagoon 5A IX system criticality safety is assured by limiting the U concentration to less than 140 gU/ℓ. This concentration is safe for all vessels in the system. The lagoon solids, the sand from the sand filters and the IX resin are all sampled and analyzed semiannually to confirm this concentration limit.

Criticality safety in the LUR/SPF process is assured by maintaining safe batches in all vessels and adequate spacing between vessels. Batch control is maintained by analyzing the lagoon solution which enters the system to determine how much solution can be processed while maintaining a safe batch.

In all these areas the enrichment is limited to 5%.

15.12.1.2 Radiation Protection

The lagoons are within SPC's fenced area. Bird alarms are in use to keep birds away from the lagoons. The sand trench is covered whenever inventory is present. In the LUR/SPF and Lagoon 5A IX areas the U-bearing solutions are in closed containers.

15.12.1.3 Fire Safety

Fire in the lagoons and trenches is not credible. The Lagoon 5A IX system and LUR/SPF buildings contain manual and fixed/rate-of-rise temperature sensors to alarm a fire and the buildings are rated noncombustible. There are portable fire extinguishers available at both the Lagoon 5A IX and LUR/SPF. In addition the LUR/SPF building is equipped with a fire suppression sprinkler system.

15.12.1.4 Environmental Safety

The lagoons and leach pit are equipped with multiple liners (minimum of two) with a leak detection system between the liners to detect leaks prior to reaching groundwater. The sand pit has a single liner and is covered when it contains contaminated sand. In addition there is an extensive network of groundwater sampling wells associated with the lagoon system (see Chapter 5).

The Lagoon 5A IX system resides in a building addition to the Ammonia Recovery Facility. The addition is built on a sealed concrete floor with curbs which drains to a main sump. All U-bearing material is in closed containers or process vessels. In the LUR/SPF area, once the solution is pumped from the lagoon, it is maintained in closed process vessels or containers.

TABLE I-1.1 Specific Locations of Authorized Activities (Cont.d)[1]

Location	SNM	Authorized Activity
Lagoon Uranium Recovery/Solids Processing Facility	Uranium Compounds (up to 5 wt% U-235)	Recovery of uranium from lagoon liquids and solids.
Ammonia Recovery Facility	Uranium Compounds (up to 5 wt% U-235)	Removal and recovery of ammonia from uranium contaminated liquid wastes.
Lagoon 5A IX Process-ARF Bldg.	Uranium Liquid Wastes (up to 5 wt% U-235 and less than 140 gU/ℓ concentrations in filters and resins)	Filtration and ion exchange of uranium liquid wastes.
Any Permanent or Portable Building having HEPA filtration and Isokinetic sampling.	Uranium solid waste (up to 5 wt% U-235)	Sorting and compaction.

1) The locations described in this table are shown on the site plan, Figure II-10.1

K42 exhaust system to prevent operation of the K41 supply air system without the K42 exhaust system operating. Pressure sensors are provided to maintain a minimum negative differential pressure of 0.05 inch water gauge in the cleaning area relative to the atmosphere.

The K41 supply fan is interlocked so that a loss of exhaust duct negative pressure above -3 inches water gauge (exhaust fan failure) or a signal from the exhaust duct heat detector will shut down the K41 air supply system.

Automatic visual alarms are activated when any supply or exhaust system upset occurs. Pressure differential indicating devices and airflow quantity meters are located on the main HVAC panel to provide system and zone operating conditions.

10.3.11.4 HEPA Filter Bank

The final HEPA filters are enclosed in a sheet metal housing that, in turn, is mounted on structural steel legs fastened to a concrete slab. The HEPA filters are rated at 1000 ft^3/min at one-inch water gauge pressure drop and are mounted in welded steel frames. Continuous air samplers are installed downstream of the filter bank. Visual indicators for reading the pressure drop across the filters are permanently installed, and means are provided for in-place DOS testing.

The HEPA filter medium is 100% moisture-resistant fiberglass, pleated over corrugated separators and sealed in fire-resistant plywood frames. The individual filters are certified to remove 99.97% of 0.3 micron particles and meet or exceed Military Specification MIL-F-51079.

10.3.12 LUR/SPF HVAC System

The general features of the LUR/SPF HVAC system include a combination of a once-through airflow and recirculation supply system (K64) and a double HEPA filtered exhaust system (K65). A simplified schematic diagram of the HVAC system is shown in Figure II-10.27b.

10.3.12.1 K64 Air Supply and Recirculation System

The K64 air supply and recirculation system supplies approximately 1500 ft^3/min. of outside air and also recirculates approximately 8800 ft^3/min. of building air. Recirculated air is passed through a roughing filter and a single HEPA filter with an installed efficiency of 99.95% for 0.8 micron DOS cold-generated aerosol. Provision is made in the K64 recirculation system for continuous alpha radiation monitoring of recirculated air upstream of the HEPA filter bank. The alpha air monitor is set to alarm and annunciate when alpha activity exceeds 8 MPC-hr.

10.3.12.2 K65 Air Exhaust System

Air supplied to the LUR/SPF, plus infiltration, is exhausted through the K65 exhaust system. The double HEPA filter arrangement in this system consists of the final HEPA filter bank and upstream primary HEPA filter bank plus individual prefilters located in the exhaust ducts of the two areas serviced.

The K65 system exhaust air (approximately 2000 ft^3/min.) passes from the two stage HEPA filter bank through the main exhaust fan, past a duct air monitor (measuring airflow quantities) and is discharged from a stack extending 50 ft above ground on the south side of the building. The K65 exhaust system has one fan which is connected to normal power. All final HEPA filters are in-place tested to be 99.95% minimum efficient for 0.8 micron DOS cold aerosol.

10.3.12.3 System Controls

The HVAC systems are controlled with temperature, pressure and flow sensor actuating valving and damper positions to hold temperatures, pressures, and pressure differentials constant in the various building areas. The K64 supply air system is interlocked with the K65 exhaust system to prevent operation of the K64 supply air system without the K65 exhaust system operating. Pressure sensors are provided to maintain a minimum negative differential pressure of 0.05 inch water gauge in the building relative to the atmosphere.

The K64 supply fan is interlocked so that a loss of exhaust duct flow (exhaust fan failure) or a signal from the exhaust duct heat detector will shut down the K64 air supply system.

An automatic visual alarm is activated when the recirculation system is inoperable.

10.3.12.4 HEPA Filter Bank

The final HEPA filters are enclosed in a sheet metal housing that, in turn, is mounted on structural steel legs fastened to a concrete slab. The HEPA filters are rated at 1000 ft^3/min at one-inch water gauge pressure drop and are mounted in welded steel frames. Continuous air samplers are installed downstream of the filter bank. Visual indicators for reading the pressure drop across the filters are permanently installed, and means are provided for in-place DOS testing.

The HEPA filter medium is 100% moisture-resistant fiberglass, pleated over corrugated separators and sealed in fire-resistant plywood frames. The individual filters are certified to remove 99.97% of 0.3 micron particles and meet or exceed Military Specification MIL-F-51079.

10.4 Radioactive Waste Handling

The facilities and processes which are involved in the handling of radioactive and chemical wastes produced by SPC are described in the following sections.

10.4.1 Lagoon System Description

The lagoons provide containment for all uranium and chemically- contaminated liquid wastes generated at SPC. Natural evaporation, controlled waste addition, waste discharge to the municipal sewer and water additions are used to control the volume of liquid stored in the lagoons. Inter-lagoon transfers are periodically made for both uranium accountability and volume control purposes. Sampling between lagoon liners is conducted monthly (unless prevented by freezing weather) to determine if leaks have occurred.

There are six liquid waste storage lagoons, one solids leach pit, and one sand storage pit located along the east boundary of SPC (see Figure II-10.1). The sand storage pit is located immediately west of Lagoon 3. The solids leach pit is located immediately west of Lagoon 2. The dimension and capacities of the lagoons are:

Lagoon	Dimensions	Est. Capacity 10^6 Gal
1	240' x 200' x 3' deep	1.4
2	240' x 100' x 3' deep	0.7
3	240' x 350' x 5'6" deep	3.5
4	240' x 290' x 6' deep	2.7
5A	240' x 175' x 7'6" deep	1.6
5B	240' x 175' x 7'6" deep	1.6
Leach Pit	40' x 54' x 8'6" deep	0.06
Sand Pit	39' x 300' x 6' deep	0.3

The lagoons and the solids leach pit have a "sandwich" construction; they each have two liners made of impervious material, separated by 6 inches of sand. On Lagoons 1, 2 and 3, the "sandwich" rests on an asphalt-type surface known as Petromat. In the sand layer between the impervious liners is an array of sample heads. The sand storage pit is single-lined and, therefore, does not have between-liner sampling capabilities. Tubing from each of the heads is routed to the berms on both the east and west side of the lagoons where small pumps can be periodically connected. Some additional sampler heads are located between the original Petromat liner and the lower liner. Lagoon 4 is equipped with three "dry wells" below the bottom liner. Samplers are located in each dry well. All sampler heads are pumped each month using small air-driven pumps (unless prevented by freezing weather) for leak detection purposes.

For fire detection there are rate-of-rise/fixed temperature detectors in the ceiling. These detectors set off alarms locally, at the Central Guard Station, and the Richland City Fire Department. The ion exchange room has a hand-held fire extinguisher. There is a two-hour rated fire wall between the original building and the new addition and a similar fire wall between the outside storage area for sulfuric acid and the building housing the ion exchange system.

There are no gaseous or particulate releases since all the radioactive materials are in liquid form in closed vessels or in large double lined lagoons. The release of radioactive materials from process equipment is prevented since all vessels and associated piping are designed to withstand a pressure of at least 100 psig versus the maximum pump discharge pressure of 38 psig. Radiation work shall be controlled through the Radiation Work Permit System. All operations shall be conducted within the ALARA concept.

The environmental impact of the ion exchange process for treating Lagoon 5A solution is judged to be insignificant. The equipment is located in a building within the restricted area which is committed to industrial use. The equipment is located in an area specifically designed to contain any spills or leaks. There are no gaseous effluents or increases in the quantities of radioactive waste generated. All underground transfer lines entering and leaving the new facility are completely double-encased (inner pipe surrounded by a sealed secondary plastic containment shell), with electronic leak detection systems that alarm locally and in the conversion Line 2 control room. The primary pipes are tested hydrostatically annually and the secondary pipes biennially. The process generates small quantities of additional chemical wastes, but this is more than offset by the positive environmental impact of reducing the quantities of uranium discharged to the Richland city landfill.

10.4.4 Lagoon Uranium Recovery (LUR) and Solids Processing Facility (SPF) Description

10.4.4.1 LUR

The LUR Facility is provided to recover LEU from stored high uranium content liquid chemical wastes (see Section 10.4.1). Following uranium recovery, the waste is treated for ammonia removal (see Section 10.4.2), then disposed to the municipal sewer.

The LUR Facility is located adjacent to Lagoon 4 as shown on Figure II-10.1. The equipment consists of six process vessels, one chemical makeup vessel and associated pumps, piping and filters. A brief description of the major equipment is given in Table II-10.2 and the equipment layout is depicted in Figure II-10.30. The process equipment is housed in the LUR building which includes a HEPA-filtered, isokinetically-sampled HVAC system.

A process flow diagram for the uranium recovery system is presented in Figure II-10.31. Approximately 4000-6000 gallons of high uranium content waste is pumped into the precipitator. The uranium is precipitated from solution by addition of sodium hydrosulfite and allowed to settle. At the end of the settling period, the low uranium content liquid is decanted and pumped to lagoon storage and the solids filtered out. The uranium precipitate is pumped to plastic 55-gallon drums where they are dissolved using aluminum nitrate. The resulting solutions are processed at the ELO Building where the uranium is further recovered by solvent extraction.

10.4.4.2 SPF

The SPF is provided to recover LEU entrained in the solids in the bottom of the lagoons and put the uranium into solution to be fed to LUR. The SPF process equipment is located in the south end of the building that encloses LUR. LUR and SPF share the same HVAC system. The SPF process equipment consists of two feed and product tanks, two additive makeup tanks, a filter press, and associated filters, pumps, piping and a steam generator. A brief description of the major SPF equipment is included in Table II-10.2 and the equipment layout is included in Figure II-10.30.

A small manned dredge retrieves solids from the bottom of the lagoons as a slurry and pumps them to the SPF. The slurry is screened, processed through a grinder, screened again, and pumped to a 12,000 gallon feed tank. The slurry is then mixed and heated to the required leaching temperature with steam provided by two 50 Hp boilers. A leach chemical tank and pump system injects additives into the feed tank which assist the dissolution of uranium. A body feed/precoat tank and pumps inject filter aids to the slurry to prevent blinding of the filter cloths with slimes. When the leaching is complete, the slurry is dewatered by a filter press. Residual insoluble sands, body feed, fines, debris and other solids from the lagoons collected in the filter press cake are packaged into 55-gallon drums for disposal as low level waste. Filtrates from the filter press pass through a polishing filter and are collected in a filtrate tank for sampling prior to pumping directly to LUR or to Lagoon 3 for eventual processing at LUR. A process flow diagram for the SPF is shown in Figure II-10.31.

10.4.5 Solids Uranium Recovery Facility

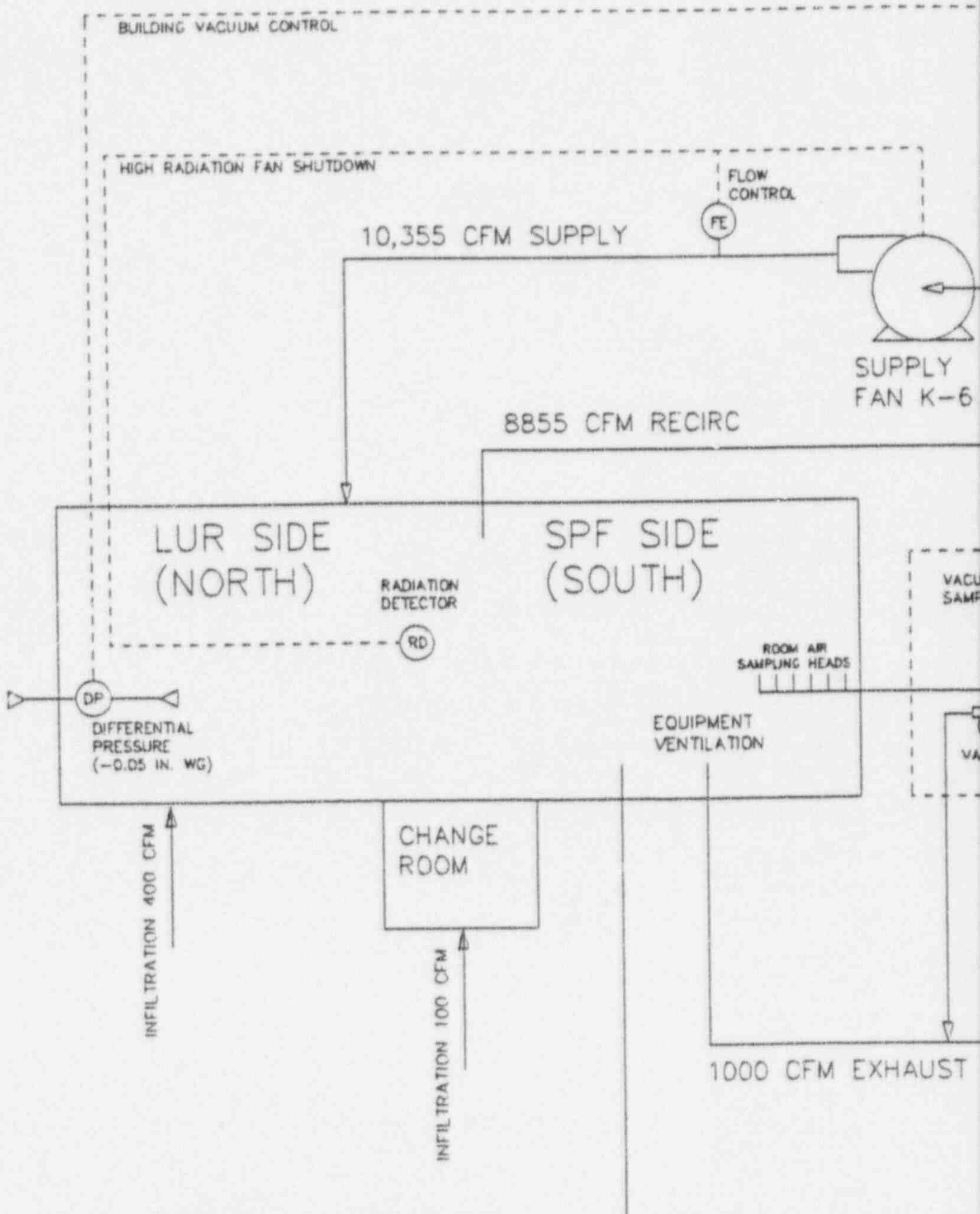
The lagoons contain a wide array of solids types, consisting largely of soluble inorganic salts containing ammonium and sodium fluorides, sulfates, and nitrates; silicates, precipitates of uranium, gadolinium, zirconium, calcium, aluminum, and other salts and metals; sand; silts and clays; and miscellaneous debris blown in by the wind. Some of the lagoon solids contain chemical constituents in economically recoverable quantities, most notably uranium and ammonia. Both the quality and composition of the lagoon solids vary from lagoon to lagoon, depending on the process waste streams that have been historically managed in each lagoon.

Processing of lagoon solids removed in conjunction with past lagoon relining/repair operations has historically been accomplished in a solids uranium recovery facility, consisting of a sand trench, leach pit, and two vibrating screens. Solids placed into the sand trench were processed via a series of physical screening/sizing and washing operations which allowed relatively higher uranium insoluble sands to be placed into lagoons (for future uranium removal) and low uranium insoluble sands to be placed into the leach pit. Contingent on meeting certain size and uranium concentration specifications (per Amendment 19 to Condition 8 of the U.S. Ecology's NRC License 16-19204-01), the washed and sized sand can be disposed of unpackaged and in bulk as backfill material at the U.S. Ecology Hanford Low-Level Radioactive Waste Disposal Facility.

Table II-10.2

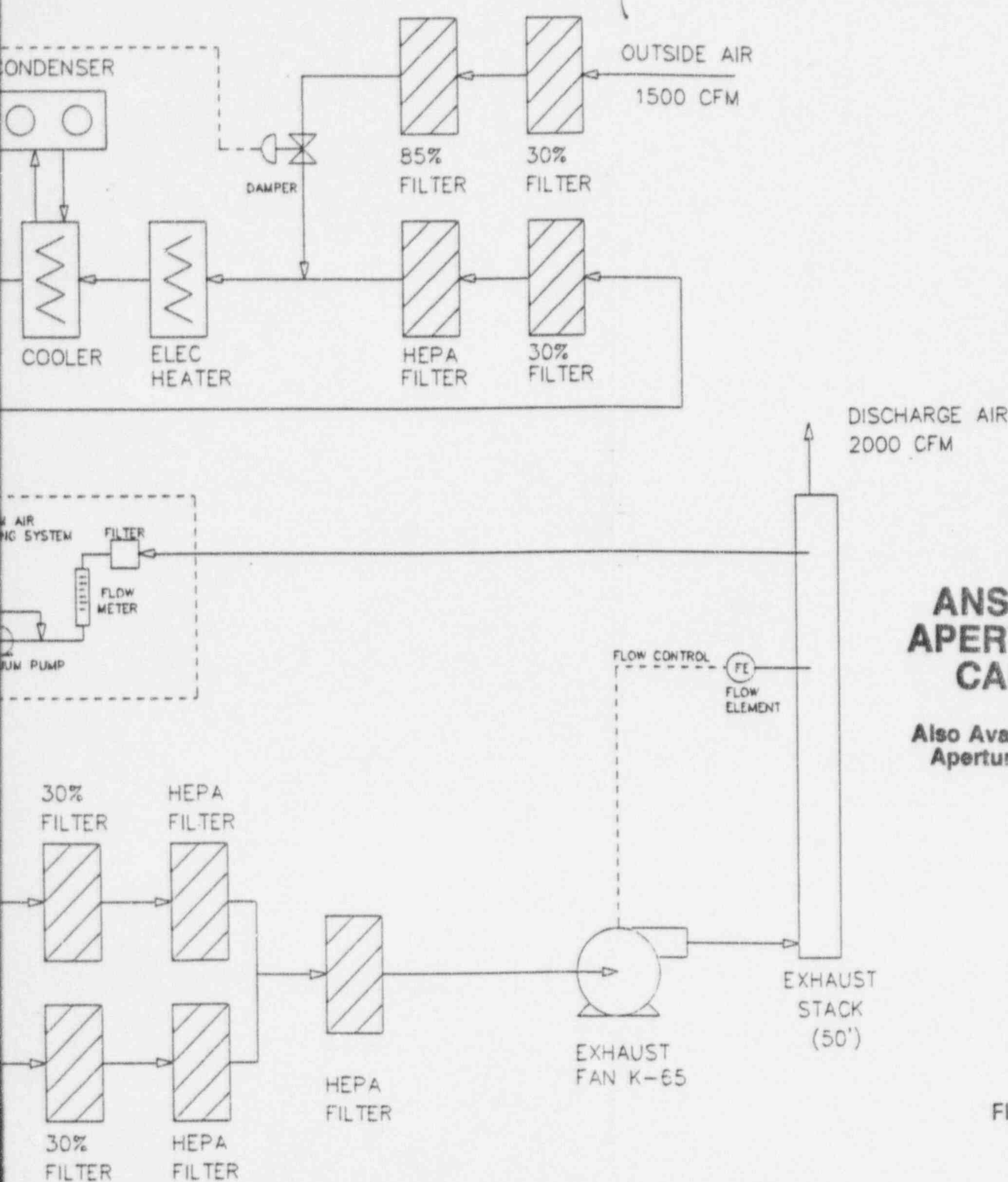
LUR Major Process Equipment		**SPF Major Process Equipment**	
		TANKS	
T-650	Precipitator #1 (6,000 gallons)	T-670	Feed Tank (12,000 gallons)
T-651	Precipitator #2 (6,000 gallons)	T-671	Precoat Tank (1,000 gallons)
T-652	Precipitator Washer #1 (350 gallons)	T-672	Filter Aid Tank (1,500 gallons)
T-653	Precipitator Washer #2 (350 gallons)	T-673	Additive Tank (250 gallons)
T-654	Filter Wash Tank #1 (70 gallons)	T-674	Filtrate Tank (12,000 gallons)
T-655	Filter Wash Tank #2 (70 gallons)		
T-656	Precipitation Agent Mix Tank (50 gallons)		
T-660.1	Dissolver Vessel (100 gallons)		
T-660.2	Dissolver Vessel (100 gallons)		
T-660.3	Dissolver Vessel (100 gallons)		
T-660.4	Dissolver Vessel (100 gallons)		
		PUMPS	
P-650	Precipitator #1 Slurry Pump	P-670	Slurry Feed Pump
P-651	Precipitator #2 Slurry Pump	P-671	Precoat Pump
P-652	Precipitator Washer Decant Pump	P-672	Filter Aid Pump
P-653.1	Decant Product Pump (portable)	P-673	Additive Pump
P-653.2	ANN Pump (portable)	P-674	Filtrate Pump
P-654	Filter Wash Pump #1	P-675	Dredge Pump
P-655	Filter Wash Pump #2	P-676	Recirc Pump
P-656	Precipitation Agent Makeup Pump		
P-657	Precipitation Decant Pump		
P-658	Lagoon Waste Feed Pump		
P-659	LUR Waste Transfer Pump		
		FILTERS	
F-652	Washer Decant Filter (25-30 micron)	F-670	Filter Press
F-657.1	Precipitation Decant Filter (5-10 micron)	F-674	Filtrate Filters (10 micron)
F-657.2	Precipitation Decant Filter (5-10 micron)	F-675	Dredge Strainers (¼", ½")
F-657.3	Precipitation Decant Filter (1-3 micron)		
F-657.4	Precipitation Decant Filter (1-3 micron)		
F-658	Lagoon Feed Filter (200 mesh)		
		AGITATORS	
A-650	Precipitator #1 Agitator	A-670	Feed Tank Agitator
A-651	Precipitator #2 Agitator	A-671	Precoat Agitator
A-652	Precipitator Washer #1 Agitator	A-672	Filter Aid Agitator
A-653	Precipitator Washer #2 Agitator		
A-654	Filter Washer #1 Agitator		
A-655	Filter Washer #2 Agitator		
A-656	Mix Tank Agitator		

LAGOON URANIUM RECOV
VENTILATION S



NOTES

ALL FILTER DP'S MONITORED
COOLER IS TEMP CONTROLLED
HEATER IS TEMP CONTROLLED
SMOKE DETECTOR IN SUPPLY DUCT
FANS HAVE VARIABLE SPEED DRIVES



ANSTEC APERTURE CARD

Also Available on Aperture Card

FIGURE II-10.27b

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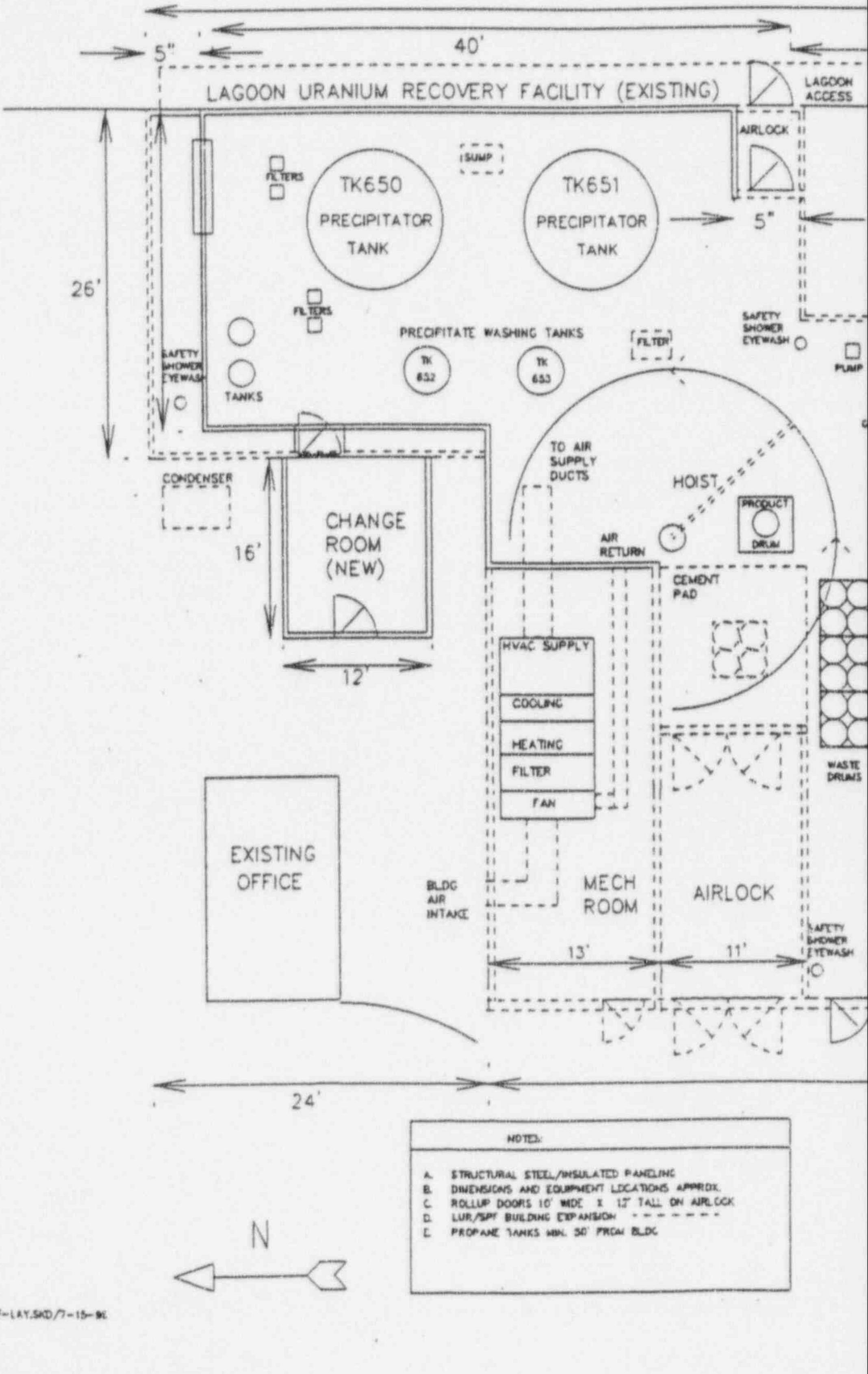
LAGOON URANIUM RECOVERY/S
GENERAL BUILDING/



NOTES:

A. STRUCTURAL STEEL/INSULATED PANELING
B. DIMENSIONS AND EQUIPMENT LOCATIONS APPROX.
C. ROLLUP DOORS 10' WIDE X 12' TALL ON AIRLOCK
D. LUR/SPF BUILDING EXPANSION - - - - - -
E. PROPANE TANKS MIN. 50' FROM BLDG

PF-LAY.SKD/7-15-96

OLIDS PROCESSING FACILITY EQUIPMENT LAYOUT

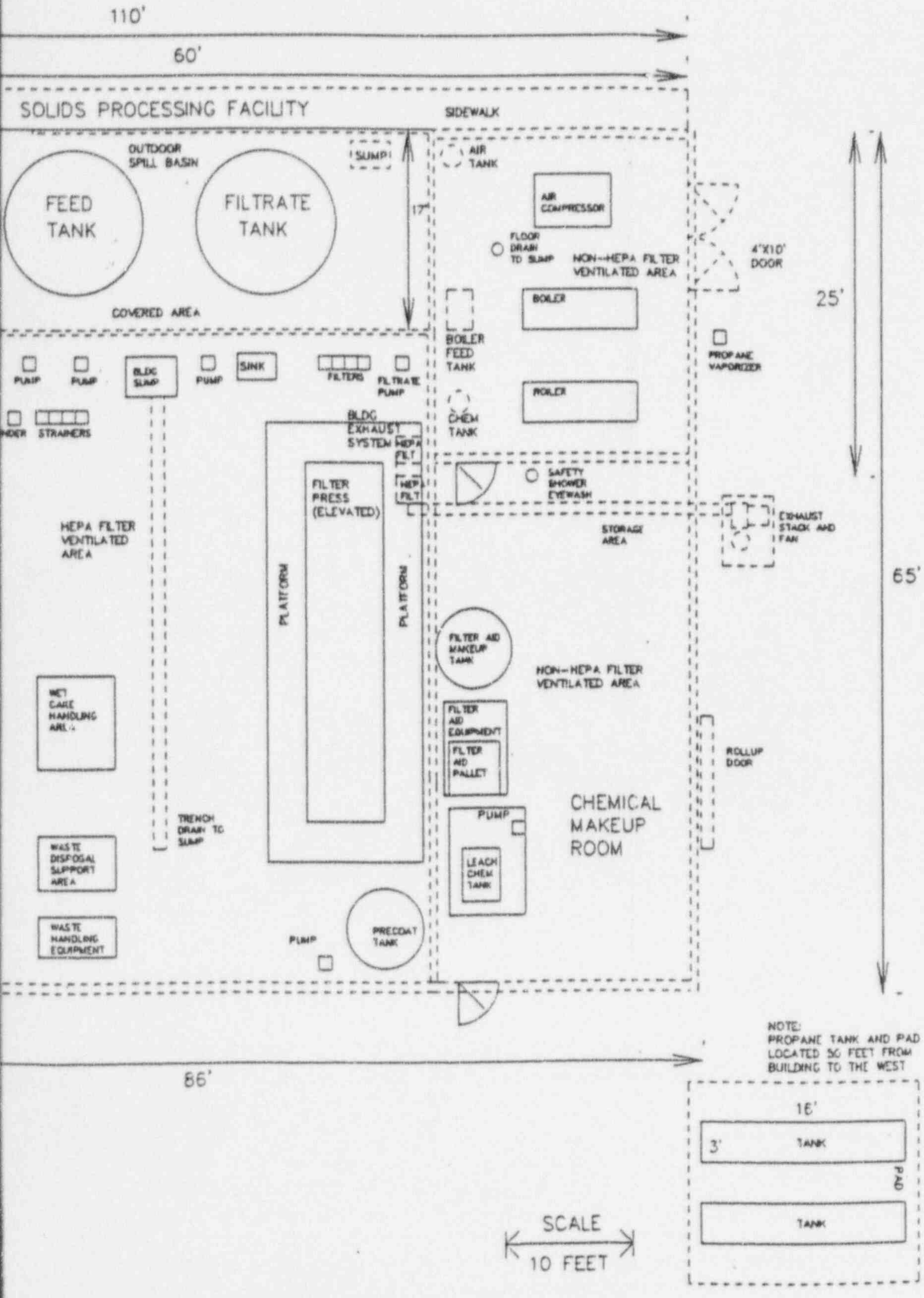


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FIGURE II-10.30

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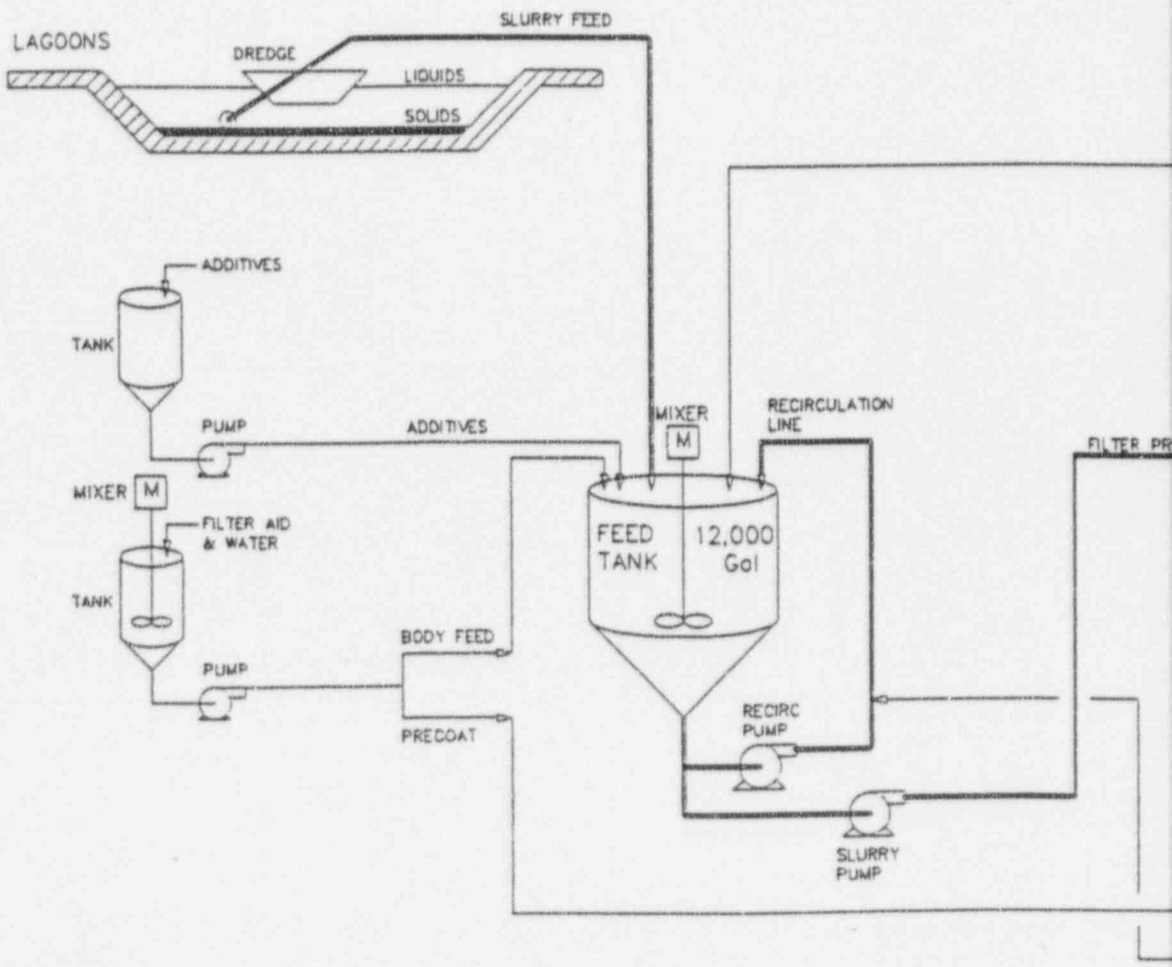
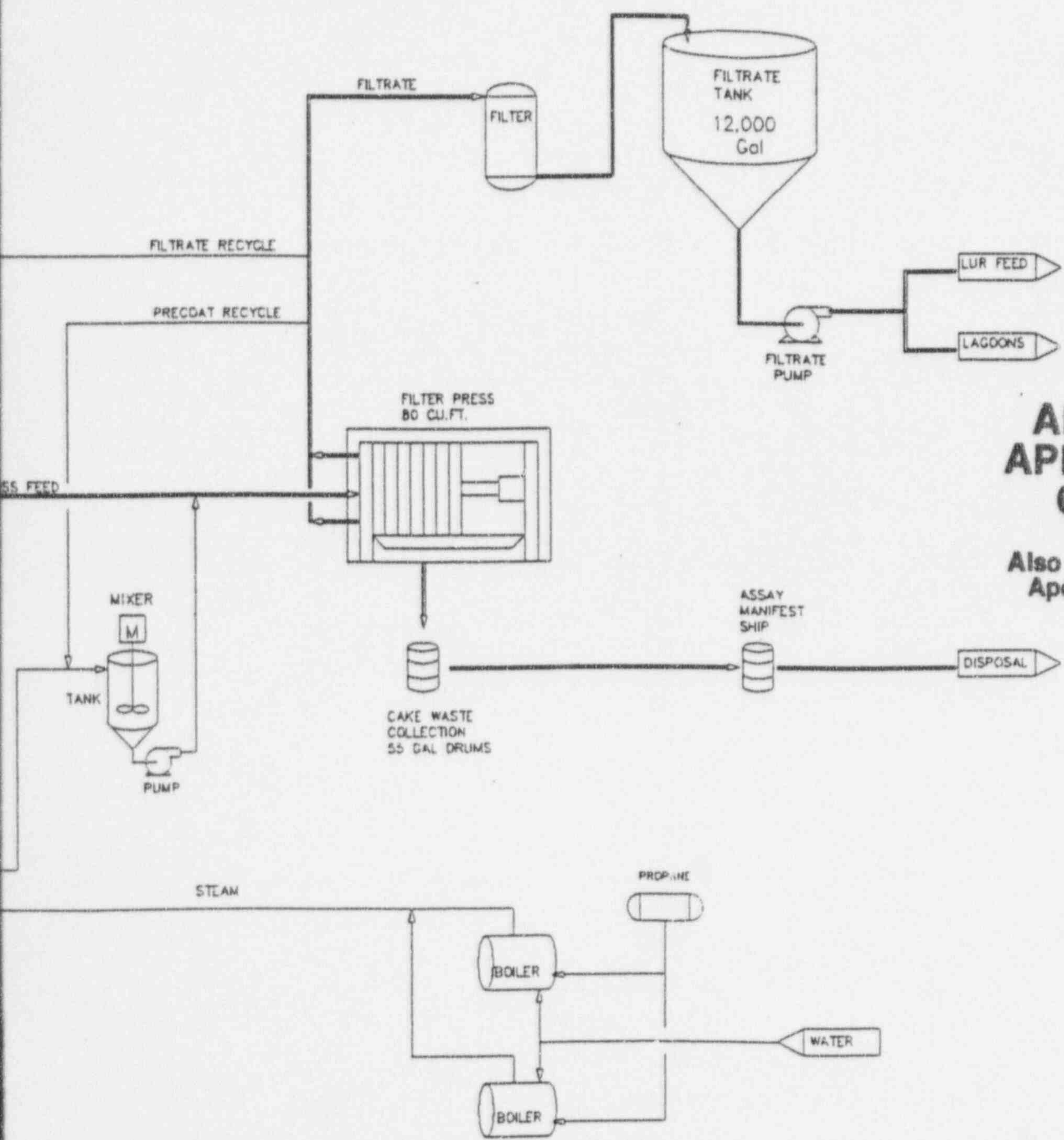
LAGOON UR
SOLIDS
PR



ANIUM RECOVERY (LUR)
PROCESSING FACILITY
OCESS FLOW DIAGRAM



ANSTEC APERTURE CARD

Also Available on Aperture Card

FIGURE II-10.31

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There are several permanent and temporary storage areas on the SPC site. These include UF_6 cylinder storage (discussed in 15.1.2.1), loaded fuel assembly shipping container storage, loaded powder and pellet shipping container storage, scrap and waste drum storage, and other temporary storage areas (e.g. sea containers).

15.4.2.1.1 Criticality Safety

Loaded shipping containers are stored in arrays which are limited in size by the criticality safety limits prescribed by the NRC/DOT container certificates. Other storage arrays (e.g. scrap and waste drums and inner pellet shipping containers) are controlled by geometry, enrichment and mass per container limits.

15.4.2.1.2 Radiation Protection

The uranium is in closed containers and is surveyed for radioactive contamination prior to going into storage. The areas are also routinely (monthly or quarterly) surveyed.

15.4.2.1.3 Fire Protection

The covered shipping container storage area is equipped with a sprinkler system. There are fuel assembly shipping containers with wooden overpacks stored there. All other shipping containers are all metal and therefore noncombustible.

15.4.2.1.4 Environmental Safety

The uranium is contained in closed containers.

15.4.3 Lagoons and Lagoon Systems

15.4.3.1 General Safety Conditions

There are six lagoons, the sand trench, and the leach pit plus two uranium recovery systems, LUR/SPF and the Lagoon 5A IX constituting the lagoon system, where SNM in varying concentrations is stored and recovered. The safety conditions of these areas are discussed collectively.

Lagoons - There are six lagoons in the lagoon system. Each lagoon is equipped with multiple liners (minimum of two) of either Hypalon, high density polyethylene (HDPE), or a combination thereof. Two of the lagoons have an HDPE covering. Each of the lagoons is equipped with an inter-liner leachate detection/collection system. The lagoons accept waste from various chemical operations. The wastes are segregated according to their source and chemical content for reprocessing to reclaim usable constituents.

After recovery, the waste is then prepared for sewering to the Richland public sewer system under the conditions of a State Waste Discharge permit. Fences have been erected around the lagoons and appropriate radiological warning signs exist.

Sand Trench - The sand trench can receive sand which is removed from various lagoons during the mid 1970's. The sand is washed with water to remove most of the chemical and radiological contaminants and screened. The fines and water go to Lagoon 3 and the solids go to the leach pit.

Leach Pit - The leach pit collects washed sand from the sand trench operations. Any liquid which drains from the sand is pumped to Lagoon 3. The sand is used as backfill in the commercial radioactive burial facility at Hanford, Washington.

Lagoon Uranium Recovery/Solids Processing Facility (LUR/SPF) System - In the LUR process, Lagoon 3 solution is pumped to tanks in the LUR facility. Sodium hydrosulfite is then added to precipitate the uranium. (Other metals as impurities also precipitate.) The liquid is decanted and pumped to Lagoon 4 and the solids are centrifuged. The centrate is pumped to Lagoon 4 and the solids are placed into a drum where they are dissolved using aluminum nitrate. Once the solids are dissolved, the uranium is recovered by solvent extraction at the ELO Building.

In the SPF process a small manned dredge retrieves solids from the bottom of the lagoons as a slurry and pumps it to the SPF where it is screened, processed through a grinder, and pumped to a feed tank. The slurry is then mixed and heated to the required leaching temperature. Additives are injected into the feed tank to assist the dissolution of uranium. When the leaching is complete, the slurry is dewatered by a filter press. Filtrates from the filter press are collected in a filtrate tank for sampling prior to pumping to LUR for uranium recovery.

Lagoon 5A Ion Exchange (IX) System - Effluent from Lagoon 5A is fed to the Lagoon 5A IX column to remove residual uranium before the effluent is sent to the Richland public sewer system. The effluent is normally less than 2 ppm uranium as it is fed to the IX column and less than 0.1 ppm uranium as it leaves the IX column. Optimum uranium removal is obtained at $8<pH<12$. When the IX resin is loaded, elution and regeneration are performed and all liquid streams are sent to Lagoon 3.

15.4.3.1.1 <u>Criticality Safety</u>

Criticality safety is assured for the lagoons, sand trench and leach pit by uranium concentration control. Inputs to the lagoons are monitored and the concentrations are limited to 1000 ppm U. Lagoon 3 is the only one of these areas that approaches this limit. The lagoons, both solution and sludge, are sampled semiannually and the samples analyzed for U concentration. Precipitating agents are controlled in Lagoon 3 to keep the U in solution and pH is controlled in all lagoons.

The Lagoon 5A IX system criticality safety is assured by limiting the U concentration to less than 140 gU/ℓ. This concentration is safe for all vessels in the system. The lagoon solids, the sand from the sand filters and the IX resin are all sampled and analyzed semiannually to confirm this concentration limit.

Criticality safety in the LUR/SPF process is assured by maintaining safe batches in all vessels and adequate spacing between vessels. Batch control is maintained by analyzing the lagoon solution which enters the system to determine how much solution can be processed while maintaining a safe batch.

In all these areas the enrichment is limited to 5%.

15.4.3.1.2 Radiation Protection

The lagoons are within SPC's fenced area. Bird alarms are in use to keep birds away from the lagoons. The sand trench is covered whenever inventory is present. In the LUR/SPF and Lagoon 5A IX areas the U-bearing solutions are in closed containers.

15.4.3.1.3 Fire Safety

Fire in the lagoons and trenches is not credible. The Lagoon 5A IX system and LUR/SPF buildings contain manual and fixed/rate-of-rise temperature sensors to alarm a fire and the buildings are rated noncombustible. There are portable fire extinguishers available at both the Lagoon 5A IX and LUR/SPF. In addition the LUR/SPF building is equipped with a fire suppression sprinkler system.

15.4.3.1.4 Environmental Safety

The lagoons and leach pit are equipped with multiple liners (minimum of two) with a leak detection system between the liners to detect leaks prior to reaching groundwater. The sand pit has a single liner and is covered when it contains contaminated sand. In addition there is an extensive network of groundwater sampling wells associated with the lagoon system (see Chapter 5).

The Lagoon 5A IX system resides in a building addition to the Ammonia Recovery Facility. The addition is built on a sealed concrete floor with curbs which drains to a main sump. All U-bearing material is in closed containers or process vessels. In the LUR/SPF area, once the solution is pumped from the lagoon, it is maintained in closed process vessels or containers.