CHEMICAL RADWASTE SYSTEM

Reference Text

Revisions

Date	Rev #	Description
07/11/96	1	Correct alarm setpoints and location
07/11/96	1	Remove heat tracing of monitor tanks and piping no longer used
07/11/96	1	Clarified location of indication for pumps running
12/09/99	2	Added PR 99.2088 material and LER 96-010-00
10/07/02	3	Incorporate figures not included in Rev. 2
03/10/05	4	Updated to address primary process is Thermex. Also updated text to closer agree with procedure.

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CHEMICAL RADWASTE SYSTEM

A. OVERVIEW

The Chemical Radwaste System collects all water from all floor sumps radio-chemistry floor drains regeneration waste from condensate demineralizers. These liquids generally have low concentration of radioactive impurities and high conductivity.

B. SYSTEM DESCRIPTION

1. System Purpose

The chemical radwaste system collects, stores, processes, and discharges liquid radwaste containing low concentrations of radioactive impurities and high conductivity. Radwaste sent to the system not requiring treatment is routed to the clean radwaste system.

To achieve this purpose, the Chemical Radwaste System:

- Collects all water from all floor sumps, radio-chemistry floor drains, regeneration waste from Condensate Demineralizers, and CRD Flushing Tank.

- Provides for safe disposal of chemical radwaste to minimize radioactive releases to the environment.

- Provides a flow path from the Monitor Tanks to the Spent Resin Tank to provide additional filtration for water containing high levels of conductivity, turbidity or organics.

During normal operation, it is expected that the daily flow from all the floor sumps will be 7,000 gallons. These liquids generally have low concentration of radioactive impurities and high conductivities.

Technical Specifications Amendment 177 relocated the Radioactive Effluent Technical Specifications (RETS) and Radiological Environmental Monitoring Program to the ODCM. Liquid effluents requirements are now in the ODCM.

2. Safety Design Basis

a. As part of the liquid radwaste system, the chemical radwaste system is designed to include equipment, instrumentation, and operating procedures such that liquid radwastes can be discharged from the station at levels which are as low as practicable.

b. The system is designed to maintain safe operating conditions by minimizing radiation hazards to station personnel.

c. The power generation design basis requires the chemical radwaste system, as part of the liquid radwaste system, to collect, process, store, and discharge liquid radwaste such that the operation and availability of the station is not limited.

3. System Components (Figure 2)

a. Floor sump systems (Figure 1)
   1) Drywell
   2) Reactor building
   3) Turbine building
   4) Radwaste building
   5) Retention building

b. Chemical waste receiver tanks (2) (Figure 2)

c. Chemical waste process pumps (2)

d. Monitor tanks (3)

e. Monitor tank pumps (2)

4. Basic System Operation

Chemical radwaste liquids having generally low activity and rather high conductivity are collected in the floor drain sumps in the drywell, reactor building, turbine building, retention building, and radwaste building. The sumps are then pumped to the Chemical Waste Receiver Tanks. The Chemical Waste Tanks can be transferred to the monitor tanks or to clean waste on a controlled basis. Tanks can also be processed through the radwaste

filter/demin or the thermex systems. (Thermex is primary means of processing Chemical Radwaste.)

Drainage flows from the reactor building quadrants rooms and torus area are isolated by block valves enroute to the floor drain sumps, thus providing containment within these areas. If the quadrant rooms or the torus area receive a high level alarm, the operator can open the block valves from the Radwaste Control Panel and control the drainage.

Chemical radwaste liquids are collected in the floor drain side of sumps in the drywell, reactor, turbine, radwaste, and retention buildings (Figure 1). Liquids from the sumps and condensate demin. regeneration system, radio chemistry lab and portable ion exchange system are pumped to one of two available chemical waste receiver tanks for batch processing. Processing of chemical waste can be performed by either batching to the clean waste receiver tank for treatment through Thermex, same as clean radwaste, or processing from the chemical waste receiver tanks directly through the radwaste demineralizer system (King Kong) or pumped to the oil flatbed filters. [See Radwaste Demin. Reference Text]

Handling of liquids in the clean waste receiver tanks or flatbed filters is covered in the system description titled clean radwaste system.

After processing, either through the clean waste system, king kong or Thermex, the water is usually collected in the treated water tanks. Once full, a treated water tank is recycled to keep solids in suspension, sampled and analyzed by Chemistry Department. Based on the results of the chemical analysis, it will then be pumped to condensate storage tank, discharged overboard or reprocessed.

C. COMPONENT DESCRIPTION

1. Floor Drain Sump Systems (Figure 1)

Chemical radwaste is collected in floor drain sumps. Each sump is equipped with two pumps. Automatic operation of the pumps uses an alternator to select and start a pump on a high sump water level. Alternators receive a signal from a ball float in each sump. The pump discharge is to a chemical waste receiver tank. A cross-tie is provided off of each discharge

line to its respective equipment drain sump discharge line. This results in discharge to the clean waste receiver tanks if water quality is acceptable. A sample must be tested from a sump before discharging to an equipment drain sump. Block valves installed in the lines isolate the two. Local indication of pump operation. All floor sump pumps receive a trip signal on a high-high level indication in a chemical waste receiver tank.

a. Drywell (Figure 1)

Drywell floor drains empty into the drywell floor sump. The drywell floor sump connects to the pump sump through two level equalization lines. The pump sump houses the pumps (P-305 A/B) used to remove excess water. Pumps are started manually or automatically from radwaste control panel C-20. Each pump has a three position hand switch (auto, off, manual) and an AUTO start pushbutton on panel C-20. The drywell floor sump pumps are usually started in the "hand" position and run until the low level alarm is received (pump starts opening AO-7017A and AO-7017B).

On a high sump water level, level switch LS-7020A sends a signal to the alternator to select a pump to be started. Prior to starting a pump, the discharge isolation valves AO-7017A and AO-7017B are opened from control room panel 904. When the valves are opened as indicated by lamps on panel C-20, the pump is started. If a pump fails to start, LS-7020B initiates an alarm on panel C-20.

The drywell sumps are located within the drywell wall. Isolation valves are required to maintain primary containment. If open, they close on coincident signals of low reactor water level and/or high drywell pressure. Circuit timers are adjustable to 30 minutes and start when a pump starts (if started in automatic). They function to shutdown the pumps if a low level indication fails to do so. Timer is normally set for 15 minutes.

If the level in the sump rises to a high-high level, a permissive signal is given to start the second pump. Pump(s) operation continues to a low level indication or if their circuit timer expire (if started in automatic). If the pumps fail to stop at a low-low level, LS-7020B initiates an alarm on panel C-20.

Depth of the drywell sumps is 5'10" with a holding capacity of 1500 gallons. Each pump has a pumping capacity of 50 gpm. Power to the pumps is from 480 V power center B-21. Red and green lamps on panel C-20 indicate if a pump is on or off.

As the water, which has been collected in the sumps, is pumped out, the discharge flow from each sump is individually metered by flow integrators, Panel C20. Total leakage rate is periodically calculated from these flow integrators and a record is maintained in order to detect increase in total leakage rate.

b. Reactor Building (Figure 1)

The reactor building sump, located in the HPCI quadrant, collects liquid radwaste from reactor building floor drains and corner room drains in the torus, A RHR quadrant, CRD quad B, RHR quad, and RCIC quad rooms. Lines from the five corner room drains are equipped with four-inch, air-operated ball valves (AO-7033 A through E), to maintain containment of the areas. Lamps on panel C-20 indicate if a valve is open.

Isolation valves AO-7033A through E are normally closed, full closed isolation valves which function to maintain spatial separation between the five reactor building compartments (Torus, 'B' RHR Quad, 'A' RHR Quad, CRD Quad, and RCIC Quad), and therefore, the ECCS Systems.

When draining one of the above five (5) reactor building compartments, ensure at Panel C20 that the other four (4) isolation valves are CLOSED. Below are the five (5) isolation valves:

- AO-7033A (Torus)
- AO-7033B ('B' RHR Quad)
- AO-7033C (CRD Quad)
- AO-7033D ('A' RHR Quad)
- AO-7033E (RCIC Quad)

If any one of these isolation valves remains open, and unattended, then a tracking LCO should be entered for this condition.

Excess water collecting in the sump is removed by one of two pumps (P-306 A/B). Each pump has a local hand switch with three positions (auto, off, manual). On a high sump level, level switch LS-7018A sends a signal to an alternator. The alternator selects and starts one pump. The second pump starts at a high-high level. At a high-high-high level, LS-7018B initiates an alarm on panel C-20. Pump operation continues to a low level where LS-7018A automatically stops the operating pump(s). If a pump is still running at a low-low level, LS-7018B initiates an alarm on panel C-20. The valves are normally closed. Upon receipt of an alarm, the respective valve is opened to drain the quadrant, the alarm is off of LS-7033A through E, which is located within the 4" pipe.

Sump depth is seven feet with a holding capacity of 500 gallons. Pumping capacity for each pump is 100 gpm. Power to the pumps is from 480 V power center B-13. Red and green lamps on local panel indicate if a pump is on or off.

c. Turbine Building (Figure 1)

The turbine building sump, located in the southend of radwaste - 3', collects water from floor drains in the turbine building and selected floor drains in the radwaste building. One of

Sump depth is 7'2" with a holding capacity of 500 gallons. Pumping capacity for each pump is 50 gpm. Power to the pumps is from 480 V power center B-22. Red and green lamps on local panel indicate if a pump is on or off.

d. Radwaste Building (Figure 1)

Drainage to the radwaste building sump, located in radwaste building elevation -13' is from floor drains in the radwaste building. One of two pumps (P-310 A/B) removes excess water collecting in the sump. The pumps are located outside of the sump on a pedestal to protect against flooding and are equipped with a recycle line. Recycle flow is through an 1½" eductor at the bottom of the sump to mix any solids that have settled in the sump.

The discharge valve can be throttled to promote recycle flow. Maximum recycle flow is based on a discharge flow rate that empties the sump volume in four minutes. Discharge capacity for each pump is 150 gpm at 30 psig discharge with the discharge valve full open. Sump volume is 250 gallons (depth - 8'2").

Each pump has a local hand switch with three positions (auto, off, manual). In AUTO, level switch LS-2F sends a signal to an alternator on a high sump level. The alternator selects and starts one pump. The second pump is started at a high-high level. At a high-high-high level, LS-3F initiates an alarm on panel C-20. Pump operation continues to a low level where LS-1F automatically stops the operating pump(s). If a pump is still running at a low-low level, LS-1F initiates an alarm on panel C-20.

Power to the pumps if from 480 volt power center B-16. Red and green lamps on local panel indicate if a pump is on or off. Seal water to the pumps is supplied by condensate seal water. A low seal water pressure (10 psig) and/or low discharge pressure (20 psig) trips the pumps after 30 seconds running time. Alarms on panel C-20 notify personnel.

e. Retention Building (Figure 1)

The retention building sump collects liquid radwaste associated with the augmented off-gas system. Excess water is removed by one of two pumps (P-331 A/B). Each pump has a local hand switch with three positions (auto, off, manual). In AUTO, level switch LS-9260 sends a signal to an alternator on a high sump level. The alternator selects and starts one pump. If a high-high level is reached, the second pump is started. At a high-high-high level, LS-9261 initiates an alarm on panel C-20. Pump operation continues to a low level where LS-9260 automatically stops the operating pump(s). If a pump is still running at a low-low level, LS-9261 initiates an alarm on panel C-20.

Power to the pumps is from 480 V power center B-31. Lamps on local panel indicate if a pump is running.

2. Chemical Waste Receiver Tanks (Figure 2)

The chemical waste receiver tanks provide a floodable volume for flow from the floor drain sumps. Holding capacity for each tank (T-312 A/B) is 15,000 gallons. Processing a large

volume of liquid radwaste is preferred to several smaller volumes. Low pressure air spargers prevent crud from settling in the tanks. The tanks are vented to the ventilation exhaust system. The tanks are lived with phenolic resin to protect against corrosion.

One tank is filled at a time, normally to 60 percent capacity. At this time, the other tank inlet valve is opened and the full tank inlet valve closed. The volume in the tank is recirculated using a chemical waste process pump and a two inch eductor located at the bottom of the tank.

Level instrumentation in each tank (LI-7203/7205) provides alarms on panel C-20 at high or low levels. Chemical waste receiver tank level select switch on panel C-20 must be positioned accordingly. (Two position: 1) Fill tank B and process tank A. 2) Fill tank A and process tank B.) Separate logic is used for a tank being processed versus one being filled. A high-high indication during filling trips all floor drain sump pumps. A low-low level indication during processing trips the chemical waste process pump (if selected).

3. Chemical Waste Process Pumps (Figure 2)

The process pumps (P-313A/B) remove water from the chemical waste receiver tanks and recycle it back to a tank, send it to a monitor tank, pump it to the clean waste system or through the rad demin system (King Kong) or Thermex. Each pump takes a direct suction from one of the two tanks. A cross-tie is provided between the two suction lines making it possible for a pump to take a suction from either tank or both pumps to drain one tank. Air and reach rod valves are installed in the pump suction, discharge, recycle, and cross-tie lines for establishing flowpaths.

All chem. Waste should be sampled by Chemistry and results given to Radwaste before transferring to Clean Waste Receiver Tanks or Monitor Tanks. Radwaste may transfer to Clean Waste Receiver Tanks to prevent trip of Thermex to minimize dose.

The pumps are started manually from panel C-55. Power to the pumps is from 480 V power center B-22. The pumps trip on a low-low level in the chemical waste receiver tanks.

4. Monitor Tanks (Figure 2)

The monitor tanks are utilized for surge volume, excessive liquid waste, waste to be processed later, etc. is stored in the monitor tanks. Holding capacity for each tank is 20,000 gallons. Water held in a monitor tank is recycled for an hour using a monitor tank pump and a two inch eductor at the bottom of each tank. A sample is taken and analyzed. Water is recycled back to the receiver tanks or sent to the ion exchange system for further processing.

The tanks are equipped with, vents, and level instrumentation. High and low tank levels initiate alarms on panel C-20. Monitor tank level select switch must be positioned accordingly. The three-position switch determines which tanks level instrumentation is operating. Only one level instrument will operate at a time. If a tank is being emptied at the same time another is being filled, the level instrumentation in the tank being emptied is to be operating. This is to protect the pumps. The tanks are equipped with overflow lines to the floor drains in the room which are directed to the turbine building equipment sump.

5. Monitor Tank Pumps (Figure 2)

Each monitor tank has two outlet lines supplying two different headers. One header provides suction for monitor tank pump P-312A, the other for pump P-312B. Discharge piping off of the pumps supplies recycle flow back to the monitor tanks and receiver tanks. Discharge from the monitor tanks can be directed to chemical waste, ion exchange system, Thermex. Flow to the ion exchange system is from this line. Reach rods and hand operated valves installed in the lines are used to establish a flowpath.

The monitor tank pumps are started manually from controls on panel C-56. Power to the pumps is from 480 V power center B-22. The pumps trip on a low-low monitor tank level or a high radiation trip signal sent from the overboard discharge monitor.

6. Neutralizing Sump

The Neutralizing Sump is a 16,700 gallon tank located below the floor level of the 23' Aux Bay. It is currently used to receive, hold, and treat water from the Aux Bay Salt Water Sump and floor drains in the 23' Aux Bay area prior to release into the storm drain. Recirculation

and discharge of the sump contents are handled by one of two pumps rated at 100 gpm each. Pumps P-117A and P-117B are powered from B13, breakers 61 and 62.

The waste in the Neutralizing Sump must be filtered prior to being pumped overboard into the storm drain. A basket strainer was installed on the discharge line during original plant construction. While the basket strainer was designed to remove large particles, it would not be able to remove small particles to ensure compliance with PNPS NPDES permit for total suspended solids. The original basket strainer is not capable of acting as a filtration device.

The filtration system was installed. The system has an air actuated double diaphragm pump and a carbon steel filter housing with polypropylene filter cartridges. The pumps recirculate the Neutralizing Sump waste until the filter cartridge has lowered the suspended solids to the appropriate limits. Discharge of the Neutralizing Sump to the storm drain shall involve the Chemistry Department and the use of PNPS 2.5.2.17, PNPS 7.9.2 and PNPS 7.9.5. The Neutralizing Sump shall be sampled for radioactivity prior to release [LER 96-010-00].

The Neutralizing Sump is primarily covered in the miscellaneous reference text.

D. INSTRUMENTATION AND CONTROLS

1. Control Room Instrumentation

None

2. Local Instrumentation

Instrument/Location	Description
FQ-7032 Panel C-20	Drywell sump discharge flow integrator 0-100,000 gallons
LI-7203, 7205 Panel C-20	Chem waste receiver tank A, B level 0-100 percent
LI-7219, 7221, 7223 Panel C-20	Monitor tank A, B, C level 0-100 percent
RR-1792 (3 pen recorder with FE-7124 A, B) Panel C-20	Discharge header radiation level $0\text{-}10^6$ cps.
PI-7105 (Reactor Building) PI-7016 (Drywell) PI-7022 (Turbine Building) PI-7025 (Rad. Building) Local	Indicates pump(s) discharge pressure
AI-7229 A, B Panel C-55	Chemical waste tank A, B pH level 0-14
PI-7212 A, B Panel C-55	Process pump A, B discharge pressure 0-100 psig (42 psig)
PI-7255 A, B Panel C-56	Monitor pump A, B discharge pressure 0-100 psig
PI-7228, 7230 Panel C-55	Chem. waste tank A, B sample line pressure 0-100 psig (8 psig)
CI-2501 Panel C-27	Ion exchange system inlet conductivity Various range
PI-2502 Panel C-27	Demin. assembly outlet pressure meter 3 pen indicator various ranges
FR-103 (2 pen recorder, FR-116) Panel C-27	Ion exchange system outlet flow meter 0-30 gpm
pHI-2507 Panel C-27	Ion exchange system outlet pH meter
CIR-2502 Panel C-27	Ion exchange system outlet conductivity recorder
Drywell floor sump isolation valves AO-7017 A/B indicating lamps Panel C-20	Red indicates a valve is open Green indicates a valve is closed
RM-2501 Local	Demin. assembly radiation monitor

3. **Alarms**

Title/Location	Setpoint/Initiation Device
Drywell Floor Pump Sump High Level C20L A-2	58 inches (increasing) LS-7020B
Reactor Building Floor Drain Sump High Level C20L A-4	66 inches (increasing) LS-7018B
Drywell Floor Pump Sump Low Level C20L B-2	14 3/4 inches (decreasing) LS-7020B
Reactor Building Floor Drain Sump Low Level C20L B-4	8 7/8 inches (decreasing) LS-7018B
Turbine Building Floor Drain Sump High Level C20L A-6	54 inches (increasing) LS-7023B
Turbine Building Floor Drain Sump Low Level C20L B-6	12 3/4 inches (decreasing) LS-7023B
Monitor Tank C Low-High Level C20L C-4	1) 90% (increasing) 2) 10% (decreasing) LAHL-7223
Monitor Tank B Low-High Level C20L D-4	1) 90% (increasing) 2) 10% (decreasing) LAHL-7221
Chem Waste Receiver Tank A Low-High Level C20L C-3	1) 83% (increasing) 2) 14% (decreasing) LAHL-7203
Chemical Waste Filter B High Diff Press C20L E-3	N/A PAH-7210
Monitor Tank A Low-High Level C20L E-4	1) 90% (increasing) 2) 10% (decreasing) LAHL-7219
Chemical Waste Filter A High Diff Press C20L F-3	N/A PAH-7208
Radwaste Building Floor Drain Sump High Level C20C A-2	86 inches (increasing) LS-7026B

3. Alarms (cont.)

Title/Location	Setpoint/Initiation Device
Radwaste Building Floor Drain Sump Low Level C20C B-2	19 3/4 inches (decreasing) LS-7026B
Drywell Floor Drain Sump Disch High Total Flow C20C B-3	100 gpm for 2 minutes flow counter FQ-7032
Drywell Floor Drain Sump Disch High Press C20C B-4	30 psig (increasing) PS-7030
Chem Waste Rcver Tk A or B Low-High pH C20C B-5	high: 11.0 (increasing) low: 7.0 (decreasing) 1) AI-7229A 2) AI-7229B
Retention Bldg. Floor Drain Sump High Level C20R A-2	31 inches (increasing) LS-9261
Retention Bldg. Floor Drain Sump Low Level C20R B-2	8 inches (decreasing) LS-9261
Floor Failure Rad Bldg. Equip Sump Pump C20R C-2	10 psig (decreasing) **AND** 30 sec time delay PS-7025
Ion exchange system low discharge flow Panel C-20	5 gpm (decreasing) FS-2506
Ion exchange system discharge high conductivity Panel C-20 C-27	≥50 micromho CR-2502
Retention building sump hi-hi-hi level	XXXX LS-9261
Retention building sump low-low level Panel C-21 A-5	XXXX LS-9261

4. Interlocks and Trips

Interlock or Trip	Function
Floor drain sump pumps (drywell, reactor, turbine, radwaste and retention)	Floor sump pumps start and trip from respective high/low level switches, except for the drywell floor and equipment sump pumps, which must be manually started in the AUTO mode. They will, however, trip on either low level or time out through timers.
Floor drain sump pumps	Equipment and floor sump pumps are alternately selected for initial operation by an automatic pump alternator.

4. Interlocks and Trips (cont.)

Interlock or Trip	Function
Drywell sump pumps	Coincident signals of low reactor water level and/or high drywell pressure will close the drywell isolation valves to the drywell sumps.
Radwaste sump pumps P-310 A/B	Low seal water pressure (10 psig) or low discharge pressure (20 psig) after 30 seconds running time. Protect pumps.
Monitor tank pumps P-312 A/B	Trip on: a) Low-low monitor tank level (15.0"). Protect pumps. b) High radiation in discharge structure. Contain radiation.
Chemical waste process pumps P-313 A/B	Trip on: a) Low-low level in chemical waste receiver tanks. Protect pumps. b) High or low pH level in Chem. Radwaste receiver tank recycle flow. (May be bypassed for processing.)

5. Control Room Controls

Item/Location	Function of Positions
Drywell sump pump discharge line isol. valves (AO-7017 A/B) Panel 904	OPEN Permits discharge to clean or chem. receiver tanks. CLOSE Primary containment isolation valve.

6. Local Controls

Item	Functions	
Rx building floor sump pumps (P-306 A/B) Turbine building floor sump pumps (P-304 A/B) Control panel SW handles removed Retention building floor sump pumps (P-331 A/B) Local hand switches 3-Position	AUTO OFF MANUAL	Operation of pumps controlled by level switches Stops pumps Starts pumps on high sump level
Drywell floor sump pumps (P-305 A/B) 3-Position handswitches on Panel C-20	AUTO OFF MANUAL	Operation of pumps controlled by level switches and timer. Stops pumps. Starts pumps on high sump level.
Drywell floor sump pumps (P-305 A/B) Start push-button Panel C-20	PUSH-BUTTON	Starts pump on permissive signal.
Drywell floor pump timer Timer - 2173/2174 Panel C-20	TIMER	Controls operating time of pumps. Adjustable 0-30 mins. (15 mins.)
Monitor tanks level select switch Panel C-20	A, B or C	Level instrumentation for tank selected initiates alarms and pump trip.
Chemical waste receiver tanks level select switch Panel C-20	(1) (2)	Fill tank B and process tank A or Fill tank A and process tank B Lines up level instrumentation accordingly.
Chemical waste process pumps (P-313 A/B) Panel C-55	1 PUMP OFF 2 PUMP	One pump mode. Stops pump. Two pump mode.
Monitor tank pumps (P-312 A/B) Panel C-56	ON OFF	Starts pump. Stops pump.
pH trip override A/B Rack C-55	NORMAL OVERRIDE	Prevents chemical waste process pump trip from high or low pH value. pH trips not in effect.
Handswitch 2501, 2502 Panel C-27	OPEN CLOSE	Service air admitted to pumps (P-336 A/B) through SV-2501, 2502 according to level elements (LE-2501, 2502). Isolates service air
Pressure control valves (PCV-2501, 2505) Local		Adjusts flow of service air to pumps (P-336 A/B)

6. Local Controls (cont.)

Item	Functions	
Three-way valve AO-2508 3-Position handswitch Panel C-27	CHEM AUTO CLEAN	Bypass conductivity control. Position of valve controlled by CR-2502. Bypass conductivity control.
Torus room to reactor building sump valve AO-7033A Panel C-20	OPEN CLOSED	Drains water from Torus room to sump. Isolates pump room.
CRD pump room to reactor building sump valve AO-7033C Panel C-20	OPEN CLOSED	Drains water from CRD pump room. Isolates pump room.
SE RHR pump room to reactor bldg. sump valve AO-7033D Panel C-20	OPEN CLOSED	Drains water from SE RHR pump room. Isolates pump room.
Valves AO-2503 and 2504 Handswitch 2505 Panel C-27	AUTO OFF	Allows LE-2501 and 2502 to control valve position. Closes valve.
Chem. waste process pump A/B inlet valves, AO-25, 27 Panel C-55	OPEN CLOSE	Opens suction to pump. Isolate flow to pump suction.
Chem. waste tank A/B recirculation valve, AO-34, 40 Panel C-55	OPEN CLOSE	Directs pumps discharge back to tank. No return flow to tank.
Chem. waste process pumps A/B discharge valves, AO-28, 42 Panel C-55	OPEN CLOSE	Directs pump discharge to monitor tanks. No flow to monitor tanks.
Monitor tank pumps P-312 A/B Panel C-56	START STOP	Removes water from selected tank. Stops pump.

E. SYSTEM INTERRELATIONSHIPS

1. Clean Radwaste System

Alternative process system to Rad Demin (King Kong) for treatment of chemical waste water. Prior to installation of Rad Demin System, all chemical radwaste was batched with clean waste and treated through the flatbed filters.

2. Instrument Air System

Supplies air for operation of control valves and level instrumentation.

3. Low Pressure Service Air System

Supplies air to chemical waste receiver tank spargers.

4. High pressure Service Air System

Supplied HP service air to the ion exchange system sandpiper pumps.

5. Rad Demineralizer System

Primary treatment system for chemical waste water. Received effluent from chemical radwaste receiver tanks and processes it through two, thirty-five cubic foot deep bed demineralizer and returns high quality water to the treated water tanks.

6. Radwaste Liquid Discharge Rad. Mon. System

Indicates radioactivity level of liquid released through discharge header.

7. Power Supplies

a. Reactor building floor drain sump pumps (P-306 A/B) are powered from 480 volt power center B-13.

b. Drywell floor drain sump pumps (P-305 A/B) are powered from 480 volt power center B-21.

c. Turbine building floor drain sump pumps (P-304 A/B) are powered from 480 volt power center B-22.
d. Radwaste building floor drain sump pumps (P-310 A/B) are powered from 480 volt power center B-16.
e. Panel C-20 instruments receiver power from 120 volt AC instrument power supply panel Y-1.
f. Radwaste annunciators receiver power from 125 volt DC distribution panel D-6.
g. Chemical waste process pumps (P-313 A/B) are powered from 480 volt power center B-22.
h. Monitor tank pumps (P-312 A/B) are powered from 480 V power center B-22.

8. Control Panels

a. Panels C-20 and C-21 are located in the radwaste control room.
b. Panel c-22 is located in the general area between the flatbed filters and concentrator along the east wall. Floor elevation (-) 1'0".
c. Panel C-55 is located in the general area west of the ChRW receiver tanks and process pumps on the (-) 1'0" elevation.
d. Panel C-56 is on the (-) 1'0" floor elevation along the north wall outside of monitor tank room.

F. SYSTEM OPERATIONAL SUMMARY

NOTE: This section outlines the major steps performed during system operations and is not intended to be substituted for plant operating procedures.

1. Normal System Operation (Figure 2)

Chemical radwaste is collected from the drywell, reactor, turbine, radwaste, and retention buildings. Several floor drains are placed in these areas to route liquid waste to sumps. Each sump is equipped with two pumps to transfer liquid to the chemical radwaste receiver tanks. A sample must be taken and evaluated before sending any water to a clean waste receiver tank.

The monitor tanks are used to store liquid radwaste for further processing in the Rad Demin. system. Fully treated water is sent to the condensate storage tanks for plant use or to the radwaste discharge header.

2. Infrequent Operations

a. Sump discharge to clean radwaste system (Figure 1)

Discharge piping from each sump has a cross-tie to the discharge piping from its respective equipment drain sump. A block valve isolates the two lines. Another block valve is located immediately downstream of the cross-tie connection. Discharge to the clean radwaste system is accomplished by closing the valve in the discharge piping and opening the valve in the cross-tie. Before discharging to the clean radwaste system, water in a sump should be sampled and found to be acceptable (cond. less than 50 micromho, pH less than 7.5).

b. Transfer to clean waste system (Figure 2)

Connections upstream of process pump discharge valving allows water to be routed to the clean waste receiver tanks. Hand and reach rod operated block valves isolate the piping if the water quality unacceptable. Water is transferred to the clean radwaste system only after it has been sampled and found to be acceptable.

Provisions are made for local venting, flushing, air sparging, and sampling. Sampling is done at prescribed intervals as directed by the chemical laboratory. Venting, flushing, and air sparging are performed as needed. Flushing is required for extended system shutdown.

3. Abnormal Operations

a. Drywell Leakage Management

Drainage from selected drywell areas collect in the drywell floor sump. The drain sump is connected by level equalizing lines to a second sump containing two sump pumps. Each pump (P-305A/B) has a hand switch (auto, off, manual), auto start push-button, and timer on radwaste control panel C-20. Normal operation of the sump is by "hand". On 4-hour intervals, the sumps are pumped by "hand" to the low level alarm, at which the

integrated volume is recorded and logged. On a high sump level, level switch LS-7020B initiates an alarm on panel C-20 and LS-7020A sends a signal to the alternator. The alternator selects a pump to be started. Isolation valves in the discharge line must be opened from control room panel 904 before starting a pump. Isolation valves AO-7017A and B are part of the primary containment system. If open, they close on a primary containment isolation signal of high drywell pressure and/or low reactor water level. Hand switches for the valves have AUTO and CLOSE positions. Lamps are provided on panels C-20 and 904 that indicate if a valve is open or closed.

When the valves are opened, the AUTO START PUSH-BUTTON can be used to start the selected pump. The timer automatically starts as pump operation begins. Timers are adjustable to 30 minutes and allow operators to remove a portion of the sump volume. Pump operation stops when a timer expires or at a low sump level. At a low sump level, LS-7020A automatically stops any operating pumps. If the pump(s) fail to stop at a low-low level, LS-7020B initiates an alarm on panel C-20. If the level in the sump were to rise to a high-high level, LS-7020B initiates an alarm and LS-7020A gives a permissive signal to start the second pump.

As the water, which has been collected in the sumps is pumped out, the discharge flow from each sump is individually metered by flow integrators, Panel C20. Total leakage rate is periodically calculated from these flow integrators and a record is maintained in order to detect increase in total leakage rate.

G. INDUSTRY LESSONS LEARNED

1. None

H. LIST OF FIGURES

1. Radwaste Equipment Location Drawing
2. Radwaste Floor Sumps
3. Chemical Radwaste System

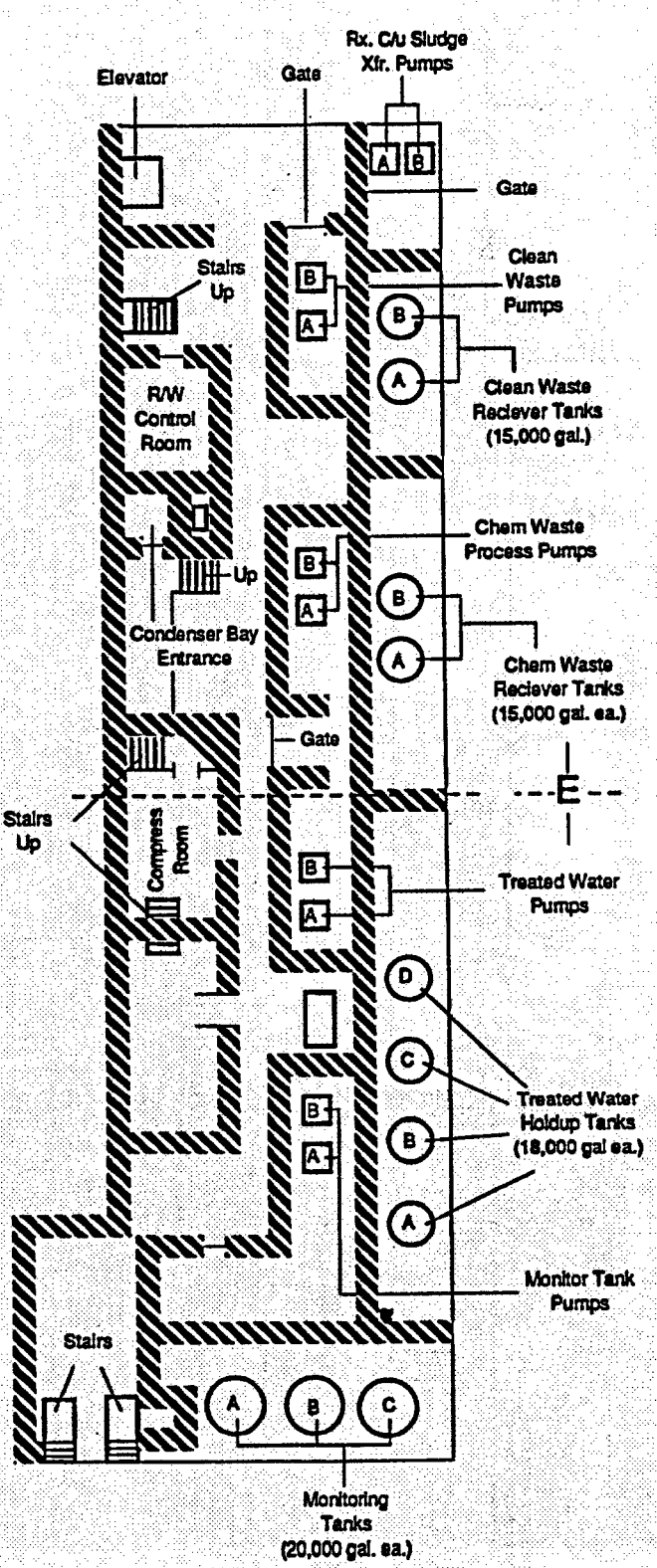
Rx. C/u Sludge
Xfr. Pumps
Elevator
Gate
A
B
Gate
Clean
Waste
Pumps
Stairs
Up
B
A
B
A
Clean Waste
Reciever Tanks
(15,000 gal.)
R/W
Control
Room
Chem Waste
Process Pumps
Up
B
A
B
A
Condenser Bay
Entrance
Chem Waste
Reciever Tanks
(15,000 gal. ea.)
Gate
E
Stairs
Up
Compress
Room
B
A
Treated Water
Pumps
D
C
B
A
B
A
Treated Water
Holdup Tanks
(18,000 gal ea.)
Monitor Tank
Pumps
Stairs
A
B
C
Monitoring
Tanks
(20,000 gal. ea.)

Figure 1

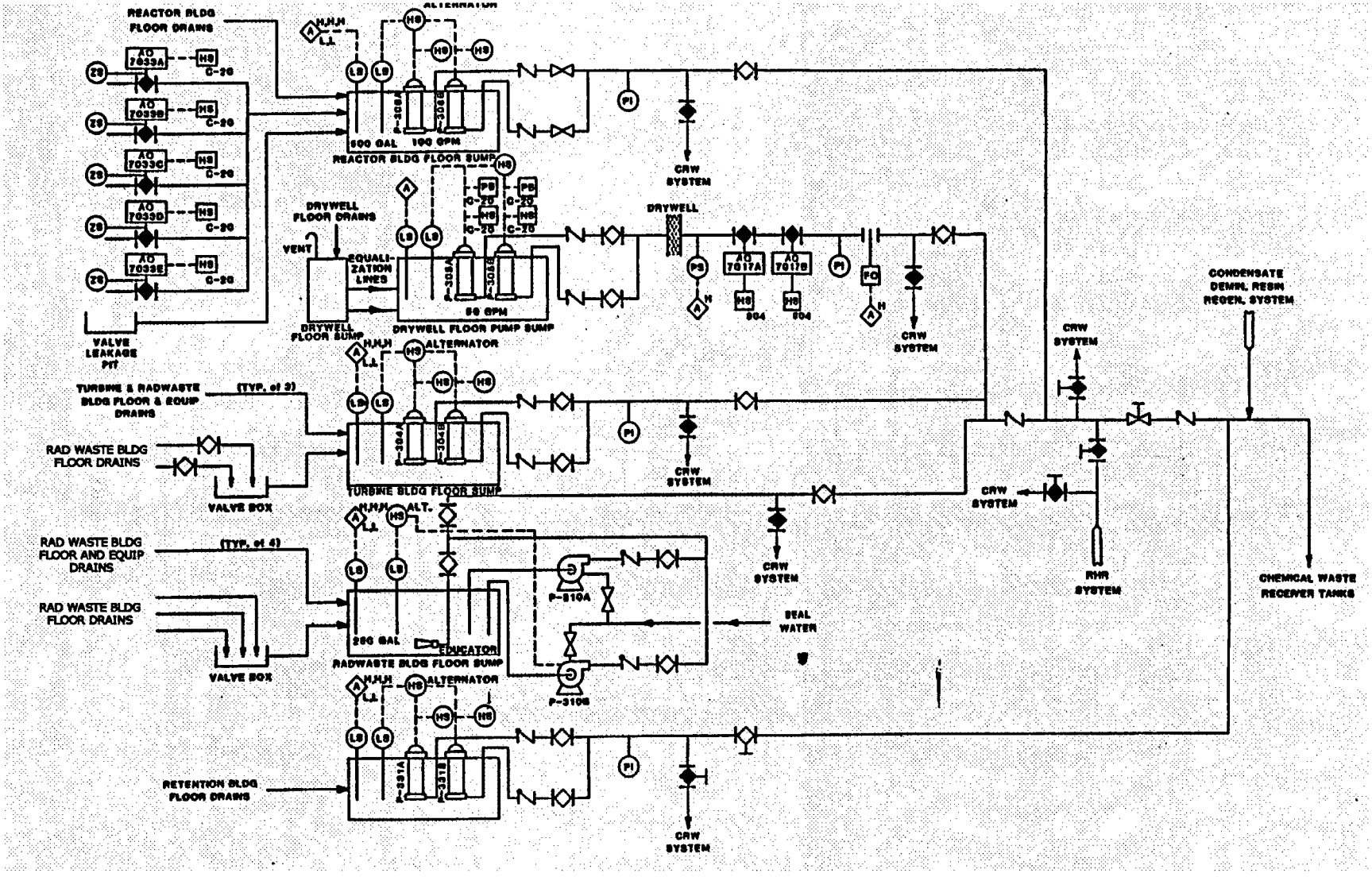
REACTOR BLDG FLOOR DRAINS
AO 7039A
AO 7039B
AO 7039C
AO 7039D
AO 7039E
C-20
VALVE LEAKAGE PIT
H,H,H
L.L.
ALTERNATOR
500 GAL
100 GPM
REACTOR BLDG FLOOR SUMP
P-308A
P-308B
CRW SYSTEM
DRYWELL FLOOR DRAINS
VENT
EQUALI-ZATION LINES
DRYWELL FLOOR SUMP
DRYWELL FLOOR PUMP SUMP
50 GPM
DRYWELL
AO 7017A
AO 7017B
S04
FC
TURBINE & RADWASTE BLDG FLOOR & EQUIP DRAINS
(TYP. of 3)
RAD WASTE BLDG FLOOR DRAINS
VALVE BOX
TURBINE BLDG FLOOR SUMP
P-304A
P-304B
RAD WASTE BLDG FLOOR AND EQUIP DRAINS
(TYP. of 4)
ALT.
200 GAL
EDUCATOR
RADWASTE BLDG FLOOR SUMP
P-310A
P-310B
SEAL WATER
RETENTION BLDG FLOOR DRAINS
P-331A
P-331B
CONDENSATE DEMIN. RESIN REGEN. SYSTEM
RHR SYSTEM
CHEMICAL WASTE RECEIVER TANKS

Figure 2

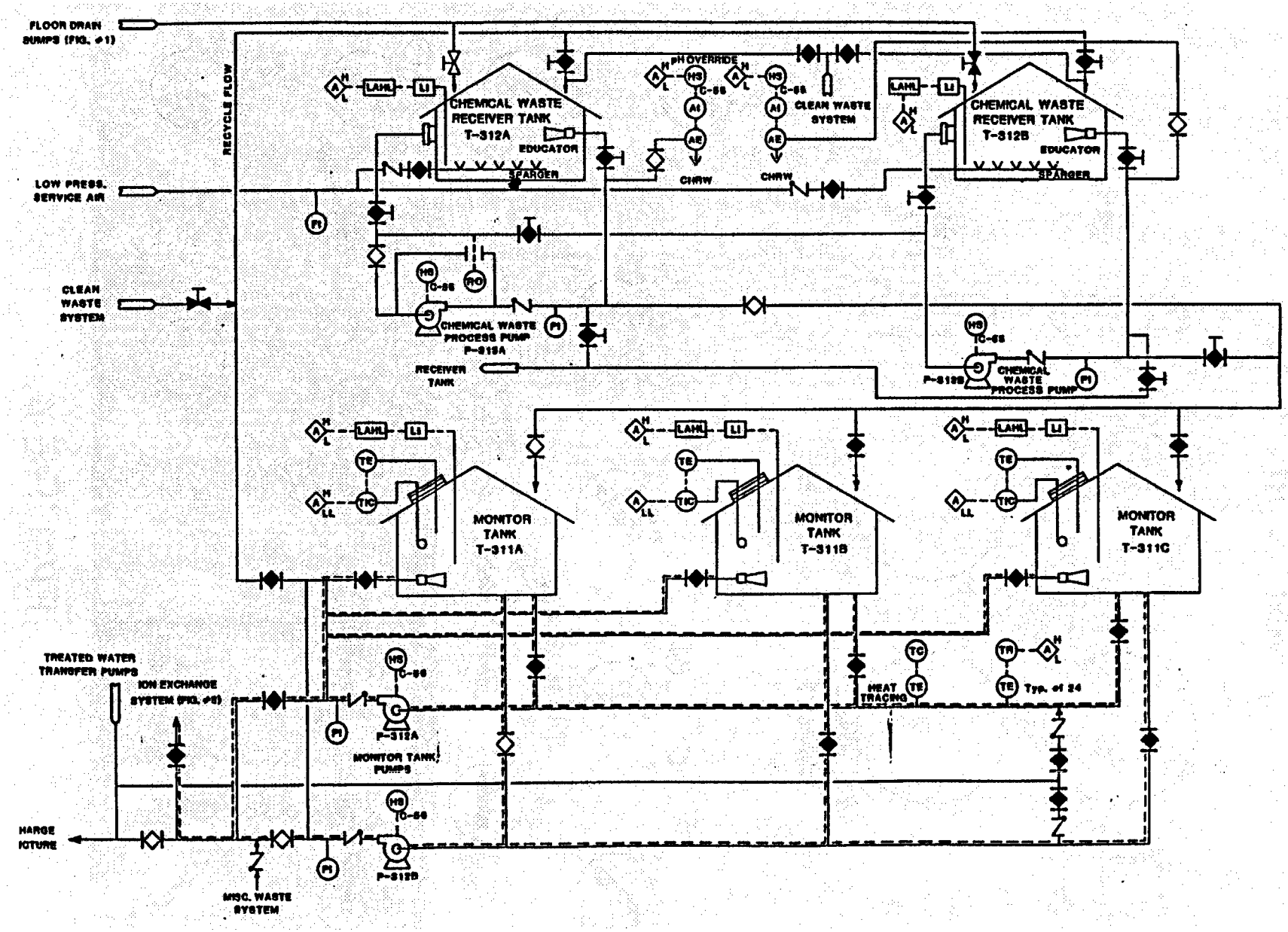
FLOOR DRAIN SUMPS (FIG. #1)
RECYCLE FLOW
LOW PRESS. SERVICE AIR
CLEAN WASTE SYSTEM
CHEMICAL WASTE RECEIVER TANK T-312A
EDUCATOR
SPARGER
pH OVERRIDE
CLEAN WASTE SYSTEM
CHRW
CHEMICAL WASTE RECEIVER TANK T-312B
CHEMICAL WASTE PROCESS PUMP P-312A
RECEIVER TANK
CHEMICAL WASTE PROCESS PUMP P-312B
MONITOR TANK T-311A
MONITOR TANK T-311B
MONITOR TANK T-311C
HEAT TRACING
Typ. of 24
TREATED WATER TRANSFER PUMPS
ION EXCHANGE SYSTEM (FIG. #2)
P-312A
MONITOR TANK PUMPS
P-312B
MISC. WASTE SYSTEM

Figure 3

PANEL C-55

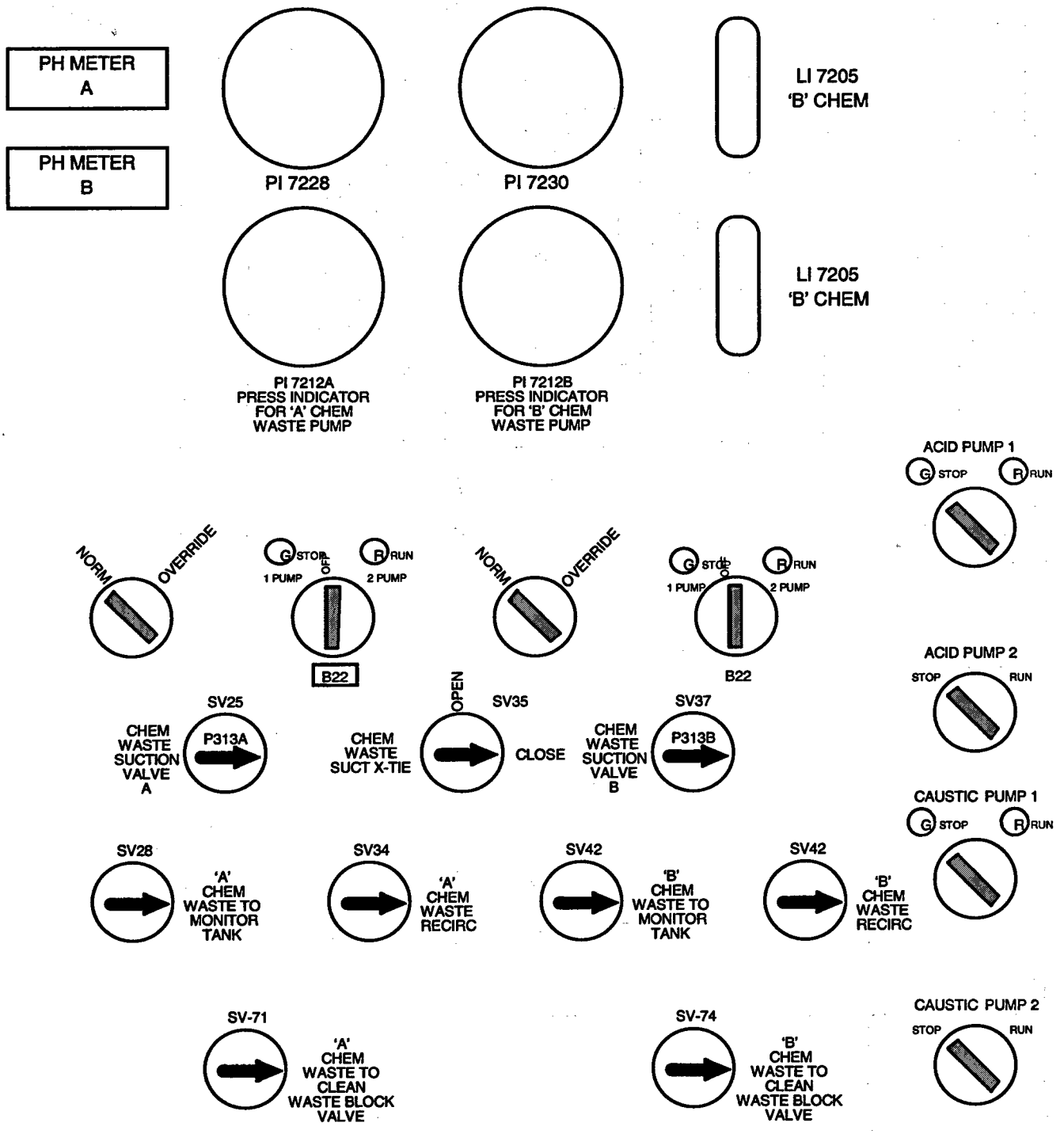

FIGURE 4

CLEAN RADWASTE SYSTEM

REFERENCE TEXT

Revisions

Date	Rev #	Description
12/17/97	1	Added rev. 1 - PDC-97-17, RW flatbed filter circuit mod. belt spray valve open in belt forward travel only.
12/17/97	1	Added description of D.E. Cart Vibrator
03/08/05	2	Re-examined flatbed filter material and references to Thermex. Also added Radwaste PRM to system inter., cross-checked material to process

Revision March, 2005

Submitted by: _____

Approved by/Date _____

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3. Section 4.8A, liquid effluents

CLEAN RADWASTE SYSTEM

A. OVERVIEW

The Clean Radwaste System collects, treats, processes and stores or discharges radioactive and potentially radioactive liquid wastes in a controlled and safe manner such that the operation and availability of the station is not limited.

Clean radwastes are liquids of varying radioactivity and low conductivity.

B. SYSTEM DESCRIPTION

1. System Purpose

The clean radwaste system collects, treats, processes, stores, and discharges liquids having low conductivity and varying amounts of radioactivity.

2. Safety Design Bases

a. Clean radwaste system includes equipment, instrumentation, and operating procedures to discharge liquid radwaste at permissible radiation levels.

b. Limit radiation exposure to personnel.

Power Generation Design Basis

a. The clean radwaste system is required to collect, process, store, and discharge liquid radwaste in a safe manner.

3. System Components (Figure 1)

a. Equipment drain sump systems

1) Drywell
2) Reactor
3) Turbine
4) Radwaste
5) Retention

b. Clean waste receiver tank (2)
c. Clean waste process pump (2)
d. Flatbed filter (2)
e. Radwaste filter slurry tank
f. Radwaste filtrate tank (2)
g. Filtrate transfer pump (2)
h. Radwaste filter precoat pump (2)
i. Radwaste demineralizer
j. Radwaste demineralizer filter
k. Treated water holdup tanks (4)
l. Treated water transfer pumps (2)
m. Radioactive solid waste container
n. Discharge structure

4. Basic System Operation (Figure 1)

The Liquid Radwaste System is designed to collect, treat, process and store or discharge radioactive and potentially radioactive liquid wastes in a controlled and safe manner such that the operation and availability of the Station is not limited.

Clean radwastes are liquids having a varying amount of radioactivity and are expected to have low conductivity.

Clean radwaste is collected in the following sumps:

(a) Drywell Equipment Drain Sump
(b) Reactor Building Equipment Drain Sump
(c) Turbine Building Equipment Drain Sump
(d) Radwaste Building Equipment Drain Sump
(e) Retention Building Equipment Drain Sump

From these sumps, the wastes are transferred to the Clean Waste Receiver Tanks for processing. In addition, URC overflow, Reactor Water Cleanup Reject, Disposable Cartridge Filter Demineralizer System effluent, and cleanup filter demineralizer sludge storage tank

decantation are routed to the Clean Waste Tank. Wastes from the receiver tanks are processed through the Thermex System as the primary processing system before collection in the Treated Water Holdup Tanks. The Radwaste Filter/Demineralizer and the Radwaste Mixed Bed Demineralizer are for backup service.

After the liquid wastes in the Treated Water Holdup Tanks have been sampled and analyzed, they are normally returned to the Condensate Storage Tanks for reuse within the plant.

If the analysis of the treated water sample reveals water not meeting the Chemistry specifications, it may be wither reprocessed, discharged at a controlled rate through the liquid radwaste discharge header to the circulating water discharge canal or transferred to Monitor Tanks.

The Clean Radwaste System is expected to process an average of 40,000 gallons per day at an average radioactive content of 0.1 μCi/cc or less. The maximum volume is approximately 100,000 gallons per day.

Technical Specifications Amendment No. 177 relocated to the Radioactive Effluent Technical Specifications (RETS) and Radiological Environmental Monitoring Program to the ODCM in accordance with recommendations of GL89-01 and NUREG 1433. This impacts radioactive liquid effluents by moving the requirements to the ODCM.

C. COMPONENT DESCRIPTION

1. Equipment Drain Sump (Figure 2)

Clean radwaste is collected in equipment drain side sumps. Each sump is equipped with two pumps. Automatic operation of the pumps uses a mechanical alternator to start and stop the pumps according to sump level. The alternators open and close the pump electric circuits by the upward and downward movement of a lever arm. An adjustable float and guide position the lever arm. As the float rises to a predetermined level, the lever arm opens one of the two electric circuits and starts one pump. If the float continues to rise, the second pump is started. As the float lowers, the circuits are closed and the pumps stopped. (Note: Attachment A lists the individual pump start and stop level setpoints.) Manual operation of the pumps is also

available. A cross-tie is provided off of each discharge line to its respective floor sump. Hand operated block valves isolate the two lines. Sump overflow drains through vent lines to respective floor side sump. Operating pumps trip on a high clean waste receiver tank level.

a. Drywell

Drainage from selected drywell areas collect in the drywell equipment drain sump. The drain sump is connected by level equalizing lines to a second sump containing two sump pumps. Each pump (P-301A/B) has a hand switch (auto, off, manual), auto start pushbutton, and timer on radwaste control panel C-20. On a high sump level, level switch LS-7003B initiates an alarm on panel C-20 and LS-7003A sends a signal to the alternator. The alternator selects a pump to be started, but does not start the pump. Isolation valves in the discharge line must be opened from control room panel 904 before starting a pump. Isolation valves AO-7011A and B are part of the primary containment system. If open, they close on a primary containment isolation signal of high drywell pressure and/or low reactor water level. Hand switches for the valves have AUTO and CLOSE positions. Lamps are provided on panels C-20 and 904 that indicate if a valve is open or closed.

When the valves are opened, the AUTO START PUSHBUTTON is used to start the selected pump. The timer automatically starts as pump operation begins. Timers are adjustable to 30 minutes and allow operators to remove a portion of the sump volume. Pump operation stops when a timer expires or at a low sump level. At a low sump level, LS-7003A automatically stops any operating pumps. If the pump(s) fail to stop at a low-low level, LS-7003B initiates an alarm on panel C-20. If the level in the sump were to rise to a high-high level, LS-7003B initiates an alarm and LS-7003A gives a permissive signal to start the second pump.

As the water, which has been collected in the sumps is pumped out, the discharge flow from each sump is individually metered by flow integrators, Panel C20. Total leakage rate is periodically calculated from these flow integrators and a record is maintained in order to detect increase in total leakage rate.

Depth of the drywell sumps is 5'10", with a combined holding capacity of 1500 gallons. Each pump is rated at 50 gpm and receives power from 480 volt power center B-21.

Drywell sump discharge is routed to the clean waste receiver tanks through AO-7374B (normally open) or to the condenser through AO-7374A. Valve controls are on panel C-20.

b. Reactor Building

The reactor building sump is equipped with two sump pumps to remove water collecting in the sump. Each (P-302A/B) pump has a local hand switch with three positions (auto, off, manual). In AUTO, level switch LS-7001A sends a signal to an alternator on a high sump level. The alternator selects and starts a pump. LS-7001A sends a signal to start the second pump on a high-high level. If the level rises to a high-high-high level, level switch LS-7001B initiates an alarm on panel C-20. Pump operation continues to a sump low level. If the pumps fail to stop, LS-7001B initiates a low-low level alarm on panel C-20.

The sump receives liquid radwaste from:

1) condensate storage tank overflow,
2) auxiliary bay equipment drain,
3) reactor building equipment drains, and
4) condensate demineralizer regeneration backwash.

The condensate demineralizer regeneration process stops at a high-high-high sump level. Depth of the sump is 7'0" with a holding capacity of 1000 gallons. Each pump has a discharge capacity of 200 gpm. The pumps receiver power from 480 volt power center B-13.

c. Turbine Building

Liquid radwaste from turbine building and selected radwaste building equipment drains collect in the turbine building equipment drain sump. The sump is equipped with two sump pumps to remove excess water. Each pump (P-303A/B) has a local hand switch with three positions (auto, off, manual).

In AUTO, level switch LS-7005A sends a signal to the alternator on a sump high level. The alternator selects and starts one pump. The second pump is started on a high-high level. At a high-high-high level, LS-7005B initiates an alarm on panel C-20. Pump(s) operation continues to a low level. If a pump is still running at a low-low level, LS-7005B initiates an alarm on panel C-20.

Depth of the sump is 7'2" with a holding capacity of 1500 gallons. Each pump is rated at 50 gpm. Pump discharge is to the clean waste receiver tanks through AO-7013A or to the condenser through AO-7013B and C. Discharge path is controlled by conductivity recorder CR-7013. Valve AO-7013A is normally open, but if a pump starts and the conductivity is low enough, AO-7013A closes with AO-7013B and C opening.

d. Radwaste Building

Drainage to the sump is from radwaste building floor drains and seal water leakage from the radwaste equipment and floor pumps.

Radwaste pumps (P-307A/B) are located outside of the sump and are equipped with a recycle line. Recycle flow is through a 1½" eductor at the bottom of the sump to mix any solids that have settled. Each pump has a local hand switch with three positions (auto, off, manual). In AUTO, level switch LS-7007A sends a signal to an alternator on a high level. The alternator selects and starts a pump. If a high-high level is reached, the second pump is started. At a high-high-high level, level switch LS-7007B initiates an alarm on panel C-20. Pump operation continues to a low level where LS-7007A automatically stops the operating pump(s). If a pump is still running at a low-low level, LS-7007B initiates an alarm on panel C-20.

Recycle flow is controlled by manually throttling a valve in the discharge line. Maximum recycle flow allowable requires discharge flow to be able to empty the sump to a low level in four minutes. Discharge capacity of each pump is 150 gpm at 30 psig discharge with the valve full open.

Condensate seal water supplies seal water to the pumps. A low seal water pressure (10 psig) and/or low discharge pressure (20 psig) trip the pump(s) after 30 seconds running time. Sump depth is 8'2" with a holding capacity of 250 gallons. Power to the pumps is from 480 V power center B-16.

e. Retention Building

The retention building sump collects liquid radwaste associated with the augmented off-gas system. Excess water is removed by one of two pumps (P-332A/B). Each pump has a local hand switch with three positions (auto, off, manual). In AUTO, level switch LS-9245 sends a signal to the alternator on a high level. The alternator selects and starts one pump. If a high-high level is reached, the second pump is started. At a high-high-high level, level switch LS-9246 initiates an alarm on panel C-20. Pump operation continues to a low level where LS-9245 automatically stops the operating pump(s). If a pump is running at a low-low level, LS-9246 initiates an alarm on panel C-20.

The equipment drain sump pumps discharge to the clean waste receiver tanks. The pumps trip on a high level in the tanks. Power to the pumps is from 480 V power center B-31.

2. Clean Waste Receiver Tanks (Figure 3)

The clean waste receiver tanks (T-301A/B) collect and store incoming clean radwaste to be processed. There are two tanks, each with a holding capacity of 15,000 gallons. Sources of clean radwaste are:

a. equipment drain sumps,
b. ion exchange system,
c. RWCU system, and
d. URC overflow.

Liquid radwaste is routed to the tanks from a common inlet line. Hand operated valves select which tank is to be filled. One tank is filled at a time, with the second being processed or isolated. A tank is normally filled to 60 percent capacity. At 60 percent the inlet valve to the other tank is opened and the full tanks inlet valve is closed. Level instrumentation permits filling a tank to 90 percent. Inlet supply systems are tripped to 90 percent. Overflow lines are provided to the chemical radwaste system if needed.

Level indicators installed in each tank monitor the processing, emptying or filling of a tank. Separate logic is used for a tank being filled versus one being emptied. If a tank is being filled, level indicator LI-7102/7105 initiates a high level alarm (90 percent) on panel C-20 and trips the inlet supply systems. If a tank is being emptied, level indicator LI-7102/7105 initiates a low level alarm (6 percent) and trips the operating process pump. A selector switch on panel C-20 determines logic applied.

Processing a receiver tank involves recirculating the volume of water so that a representative sample can be taken. A two inch eductor at the bottom of each tank is connected to a recirculation line off of the clean waste process pumps. Low pressure air spargers at the bottom of the tanks assist in preventing crud from settling. The volume is recirculated, sampled, and analyzed. If the water quality is found to be acceptable, a bypass of the flatbed filters is available. Otherwise, water is sent to a flatbed filter to be fully processed.

Piping within the system permits draining of a tank to either flatbed filter on both filters at the same time. One tank must remain available at all times.

3. Clean Waste Process Pumps (Figure 3)

The clean waste process pumps (P-308A/B) remove water from the clean waste receiver tanks and discharge to the flatbed filters. They are also used to recirculate water back to the tanks or assist the chemical waste process pumps in routing water from the chemical to clean radwaste system. A crosstie between the two pump suction lines makes it possible for a pump to take a suction from any of the tanks (T-301A/B or T-312A/B). A crosstie between the discharge lines allows a flatbed filter to receive liquid radwaste from either tank. Hand operated block valves are used to select a flowpath. Select switches using level indicators in the chemical and clean receiver tanks must be positioned accordingly. A low level in a tank trips the operating pump.

Controls for the pumps are on panel C-21 (auto, off, hand). In AUTO, the pumps are controlled by the flatbed filter control system (panel C-21). The tank to be processed is selected from panel C-21. The HAND position is used for manual operations such a recycle flow or transfer of water from a chemical to clean waste receiver tank. The pumps are rated for 170 gpm at 176' total discharge head. The 15 HP pumps receive power from 480 volt power center B-16. Red and green lamps on panel C-21 indicate if a pump is on or off.

4. Flatbed Filters (Figure 4)

The flatbed filters (X-321A/B) remove insoluble, suspended impurities. Flatbed filter X-321A receives liquid radwaste from clean waste receiver tank T-301A, and X-321B receives liquid radwaste from T-301B. Each filter provides 60 ft^2 of filter area. Diatomacious earth (DE) is used as a filtering medium. Inlet piping connects to a header that evenly distributes flow across the area. Filtered water leaves the units through a second header falling through a common line to the radwaste filtrate tanks (Figure 5).

Flatbed filter units are comprised of two halves (Figure 6). The top half is divided into three equal filter modules in series. The modules are separated and defined by stainless steel rectangular rings. The three rings are attached to the main body using spring loaded bolts (Figure 6). A rubber diaphragm is attached between each seal ring and the main housing. Seal air entering the diaphragms overcomes the spring forces and seals the ring against the filter belt. Located around the perimeter of the lower half, beneath the belt, is a gasket with vacuum groove. The ¼" groove provides a suction for eductor B-2. The eductor maintains a negative pressure to assist in sealing the two halves.

The filter belt is a stainless steel screen that collects and holds the diatomacious earth. The belt is supported by a beltsupport grid attached to the lower half. Belt ends are attached to rollers contained in the lower half. To facilitate the cake discharge cycle drive, motors are attached to the rollers and belt length is doubled. Spray nozzles and brushes are provided to assist in cleaning the belt during discharge (Figure 7).

Filter, pre-coat, and cake discharge cycles are all controlled by the flatbed filter control system located on panel C-21 (Figure 8). Cycles may be initiated automatically or manually. Separate controls, indicators, and instrumentation are provided for each filter (Appendix A). However, only one unit may be precoated or dyed at a time. Programmers installed in the system prevent a precoat or discharge cycle if the other filter is in the same mode. Both filter cycles may occur simultaneously. However, since the maximum flow through the radwaste demineralizer is 100 gpm, only one is operated at a time.

a. Filter Cycle

A filter cycle is started following precoat operations only. This is done to prevent the diatomacious earth from lifting off the screen. Initiation of a precoat cycle uses the FILTER OPERATION AFTER DISCHARGE switch or FILTER PRECOAT CYCLE, START CYCLE pushbutton.

Filter operation is governed by filter pressure and filtrate tank level. Filter inlet valve CV-2 positions automatically to maintain 15 psi across the filter. Level controller LIC-1AB positions outlet valve CV-4 according to filtrate tank level. Operation continues until:

1) low filter flow (50 gpm),
2) high turbidity,
3) high filter chamber pressure (19 psi), or
4) low level in the clean waste recirculation tank (15.5")

Any of the above initiates a cake discharge cycle if permissible.

Precoat operations use the filtrate transfer and radwaste filter precoat pumps and a recirculation line to the filter (Figure 3). After a precoat operation, the precoat pump stops and recirculates. Valve CV-5 closes. At the same time, filter inlet valve CV-2 opens, a clean waste process pump starts, and filter outlet valve CV-4 opens to start the filter cycle.

b. Cake Discharge Cycle

The cake discharge cycle involves drying the wet diatomacious earth and dumping it to a solid waste container. If the cycle is not started automatically, the START CYCLE, CAKE DISCHARGE CYCLE pushbutton provides manual initiation. The cycle starts by closing filter outlet valve CV-4, stopping the clean waste transfer pump, and closing pump suction valve CV-1 (Figure 4). The filtrate transfer pump is stopped and the cake drying begins. Low pressure air is supplied to the filter through CV-14 to dry the cake for a predetermined time set on the "Cake Dry Cycle Timer".

When completely dry, seal air is closed off to the diaphragm, lifting the stainless steel rectangular rings from the screen. A belt drive motor, connected to a roller, winds the screen toward the cake discharge chute (Figure 7). As the coated screen passes the chute, the dried cake falls and is brushed off. Chute valve CV-3 is open allowing the waste to tumble to the solid waste container during the forward belt travel. A vibrator attached to the chute assists discharge operations. Spray nozzles located past the chute and a divider wash down the screen as it is being rolled by. The spray drains to a clean waste receiver tank. Duration of operation for the belt drive motor is set by a timer on panel C-21. When the set time has expired, chute valve CV-3 closes, the motor is reversed and the timer reset. Manual indexing of the belt is available. When the belt is fully returned, the brush is stopped. Following completion of the discharge cycle, the unit it put in standby or put back on line via a precoat sequence.

c. Precoat Cycle

Following the precoat cycle, the filter must go on line or the low flow signal initiates a cake discharge cycle. Therefore, the precoat cycle should be started only when the filter is able to go back on line.

FILTER OPERATION AFTER DISCHARGE selector switch has AUTO and SHUTDOWN positions. In AUTO, precoat operations begin immediately following the cake discharge cycle, if the pump hand switches are in AUTO.

In SHUTDOWN, a filter is placed in standby following cake discharge cycle. Manual initiation from standby uses the START CYCLE, PRECOAT FILTER CYCLE pushbutton to begin the precoat cycle.

With the stainless steel screen properly positioned, seal air is supplied to the diaphragm. As the rectangular rings seal against the screen, the filter precoat pump is started. With a sufficient volume of water in the filtrate tank, recirculation valve CV-5A/B opens and water enters the filter. Eductor valve CV-5C/D also opens to maintain a negative pressure in the filter to assist in sealing the filter. The filtrate transfer pump is started, increasing the recirculation flow rate.

When the concentration of diatomacious earth (DE) in the slurry tank is correct, valves CV-10 and CV-11 are opened (Figure 4). The solution is drawn into the recirculation flow and enters the filter. The DE collects on the screen and bridges over the openings. Amount of precoat required is predetermined and a precoat cycle timer assures proper precoat application. As the timer times out, CV-10 is closed, the piping is flushed out, and then CV-11 closes. The pumps remain in a precoat recirculation phase until all of the DE is retained by the screen.

Operation of the filter control system is much more involved than described. Attachment C to operational procedure 2.2.72 provides an in depth explanation of the system.

5. Radwaste Filter Slurry Tank (Figure 4)

The radwaste filter slurry tank (T-316) contains the solution of diatomacious earth (DE) and water used to pre-coat the flatbed filters. The radwaste filter pre-coat and filtrate transfer pumps draw the solution from the tank and route it to the top of the filter. Inside the filter, the DE bridges over the openings on the stainless steel screen.

Amount of pre-coat used on the screen is 0.1 lbs of DE per square foot. Concentration of DE in the slurry tank is maintained at 50 lbs DE per 100 gallons water. At an area of 60 ft^2, 12 gallons of solution is required for one pre-coat operation.

$$\frac{50 \text{ lbs DE}}{100 \text{ gallons}} \times 12 \text{ gallons} = 60 \text{ ft}^2 \times 0.1 \frac{\text{lb}}{\text{ft}^2}$$

Slurry tank outlet valves CV-10 and CV-11 are controlled by the flatbed filter control system. The PRECOAT EDUCTOR TIMER on panel C-21 controls how long the valves remain open. The timer is set to close the valves after 12 gallons is withdrawn. Addition of DE and water to the tank is performed by a nuclear auxiliary operator. Agitator X-317 is provided to mix the two. It is stopped during the precoat cycle. Tank overflow and drain lines are provided to the chemical radwaste system.

6. Radwaste Filtrate Tanks (Figure 4)

The radwaste filtrate tanks (T-317A/B) collect filtered water falling from the flatbed filters. Located beneath the filters, the tanks serve several purposes. First, they insure net positive suction head is available for filtrate transfer pump operation. Second, they provide storage of water if availability of the radwaste demineralizer is limited. Third, they store a sufficient amount of water for precoat operations.

Level of water in the tank is maintained by level controllers. LIC-1A/1B position outlet flow control valves CV-4A/4B. The two-inch ball valves are located in the discharge piping off the radwaste filter precoat and filtrate transfer pumps. Both pumps trip on a low tank level (19"). Level switch LS-1A/1B provide high and low tank level alarms on panel C-20. Any overflow from the tanks is routed to the chemical waste receiver tanks.

7. Filtrate Transfer Pumps (Figure 3)

The filtrate transfer pumps (P-319A/B) remove water from the radwaste filtrate tanks and pump it to the radwaste demineralizer. During pre-coat operations, they recirculate flow back to the flatbed filter. Pump discharge to the radwaste demineralizer is controlled by flow control valves CV-4A/4B. The valves are positioned by level controllers in the filtrate tanks.

Controls for the pumps are on panel C-21 (auto, off, manual). In AUTO, pump operation is determined by the flatbed filter control system. Power to the pumps is from 480 volt power center B-16.

8. Radwaste Filter Precoat Pumps (Figure 4)

The radwaste filter precoat pumps (P-320A/B) remove water from the radwaste filtrate tank and recirculate it back to the flatbed filters. Recirculation flow from the precoat and filtrate transfer pumps withdraw precoat from the slurry tan. Pump operation continues until all of the precoat is deposited on the filter screen.

Controls for the pumps are on flatbed filter control panel C-21 (auto, manual, off). In AUTO, the pump is started and stopped automatically by the flatbed filter control system. Total recirculation flow is 900 to 1000 gpm. The precoat pumps supply 600 gpm. Power to the pumps is from 480 volt power center B-16.

9. Radwaste Demineralizer (Figure 4)

The radwaste demineralizer uses ion exchange processes to remove soluble impurities from clean radwaste. The demineralizer contains mixed cation and anion ion exchange resins. Positively charged ions (cations) are replaced H^+ ions and negatively charged ions (anions) are replaced by OH^- ions. Mixed bed resins in the demineralizer can process filtered clean waste at a maximum flow of 100 gpm. At this flow rate, the quality of water leaving is 0.1 ppm silica, 0.01 ppm chloride, ph of 6.0 to 7.5, and a conductivity of 0.1 micromho/cm.

Clean radwaste enters the top of the demineralizer from the filtrate transfer pumps. Water flows downward and exits at the bottom where it is routed to the radwaste demineralizer filter. Effectiveness of the demineralizer is indicated by differential pressure instrumentation monitoring inlet and outlet pressure and outlet conductivity instrumentation. An alarm is initiated on panel C-20 on a high differential pressure (20.2 psi) or high conductivity.

Replacing spent resins involves isolating the demineralizer and draining the tank. The tank is drained through the freeboard drain to the clean waste receiver tanks. Spent resins are removed to the spent resin tank or to a radwaste shipping cask. After flushing, new resins are added using the resin addition hopper. The tank is filled using sluice water and placed in service.

10. Radwaste Demineralizer Filter (Figure 4)

The radwaste demineralizer filter (X-322) retains escaped resins or other, larger particles remaining in the flow. The filter is a cuno disposable cartridge filter.

Failure of the demineralizer lower retention element results in an excessive amount of particles in the filter. Differential pressure across the filter is monitored on panel C-20 (PID-7120). An alarm is initiated on panel C-20 (PAH-7120) on a high dp (8.5 psi). Conductivity treated water is monitored downstream of the filter. Conductivity recorder CR-7115 provides a readout on panel C-20 and initiates an alarm on a high conductivity. Both instruments (PID-7120 and CR-7115) assist in monitoring the effectiveness of the demineralizer.

11. Treated Water Holdup Tanks (Figure 3)

Fully treated water is sent to one of four treated water holdup tanks (T-304 A, B, C, D). Hand operated valves determine which tank is filled. The high level alarm/pump trip selector switch on panel C-20 is positioned to the tank being filled unless one is being processed. Tank level instrumentation is located on panel C-20. High level alarms are initiated at 90 percent tank volume. Each tank holds 18,000 gallons.

The Treated Water Tank selector switch should be used when transferring treated water to the Condensate Storage Tank (CST), the Clean Waste Tanks (to be reprocessed), the Monitor Tanks, or to Overboard Discharge. The Treated Water Tank selector switch should be switched to the Treated Water Tank, which is being transferred. When the Treated Water Tank selector switch is switched to the tank, which is being transferred, the trip logic circuits for that tank will control the Treated Water Pumps. As water is transferred from the selected tank and low level in that tank is reached, the logic circuits will trip Treated Water Pump P-316A or P-316B, or if both pumps are running, Treated Water Pumps P-316A and P-316B.

Processing a full tank consists of recirculating, sampling, and discharging the water accordingly. Recirculating the treated water uses a treated water transfer pump and a recirculation line. The water is sampled for pH, conductivity, radioactivity, silica, and chloride content. Based on the analysis, the water is:

a. returned to the clean waste receiver tanks for reprocessing,
b. sent to the radwaste discharge header,
c. transferred to the condensate storage tank, or

d. drained to the turbine building equipment sump to be routed to the condenser

The high level alarm/pump trip selector switch is positioned to the tank being emptied. This is done to protect the pumps. Low level alarms are initiated at 10 percent tank volume. A low-low level trips an operating pump. Overflow from a tank drains to the receiver tanks.

Bypass of the tanks is available. If water quality is known to be unacceptable, flow can be routed back to the receiver tanks for reprocessing.

12. Treated Water Transfer Pumps (Figure 2)

The Treated Water System utilizes two pumps; P-316A and P-316B. Normally, "A" pump is used for A and B Treated Water Tanks and "B" pump is used for C and D Treated Water Tanks, but either pump may be used for any tank.

The treated water transfer pumps (P-316A/B) remove water from the treated water holdup tanks. Depending on water quality, discharge is to the condensate storage tanks, radwaste discharge header, or recycled back to the receiver tanks for reprocessing. Piping and valves are installed so that either of the pumps can remove water from any tank.

Discharge to the condensate storage tanks is limited by conductivity.

Air-operated block valve AO-7133 in the discharge line closes on a high conductivity level of 1.0 micromhos. A recycle line installed around the pumps prevents damage on a valve closure. There are two condensate storage tanks (T-105A/B). Capacity for each tank is

275,000 gallons. They are described further in the system description titled, "Condensate System".

Controls for the pumps are on panel C-20. Each pump has a two position hand switch (start, stop). Power to the pumps is from B-16. Pump discharge pressure is indicated on panel C-57 (PI-712A/3D).

13. Radioactive Solid Waste Container (Figure 4)

The radioactive solid waste container or high integrity container (HIC) collects diamotacious earth discharged from the flatbed filters. Chutes from the filters direct the exhausted, dried earth to the container. Both chutes empty to the same container. Dump chute valve CV-3 A, B isolate the container when not in a cake discharge cycle.

The (HIC) sits on a movable cart which rides on a set of rails. The cart can be positioned under the flatbed discharge chute, under a close circuit TV camera or under floor plugs in the RW trucklock for removal and final shipping. This cart is equipped with vibrators for compacting the dry diamotacious earth. This vibrator has doubled the amount of D.E. that can fit into the HIC.

14. Liquid Radwaste Discharge Header (Figure 9)

The liquid radwaste discharge header receives flow from monitor tank pumps, treated water transfer pumps, and the miscellaneous waste drain tank pump. Liquid radwaste from all pumps is routed to the header through a low flow line (1", 0-20 gpm) or a high flow line (2", 0-200 gpm). Discharge from both lines is directed through a 4-inch header to the circulating water discharge canal. Condenser circulating water is added to the canal and the liquid radwaste is released to the environment.

Liquid radwaste to be released from a tank is recirculated for 60 minutes, sampled, and analyzed. Radiation release rates are defined to technical specifications section 3.8. The pH level must be 5.8 to 8.5. Depending upon pH radiation level and amount of water being added to the canal, an allowable release rate is calculated. Release rate is controlled by flow controls valves FV-7214A and FV-7214B in the 2" and 1" lines respectively. Each valve is controlled by an AUTO-MANUAL SET DIAL on panel C-20. AUTO position uses a dial to position the valve by setting a flow rate. MANUAL provides valve position adjustment. Actual

flow rate and valve position are indicated on the control. Selection of a flow line is made from panel C-20. Isolation valve AO-7216A (2") and AO-7216B (1") have a two position hand switch (open, close) on panel C-20. Both lines may be used at the same time.

Flow through a discharge header is monitored for pH (AE-7235) and radiation (RM-1705-30) level. A high radiation level or downscale reading initiates an alarm on panel C-20 and control room panel 903. A high-high radiation level closes FV-7214A and B and trips any operating pumps. Radiation level is represented by a red line on a three pen recorded on panel C-20. The other two pens (blue and green) record flow out of the 2" and 1" lines. Other instrumentation includes flow integrators on panel C-20. The flow integrators indicate amount of water discharged through each line.

Discharge of liquid radwaste requires:

a. check of valve line up
b. recirculate and sample water
c. establish flow rate (not to exceed 200 gpm) taking into account dilution water
d. start discharge, monitoring flow rate and radiation level.

Procedure 2.5.2.117, "Processing Liquid Radwaste Discharges" states that:

All liquid wastes in the Station, except sanitary wastes, oily wastes, and seawater wastes, are processed through the radwaste facilities.

To prevent inadvertent liquid releases from radwaste, critical valves are checked prior to beginning a release on Forms OPER-28A, OPER-28B, OPER-28C and OPER-28D (Attachments 1, 2, 3 and 4).

Technal Specifications Amendment 177 relocated the Radioactive Effluent Technical Specifications (RETS) and the Radiological Environmental Monitoring Program to the ODCM in accordance with recommendations of GL89-01 and NUREG 1433. This impacted Radioactive Liquid Effluents by moving all requirements to the ODCM.

PPDC98-05 added a filtration system to the neutralizing sump. If necessary, water from the sump can be pumped through the filter system and returned to the sump. This filtration

system allows for the removal of suspended solids in the event that a sump is over the NPDES limit for total suspended solids (TSS). Due to the possible presence of radioactivity and concentration of radioactivity on a filter, a calculation of the possible dose rate effects was performed (PNPS-1-ERHS-VI.B-4, "Neutralizing Sump Filtration System Concentration Limits").

If a dilution water pump in operation at the start of a release fails, the Shift Manager (SM) should terminate the release immediately and have a new Discharge Permit issued, which reflects the decreased dilution flow and possible new discharge flow rate.

If in the course of a release the discharge flow rate recorder (FR-7214A or FR-7214B) on Panel C20 fails, the operator assigned to Radwaste is to stop the release immediately and notify the SM. With SM consent, the operator may initiate OPER-28E (Attachment 5), restart the release, and monitor the tank level, recording such levels on the form every 5 minutes until the release is finished.

D. INSTRUMENTATION AND CONTROLS

1. Control Room Instrumentation

Instrumentation/Location	Description
Radiation monitor RM-1705-30 on panel 910	0-102 cps Receives input from RE-1721

2. Local Instrumentation

Instrumentation/Location	Description
LI-7102/7105 Panel C-20	Clean waste receiver tank A/B level meter 0-100 percent
LI-7122, 24, 26, 28 Panel C-20	Treated water holdup tanks A,B,C,D level meter 0-100 percent
FQ-7031 Panel C-20	Drywell equipment drain sump pumps flow integrator
CR-7133 Panel C-20	3-Pen conductivity recorder Demineralizer filter disch. (green) Turbine building sump disch. (red) Treated water disch. (blue) 0-10 micromhos
PID-7120 Panel C-20	Differential pressure across radwaste demin. 0-30 psi
PID-7120 Panel C-20	Differential pressure across demineralizer filter 0-50 psi
AR-7235 Panel C-20	Disch. header pH level recorder
AE-7149 Panel C-21	Flatbed filter disch. turbidity meter
PI-7009 (Reactor. Building) PI-7010 (Drywell) PI-7012 (Turbine Building) PI-7014 (Rad. Building) PI-9322 (Ret. Building)	Equipment sump pumps discharge pressure
PI-1A/1B Local	Clean waste process pumps disch. pressure
PI-8A/8B Local	Radwaste filter precoat pumps disch. pressure
PI-2A/2B Local	Filtrate transfer pumps discharge pressure

2. **Local Instrumentation (cont.)**

Instrumentation/Location	Description
PI-7129/30 Panel C-57	Treated water transfer pumps discharge pressure
FI-7135 Local	Mixing air to clean waste receiver tanks flowrate
FI-7172 Local	Low pressure service air to radwaste demineralizer flowrate (sluicing air)
FI-7173 Local	Low pressure service air to radwaste demineralizer flow rate (mixing air)
FR-7214A FR-7214B RR-1792 Panel C-20	3-Pen recorder Flowrate 2" line (blue) Flowrate 1" line (green) Disch. radiation level (red) $0\text{-}10^6$
FQ-7214A Panel C-20	2" Radwaste discharge to canal 0-1,000,000 gallons
FQ-7214B Panel C-20	1" Radwaste discharge to canal 0-100,000 gallons

(**NOTE:** See Attachment B for instrumentation on Panel C-21.)

3. **Alarms**

Title/Location	Setpoint/Initiating Device
Drywell equipment drain pump Sump high level Panel C-20 A-1	58"/LS-7003B Alarm Hi-Hi
Drywell equipment drain sump Sump low level Panel C-20 A-2	14/"/LS-7003B Alarm Lo-Lo
Clean waste receiver tank B/A Low-high level Panel C-20 A-6/B-5/B-5/B-6	High alarm 86 percent (increasing) Low alarm 6 percent (decreasing) LAHL-7105/7102
Treated water holdup tank D/C/B/A Low-high level Panel C-20 A-6/B-4/B-5/B-6	High alarm 90 percent (increasing) Low alarm 10 percent (decreasing) LAHL-7128/7126/7124/7122
Reactor building equipment drain sump Hi-Hi level Panel C-20 A-7	70" LS-7001B

3. **Alarms (cont.)**

Title/Location	Setpoint/Initiating Device
Reactor building equipment drain sump Lo-Lo level Panel C-20 A-8	13" LS-7001B
Turbine building equipment drain sump Hi-Hi level Panel C-20 A-13	54" LS-7005B
Turbine building equipment drain sump Lo-Lo level Panel C-20 A-14	12 /" LS-7005B
Radwaste filter slurry tank High level Panel C-20 A-18	LS-2
Treated water tanks disch. High conductivity Panel C-20 B-13	1.0 micromhos CR-7133
Radwaste filter slurry tank Low level Panel C-20 B-16	LS-2
Radwaste building equipment drain sump Hi level Panel C-20C A-1	70" LS-7007B
Radwaste building equipment drain sump Lo-Lo level Panel C-20 A-2	18 /" LS-7007B
Flatbed filter B/A High pressure Panel C-20 A-3/B-1	PS-1B/1A
Flatbed filtrate tank B/A High level Panel C-20C A-6/B-4	LS-1B/LS-1A
Drywell equipment drain sump discharge High pressure Panel C-20C A-4	30 psi PS-7028
Flatbed filter tank B/A Low level Panel C-20C A-9/B-7	LS-1B/LS-1A
Flatbed filter B/A Seal air low pressure Panel C-20R A-12/B-10	PS-3B/3A
Drywell equipment drain sump Discharge high total flow Panel C-20C A-3	100 gpm for 2 mins. FW-7031

3. **Alarms (cont.)**

Title/Location	Setpoint/Initiating Device
Radwaste demineralizer high Differential pressure Panel C-20 B-2	20 psid PAH-7118
Radwaste demineralizer eff. strainer High differential pressure Panel C-20 B-5	8.5 psi PAH 7120
Radwaste demineralizer eff. High conductivity Panel C-20 B-8	CE-7115
Flatbed filter A/B disch. High turbidity Panel C-20 B-13/B-14	

4. **Interlocks and Trips**

Interlock or /trip	Functions
Drywell equipment drain sump pumps Reactor Building (P-302A/B) LS-7001A Drywell (P-301A/B LS-7003A Turbine Building (P-303A/B) LS-7005A Radwaste Building (P-307A/B) LS-7007A Retention Building (P-332A/B) LS-9245	Level switches provide signal to alternator to select and start a pump. Low level indicator stops operating pumps. High level indication starts one pump. High-high level starts second pump (Drywell pumps require start pushbutton.) **Note:** See Attachment A for start/stop setpoints.
Drywell equipment drain sump pumps	High level (90 percent) clean radwaste receiver tanks. Prevent tank overflow.
Drywell equipment sump discharge isolation vlvs. AO-7011A/B	Coincident signals of low reactor water level and/or high drywell pressure. Maintain primary containment boundary.
Turbine blding equip sump discharge vlvs to cond AO-7013B/C (Valve AO-7013 opens)	Close on high conductivity of 1.0 micromhos in discharge. Prevent low quality water from entering condenser.
Treated water discharge Valve AO-7033	Closes on high conductivity in discharge. Prevents low quality water from entering condensate storage tanks.

4. Interlocks and Trips (cont.)

Interlock or /trip	Functions
Treated water discharge pumps P-316A/B	A. Pumps trip on a low level in holdup tank (5.0") 8%. Protects pumps from damage. B. High radiation level in discharge header.
Clean waste process pumps P-308A/B	A. Low-low level in clean waste receiver tanks (9.0") 6% or low level in chemical waste receiver tanks. Prevent pump damage. B. Low filter flow 50 gpm. Filter cake exhausted drying to begin for discharge. (Low air pressure also.) C. Low seal air pressure to filter. Prevents leakage through filter seals. D. Loss of air to flatbed filter inlet flow control valve CV-2A, B. E. High-high pressure of filter supply header (28 psi). Filter cake exhausted, drying cycle to in.
Filtrate transfer pumps P-319A/B	A. Filtrate tank low level 1.0'. Prevent pump damage. B. Low seal air pressure to filter. Prevent leakage past filter seals.

5. Control Room Controls

Item/Location	Functions of Positions
Drywell equipment drain sump discharge valves (AO-711A/B) Panel 904	OPEN Permits pump discharge CLOSE Maintains primary containment boundary

6. Local Controls

Item	Functions of Positions	
Equipment drain sump pumps: Reactor building (P-302A/B) Turbine building (P-303A/B)	AUTO	Mechanical alternator selects and operates pumps according to sump water level.
Radwaste building (P-307A/B) Retention building (P-332A/B) Local 3 - Position handswitch	OFF MANUAL	Stops pump Permits operation of pump if alternator fails
Drywell equipment drain sump pumps (P-301A/B) Local 3 - Position handswitch on Panel C-20 (Start pushbutton must be depressed to start pumps in auto.)	OFF MANUAL	Stops pump Permits operation of pump if alternator fails
Drywell equipment drain sump pumps Start pushbutton Panel C-20		Depressing button starts pump(s) following permission signal, if switch is in auto.
Treated water transfer pumps (P-316A/B) Panel C-20	START STOP	Starts pump Stops pump
Drywell equipment drain sump discharge valve to main condenser (AO-7374A) Panel C-20	OPEN CLOSED	Pump discharge is routed to main condenser. Pump discharge is routed through AO-7374B.
Drywell equipment drain sump discharge valve to clean waste receiver tanks (AO-7374B) Panel C-20	OPEN CLOSED	Routes pump discharge to receiver tanks Discharge routed through AO-7374A
Clean waste receiver tank level select switch Panel C-20		Controls operating time of pumps adjustable 0-30 minutes (1) Fill tank A and process tank B, or (2) Fill tank B and process tank A. Line up level instrumentation accordingly.
Treat water holdup tank select switch Panel C-20	A,B,C,D	Level instrumentation for tank selected initiates alarms and pump trip.
Discharge valve to canal AO-7216A (2") AO-7216B (1") Panel C-20	OPEN CLOSE	Liquid radwaste discharged to canal Isolates canal

6. Local Controls (cont.)

Item	Functions of Positions	
Flow indicating controls FIC-7214A (AO-7214A) FIC-7214B (AO-7214B)	AUTO	Positions valve according to flow dial setting.
	MANUAL	Valve position adjustable.
Chem waste dest. select switch Panel C-20	P-308A P-308B	Level instrumentation trips pump selected A or B.
	CONC	Water sent to monitor tanks.
Clean waste process pumps Panel C-21	AUTO	Pump operation controlled by flatbed filter control system.
	OFF	Off
	HAND	Manual operation
Radiation monitor override switch Panel C-20	AUTO	Trips and alarms associated with monitor are in effect.
	OVERRIDE	Monitor trips and alarms are bypassed.

E. SYSTEM INTERRELATIONSHIPS

1. Service Air System

Service air supplies low pressure air to spargers in the clean waste receiver tanks. Low pressure air is used by the flatbed filters for sealing air and cake drying. The radwaste demineralizers use low pressure air for sluicing and mixing resins.

2. Instrument Air System

Instrument air is supplied to level indicators and solenoid valves.

3. Condensate Transfer System

Condensate water is supplied to:

a. radwaste filter slurry tank,
b. resin addition hopper,
c. flatbed filter hood and belt spray, and
d. filtrate tanks

The condensate storage tanks receive treated water from the treated water transfer pumps.

4. Chemical Radwaste System

The chemical waste receiver tanks receive overflow from the clean waste receiver tanks, equipment drain sumps, and discharge from the treated water transfer pumps.

5. PRM's – Radwaste liquid effluent PRM.

6. Power Supplies

a. 480 volt power center B-16 supplies:
   1) clean waste process pumps (P-308A/B)
   2) flatbed filter cart vibrators
   3) radwaste filter precoat pumps (P-320A/B)
   4) flatbed filter brush drive motors A/B
   5) filtrate transfer pumps (P-319A/B)
   6) flatbed filter slurry tank agitator (X-317)
   7) treated water transfer pumps (P-316A/B)

b. Flatbed filter belt drives receive power from 480 volt power center B-23.

c. Radwaste annunciators on panel C-20 receive power from 125 volt DC panel D-6.

d. Radwaste controls, select valves, and relays are powered from 120 volt AC instrument power panel Y-1.

e. Controls for the flatbed filter are powered from 120 volt AC instrument power panel Y-2.

f. Equipment drain sump pumps receive power from 480 volt power centers:

1) reactor building (P-302A/B)	B-13
2) drywell (P-301A/B)	B-21
3) turbine building (P-303A/B)	B-22
4) radwaste building (P-307A/B)	B-16
5) retention building (P-332A/B)	B-31

F. SYSTEM OPERATIONAL SUMMARY

NOTE: This section outlines the major steps performed during system operations and is not intended to be substituted for plant operating procedures.

1. Normal System Operation

Clean liquid radwaste from the plant enters one of two receiver tanks. As one tank fills, it is isolated, and flow is routed to the second tank. Water in a filled tank is recycled, sampled, and analyzed. Low quality water is pumped by the clean waste transfer pump to the flatbed filters. High quality water bypasses the filters to the radwaste demineralizer.

The flatbed filters remove insoluble impurities, while the demineralizer removes soluble impurities. Filtrate transfer pumps remove filtered water from the filtrate tanks, pumping it to the demineralizer. Fully treated water leaves the demineralizer and passes through the radwaste demineralizer filter. One of four treated water holdup tanks stores the treated water.

As a tank is filled, it is isolated and its volume is recirculated, sampled, and analyzed. One of two treated water transfer pumps discharge the water to the condensate storage tanks, discharge header, or back to the clean waste receiver tanks.

2. Infrequent Operations

a. Processing chemical waste through the clean waste system

Chemical liquid radwaste which is analyzed and found to be comparable to clean radwaste may be processed through the clean radwaste system. Discharge from the chemical waste process pumps (P-313A/B) is routed to the suction side of the clean waste process pumps. A selector switch located on panel C-21 provides the option of processing a chemical or clean waste tank. When processing a chemical waste tank, the clean waste transfer pumps trip on low chemical waste tank level. Chemical waste destination select switch on panel C-20 is positioned to P-308A or P-308B.

b. Transferring clean waste to chemical waste system

Clean liquid radwaste can be routed directly to the chemical radwaste receiver tanks. Discharge piping from each equipment sump pump has a crosstie to the discharge piping of its respective floor sump pump. Hand-operated block valves are installed downstream of the crosstie connections and in the crosstie itself.

c. High integrity container change out

Cake discharged from both flatbed filters falls through chutes to the HIC. The HIC rests on a cart below the chutes. A full HIC is replaced by raising the chutes, jacking out the container, removing it, and preparing it for shipment. A new unit is set on the cart, jacked into place, and the chutes lowered. See solid radwaste system for disposal of.

d. Filter servicing

Filter inlet and outlet piping is equipped with removable spool pieces to facilitate servicing. Decontamination spray nozzles mounted on the filter reduce radiation levels.

3. Abnormal Operations

a. Drywell Leakage Management

Drainage from selected drywell areas collect in the drywell equipment drain sump. The drain sump is connected by level equalizing lines to a second sump containing two sump pumps. Each pump (P-301A/B) has a hand switch (auto, off, manual), auto start pushbutton, and timer on radwaste control panel C-20. On a high sump level, level switch LS-7003B initiates an alarm on panel C-20 and LS-7003A sends a signal to the alternator. The alternator selects a pump to be started, but does not start the pump. Isolation valves in the discharge line must be opened from control room panel 904 before starting a pump. Isolation valves AO-7011A and B are part of the primary containment system. If open, they close on a primary containment isolation signal of high drywell pressure and/or low reactor water level. Hand switches for the valves have AUTO and CLOSE positions. Lamps are provided on panels C-20 and 904 that indicate if a valve is open or closed.

When the valves are opened, the AUTO START PUSHBUTTON is used to start the selected pump. The timer automatically starts as pump operation begins. Timers are adjustable to 30 minutes and allow operators to remove a portion of the sump volume. Pump operation stops when a timer expires or at a low sump level. At a low sump level, LS-7003A automatically stops any operating pumps. If the pump(s) fail to stop at a low-low level, LS-7003B initiates an alarm on panel C-20. If the level in the sump were to rise to a high-high level, LS-7003B initiates an alarm and LS-7003A gives a permissive signal to start the second pump.

As the water, which has been collected in the sumps is pumped out, the discharge flow from each sump is individually metered by flow integrators, Panel C20. Total leakage rate is periodically calculated from these flow integrators and a record is maintained in order to detect increase in total leakage rate.

G. INDUSTRY LESSONS LEARNED

1. Oil Intrusion into Radwaste - Pilgrim Station

The history of oil intrusion into the radwaste systems dates back prior to 1982 and manifests itself in the following problems.

- Oil found in sump requiring cleanup. Labor intensive, expensive.
- Oil on flatbed filter screens, required steam cleaning in high rad areas. Exposure could be saved.
- Oil in piping, contaminating multiple tanks; extensive processing, expensive.
- A degreasing agent used in decon of the D/W, found in R/W, expensive processing.

The intrusions are infrequent, but very expensive. The oil cannot be discharged or buried. The radwaste systems were not designed to process oil; which results in inefficient and expensive treatment (dollars and exposure which could be better used).

The most recent occurrence May/June 1990 involved a quantity of less than 5 gallons of light weight lube oil, in the radwaste system (most likely pathway, a floor drain) which resulted in a cost of approximately $125,000 to process.

We must sensitize and emphasize the importance and practical aspects of the Chemical Control Program. The station by design is a closed system (to protect the public and employee). *If you put anything on the floor or down a drain it will come back. Any amount of* oil or cleaning agent not controlled is a threat. It takes money away from betterment programs and wastes our exposure; so we all have a personal stake in it.

TABLE 1

MAJOR SYSTEM CONTROL VALVES

A. CV-1A, B	Clean waste process pump suction valve (open-close). Controlled by flatbed filter control system.
B. CV-2A, B	Flatbed filter inlet flow control valve. Maintains pressure across filter. Loss of air to valve trips process pump.
C. CV-3A, B	Dump chute valve (open-close). Open when dried cake is being dumped.
D. CV-4A, B	Flatbed filter outlet flow control valve. Maintains level in filtrate tank. Positioned by LIC-1A, B. Loss of air to valve trips filtrate transfer pump.
E. CV-5A, B	Precoat recirculation valve.
F. CV-5C, D	Eductor (E-2A, B) inlet flow control valve. Supply water to eductor for sealing the flatbed filter halves.
G. CV-6A, B	Belt spray control valve (open-close). Permits condensate water to clean belt.
H. CV-10	Precoat suction valve.
I. CV-11A, B	Precoat discharges valve.
J. CV-14A, B	Cake dry air inlet valve. Allows low pressure service air to filter.
K. CV-16A, B	Seal air valve. Controls seal air used to raise and lower seal rings. Seal air pressure set at 25 psi.

ATTACHMENT A

PUMP START/STOP LEVEL SETPOINTS

Drywell equipment drain sump pumps (P-301A/B):
(Initiated by LS-7003A)

1st pump starts at - 44" inc.
2nd pump starts at - 51" dec.
1st pump stops at - 23" dec.
2nd pump stops at - 22.5" dec.

Reactor building equipment drain sump pumps (P-302A/B):
(Initiated by LS-7001A)

1st pump starts at - 58" inc.
2nd pump starts at - 65" inc.
1st pump stops at - 21" dec.
2nd pump stops at - 19" dec.

Turbine building equipment drain sump pumps (P-303A/B):
(Initiated by LS-7005A)

1st pump starts at - 43" inc.
2nd pump starts at - 50" inc.
1st pump stops at - 18 /" dec.
2nd pump stops at - 12 /" dec.

Radwaste building equipment drain sump pumps (P-307A/B):
(Initiated by LS-7007A)

1st pump starts at - 74" inc.
2nd pump starts at - 80" inc.
1st pump stops at - 24 /" dec.
2nd pump stops at - 18 /" dec.

ATTACHMENT B

PANEL C-21 (Figure 8)

1. VALVE INDICATING LIGHTS - lamps are provided on panel C-21 for selected automatic control valves. Red, green, and white lamps indicate if a valve is open, closed, or throttled.

2. BODY FEED CYCLE TIMER - not used.

3. RECIRCULATION TIMER - determines time interval that a radwaste filter precoat pump remains in operation following precoat application. Timer starts seconds before precoat discharge valve CV-11 closes.

4. FLOW INDICATOR TOTALIZER - indicator flow rate into flatbed filter.

5. PRECOAT CYCLE TIMER - controls open time of precoat suction valve CV-10 and precoat discharge valve CV-11. Timer is adjusted to permit proper amount of precoat withdrawn from filter slurry tank.

6. CAKE DRY CYCLE TIMER - determines time interval cake dry valve CV-14 is open allowing low pressure service air to filter for cake drying. CV-14 opens and timer begins automatically as cake discharge cycle begins.

7. FILTER TURBIDIMETER - indicates filter inlet and outlet turbidity. Initiates cake discharge cycle on high turbidity, if not in override.

8. START CYCLE, TANK SELECT SWITCH - positioned to tank (chemical or clean) to be processed.

9. STATUS INDICATING LIGHTS - lamps indicate cycle in operation.

H. LIST OF FIGURES

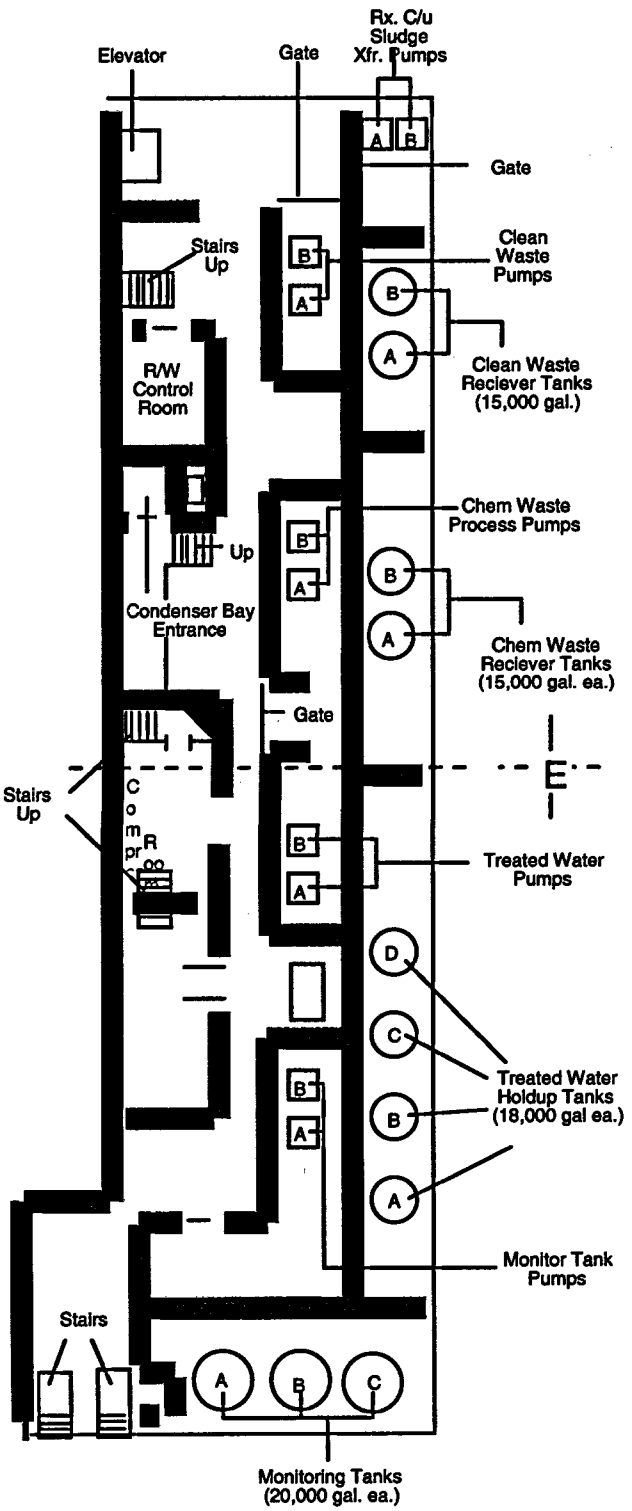
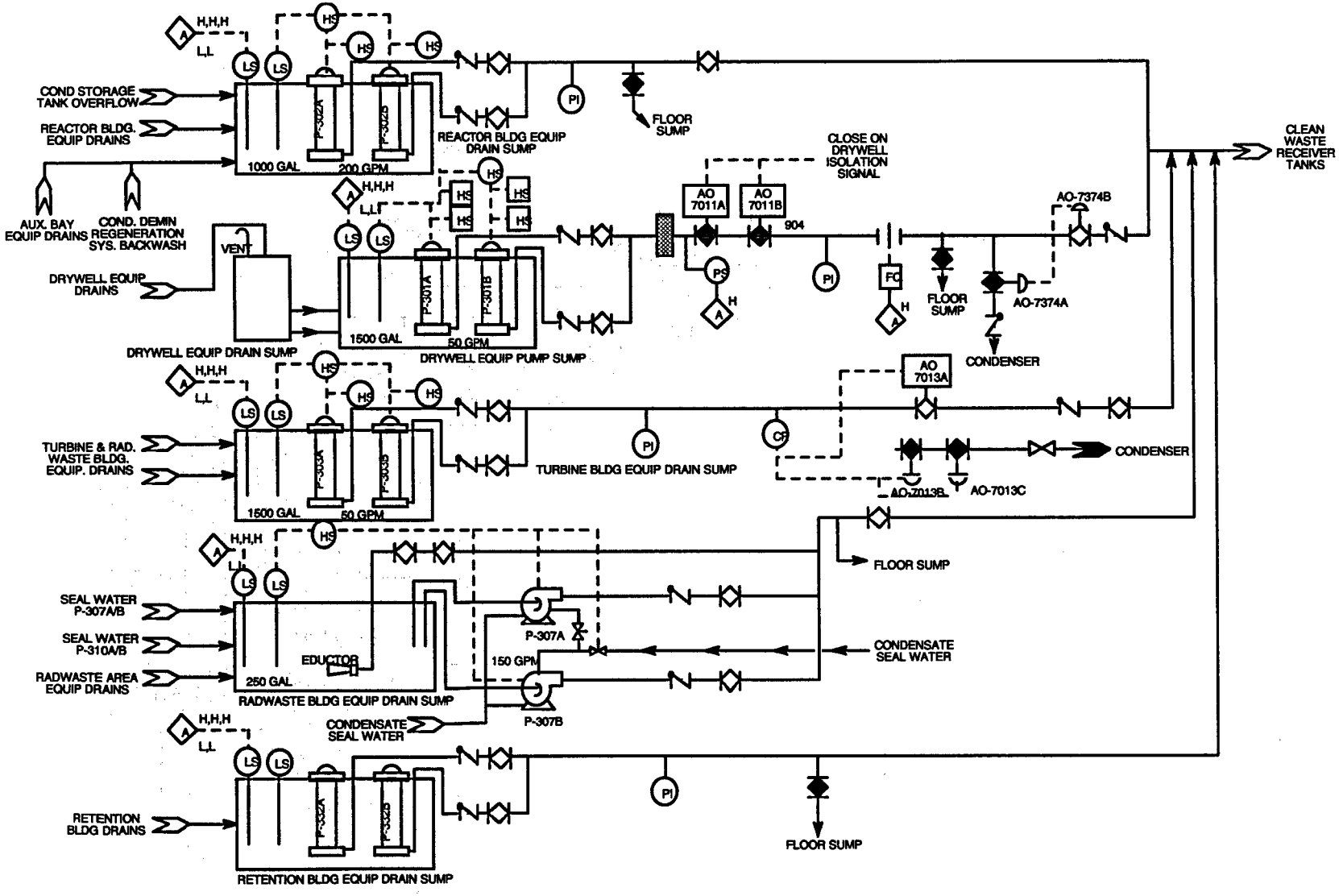


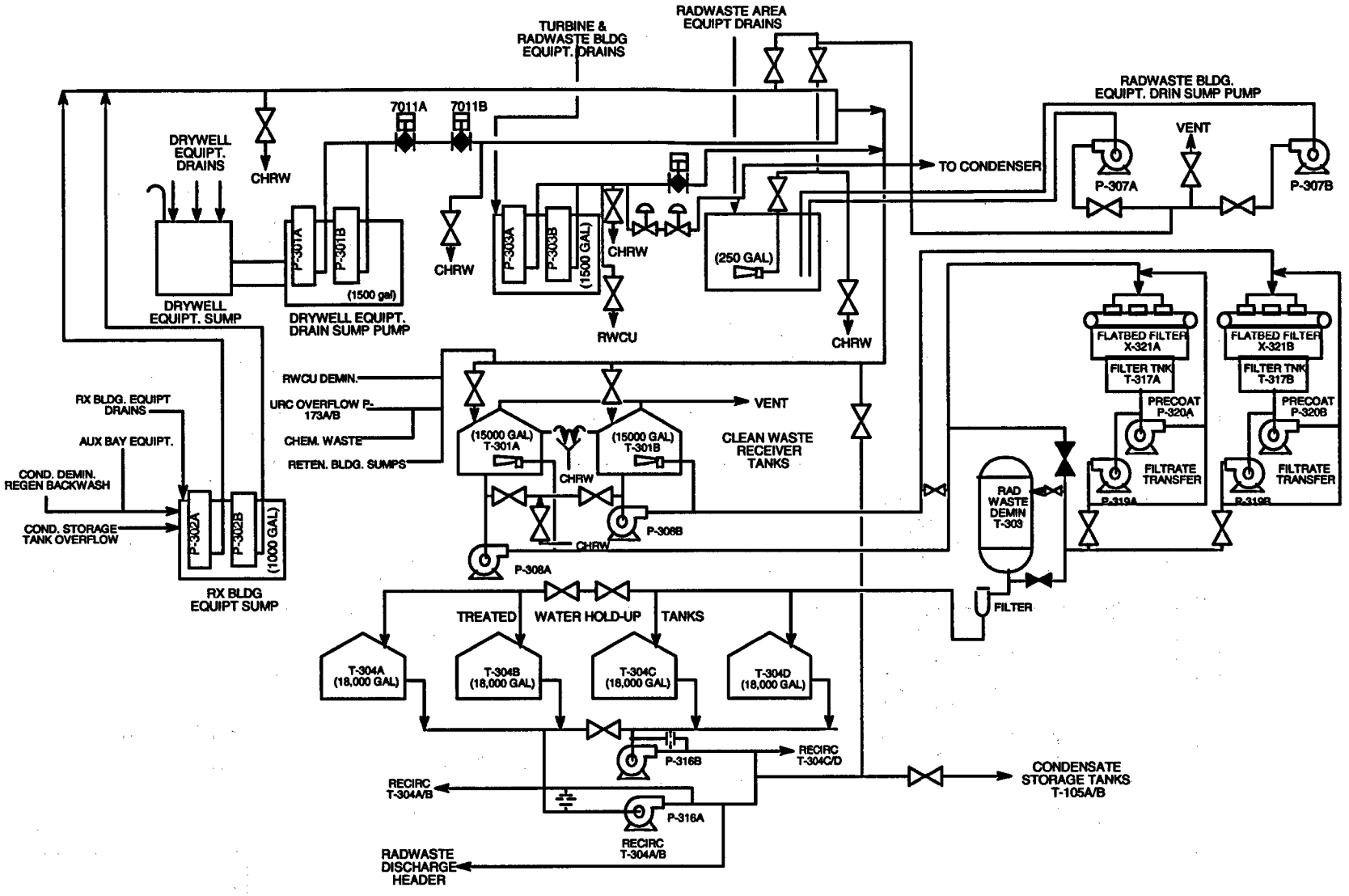
FIGURE 1

C-TS-03-05-08
TP-2
60te1240a



EQUIPMENT SUMPS

60te1240f



CLEAN RADWASTE SYSTEM

FIGURE 3

C-TS-03-05-08
TP-4
REV. 0
60te1240c

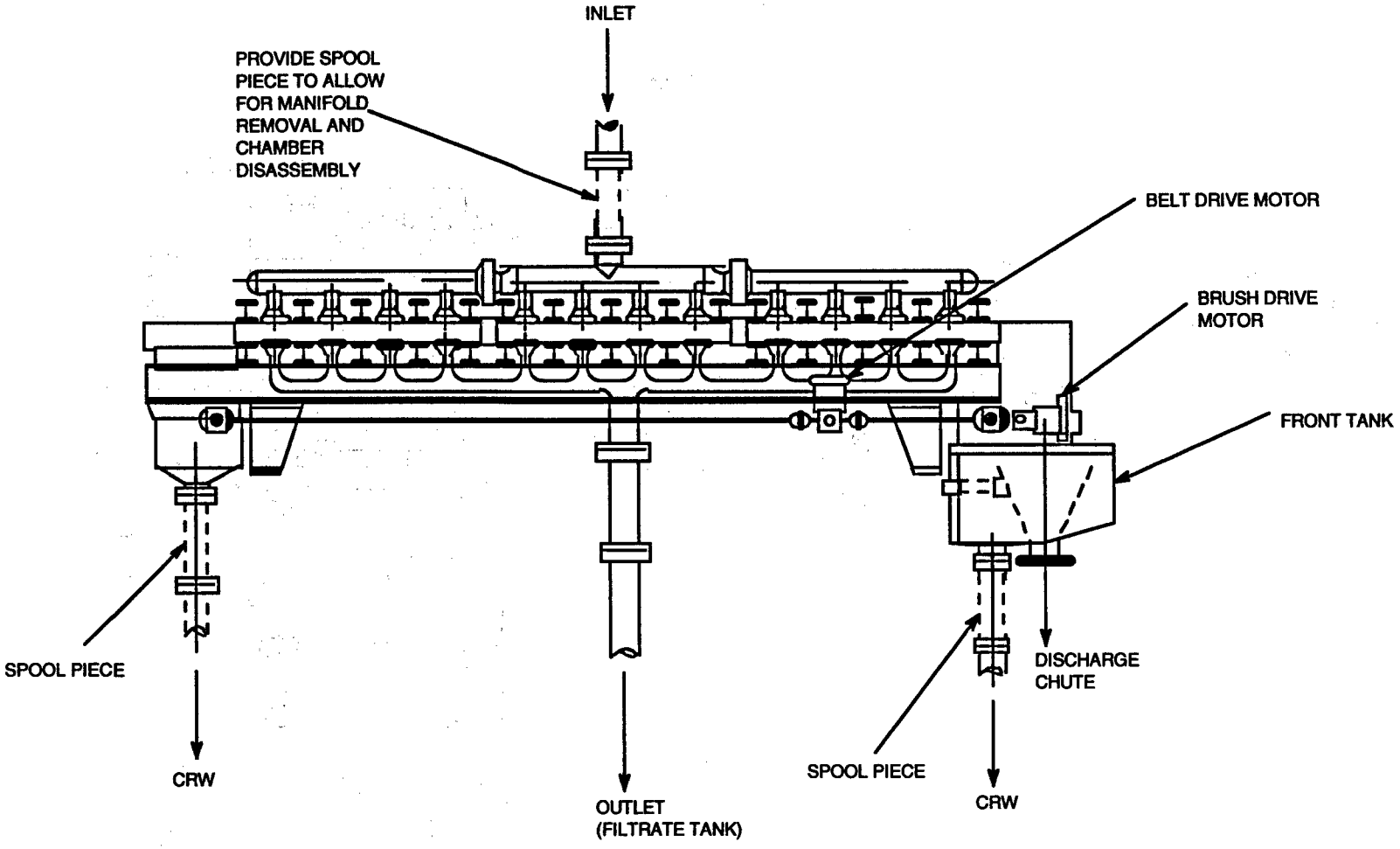
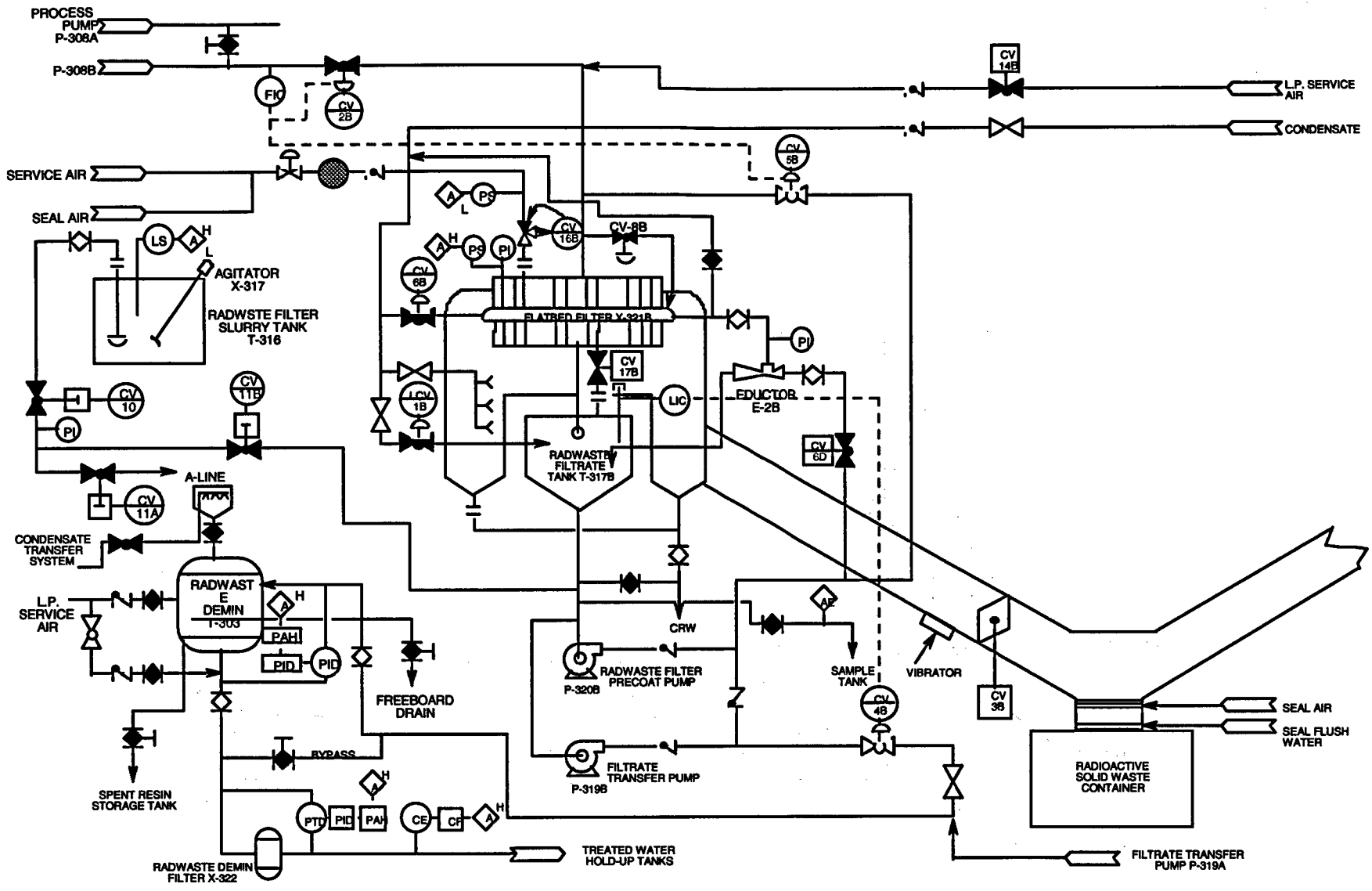

INLET
PROVIDE SPOOL PIECE TO ALLOW FOR MANIFOLD REMOVAL AND CHAMBER DISASSEMBLY
BELT DRIVE MOTOR
BRUSH DRIVE MOTOR
FRONT TANK
SPOOL PIECE
CRW
OUTLET (FILTRATE TANK)
SPOOL PIECE
CRW
DISCHARGE CHUTE

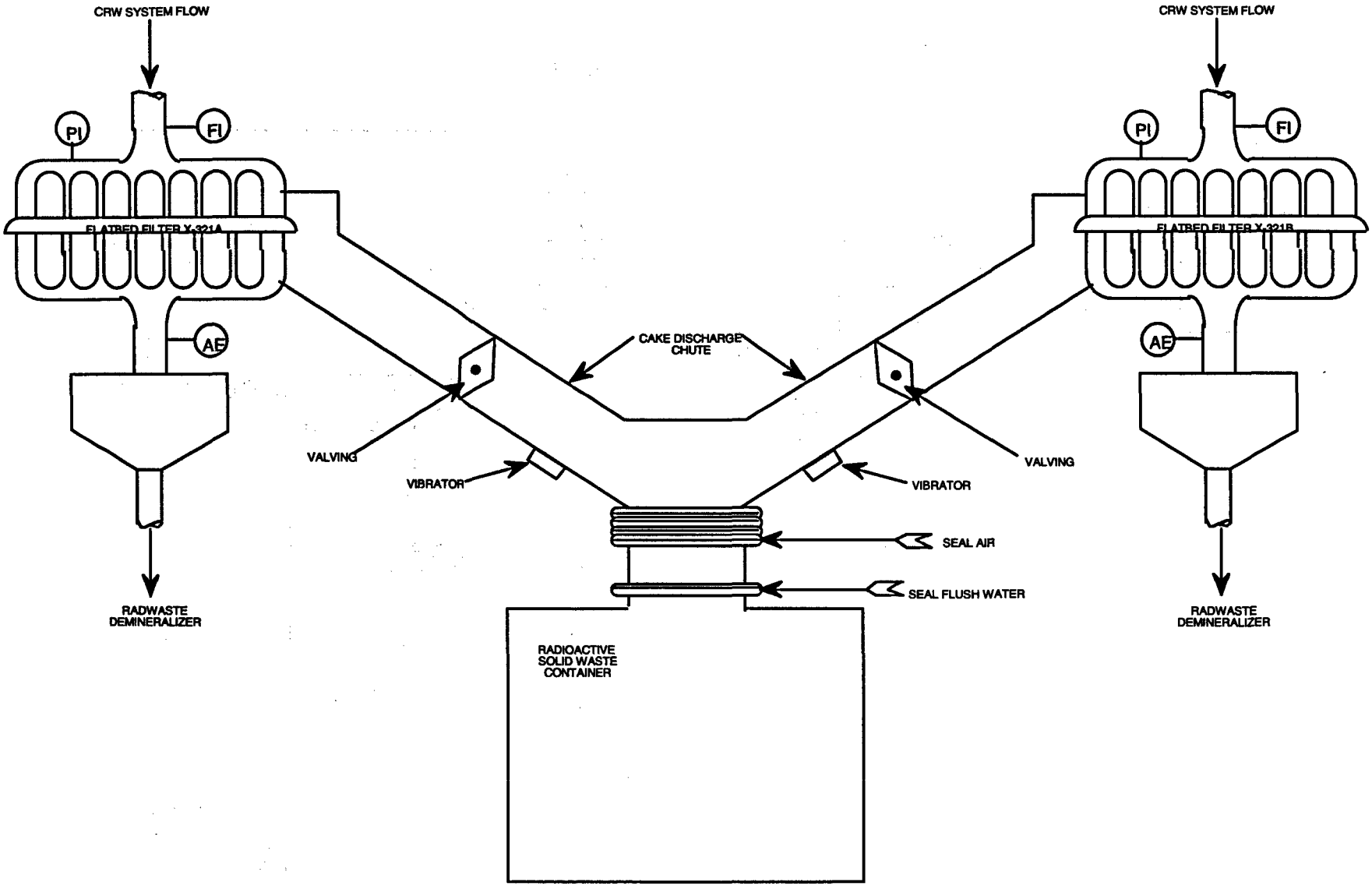
FIGURE 4



FLATBED FILTERS

60te1240d

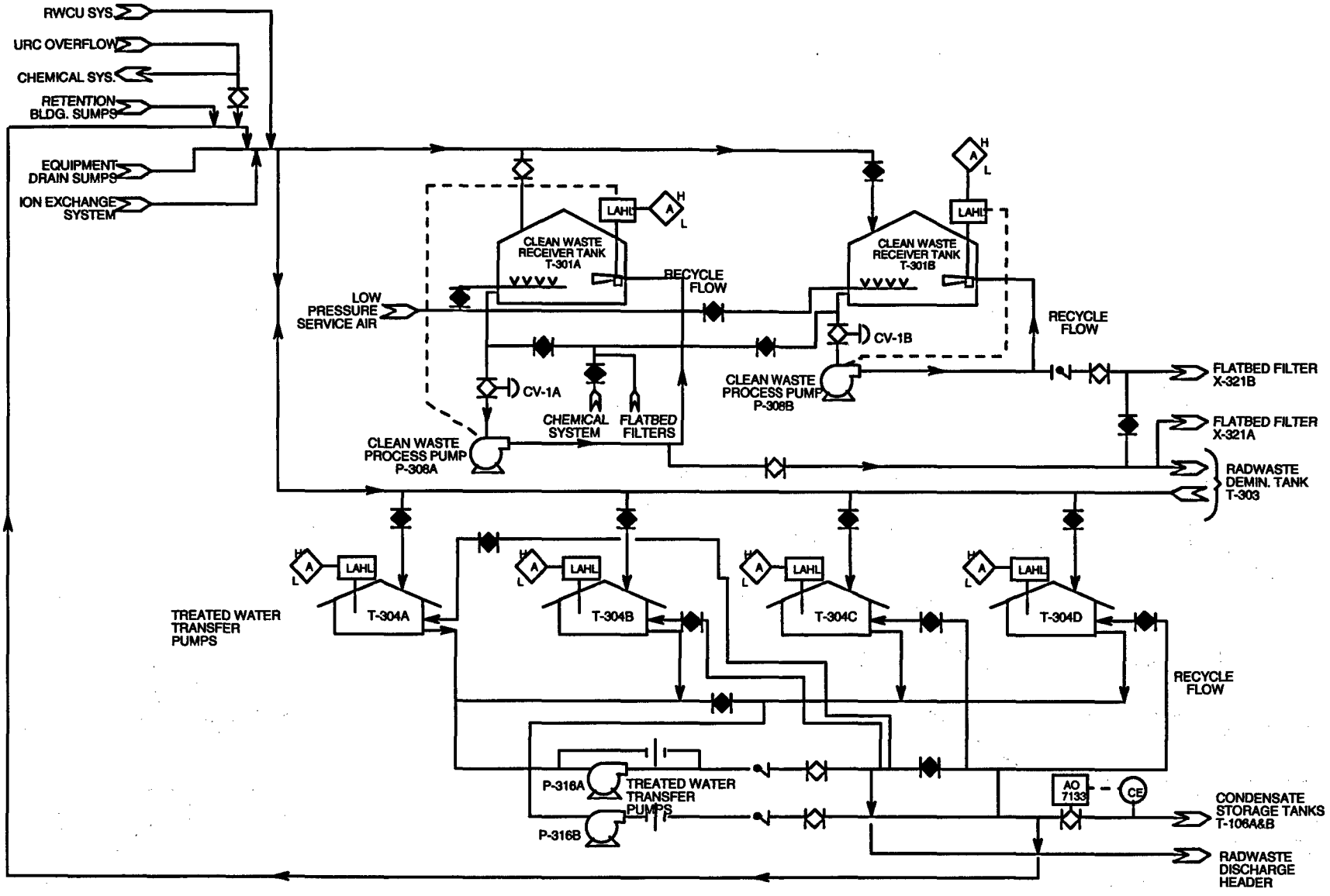
FIGURE 5



CLEAN RADWASTE AND RECOVERY SYSTEM

FIGURE 6

C-TS-03-05-08
TP-14
REV. 0
60te1240k



CLEAN RADWASTE SYSTEM

FIGURE 7

C-TS-03-05-08
TP-6
REV. 0
60te1240o

RAD-DEMIN

REFERENCE TEXT

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RAD-DEMIN

References

A. FSAR
None

B. Piping and Instrumentation Drawings

1.	Radwaste Filter/Demineralizer	M-273
2.	Clean Radwaste System	M-233 sh 1 of 2
3.	Chemical & Non-Reclaimable Radwaste System	M-234
4.	Radwaste System Filt/Demin skid outline	M-297-1

C. Vendor Manuals
1. Anatel Instrument Corporation, A 100 user guide, part no. FG/57000-D4, Dec. 86
2. Westronics Series 2100 Miniature programmable recorder
3. KEP (kessler Ellis Products Co.) Intellect-69PM2 Process Monitor
4. L&N (Leads & Northrup) Model 7082 Conductivity Analyzer
5. L&N (Leads & Northrup) Model 7758 ph Analyzer
6. Fisher type DPR900 Intregrl Controller

D. Vendor Drawings
1. TTI Engineering Dwg 1346B-K-121

E. PNPS Procedures
1. Pre-Operational Functional Test of new Radwaste filter/demineralizer system TP94-011
2. PNPS 2.5.2.118
3. PNPS 2.5.2.72 Clean Radwaste System
4. PNPS 2.5.2.73 Chemical Radwaste System

F. Technical Specifications
1. None

G. Other
1. PDC 92-73

List of Effective Pages		Tables	Attachments	Figures
RD-1	RD-9	1	None	1
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Reviewed by/Date _____

Approved by/Date _____

RAD DEMIN

A. OVERVIEW

This text will describe the Radwaste Filter/Demineralizer function and operation at Pilgrim Nuclear Power Station.

B. SYSTEM DESCRIPTION

1. System Purpose

The Radwaste Filter/Demineralizer processes high conductivity liquid radwaste (Chem. Radwaste) separately from low conductivity liquid radwaste (clean radwaste). This system offers operational flexibility to allow multiple sluicable media to control a particular intrusion. In order to minimize the impact of chemical intrusion and to have a flexible system that allows treating water from various sources and allows repairs without the loss of radwaste processing capability, additional filtration and demineralization capacity are provided by the addition of this system.

2. Design Basis

The new filter/demineralizers can process liquid radwaste at 35 gpm in series flow or up to 100 gpm in parallel flow. Skid valve line ups are provided by remote manual valve operation from a new control panel installed at -13' elevation at the bottom of the access stairwell.

The new filter/demineralizer system is integrated into the existing radwaste systems. New cross connecting piping allows influent to the new filter demineralizer system to come from either the chemical waste pumps, clean waste pumps, or the monitor tank pumps. The valve line up to choose the source of influent is made manually by positioning the appropriate valves. These manual valves are accessible from the radwaste corridor.

Effluent from the new filter/demineralizer system is directed to the existing three-way valve (AO2508) in the radwaste corridor. One path from the three-way valve can be manually directed to the treated water tanks or the clean waste tanks. The other path from the three-way valve can be manually directed to the chemical waste tanks or the monitor tanks. The three-way valve itself can be switched from one path to the other by either remote manual control from the new control panel or automatically based on conductivity.

3. System Components

a. Filter/demin skid
   1. (2) 35 cu. ft. deep bed filter/demineralizer pressure vessels
   2. Rad. shielding (wall with access door)
   3. Pipes and associated valves for:
      a) process in
      b) resin in
      c) instrument air
      d) service air
      e) resin out
      f) process out
      g) condensate transfer water in (two separate tie-ins)

b. Control panel C-142

c. Resin addition hopper
   1) Hopper block valve 20-HO-47

d. F/D return three-way valve AO-2508

e. Hand operated valves

4. Basic System Operation

The new filter/demineralizer system normally processes water from the chemical waste tanks (2 tanks -- 15,000 gallons each) discharging to the treated water tanks (4 tanks -- 18,000 gallons each) when the discharge is in specification. The new filter/demineralizer system normally discharges to the treated water tank header on the tank A end. This allows simultaneous processing through the new filter/demineralizer system into treated water tanks A or B and from the radwaste demineralizer into treated water tanks C or D by closing manual block valves (either 269 or 270) between the two pairs of treated water tanks.

The alternate normal discharge path for effluent from the new filter/demineralizer system is to the clean waste tanks (2 tanks -- 15,000 gallons each). To employ this alternate path, a manual valve lineup is necessary.

The off-specification discharge from the new filter/demineralizer system is directed to the monitor tanks (3 tanks 20,000 gallons each). This diversion can be initiated automatically upon high conductivity or by remote manual control by switching of a 3-way valve on the discharge line.

The alternate off-specification discharge path for effluent from the new filter/demineralizer system is to the chemical waste tanks. To employ this alternate path, a manual valve lineup is necessary.

Resin is added to the new filter/demineralizer system via a new resin hopper located in the radwaste trucklock. Resin is manually charged to the resin hopper and flushed into one of the two demineralizer vessels using decon water piped to the hopper from a local header. Water is removed during resin fill through a freeboard drain on the new filter/demineralizer system skid piped to a local floor drain. Resin level can be determined via sight glasses (one on each vessel) which are accessed by a door in the local shielding.

Resin is removed, when spent, by sluicing to the spent resin tank. This is accomplished by pressurizing the demineralizer vessel with air (pressure indication is on the control panel) and pushing the resin/water into the spent resin tank.

C. COMPONENT DESCRIPTION

1. Rad-Demin Skid

The new filter/demineralizer system provides two filter/demineralizer vessels, each 35 cubic feet of resin capacity, installed in the electric cart (*King Kong*) room at -13' elevation in the radwaste building. The new filter/demineralizer unit is skid mounted (approximately 8' by 8' by 8' high).

a. Filter/Demineralizers (2)

The new filter/demineralizer system contains 35 cubic feet of resin in each vessel for a total of 70 cubic feet (See Table 2).

Under normal conditions, the new filter/demineralizer system can process approximately 900,000 gallons of clean waste tank influent or 400,000 gallons of chemical waste tank influent before exhaustion. This is approximately 55 clean waste tank volumes or 27 chem waste tank volumes. At 35 gpm, this results in 25 days operation on clean waste tank influent (based on two shift operations per day) or 12 days operation on chemical waste tank influent.

b. Shielding

An eight foot long by approximately eight foot high, six inch thick lead shot full wall separates the two F/D tanks from the front half of the skid. This wall provides radiation shielding for the operators. An inspection door is provided for access to sight glasses in the F/D tanks to monitor resin and water level.

c. Pipes and Valving

The following air-operated valves are located on piping contained with the F/D skid, are remotely controlled from panel C-142 and are designed to fail closed.

The bypass valve AO-71009 allow flow to bypass both filter demineralizers.

Each F/D has an inlet valve (AO-7161A&B). They provide F/D inlet isolation.

Each F/D also has a resin addition valve (AO-7162A&B) to provide resin from the resin addition hopper.

To provide F/D venting to Chrw, each vessel is equipped with vent valve (AO-71004A&B).

Outlet of process water can be isolated from each filter/demin by valves (AO-7167A&B).

F/D resin removal is through (AO-7163A&B) for the upper part of the bed and any remaining via (AO-7164A&B). Air and condensate for backwashing resin from the F/D is through (AO-7166A&B) through internal lateral.

Service air to the top of the resin beds are through (AO-71005A&B).

Service air to bottom laterals are through (AO-7166A&B).
Condensate xfer to F/D for sluicing spent resin is through (AO-7168).

A drain flow path to Chem Radwaste for each F/D demin is through (AO-71008A&B).

Process flow is controlled by flow control valve (FCV-7195).

2. Control Panel C-142

The new filter/demineralizer system is controlled from control panel C-142, located on the -13' elevation. The panel is operable from the landing at the foot of the stairway to the -13' elevation. The new filter/demineralizer system incorporates several control loops. They are flow, conductivity, pH, differential pressure, vessel pressure, and total organic carbon. These loops are 24 volt DC power supply in the control panel. The pH, differential pressure, and total organic carbon signals are used for local panel monitoring and alarming only. The flow signal is also used to position a flow control valve on the discharge of the new filter/demineralizer system. The conductivity signal is also used to control the existing three-way valve (AO-2508) in the radwaste corridor. This provides automatic diversion in the case of high conductivity. The vessel pressure signals are used to monitor pressure for normal operations and when transferring resin out of the vessel with air.

The control panel provides open/closed control for all skid mounted air-operated valves. Position indication is provided by local limit switches for each valve. Each valve has a green light energized when the valve is not fully open and a red light energized when the valve is not fully closed. This means that the green light is on when the valve is fully closed and the red

light is on when the valve is fully open. Both lights are on in any intermediate position. This is accomplished by using the normally closed contacts of the open limit switch to drive the green light and the normally closed contacts of the closed limit switch to drive the red light.

The control panel also houses the analog instrumentation described above. Each analog instrument has a visual display. A four point inkless recorder records flow, conductivity, pH, and total organic carbon. This recorder provides totalizer functions. The four point recorder also provides alarm signals at the new filter/demineralizer system control panel.

A common trouble alarm, initiated from the new filter/demineralizer system control panel, annunciates in the radwaste control room.

3. **Resin Addition Hopper**

The resin addition hopper located in the radwaste truck lock is equipped with a demin water supply for sluice of resin to the F/D.

A block valve (20-HO-47) provide system isolation.

4. **F/D Return Three-Way Valve**

Effluent from the new filter/demineralizer system is directed to the existing three-way valve (AO-2508) in the radwaste corridor. One path from the three-way valve can be manually directed to the treated water tanks or the clean waste tanks. The other path from the three-way valve can be manually directed to the chemical waste tanks or the monitor tanks. The three-way valve itself can be switched from one path to the other by either remote manual control from the new control panel or automatically based on conductivity.

5. Hand Operated Valves

Located in the radwaste corridor are the following hand-operated valves. Downstream of the inspec. branch (low conductivity) from AO-2508 are 20-HO-21 valve to the treated water tanks and 20-HO-432 to the clean waste receiver tanks. Downstream of the out of spec. branch (high conductivity) from AO-2508 are 20-HO-361B valve to the monitor tanks and 20-HO-44 valve to the chem waste receiver tanks.

Also in the radwaste corridor on process in-lines are 20-HO-339 (mezzanine above filter room) from the monitor tank, 20-HO-45 from the chem waste receiver tanks, and 20-HO-271 and 20-HO-42 from the clean waste receiver tanks.

D. INSTRUMENTATION AND CONTROLS

1. Control Room Instrumentation

None

2. Local Instrumentation

Instrument/Location	Description
Cond supply valve flow controller Panel C-142 Upper right	0-100% valve 7168 pos. HC-7168
A F/D pressure indication Panel C-142 Upper right	0-100 psig PI-71006A
A F/D diff pressure indicator Panel C-142 Lower right	0-100 psid DP-7198A
4-Point recorder panel C-142 Upper center	PH-0-14 Conductivity 0-2.0 US/CM Total organic carbon 0-500 PPB Flow 0-100 gpm
B F/D pressure indicator Panel C-142 Upper left	0-100 psig PI-71006B
Process flow controller Panel C-142 Right	0-100 gpm FC-7195
pH indicator Panel C-142 Upper right	0-14 PHI-7196
Conductivity indicator Panel C-142 Upper right	0-2.0 us/cm CI-7197
Total organic carbon Panel C-142 Lower right	0-500 PPB AT-7199
B F/D diff. pressure indicator Panel C-142 Lower left	0-100 psid DPI-71981B

3. Alarms

Title/Location	Setpoint
Panel 142 Trouble C-20	Any panel 142 alarm Not yet installed
F/D common Panel 142 Upper left Low pH High pH High conductivity Low process flow High DP High total organic carbon	 6.0 and lowering PHI-7196 8.0 and rising PHI-7196 .06 us/cm rising CI-7197 5 gpm and lowering FC-7195 25.0 psid and rising DPI-7198A&B 100 PPB and rising AT-7199

4. Interlocks and Trips

Interlock or Trip	Function
High conductivity of F/D	High conductivity >0.1 us/cm Trips three-way valve 2508 from inspec (to clean waste receiver tanks or treated water tanks to out of spec (to chem waste receiver tanks or monitor tanks) when switch for AO-2508 is in auto

5. Control Room Controls (Radwaste)

None

6. Local Controls

Item/Location C-142	Functions of Positions
Resin in vessel A control switch Lower left (7162A)	OPEN Valve opens (red light on) CLOSE Valve closes (green light on)
Resin in vessel B control switch Lower left (7162B)	OPEN Valve opens (red light on) CLOSE Valve closes (green light on)
Air to vessel A control switch Lower left (71005A)	OPEN Valve opens (red light on) CLOSE Valve closes (green light on)
Air to vessel B control switch Lower left (71005B)	OPEN Valve opens (red light on) CLOSE Valve closes (green light on)

6. Local Controls (cont.)

Item/Location C-142	Functions of Positions	
Condensate in control switch Lower left (7168)	AUTO	Valve position controlled by HC7168 cond supply controller setting (red light on) and green light on during valve travel
	CLOSE	Valve closes (green light on)
Process in A control switch Lower left (7161A)	OPEN	Valve opens (red light on)
	CLOSE	Valve closes (green light on)
Air to screens control switch Lower left (7169)	OPEN	Valve opens (red light on)
	CLOSE	Valve closes (green light on)
Resin out vessel A control switch Lower left (7163A)	OPEN	Valve opens (red light on)
	CLOSE	Valve closes (green light on)
Resin out vessel A control switch Lower left (7164A)	OPEN	Valve opens (red light on)
	CLOSE	Valve closes (green light on)
Air/cond to screen A control switch Lower left (7164B)	OPEN	Valve opens (red light on)
	CLOSE	Valve closes (green light on)
Vent vessel A control switch Lower center (71004A)	OPEN	Valve opens (red light on)
	CLOSE	Valve closes (green light on)
Air/cond to screen B control switch Lower center (7166B)	OPEN	Valve opens (red light on)
	CLOSE	Valve closes (green light on)
Vent vessel B control switch Lower center (71004B)	OPEN	Valve opens (red light on)
	CLOSE	Valve closes (green light on)
X-tie valve control switch Lower center (7165A)	OPEN	Valve opens (red light on)
	CLOSE	Valve closes (green light on)
X-tie valve control switch Lower center (7165B)	OPEN	Valve opens (red light on)
	CLOSE	Valve closes (green light on)
Process in F/D B control switch Lower center (7161B)	OPEN	Valve opens (red light on)
	CLOSE	Valve closes (green light on)
Resin out F/D B control switch Lower center (7163B)	OPEN	Valve opens (red light on)
	CLOSE	Valve closes (green light on)
Resin out F/D B control switch Lower center (7164B)	OPEN	Valve opens (red light on)
	CLOSE	Valve closes (green light on)
Process out F/D B control switch Lower right (7167B)	OPEN	Valve opens (red light on)
	CLOSE	Valve closes (green light on)
Freeboard drain B control switch Lower right (71008B)	OPEN	Valve opens (red light on)
	CLOSE	Valve closes (green light on)
Freeboard drain A control switch Lower right (71008A)	OPEN	Valve opens (red light on)
	CLOSE	Valve closes (green light on)
Process out F/D A control switch Lower right (7167A)	OPEN	Valve opens (red light on)
	CLOSE	Valve closes (green light on)
System bypass control switch Lower right (71009A)	OPEN	Valve opens (red light on)
	CLOSE	Valve closes (green light on)

6. **Local Controls (cont.)**

Item/Location C-142	Functions of Positions	
Flow control control switch Lower right (7195)	AUTO	Valve position controlled by FC7195 (red light and green light on during valve travel)
	CLOSE	Valve closed (green light on)
3-Way diverter control switch Lower right (2508)	MONITOR/ CHEM	Valve lined up to monitor/chem tanks (green light on)
	TW/CLEAN	Valve lined up to TW/clean tank (red light on)
	AUTO	Valve lined up to TW/clean tank (red light on) will auto switch to monitor chem on high conductivity >1.0 us/cm

E. SYSTEM INTERRELATIONSHIPS

1. Power Supply

   Light panel BK PL 29L supplies all electrical requirement for control panel C142 lights, alarms, limit switches, solenoid valves, instruments and 24 volt DC internal power supply. The panel is located in the landing outside the door to the main control room annex.

2. Radwaste system provides the water to be treated from clean waste receiver tanks, chem waste receiver tanks and radwaste monitor tank and discharges treated water to clean, chem treated and monitor tanks.

3. Instrument air is provided for operation of all air-operated valves in the radwaste filter/demineralizer system.

4. Service air is utilized for blowing spent resin from the Rad F/D to the spent resin storage tank.

5. Condensate transfer is used to sluice resin in the spent resin removal and also to rinse the F/D clean afterwards.

6. Demin water is used to sluice new resin to the F/D from the resin addition hopper.

F. SYSTEM OPERATIONAL SUMMARY

In summary, the new filter/demineralizer system can process water from the chemical waste, clean waste or monitor tanks and send the effluent to the treated water/clean waste tanks or monitor/chemical waste tanks.

The new filter/demineralizer system processes liquid radwaste at a normal flow rate of 35 gpm. Normal flow is processed in series or parallel, depending upon the quantity of dissolved solids. The design flow is 100 gpm which can only be handled by parallel flow due to the pump and piping limitations.

G. INDUSTRY LESSONS LEARNED

None

TABLE 1

The design input and output is listed in the following table. It generally reflects the chemical waste tank contents for influent. The clean waste tanks are higher quality and the monitor tanks are lower quality.

Parameter	Specified Influent	Specified Effluent
Conductivity	50 uS/cm	.06 uS/cm
Radioactivity	2E-03 uCi/ml	1E-06 uCi/ml
Total Organic Carbon	2 ppm	100 ppb
Chloride	10 ppm	5ppb
Nitrite	2 ppm	1 ppb

Table 2

Chemical Waste Tanks	Normal Abnormal Maximum	40 to 50 umho/cm, 10 ppm chlor 80 to 100 umho/cm 200 umho/cm, 20 ppm chloride
Clean Waste Tanks	Normal Maximum	20 umho/cm or less, <6 ppm chl 40 umho/cm, 7 ppm chloride
Monitor Tanks	Normal	500 umho/cm, 100 to 200 ppm chloride

H. LIST OF FIGURES

1. F/D Skid M273
2. F/D Integration into RW
3. Chem to Treaded
4. Chem to Clean
5. Chem to Monitor
6. Clean to Treated
7. Clean to Chem
8. Clean to monitor
9. Monitor to Treated
10. Monitor to Clean
11. Monitor to Chem

Fig- 1

Radwaste Filter/Demin - PDC 92-73, Des. Rev. A GENERAL NARRATIVE Page ____ of ____

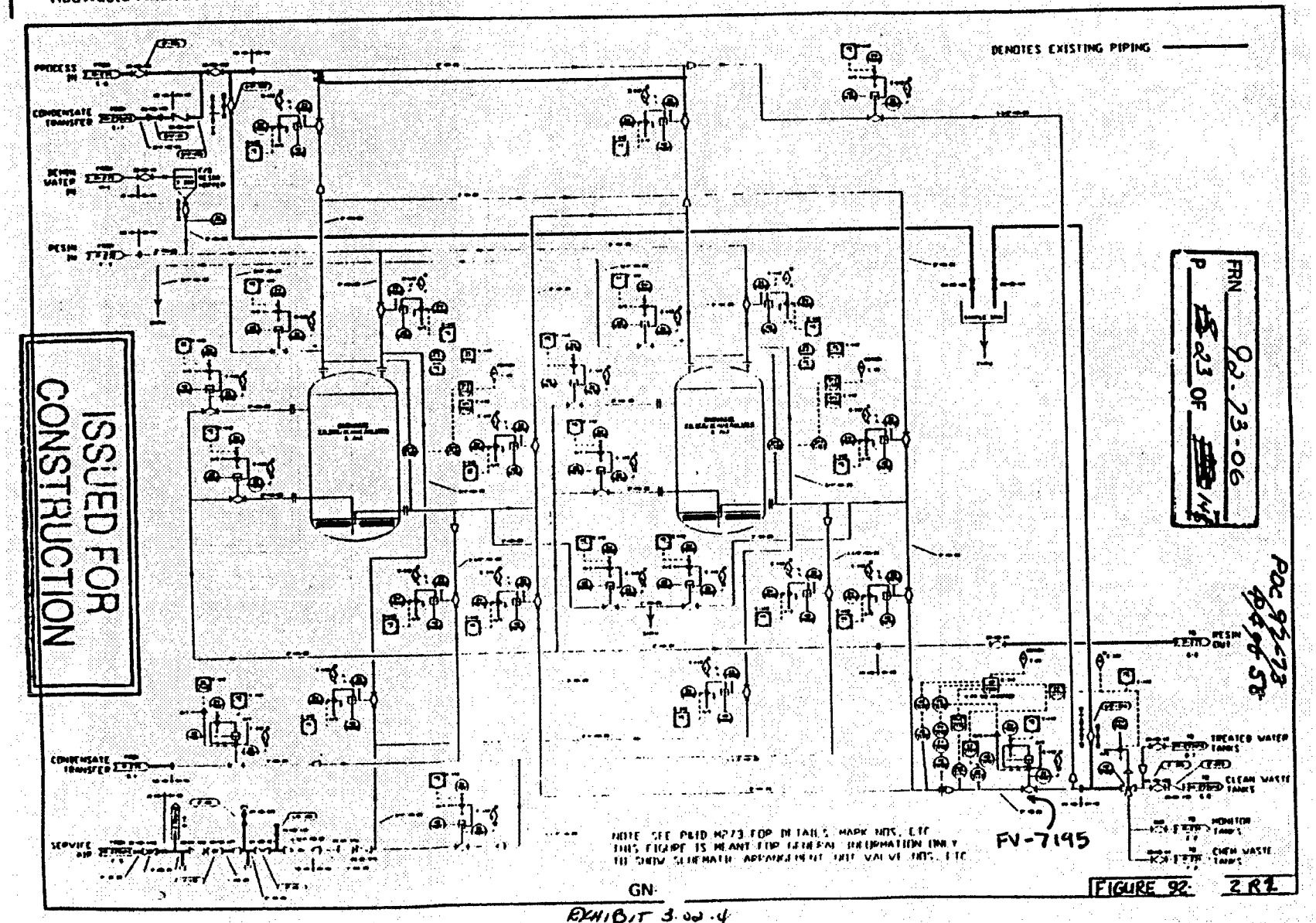

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EXHIBIT 3.00-4

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Radwaste Filter/Demin - PDC 92-73, Des. Rev. A GENERAL NARRATIVE Page ____ of ____

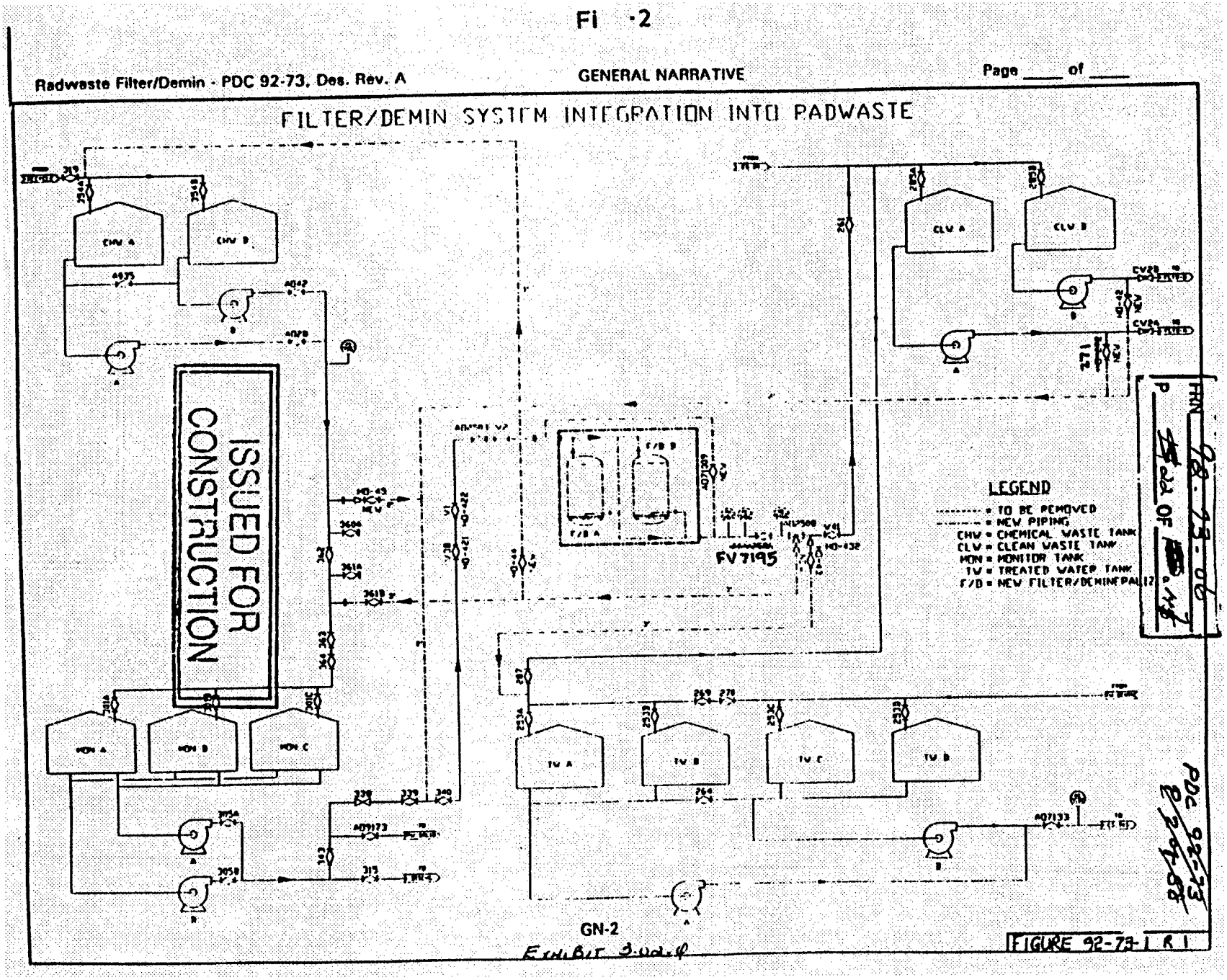

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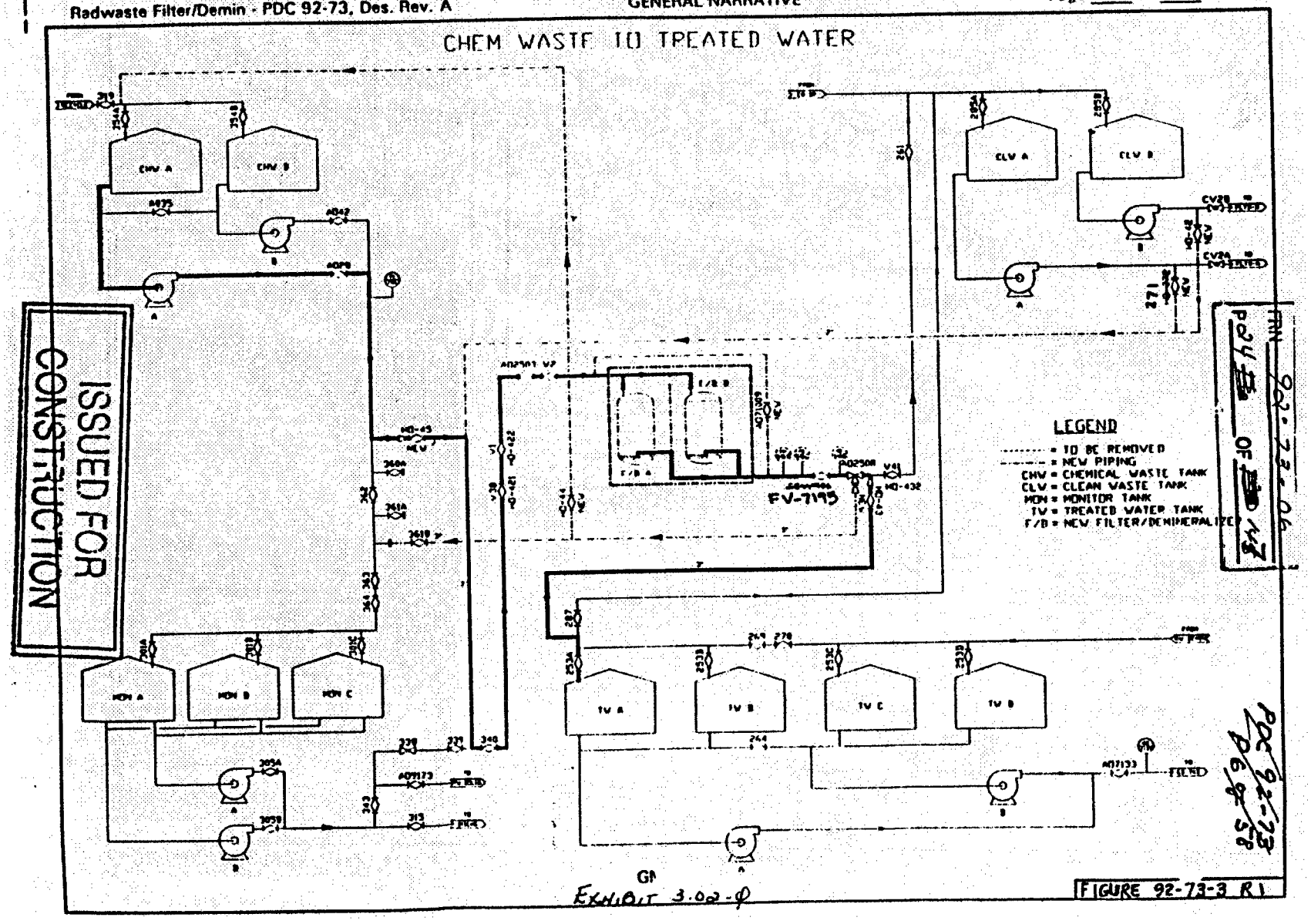
Exhibit 3 Vol. 9

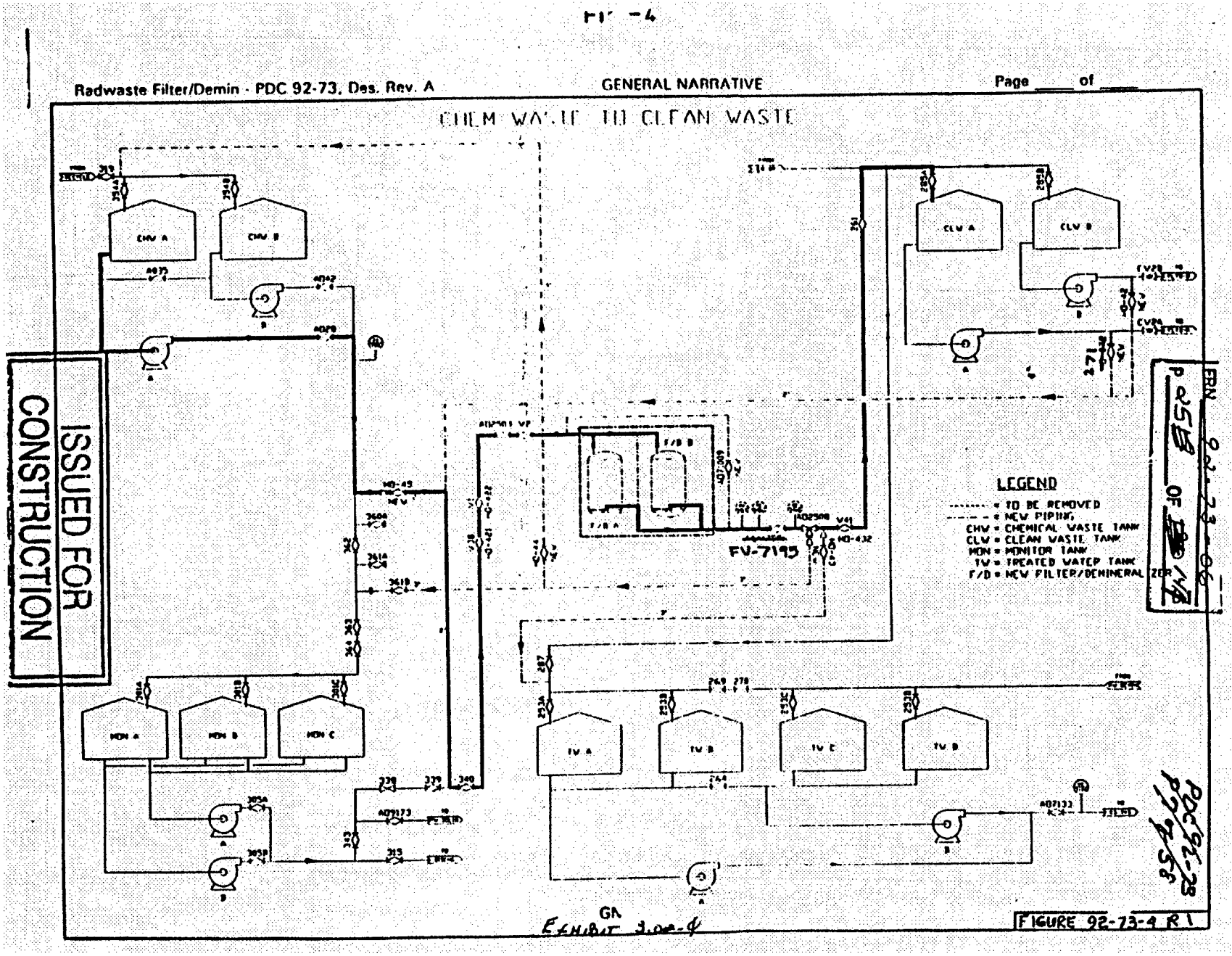
FIGURE 92-73-1 R1

Fig—3

Radwaste Filter/Demin - PDC 92-73, Des. Rev. A GENERAL NARRATIVE Page ____ of ____



Radwaste Filter/Demin - PDC 92-73, Des. Rev. A GENERAL NARRATIVE Page ____ of ____



Fig—

Radwaste Filter/Demin - PDC 92-73, Des. Rev. A GENERAL NARRATIVE Page ____ of ____

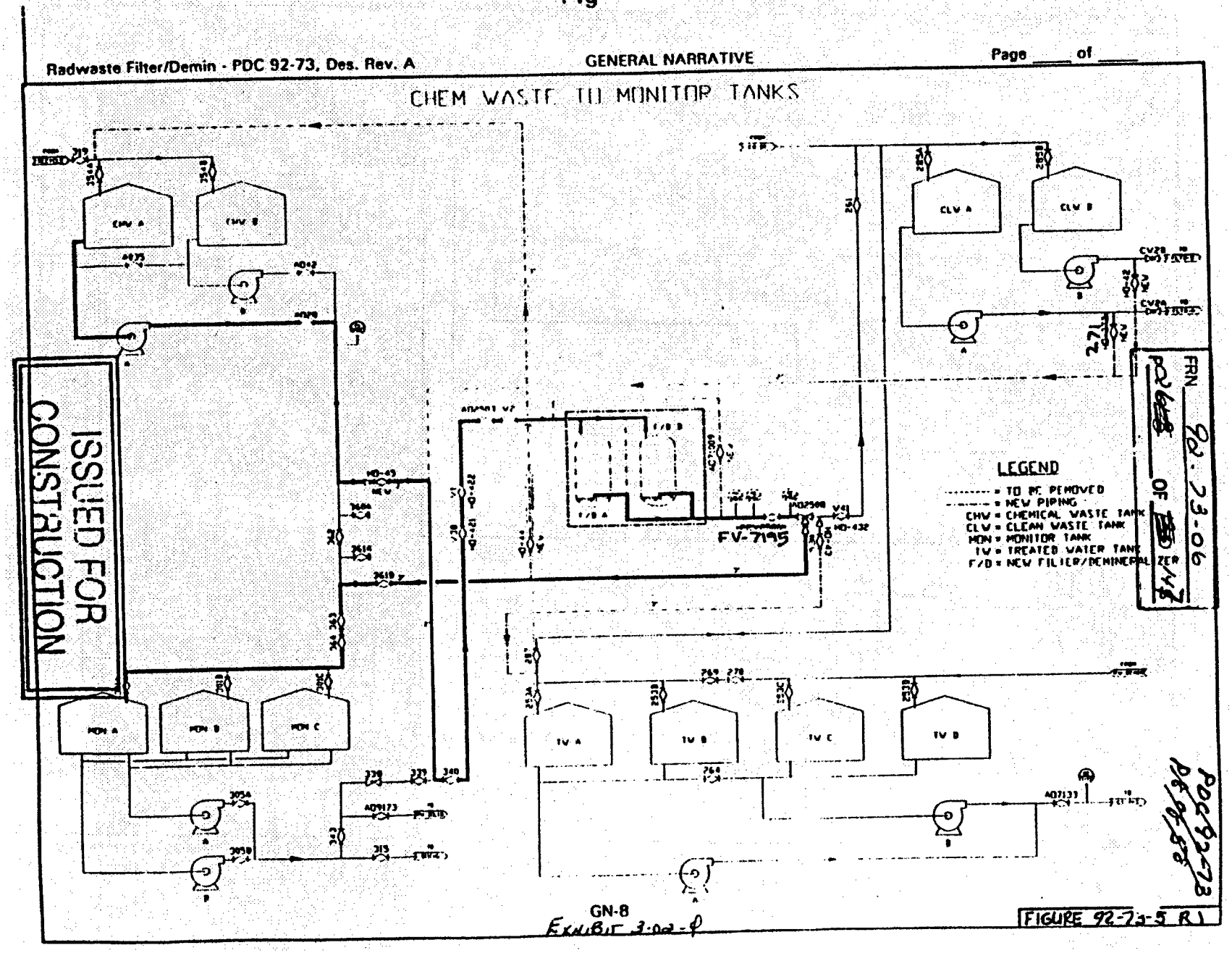


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Exhibit 3.02-f

FIGURE 92-73-5 R1

Fig-r

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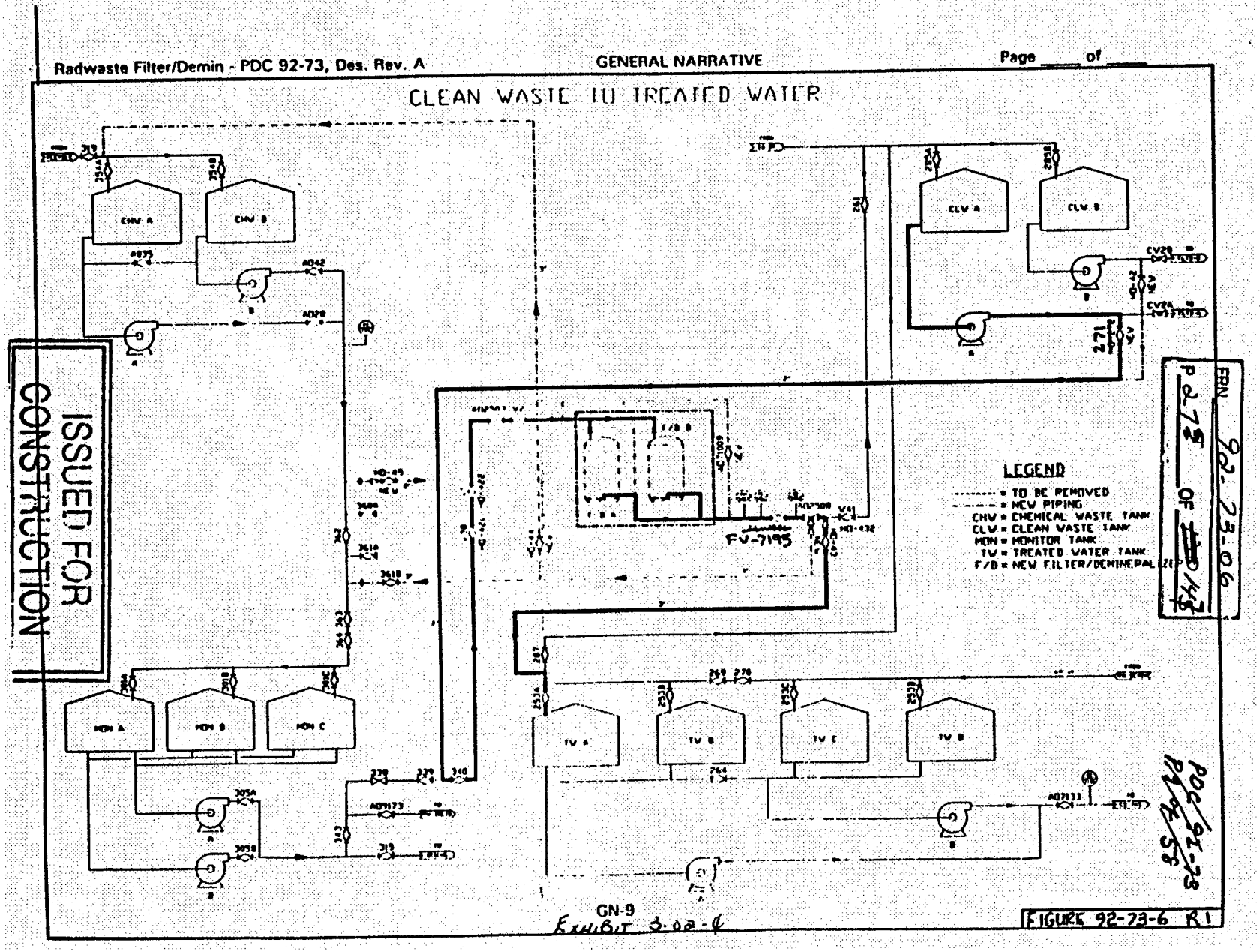

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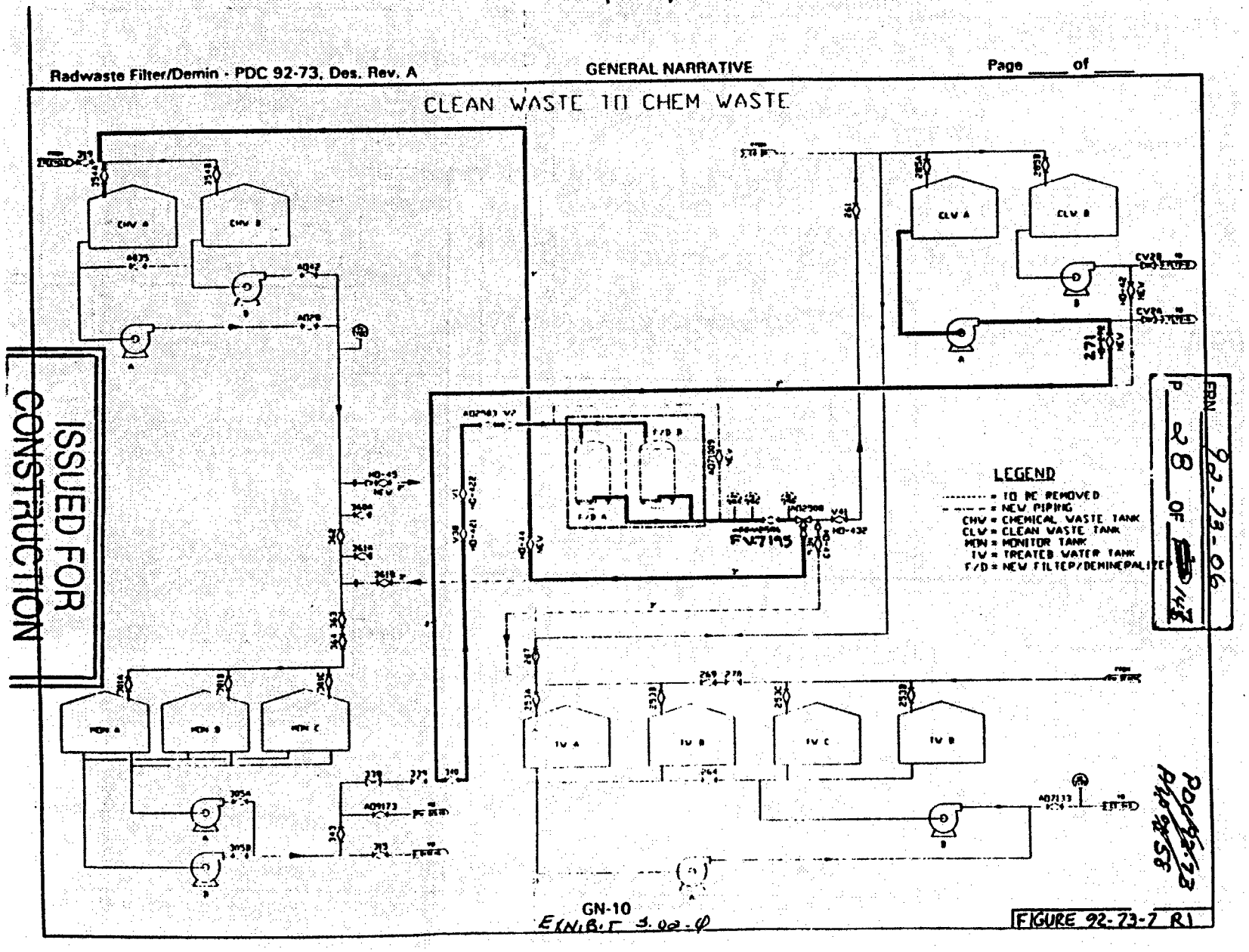

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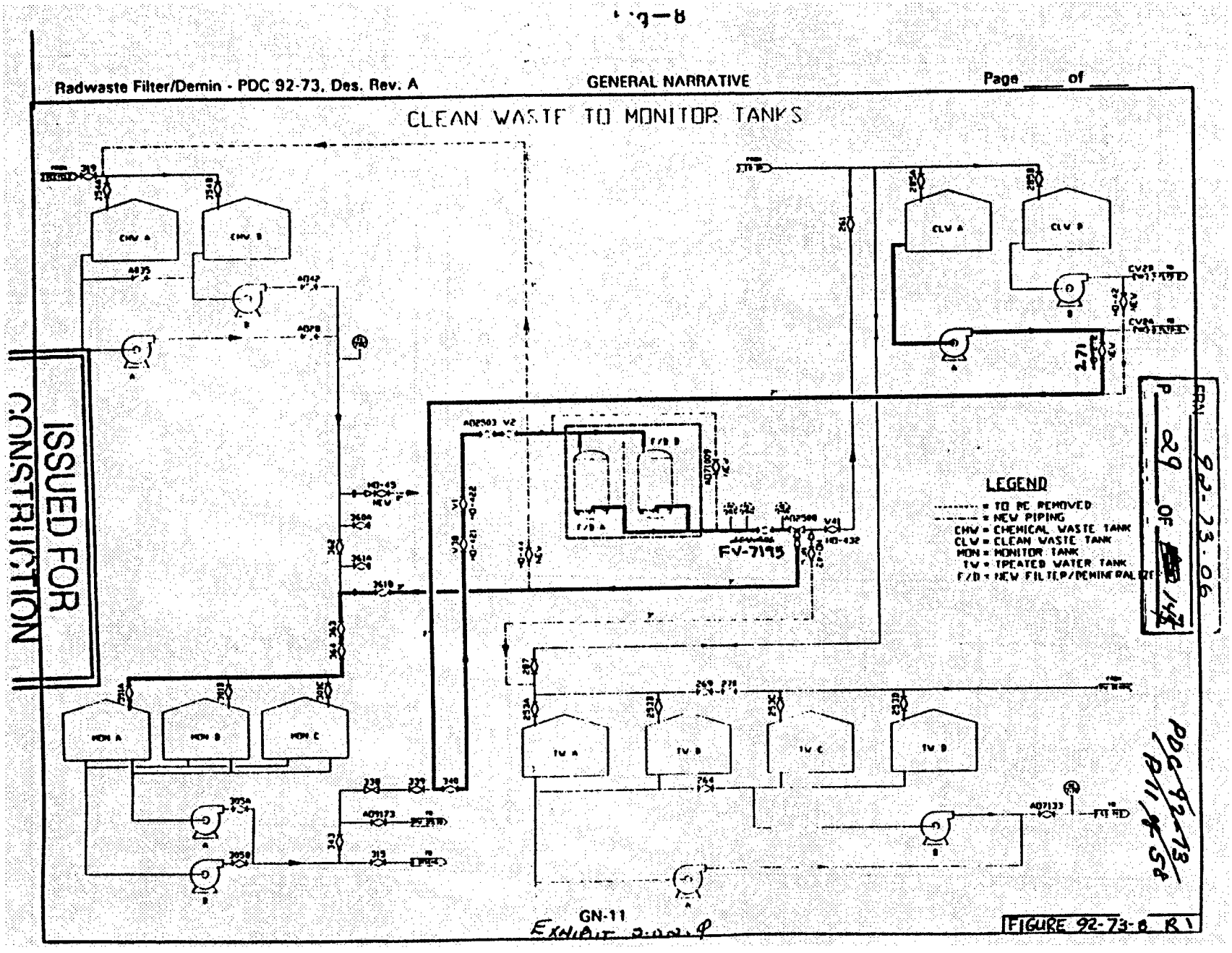
EXHIBIT 3.02-9

FIGURE 92-73-7 R1

Radwaste Filter/Demin - PDC 92-73, Des. Rev. A GENERAL NARRATIVE Page ___ of ___



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MONITOR TANKS TO TREATED WATER

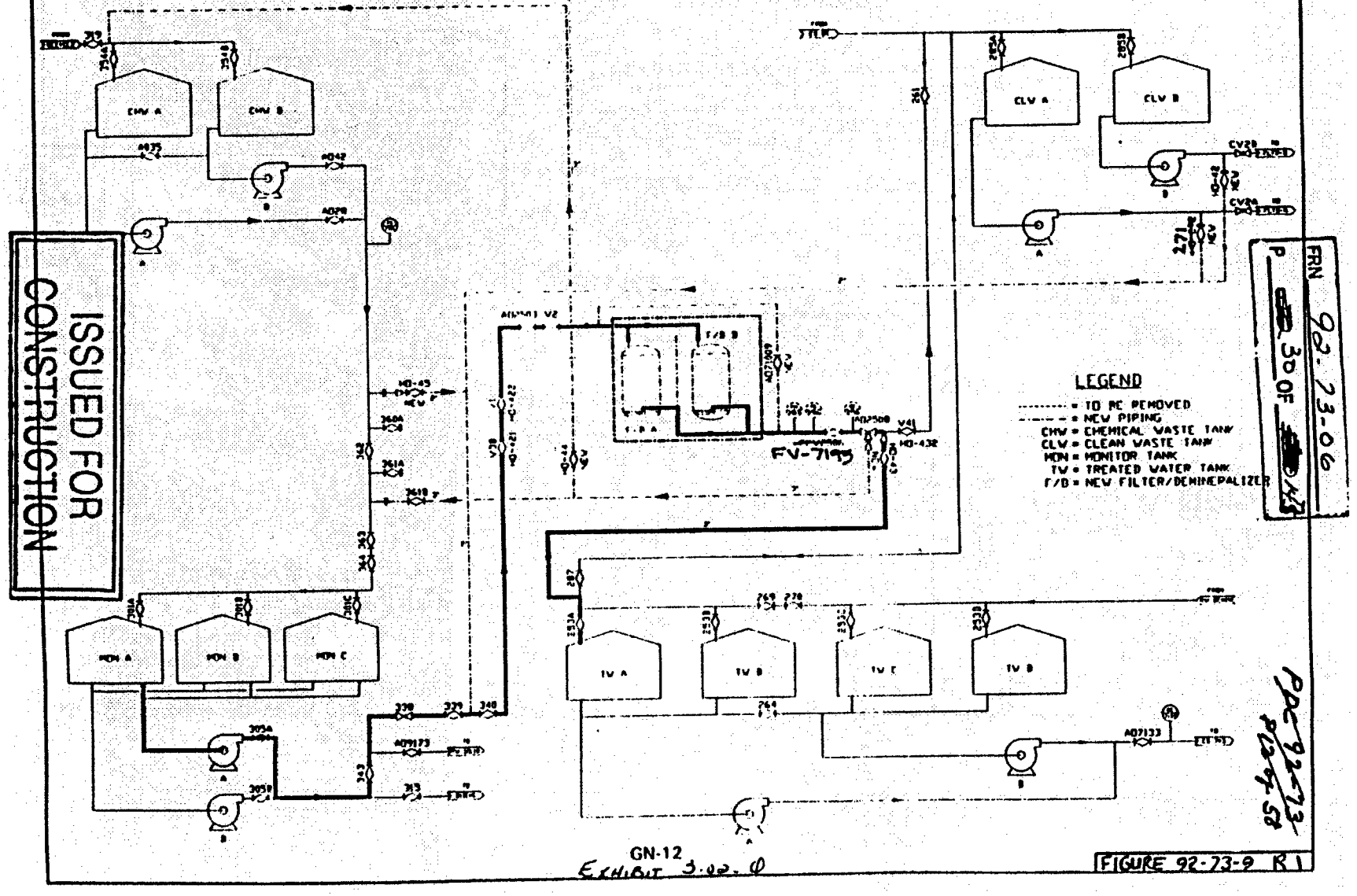

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FIGURE 92-73-9 R1

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MONITOR TANKS TO CLEAN WASTE

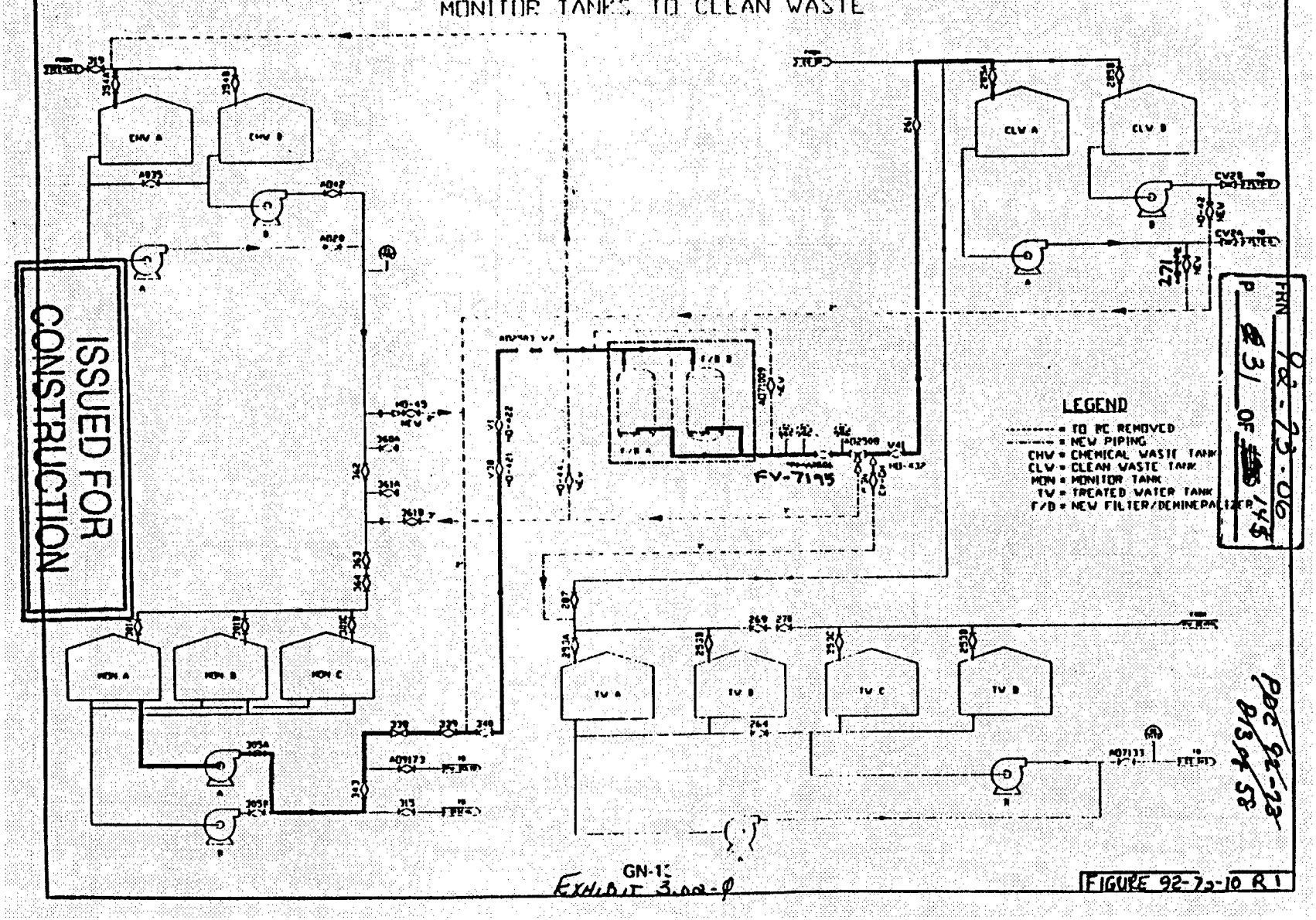

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FIGURE 92-73-10 R1

Fig. 11

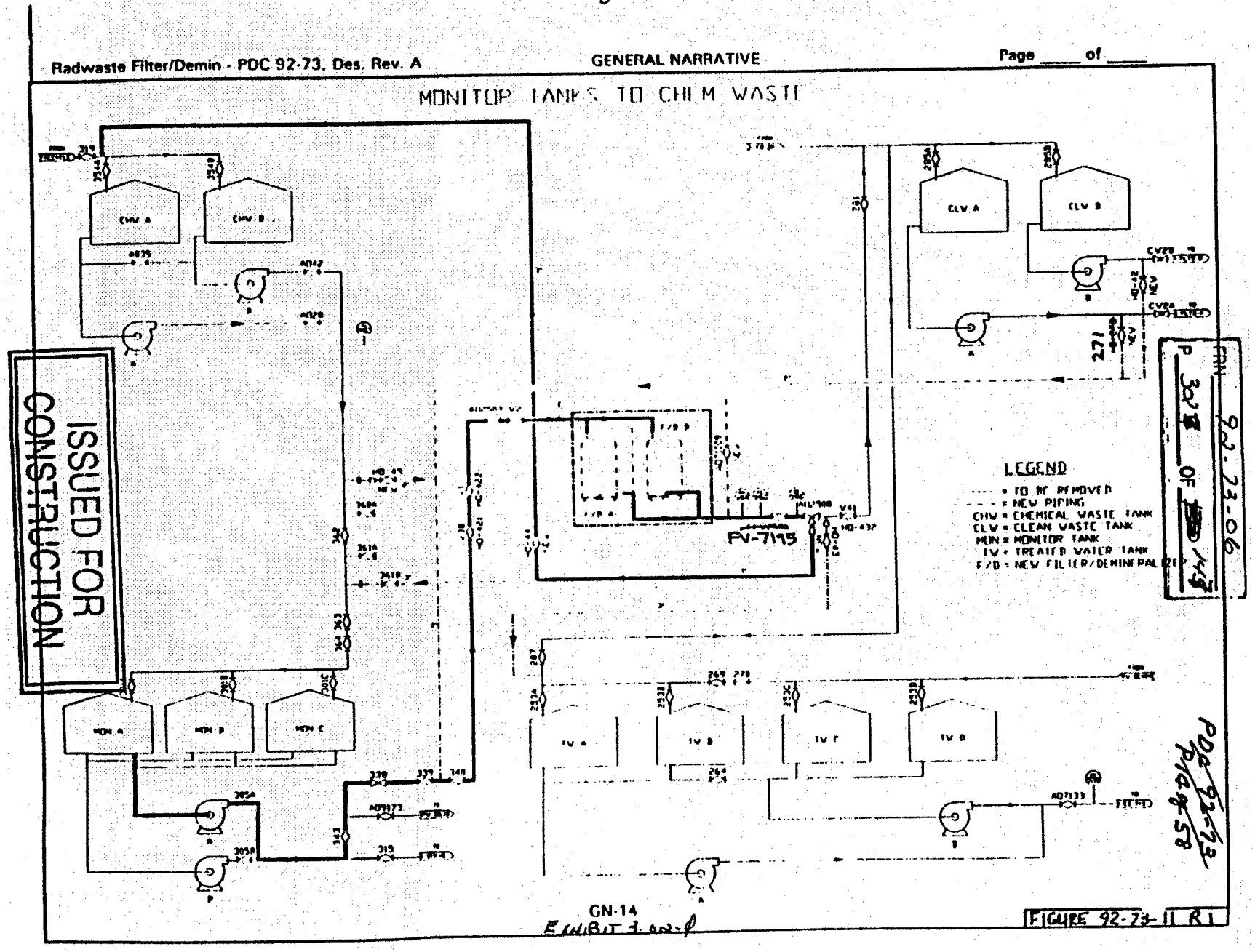

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EXHIBIT 3 and 4

FIGURE 92-73-11 R1

MISCELLANEOUS WASTE SYSTEM

Reference Text

Revisions

Date	Rev #	Description
03/25/96	1	New format; typos;Instrument Tables
07/12/96	2	Correct alarm locations and setpoints
12/08/99	3	Added information pertaining to the neutralizing sump.
9/22/04	4	Incorporate Pen & Ink changes to facilitate electronic files.
3/7/05	5	Added Figure 2.0 for Misc. Tank and Figure 3.0 for Neutralizing Sump. Removed reference to 7.9.5, Waste Neutralizing Sump Discharge procedure due to its retirement.

Revision March 07, 2005

Submitted by: Robert W. Geracie

Approved by/Date _____

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2. Chemical Radwaste System, M-234
3. Solids Recovery System, M-235
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C. PNPS Procedures

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2.5.1.1	Sluice Diatomaceous Earth from Filter Freeliner to Ecodex Liner
2.5.1.6	Dewatering the Spent Resin Tank from the Radwaste Trucklock
2.5.1.10	Transferring of Spent Bead Resin and Dewatering HIC Liners Using NU PAC Services (Pacific Nuclear) Dewatering Systems
2.5.1.11	Transferring of Sludge and Dewatering HIC Liners Using NU PAC (Pacific Nuclear) Dewatering Systems
2.5.2.17	Processing Liquid Radioactive Discharges
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2.5.2.127	Condensate Demineralizer Operations
2.5.2.128	Demineralizer Water Permit
7.9.12	Radioactive Effluent Tracking And Dose Assessment Software

D. Technical Specifications

1. Amendment No 177, Relocation of Radioactive Effluent Tech Specs (RETS) and Radiological Environmental Monitoring Program to ODCM

2. Section 5.5.4, Radioactive Effluents Control Program

MISCELLANEOUS WASTE SYSTEM

A. OVERVIEW

The liquids in the Miscellaneous Radwaste System have a potentially high detergent level and low radioactive content. They are collected in the miscellaneous drain tank for sampling. Based on sample results the tanks is batched to Chem Waste for processing or discharged at a controlled rate to the discharge canal.

Waste water from the auxiliary bay salt water sumps and floor drains from the 23' elevation of the auxiliary bay are collected in the neutralizing sump. They are sampled and analyzed here before discharge into the storm drain system.

B. SYSTEM DESCRIPTION

1. System Purpose

The miscellaneous radwaste system collects, stores, and discharges liquids having a high detergent level and low radioactivity concentration. Discharge is to the chemical waste system for further processing or to the environment for release.

2. Safety Design Bases

a. Collect low level radioactive liquid wastes that have potentially high detergent levels.
b. Provide processing of miscellaneous wastes such that operation and availability of the station is not limited.
c. Minimize radioactive liquid effluent releases to levels which are ALARA.

3. System Components (Figure 1)

a. Miscellaneous waste drain tank
b. Miscellaneous waste drain tank pump
c. Miscellaneous drain tank strainer
d. Neutralizing sump

4. Basic System Operation (Figure 1)

The miscellaneous radwaste system collects liquid radwaste (from floor drains in the personnel and machine shop decontamination areas, turbine washdown area, fuel cask decontamination area, and reactor head washdown area). Miscellaneous radwaste has a potentially high detergent level and relatively low radioactivity concentration.

Samples from the Miscellaneous Waste Drain Tank are tested and analyzed for quality and radioactivity level. Depending on the results, the water is routed to the chemical waste receiver tanks for processing or pumped to the discharge canal.

Flowpaths are determined through hand operated local valves. Level instrumentation installed in the tank assists in filling and draining processes.

The Neutralizing Sump collects water from local floor drains in the Aux Bay 23' or water pumped from the salt water sump in the "A" Aux Bay. When full, the sump is recirculated and air sparged for mixing. A sample is taken and if necessary water quality is adjusted to meet regulatory limits. When acceptable water quality has been achieved, the tank is pumped to a storm drain, which leads to the discharge canal.

C. COMPONENT DESCRIPTION

1. Miscellaneous Waste Drain Tank (Figure 1 OR P&ID M235)

Liquid radwaste from the personnel and machine shop decontamination areas and the turbine washdown area flows through drains to a common header which discharges to the miscellaneous waste drain tank (T-306). The drain tank is divided into two sections, with a baffle/divider plate, an east (A) and west (B) side. Each side holds 500 gallons. The drain header is equipped with two drain lines, one to each side. Four inch manually operated block valves are installed in each line. As one side fills to 60 percent capacity, the inlet valve to the other side is opened. Liquid radwaste held in a tank is recirculated, sampled, and analyzed. Depending on the results, water is drained to the chemical radwaste system for processing or pumped to the radwaste discharge header.
(See P&ID # M-235.)

Independent level instrumentation is installed in each side. The tank level alarm/pump trip selector switch (panel C-20) determines the instrumentation used. Level switch LS-7317A or LS-7320A initiate a high level alarm on panel C-20 during filling. A low level alarm is initiated by LS-7317B or LS-7320B during processing. Level switch LS-7317C or LS-7320C trip the pump on a low-low level.

The carbon steel horizontal tank is 8' long with an outside diameter of 4'6". The tank operates at atmospheric pressure. Vent lines prevent over pressurization. Drain lines to the chemical waste system are located at the bottom of the tank. Two inch manually operated block valves are installed in each line. Drain lines from the fuel cask decontamination area and reactor head washdown area are piped into both lines. Manually operated block valves are installed in those lines also. Each side is equipped with an overflow line at 1'9" from tank center. Overflow drains through separate lines to the chemical waste receiver tanks. Other inlet lines to the tank include recycle lines off of pump discharge.

2. Miscellaneous Waste Drain Tank Pump (Figure 1 OR P&ID M235)

The drain tank pump removes liquid radwaste from the drain tank and pumps it to the radwaste discharge header or recycles it back to the drain tank. Before liquid radwaste is discharged to the environment, it must be sampled, analyzed, and found to be acceptable. Recycle flow is used to get a representative sample or to transfer from one side of the tank to the other.

Controls to manually start and stop the pump are on panel C-20. The pump trips on a low-low tank level (1-1/2") or high radiation level in the discharge header. Suction for the pump is from the tank bottom. Manually operated block valves are used to select which side is to be emptied. The 1 HP-pump motor is rated for 30 gpm at a differential head of 30 feet. Net positive suction head required is 1.25 feet.

3. Miscellaneous Drain Tank Strainer (Figure 1 OR P&ID M235)

The drain tank strainer removes insoluble, suspended particles from flow to the discharge header. The strainer is located downstream of the drain tank pump and recycle line. The strainer is a duplex type strainer. High differential pressure across the strainer initiates an alarm on panel C-20.

4. Neutralizing Sump (P&ID M225)

The neutralizing sump is a 16,700 gallon tank located below the floor level of the 23' Aux bay. It is currently used to receive, hold, and treat water from the aux bay salt-water sump and floor drains in the 23' aux bay area prior to release into the storm drain. Recirculation and discharge of the sump contents are handled by one of two pumps rated at 100 gpm each. Pumps P-117A and P-117B are powered from B13, breakers 61 and 62.

Discharge of the neutralizing sump to the storm drain shall involve the Chemistry Department and the use of PNPS 2.5.2.17, PNPS 7.9.12, and PNPS 7.9.5. The neutralizing sump is placed in recirculation / sparge for a predetermined amount of time to ensure a representative sample can be obtained. Chemistry obtains a sample and performs analysis to ensure that radioactive limits and Environmental Protection Limits (as specified in the station NPDES permit) are not exceeded. Administrative limits (70 inches by procedure) are placed on maximum neutralizing sump level to prevent overflow during periods of recirculation / sparge.

If sampling determines that the sump contains an unacceptable level of Total Suspended Solids (TSS), an air driven pump and filtration skid can be utilized to filter the sump until acceptable levels are achieved.

D. INSTRUMENTATION AND CONTROLS

1. Control Room Instrumentation

None

2. Local Instrumentation

Instrument/Location	Description
LI-7316/7319 Panel C-20	Miscellaneous waste drain tank A/B level 0-100 percent
PI-7322 Local	Drain tank pump discharge pressure
FI-7321 Panel C-20	Drain tank pump discharge flow rate 0-30 gpm
LI-4702 Local	Neutralizing sump level
PI-4703 Local	Pump discharge press

3. Alarms

Title/Location	Setpoint/Initiating Device
Miscellaneous Waste Drain Tank Compartment A Low-High Level C20L E-1	1) 80% (increasing) 2) 10% (decreasing) LS-7317
Miscellaneous Waste Drain Tank Compartment B Low-High Level C20L F-1	1) 80% (increasing) 2) 10% (decreasing) LS-7320
Misc Drain Tank Filter High Diff Press C20C F-5	4 psid (increasing) PSID-7386
Misc Waste High D-P C20R E-2	4 psid (increasing) PSID-7386
Neut Tank High Level C33-Q2	72 inches water LS-4702

4. Interlocks and Trips

Interlocks and Trips	Functions
Drain tank pump trip	Low-low tank level (T-306) (LS-7317C/20C) (1-1/2") Prevent damage to the pump (P-317)
Drain tank pump trip	High radiation in discharge header (RM-1705-30) Control radiation release
Equipment lockout	High level in clean and chem waste. Receiver tanks will trip and lockout the respective equipment or floor drain sumps.

5. Control Room Controls

None

6. Local Controls

Interlock or Trip	Functions	
Drain tank pump Panel C-20	START STOP	Removes water from or recycles waste drain tank. Stops system flow.
Tank level alarm/pump trip selector switch Panel C-20		Determines monitored side of tank level instrumentation. Two position EAST-WEST.
Radiation monitor override switch	AUTO OVERRIDE	Radiation trips and alarm in effect. Input from monitor ignored.
Neut sump pump trip A/B	Low tank level LS 4702A(B)	

E. SYSTEM INTERRELATIONSHIPS

1. Chemical Radwaste System

Misc radwaste is routed to the chemical waste tanks for processing and reuse.

2. Instrument Air System

Instrument air is used for operation of control valves and level indications. Non-essential instrument air is used for the air driven diaphragm pump when filtering the neutralizing sump

3. LP Service Air

LP service air is used during recirculation / sparging of the neutralizing sump.

4. Power Supplies

a. Power for the reactor building floor and equipment sump pumps.
   - 480 VAC power center B-13.

b. Power for the drywell floor and equipment sump pumps.
   - 480 VAC power center B-21.

c. Power for the turbine building floor and equipment sump pumps.
   - 480 VAC power center B-22.

d. Power for the miscellaneous waste drain tank pump.
   - 480 VAC power center B-16.

e. Power for the retention building floor and equipment sump pumps.
   - 480 VAC power center B-31.

f. 120 VAC instrument power supply panel Y-1
   - Bkr 12 - Panel C-20 Instruments

g. 125 VDC distribution panel D-6
   - Bkr 7 - Radwaste Annunciators

h. Power for the neutralizing system pumps
   - 480 VAC power center B-13

5. Radwaste Liquid Effluent Process Radiation Monitoring System

Monitors radiation level (of discharge line) during discharge. Automatically trips the drain tank pump and auto-closes the overboard discharge valves on a sensed high radiation condition (see P&ID # M-234, section # B8).

F. SYSTEM OPERATIONAL SUMMARY

NOTE: This section outlines the major steps performed during system operations and is NOT intended to be substituted for plant operating procedures.

1. Normal System Operation (Figure 1)

a. Liquid radwaste from selected areas collects in one side of the drain tank. When one side fills to 60 percent, drainage is directed to the other side. Water in the filled side is recirculated, sampled, analyzed, and released. Valves to the east side of the tank (S-20-49) are normally open; and the west side (S-20-45) are normally closed. To remove water:

- open applicable pump suction valve
- open strainer isolation valves
- close recycle valves (S-20-50, S-20-46)
- start pump
- stop pump at low level alarm

The tank level alarm/pump trip selector switch is placed to the side being processed. Upon completion of processing, the selector switch should be selected to the side receiving drainage. Any overflow from the tank drains to the chemical radwaste system. Valves are equipped with stem extensions. They are controlled from the west wall of the radwaste corridor across from the radwaste filter slurry tank.

b. Discharges

Shift Manager

1) Reviews and signs PNPS 7.9.12, Att. 1.0.

2) Personally supervises the lineup of valves for the tank to be discharged and checks off such verification on Att. 1.0.

3) Sets Radwaste Effluent Monitor alarms and trip as specified on Att. 1.0.

4) Checks off this item in the permit, signs it to authorize the discharge, then gives the form to the Nuclear Auxiliary Operator who makes the discharge.

NUCLEAR AUXILIARY OPERATOR

1) Ensures that the PNPS 7.9.12, Att. 1.0 has been signed by the Shift Manager.

2) Under the supervision of the SM, performs the valve lineups for the tank to be discharged per Att. 1.0.

3) Discharges the tank at (or below) the flow rate specified on the Liquid Radwaste Verification and Discharge Form, Att. 1.0.

4) Records the appropriate data on Att. 1.0, signs it off and returns the form to the Radiochemistry Lab.

GENERAL STEPS TO PERFORM DISCHARGE

1) RECORD daily operations on Form OPER-24, "Radwaste Daily Log".

   a) FILE completed forms in the Control Room Annex.
   b) FORWARD to the Records Center semi-annually.

2) PRIOR to beginning any release, RECORD valve lineup on Att. 1.0 of PNPS 7.9.12.

a) GIVE completed forms to Chemical Lab.

3) Any time that the flow elements in the Liquid Radwaste Discharge Line are not working prior to any release, INITIATE Att. 5.0 of PNPS 2.5.2.17.

a) FILE completed forms in the Chemical Lab file.

b) FORWARD to the Record Center yearly.

4) PRIOR to the actual discharge, PERFORM the calculations for the overboard discharge of any tank. FILL OUT Att. 1.0 and Att. 3.0 for each discharge.

2. Infrequent Operation

a. Sampling (performed by Chemistry Technicians)

- open applicable suction valve
- close filter isolation valves
- open applicable recycle valve
- start pump run for at least 60 min. prior to drawing sample
- stop pump and secure valve line up

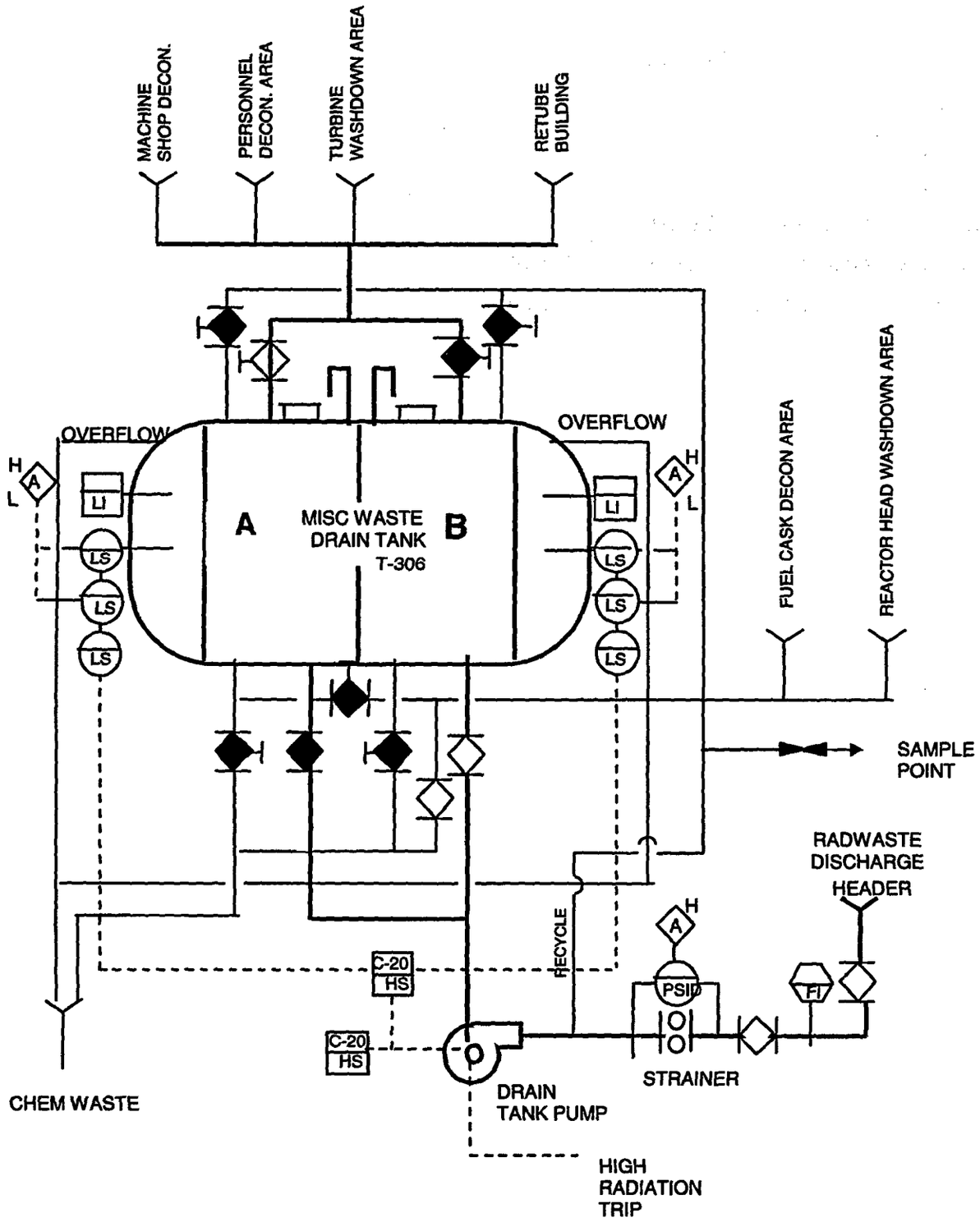
b. Transfer

Water is transferred from one side to the other using the same steps except that the opposite recycle valve is opened. Transfer of water is stopped on a low or high level alarm.

G. INDUSTRY LESSONS LEARNED

None

H. LIST OF FIGURES



MISC WASTE SYSTEM

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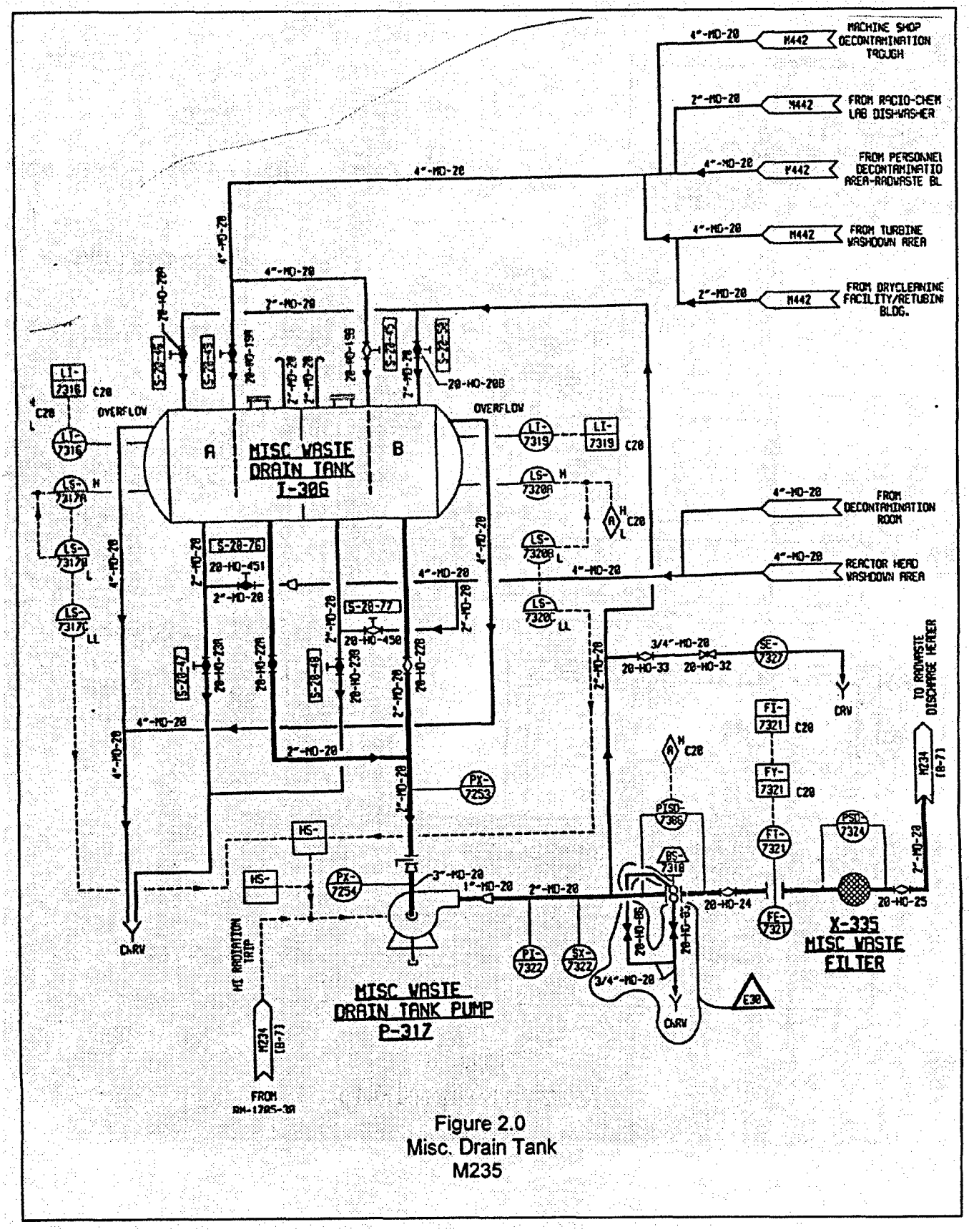

Figure 2.0
Misc. Drain Tank
M235

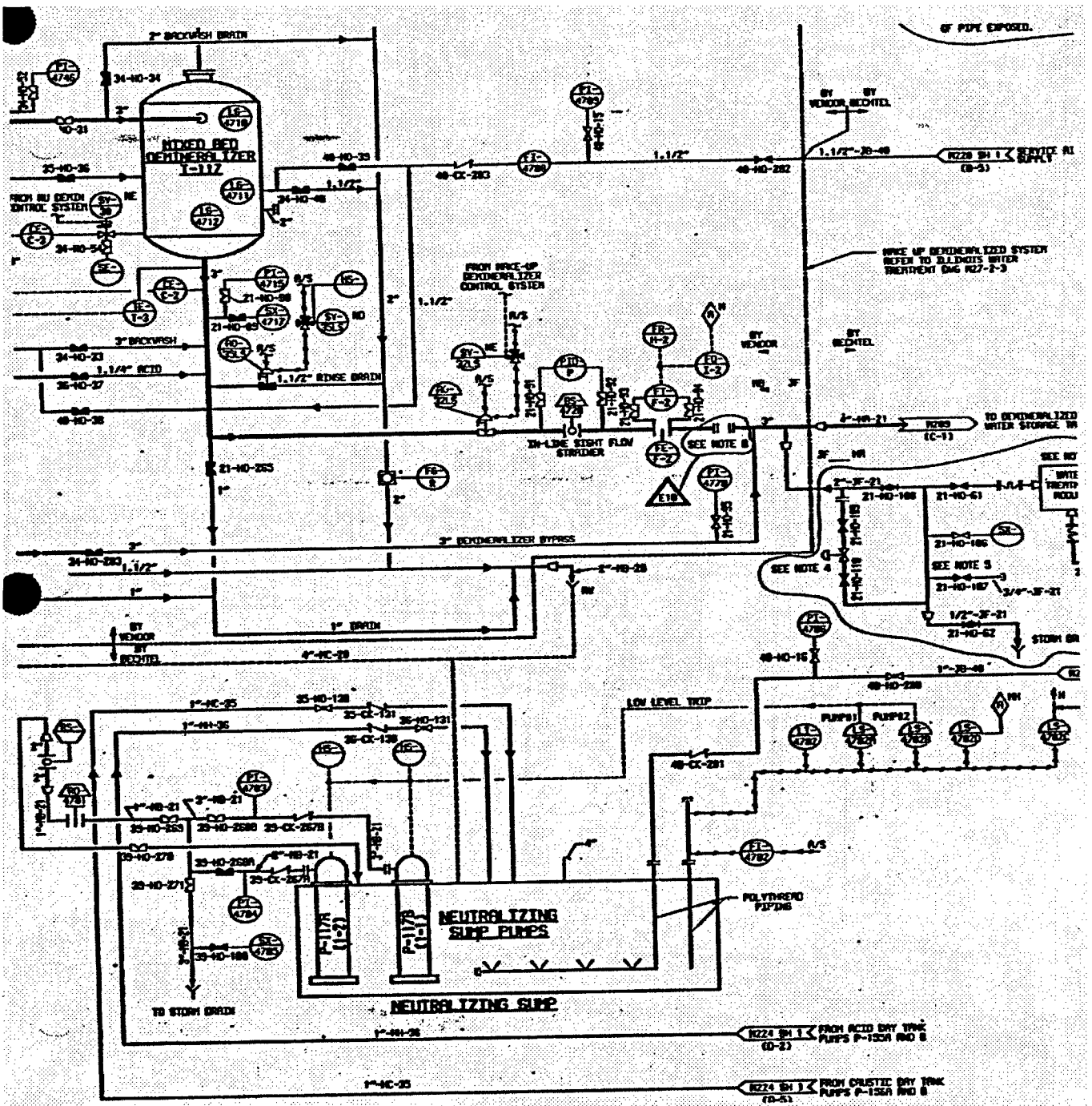

Figure 3.0
Neutralizing Sump and Pump
M225

SOLID RADWASTE SYSTEM

Reference Text

Revisions

Date	Rev #	Description
12/17/97	1	Added the description of the D.E. Cart Vibrator.
07/05/00	2	Changed material to reflect Vectra replaced by Studsvik transfer/drying system.
05/25/01	3	Remove references to flatbed filters.
01/06/05	4	Moved Rad Demin from component section to Interrelationships, added locations for components, edited content based on input from Radwaste Supervisor.

Revision: January 2005

Submitted by: _____

System Engineer Review by/Date: _____
(Enter N/A if not applicable)

Approved by/Date _____

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3. M-233, Clean radwaste system SH1, SH2
4. M-234, Chemical and non-reclaimable radwaste system
5. M-235, Solids recovery system
6. M-238, Radioactive waste and concentrate system SH1, SH2
7. M-248, Clean-up filter demineralizer system

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2. Electrical diagram E-475 through 485
3. Electrical diagram E-491

D. PNPS Procedures
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2. 2.5.1.10, Transferring of resin and dewatering liners using Studsvik Processing Facilty Thor Dewatering System
3. 2.5.1.11, Transferring of sludge or bead resin and dewatering HIC liners using Studsvik Processing Facility Thor Dewatering Systems
4. 2.2.118, Disposable cartridge filter and demineralizer system
5. 2.5.2.71, Radwaste collection system

E. U.S. Nuclear Code of Federal Regulations
1. 10 CFR 71
2. 49 CFR 172-178

F. Technical Specifications
None

G. Industry Events
1. PNPS RWTL Flooding
2. Exothermic Reaction

SOLID RADWASTE SYSTEM

A. OVERVIEW

This text will describe the Solid Radwaste System function and operation at Pilgrim Nuclear Power Station.

B. SYSTEM DESCRIPTION

1. System Purpose

The solid radwaste system collects, processes, packages, and provides temporary storage of solid radwaste prior to shipment offsite.

The solid radwaste system consists of three subsystems:

a. Reactor Water Clean-Up Sludge Radwaste System. The RWCU sludge radwaste system handles highly radioactive waste from the RWCU filter demineralizers.

b. Spent Resin Radwaste System. Handles nonregenerable, spent resins from the fuel pool, rad demin, condensate demineralizers and radwaste filter demin (king kong) and Thermex (charcoal & resin).

c. Studsvik Processing Facility - Thor Dewatering System. Processes spent ion exchange resin and other water treatment media.

2. Power Generation Design Basis

a. Collect, process, package, and store solid radwaste generated from normal plant operations.

b. Provide a safe and reliable means for handling solid radwaste and minimizing radiation exposure to personnel.

3. System Components

a. Reactor Water Clean-Up Sludge Radwaste System (Figure 1)
   1) Filter-demineralizers (RWCU system)
   2) RWCU spent resin backwash receiver tank
   3) RWCU sludge storage tanks
   4) RWCU sludge transfer pumps

b. Spent Resin Radwaste System (Figure 2)
   1) Spent resin storage tank
   2) Spent resin transfer pump

c. Studsvik, Resin Drying System (Figure 3)
   1) Fill head
   2) Resin drying skid
   3) Control panel

4. Basic System Operation

a. RWCU Sludge

Spent resin from RWCU filter-demineralizers collects in the RWCU spent resin backwash receiver tank. At 65 percent capacity, slurry from the receiver tank is drained to one of two RWCU sludge storage tanks. As one storage tank fills, slurry is directed to the second tank. The first tank is isolated for about a month's time to permit decay of sludge activity and settling of slurry. During that time the concentration of percent solids rises from 1.1 % to 5.0 - 10% solids due to sedimentation and water removal. Sludge from the storage tanks is transferred to an off-site shipment liner on the radwaste trucklock floor for shipment via clean-up sludge transfer. A filled liner is dewatered by the Studsvik system and is then sealed, cleaned, and shipped to an off-site storage facility.

b. Spent Resin

Spent resins from the fuel pool, condensate, radwaste demineralizers (king kong) and Thermex, along with charcoal from the Thermex skid, are collected in the spent resin storage tank. Resins are collected until an amount desired for off-site shipment has accumulated, not to exceed 460 ft^3. At that time, the spent resin transfer pump is used to remove resins from the tank and pump them to an off-site shipment liner on the radwaste

trucklock floor. A filled liner is dewatered by the Studsvik system and is then sealed, cleaned, and shipped to an off-site storage facility.

c. Studsvik, Resin Drying

Bead resin from the spent resin storage tank or powder resin from the sludge storage tanks are pumped through their associated piping and connecting hoses to the Studsvik fill head which is secured to the top of a shielded Thor liner. Once in the liner, the resin is first dewatered through filters and laterals by a skid-mounted dewatering pump that discharges to the radwaste floor drains. The resin is dried to various levels by repeated pumping and settling cycles IAW PNPS 2.5.1.10 or 2.5.1.11. Levels of dryness vary depending on destination of container.

C. COMPONENT DESCRIPTION

1. RWCU Filter-Demineralizers

The reactor water clean-up system (RWCU) includes two filter-demineralizer units that remove suspended and dissolved solids from reactor water. Each unit performs both a filtration and ion exchange process. The pressurized units contain stainless steel septums that are coated with powdered ion exchange resin. The resin is applied by a clean-up precoat pump and held in place by a holding pump or system flow when on line.

Flow conductivity, and differential pressure instrumentation are observed to indicate the status of each unit. Upon exhaustion of either its filtration or ion exchange capability, an exhausted unit is taken out of service and backwashed to the clean-up spent resin backwash receiving tank. The dilute slurry (1.1 percent by weight suspended solids) flows by gravity through a drain line and valving to the receiving tank. Slurry from a filter-demineralizer is highly radioactive due to the nature of its source.

For more information on these units, refer to the Reactor Water Clean-Up Reference Text.

2. RWCU Backwash Receiving Tank (Figure 1)

The backwash receiving tank (T-208) receives a slurry from both filter-demineralizer units. Individual drain lines, equipped with valving to isolate each filter-demineralizer, empty into the tank through a common drain line. Holding capacity of the tank is 1,500 gallons which is

equivalent to a little more than three backwashes (1 backwash = 30% level). Transfer of slurry from the tank is done after two backwashes (tank is maintained less than 70% full). Backwash receiver tank level instrumentation LI-256 provides an indication (0-100 percent) on panel C-20.

Slurry is removed from the tank by opening drain valve AO-8700 from panel C-20. Dilute slurry from the tank flows by gravity (difference of elevation 51' to 1') to one of two available sludge storage tanks, provided that one of these tanks is no more than 85% full. Low pressure service air spargers at the bottom of the tank prevent crud from settling and possibly clogging the drain line. The tank vents through a charcoal filter to the reactor building radioactive ventilation system.

When a backwash receiving tank is empty (from LT-256 indication), AO-8700 is closed, and drain line flush valve AO-8702 is set to RINSE. In rinse, AO-8702 opens and condensate transfer water enters the drain line and spray nozzles in the upper half of the tank. A time delay relay also starts and shuts AO-8702 after 20 seconds to limit the amount of rinse water. Rinse water in the tank is drained to a clean waste receiver tank.

3. RWCU Sludge Storage Tanks (Figure 1)

The sludge storage tanks (T-307A/B) receive and hold sludge (slurry) from the backwash receiver tank. Selection of a tank to be filled is made from panel C-20. Sludge tank inlet select switch (Tank A or Tank B) opens the inlet valve, AO-7342 or 7343, to the selected tank. The tanks are designed to concentrate the slurry from 1.1 weight percent solids to 5 to 10 percent through settling and removal of water. Dewatering uses a freeboard drain and sludge transfer pump. Discharge is directed to a monitor tank. Two level indicators are installed in each tank to provide an indication on panel C-82 of the slurry and water level in a tank. Tank level is also monitored on a board in the Radwaste control room, opposite panel-21. A selector valve selects tank A or B. A gauge (0-300 inches of water) is read and the tank level in percent is determined from a conversion table printed on the board. Each inch of water pressure corresponds to approximately 29 gallons. When a tank is being dewatered, the sludge tank level mode select switch on panel C-20 is positioned to liquid. This will trip the transfer pumps on a low water level. As one tank fills with slurry and is isolated, the inlet select switch is positioned to the opposite tank. A filled tank is held isolated until enough sludge is collected in both tanks to fill a Thor liner for shipping (200 ft.).

Sludge that has settled in a sludge storage tank is removed by one of two sludge transfer pumps and is pumped through a temporary line to the radwaste trucklock. When sludge is being removed from a tank, the sludge tank level mode select switch is positioned to SLURRY.

Each RWCU sludge storage tank has a holding capacity of 4,500 gallons. The stainless steel tanks were designed for 5 psig at 200°F. Each tank is equipped with a vent line to the room exhaust system and an overflow line to a clean waste receiver tank. Low pressure service air spargers are located at the bottom of each tank to mix the sludge. Condensate transfer water is supplied to the tank inlet and suction lines for flushing.

The tanks are located off the radwaste corridor, across from the miscellaneous waste drain tank.

4. Sludge Transfer Pumps (Figure 1)

The sludge transfer pumps (P-318A/B) remove sludge from a sludge storage tank and pump it to the radwaste trucklock. Dewatering is provided by the freeboard drain line and pumped to a monitoring tank. The freeboard line is connected to the upper half of the tank for dewatering. The line at the bottom of the tank is for sludge removal. A cross-tie is provided between the two pump suction lines. Gate valve AO-7354, installed in the line, is controlled from panel C-20.

Selection of a discharge path is made by opening the appropriate valves. To remove sludge from a tank, sludge tank outlet valves AO-7345, 7349 are opened and freeboard drain line valves AO-7348, 7352 remain closed. Valve line up for the rest of the system remains the same. The only difference is in the discharge line where valve D is open for sludge removal and valve C is open for dewatering. Before discharging sludge, the line is flushed with demineralized water to check for leaks. Demineralized water is also used to flush the line after transfer.

As stated in the component description for the storage tanks, separate level instrumentation is used to indicate sludge and water level. The mode select switch (LIQUID-SLURRY) lines up the appropriate instrumentation and pump trips. The transfer pumps trip on

a low liquid or slurry level in the tank. They also trip on a low flow signal in the discharge piping after a time delay.

The pumps are manually started and stopped from panel C-20. Red and green lamps on panel C-20 indicate if a pump is on or off. The diaphragm type pumps are air-driven and installed with quick disconnect features to reduce personnel exposure in the pump room area.

The pumps are located off the radwaste corridor, across from the elevator.

5. Spent Resin Storage Tank (Figure 2)

Spent resins from the fuel pool, condensate, and radwaste demineralizers (king kong) and Thermex are routed to the spent resin storage tank (T-308). The resins are sluiced from the demineralizers through piping using air and water. Spent resin storage tank capacity is 670 ft^3. The radwaste demineralizer contains 30 ft^3 of mixed resins which are not regenerated. Expected spent resin volume is approximately 360 ft^3/yr. The spent fuel pool demineralizer contains 90 ft^3 of mixed resins which are not regenerated. Expected spent resin volume is estimated at 180 ft^3/yr. The condensate demineralizer system consists of seven mixed bed resin demineralizers. Each demineralizer contains approximately 100 ft^3 of cation and 120 ft^3 of anion resins.

Resins in the tank are highly radioactive and are held as long as possible to decrease the radiation level. When spent resins accumulate to an amount desired for offsite shipment, the resins are pumped from the tank to a radwaste container for shipment and offsite disposal. Level is determined by remote camera.

Condensate transfer water is supplied to two lines inside the tank and to the tank bottom and transfer line. Lines inside the tank are equipped with retention screens. One line serves to vent the tank while the other directs overflow to the chemical radwaste system. Condensate transfer water supplied to the lines is for flushing the tank and to reduce screen plugging. The supply to the tank bottom and transfer line is for flushing and unclogging the suction line. Low pressure service air is piped into both condensate transfer supply lines for sparging the tank if the resins clog the suction line.

The stainless steel tank is designed for atmospheric pressure and a temperature of 160°F. Temperature indicator TI-7308 provides an indication of tank internal temperature on panel C-20. Studsvik installed a sonic level detector that indicates on its control panel.

Spent resin lines into the tank are equipped with bypass lines to a truck loading hose connection. This permits pumping spent resin directly to a shipping container if the tank were to become isolated.

The tank is located at the northeast corner of the RB -13' elevation, below the radwaste trucklock.

6. Spent Resin Transfer Pump (Figure 2)

The spent resin transfer pump (P-324) removes resin from the storage tank and pumps it to a container located on the trucklock floor. The air-driven, variable speed pump takes a suction from the bottom of the tank. Pump speed is altered by regulating air flow to the pump through pressure control valve PCV-9031. Pressure indicator PI-9032 indicates inlet pressure to the pump. Admission of air to the pump is through solenoid valve SV-9583. The valve is opened and closed by a timer from panel C-140, starting and stopping the pump. Low pressure service air is supplied to suction piping and tank bottom if a line were to become plugged with resins.

Following removal of all the resins, condensate transfer water is used to flush the transfer line. Rinse water is sent to the Thor liner.

The pump is located at the northeast corner of the RB -13' elevation, below the radwaste trucklock.

7. Radioactive Solid Waste Container

The radioactive solid waste container is a high-integrity container and is constructed of either polyethylene or stainless steel. The polyethylene container is used to receive waste from the spent resin storage tank, and the stainless steal container is used in conjunction with the sludge storage tanks. The container top fits the discharge chute. As the container is filled, the dewatering process begins to remove the water from the mixture and pumps it to the

radwaste drains. Once the container is full, the dewatering process continues until the amount of water left in the container is within specification. This water restriction depends on the final destination of the container. The Thor liner is then capped and prepared for shipment.

8. Studsvik Resin Drying System (Figure 3)

The Studsvik system is comprised of two major components, the Resin Drying Skid and its control panel. Both of these components are located in the Radwaste trucklock.

The Resin Drying Skid contains all the equipment necessary to direct radioactive waste into a high integrity container, to dewater the container to the appropriate level, and to allow flushing activities to maintain the associated piping and components as free from contamination as possible. The Fill Head is the connection point between the skid and the HIC. A fill hose directs resin from the spent resin storage tank or the sludge storage tank to a high integrity container via WS-1 on the fill head. The tank is continuously vented through a skid-mounted vent tank equipped with a HEPA filter. The supply hose isolation valve (WS-1) can be opened and closed from the control panel and has a protective auto-closure function that occurs during a HIC container or vent tank high level condition. The fill head contains a close-circuit T.V. camera that displays on the Studsvik control panel for monitoring filling and de-watering evolutions. Additionally, the fill head provides HIC temperature and level signals for instrumentation, alarms and trips that are transmitted to the control panel. Another hose allows the skid-mounted de-watering pump to remove freestanding water in the HIC through de-watering laterals via DW 1or vertical filters via DW- 2, 3, & 4 on the fill head. The water discharges to the RW building equipment sumps. The skid also contains a fill head stand that supports the fill head when not in use and allows for flushing of the underside of the fill head.

The Studsvik Control Panel contains remote indications for HIC level, and temperature, including indication and controls for component status of the dewatering pump, valve positions, spent resin storage tank level (with high level alarm), light intensity control, vent tank level alarm, fill head latch/unlatch status, etc. The control panel is equipped with a T.V. monitor for observing filling, dewatering and drying activities taking place in the HIC. Also on the control panel is the latch/unlatch remote switch, used to secure the fill head to the HIC, and an emergency stop button.

D. INSTRUMENTATION AND CONTROLS

1. Control Room Instrumentation (Radwaste Control Room)

Instrument/Location	Description
TI-7336, 7356 Panel C-20	A, B sludge pump discharge temperature 50 - 250°F
TI-7308 Panel C-20	Spent resin storage tank temperature 60 - 130°F
LI-256 Panel C-20	Rx c.u. backwash rec. tank level 0-100 percent
LS-7334, 7409, 7330 Panel C-20	Low, inter., high spent resin storage tank level. Indicating lamps on panel C-20 represent the switches (Gr., Gr., Red)
LI-7306, 7307 Panel C-82	Sludge storage tank water level
LI-7302, 7305 Panel C-82	Sludge storage tank slurry level

2. Local Instrumentation

Instrument/Location	Description
Studsvik Control Panel	
PI-7034, 7353 Local	Transfer pump P-318A, 318B discharge pressure
Liner temperature	Thermocouple in HIC (optional) readout on control panel
Power on light	Power to: panel, skid, fillhead
Fillhead block valve WS-1	Open Closed
Closed circuit T.V. monitor	Camera in fillhead monitors filling and dewatering and drying operations, FILLPORT latching
Digital waste level indication	Sonic level detector
DW-1, 2, 3 and 4 (de-watering valves)	Open/closed indication
DW pump running/stopped	
HIC pressure/vacuum	Readout on DW pump suction gage

3. Alarms

Title/Location	Setpoint/Initiating Device
Radwaste Control Room	
Spent resin tank high level Panel C-20 Left B-12	16'2" LS-7310
Cleanup sludge storage tank A, B high sludge lvl Panel C-20 Left B-17, 14	LS-7303 A, B
Cleanup sludge storage tank A, B high water lvl Panel C-20 Left B-18, 15	42" LS-7302A, 7305B
Cleanup spent resin backwash rec. tank high lvl Panel C-20	LIS-257
Studsvik Control Panel	
Liner level high	
Liner high-high level	6" from top of HIC
Vent/overflow tank high level	

4. Interlocks and Trips

Interlock or Trip	Functions
Fill head block valve WS-1 closes	- Vent/overflow tank high level - Liner high-high level - Liner high level – Emergency stop
Cleanup sludge transfer pump P-318A, B trip	- Low water level in sludge storage tank. - Low slurry level in sludge storage tank.

5. Control Room Controls

None

6. Local Controls

Item	Functions of Positions	
Radwaste Control Room		
C.U. sludge transfer pump P-318 A, B Panel C-20	STOP START	Stops pump Starts pump
C.U. sludge pumps suction tie valve AO-7354 Panel C-20	CLOSE OPEN	Isolates suction lines Permits a pump to take a suction from opp. tank
C.U. sludge transfer pump suction valve AO-7346, 7350 Panel C-20	CLOSE OPEN	Isolates pump from tank Suction line to pump is open
C.U. sludge transfer pump discharge valve AO-7347, 7350 Panel C-20	CLOSE OPEN	No pump discharge Pump discharge permitted
C.U. sludge tank outlet valve AO-7345, 7349 Panel C-20	CLOSE OPEN	Tank allowed to fill Suction line from tank is open
C.U. sludge tank freeboard drain valve AO-7348, 7352 Panel C-20	CLOSE OPEN	Isolates drain line and pump Water may be removed from tank
A, B C.U. sludge tank level mode select switch Panel C-20	LIQUID SLURRY	Level instrumentation monitors water level in tank Level instrumentation monitors sludge level in tank
C.U. sludge transfer pump select switch Panel C-20	ALT NORM	Provides override of pump trip signals Pump trips in effect
Sludge tanks inlet select switch Panel C-20	TANK A TANK B	Opens inlet valve (AO-7342) to tank A Opens inlet valve (AO-7343) to tank B
C.U. backwash receiver tank drain valve AO-8700 Panel C-20	CLOSE OPEN	Tank allowed to fill Task drains to sludge storage tank
C.U. receiver tank drain line flush valve AO-88702 Panel C-20	RINSE	Opens transfer line flush valve AO-8702 and starts time delay relay

6. **Local Controls** (cont.)

Item	Functions of Positions	
Radwaste Control Room		
Sludge storage tank level select switch Local	TANK A	Level instrumentation indicates level in tank A
	TANK B	Level instrumentation indicates level in tank B
Solenoid valve SV-9583 Panel C-140		Regulates air flow to spent resin transfer pump
Studsvik Control Panel		
Acknowledge	Silence alarms Flashing light goes solid	
Waste value (WS-1) position indication		
Emergency stop button		
Waste temperature indication	Use "optional" thermo-couple to monitor temp. during de-watering.	
Latch/Unlatch control		
DW-1, 2, 3 and 4 position indication		
SRST level indication and alarm		
HIC high temp. alarm		

E. SYSTEM INTERRELATIONSHIPS

1. **Low Pressure Service Air**
   a. radwaste demin sluicing and mixing air
   b. air for all Studsvik skid operation

2. **Condensate Transfer System**
   a. backwash receiving tank and transfer line for flushing,
   b. sludge storage tanks and transfer line for flushing
   c. spent resin storage tank and transfer line for flushing.

3. **Demineralizer Water**
   a. Studsvik - fill head flushing
   b. Studsvik vent tank flushing
   c. Studsvik hose flushing

4. **Instrument Air**
   a. level indication on plant installed equipment
   b. solenoid valves

5. **Clean Radwaste System**

   Receives flush water from backwash receiving tank and overflow from sludge storage tanks.

6. **Chemical Radwaste System**

   Receives flush water from spent resin storage tank, low quality water from ion exchange system, and water from dewatering of spent resin shipping container.

7. **Rad Demin. System [King Kong]**

   Spent Rad-Demin resin is discharged to the spent resin storage tank.

8. **Fuel Pool Cooling**

   Spent FPC demineralizer resin is discharged to the spent resin storage tank.

9. **Condensate Demineralizers**

   Spent Cond Demin resin is discharged to the spent resin storage tank.

10. **Power Supplies**
    a. Sludge transfer pumps P-318 A and B receive power from 480 MCC power center B-16.

F. SYSTEM OPERATIONAL SUMMARY

NOTE: This section outlines the major steps performed during system operations and is not intended to be substituted for plant operating procedures.

1. Normal System Operation

a. Spent resin from RWCU filter-demineralizers is sent to the clean-up spent resin backwash receiver tank. As the backwash receiver tank fills, the slurry is sent to one of two sludge storage tanks. The sludge remains in a tank for a period of time to reduce the radiation level and water content. When deemed appropriate, sludge is transferred by one of two transfer pumps through temporary piping up to a HIC on the trucklock floor. The high-integrity container is filled, dewatered, sampled and prepared for shipment.

b. The Spent Resin Storage Tank receives resin from the fuel pool, radwaste, and condensate demineralizers. Resins collecting in the tank are removed by the spent resin transfer pump and sent to the RW trucklock. Connections are made to a high-integrity container for transfer of the resins. The container is filled, dewatered, sampled, and readied for shipment.

c. Rad Demin System (king kong) - (See Rad Demin Ref. Text)

Uses two, thirty-five cubic foot mixed deep bed demins. As they are exhausted, their spent resin is discharged to the Spent Resin Storage Tank.

d. The Studsvik Resin Drying System receives spent bead resin from the spent resin storage tank and powdered resin from the sludge storage tanks. These solid waste streams are collected in a shielded High Integrity Container (HIC) or a Thor liner, dewatered, dried, (as needed) weighed and capped for shipment.

e. A 5" high curbed enclosure was installed at the north end of the radwaste trucklock. To minimize the impact of a possible radioactive spill, and resultant contamination during dewatering or other radwaste trucklock operations. At the south end of the radwaste trucklock, the curbed enclosure consists of structural steel angles bolted to the floor. The height of the steel angles ensures that a minimum spillage volume of 200 cubic feet will be

confined within the trucklock itself. The angle heights, which are lower than the concrete curbing and ramp will direct spillage volumes larger than 200 cubic feet into floor hatch #3 which will be open during dewatering.

2. **Infrequent Operation**

a. Bypassing spent resin tank

Demineralizer resin lines feeding into the spent resin storage tank are equipped with a bypass line. If the spent resin storage were to become isolated, spent resins could be transferred directly to a shipping container. The three bypass lines form a single header with an attached flange for a hose connection. A hand operated ball valve is installed in each line and another upstream of the hose connection. Spent resins are transferred using flexible hoses and opening the appropriate ball valves.

G. INDUSTRY LESSONS LEARNED

1. Pilgrim Nuclear Power Station

Flooding in the Radwaste trucklock, resulted from a discharge of liquid waste through the overhead door when sludge was being pumped to an HIC, was left unattended. The procedure did not require an operator to constantly be present during all pumping evolutions in the radwaste trucklock.

To minimize the impact of a possible radioactive spill, and resultant contamination during dewatering or other radwaste trucklock operations, a 5" high curbed enclosure was installed at the north end of the radwaste trucklock. At the south end of the radwaste trucklock, the curbed enclosure consists of structural steel angles bolted to the floor. The height of the steel angles ensures that a minimum spillage volume of 200 cubic feet will be confined within the trucklock itself. The angle height, which is lower than the concrete curbing and ramp will direct spillage volumes larger than 200 cubic feet into floor hatch #3 which will be open during dewatering.

2) Exothermic Reactions

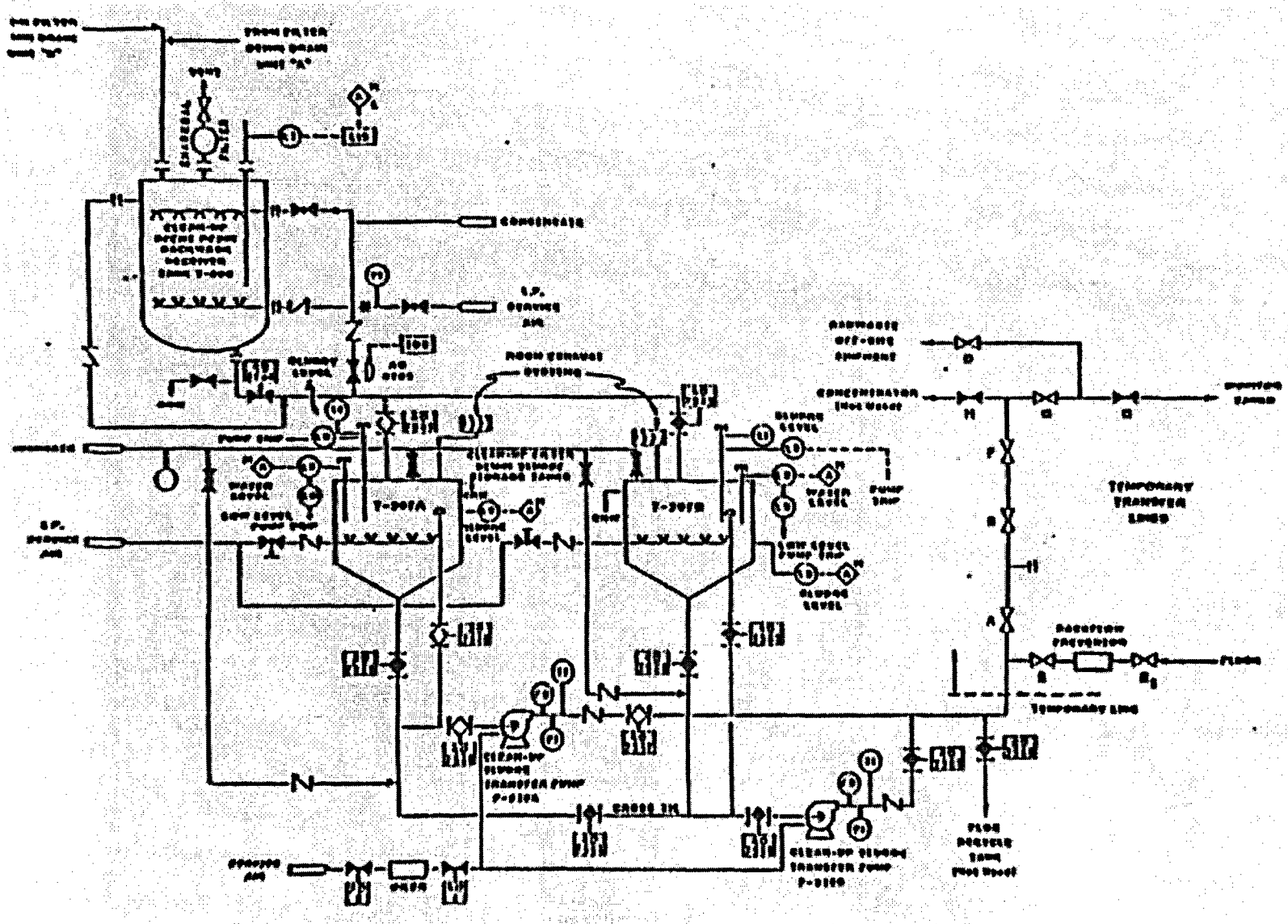
An exothermic reaction evolves heat, by definition. This is a concern in our operation because the heat can damage the container, cause a release of radioactive material from the container and create an unsafe condition for the operator.

This reaction during a dewatering operation is very, very rare. In operations at commercial nuclear reactors, it has only occurred three times, however, operators need to be able to recognize the reaction in its early stages and to take appropriate action.

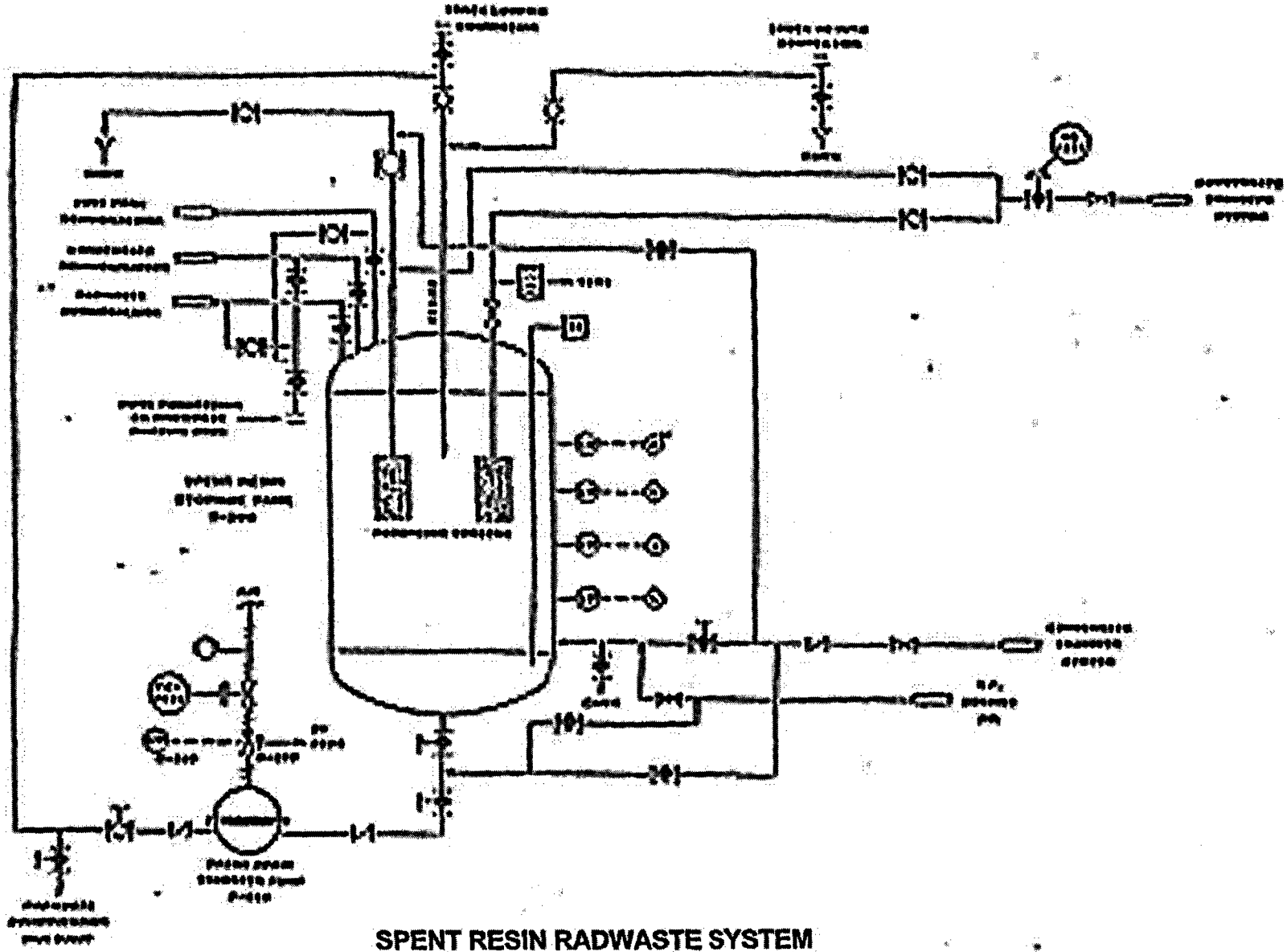
An exothermic reaction is evidenced by a rapid temperature rise in the resin bead. During the dewatering operation, if a sustained temperature rise exceeding 10°/minute is encountered or if the temperature rises rapidly to above 130°F, flood the container with water as quickly as possible.

H. LIST OF FIGURES

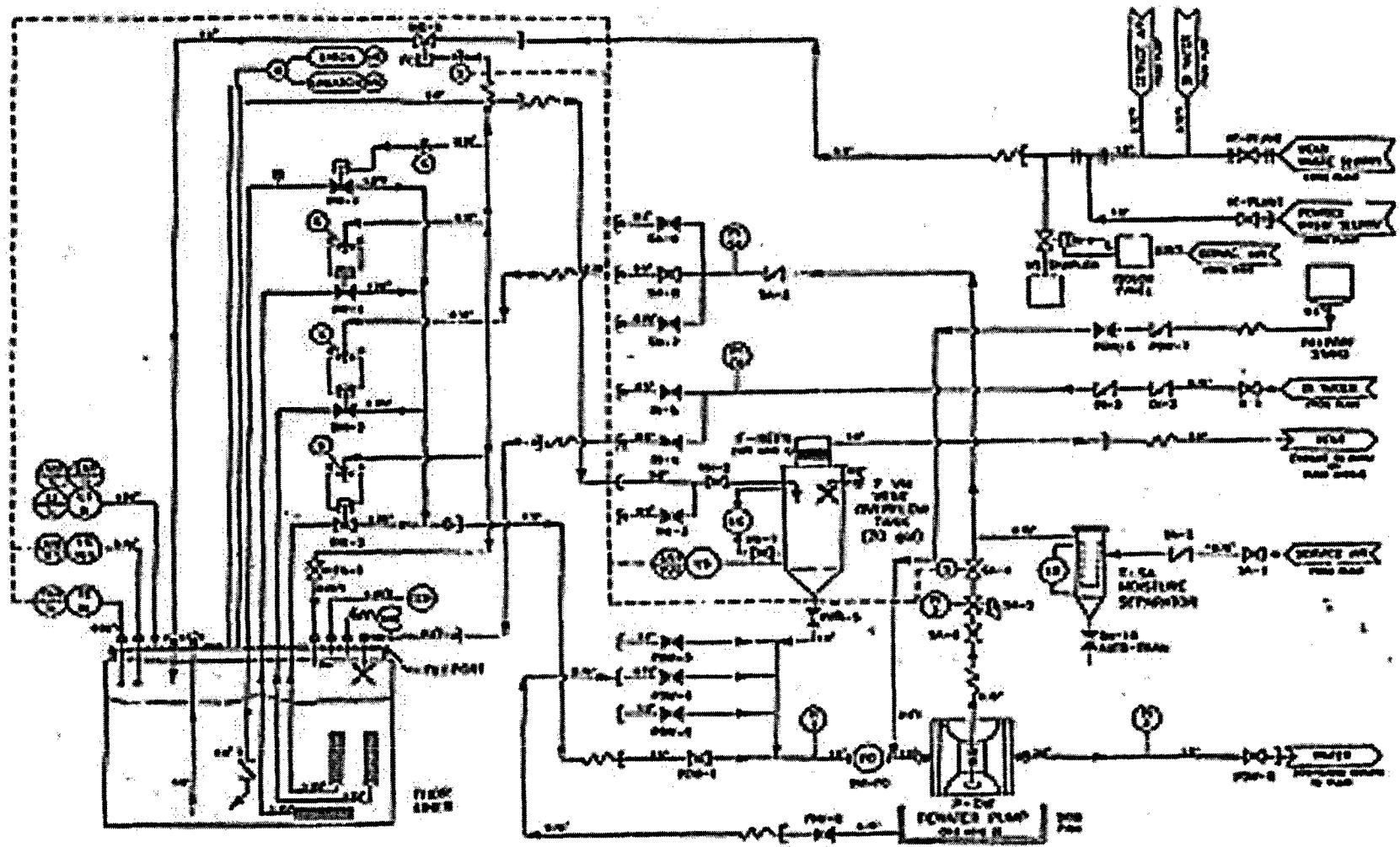
1. Reactor Water Cleanup Sludge Radwaste System
2. Spent Resin Radwaste System
3. Studsvik Dewatering System Disposable Filter and Demineralizer



REACTOR WATER CLEAN-UP SLUDGE RADWASTE SYSTEM
FIGURE 1



SPENT RESIN RADWASTE SYSTEM
FIGURE 2



STUDSVIK DEWATERING SYSTEM
DISPOSABLE FILTER AND DEMINERALIZER
FIGURE 3 REV. 1