GPU Nuclear

GPU Nuclear Corporation
Post Office Box 480
Route 441 South
Middletown, Pennsylvania 17057
717 944-7621
TELEX 84-2386
Writer's Direct Dial Number

April 28, 1983
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TMI Program Office
Attn: Dr. B. J. Snyder, Program Director
US Nuclear Regulatory Commission
Washington, DC 20555

Dear Sir:

Three Mile Island Nuclear Station Unit 2 (TMI-2)
Operating License No. DPR-73
Docket No. 50-320
Recovery System Description and Technical Evaluation Report Update

In accordance with your letter of February 4, 1982, attached are the annual updates for the following Recovery System Descriptions:

- Auxiliary Building Emergency Liquid Cleanup System (EPICOR II)
- Solid Radwaste Staging Modules
- Submerged Demineralizer System (SDS)

The EPICOR II System Description update consisted mainly of redesignating ALC-F-1 from a prefilter to a demineralizer as ALC-F-1 has historically been used as a demineralizer and not a filter. Other changes include the use of EPICOR II processed water for decontamination, and updating tables to reflect current data on system usage.

The Solid Radwaste Staging Module System Description has been updated to reflect changes made to the modules to support EPICOR II liner shipping.

The SDS System Description has been updated to reflect changes made to the SDS to support sampling and shipping of spent SDS vessels and other minor modifications. Due to the length of the SDS System Description, only those sections which were modified have been included (i.e., the text, Appendix 1, Appendix 10, and Appendix 16). Additionally, a recent modification to the SDS System allows pumping directly from the Reactor Building Sump to the SDS, bypassing the Tank Farm. The details of this modification will be included in a system description update which is currently in preparation.

D009

The SDS Technical Evaluation Report is also in the process of being revised to reflect modifications needed to support post head lift activities. This revision of the TER will also provide its annual update. These documents (SDS System Description and TER) are anticipated to be submitted during June, 1983.

If you have any questions, please call Mr. J. J. Byrne of my staff.

Sincerely,

B. K. Kanga

B. K. Kanga
Director, TMI-2

BKK/JJB/jep

Attachments

CC: Mr. L. H. Barrett, Deputy Program Director - TMI Program Office

Recovery Program

System Description

Auxiliary Building Emergency

Liquid Clean-up System (EPICOR II)

APPENDIX

1.0 INTRODUCTION

1.1 System Functions

The functions of the Auxiliary Building Emergency Liquid Cleanup System are:

a. To decontaminate, by filtration and ion exchange, radioactive waste water contained in the Auxiliary Building of TMI Unit 2, or to serve as a polishing ion exchanger system for the Submerged Demineralizer System (SDS).

b. To transfer the decontaminated waste water from the Clean Water Receiving Tank to the Liquid Waste Disposal System of TMI Unit 2, the Truck Fill Station, the Spent Fuel Storage Pool, the Processed Water Storage Tanks, Condensate Storage Tank CO-T-1A, CC-T-1 to be used for Reactor Building and Auxiliary/Fuel Handling Building Decontamination or discharge to the Off-Spec Water Receiving Batch Tank for further treatment.

NOTE: The decontaminated waste water will be transferred to Evaporator Condensate Test Tank WDL-T-9A or 9B. Although there is an interface with the Unit I Liquid Waste Disposal System, the Unit I System will not be used. In this respect Unit II will function independently.

c. To provide remote handling of spent resin containers from their position inside the Chemical Cleaning Building to the transport cask and truck.

d. To limit releases of radioactive material to the environment to "as low as reasonably achievable."

e. To provide for operation, and maintenance of the liquid cleanup system in compliance with "as low as reasonably achievable" radiation doses to personnel.

f. To accomplish the above independently from TMI Unit-1.

1.2 Summary Description of the System

The Auxiliary Building Emergency Liquid Cleanup System consists of a vendor supplied liquid radwaste process system which is located in the Chemical Cleaning Building. The system is designed to decontaminate, by filtration and ion exchange, radioactive waste water contained in the Auxiliary Building or Fuel Handling Building of TMI Unit 2. Contaminated water will be pumped from a connection located on the miscellaneous Waste Holdup Tank (WDL-T-2) by a pump located in the Chemical Cleaning Building through the yard and into the process system, or it will be obtained from the Monitor Tanks SDS-T1A/T1B, or

Reactor Coolant Bleed Tanks (RCBT's). Yard piping will be shielded and enclosed within a guard pipe, the open end of which terminates inside the Chemical Cleaning Building.

The primary process system consists of three demineralizers connected in series. Waste liquid is transferred from the Source Tank (MWHT, RCBT, or SDS-T1A/T1B) through the demineralizers, to the Clean Water Receiving Tank (CC-T-2). Changeout Criteria for the various units are indicated in Table 13 and 14.

Processed water will be delivered to the Clean Water Receiving Tank (CC-T-2) for sampling and analysis and either pumped to the Liquid Waste Disposal System of TMI Unit 2, the Spent Fuel Storage Pool, the PWST's, the BWST, CO-T-1A or WDL-T-9B the truck fill station for discharge if within specs, or transferred to the Off Spec Water Receiving Batch Tank (CC-T-1) for recycling through the process system or use in the decontamination of the Reactor Building or Auxiliary & Fuel Handling Buildings.

The Chemical Cleaning Building (CCB) has been made into a low leakage confinement building and provided with an exhaust ventilation system to maintain the building at a negative pressure.

Moisture separators, HEPA filters, and charcoal filters have been provided in the exhaust ventilation system in order to filter it before it is released to the stack at the roof line of the CCB. All effluent air is monitored for radioactivity at this point. Provisions for grab samples are available.

Normal operation of the processing system will be by remote means except for infrequent operations such as sampling, spent resin container removal and new resin container installation. All remote system operations are controlled from the TV Monitor Control Building located outside the northwest corner of the Chemical Cleaning Building.

Remote handling of spent resin containers from their position inside the Chemical Cleaning Building to the transport cask and truck is via a remotely operated twenty-ton monorail hoist system.

A fire protection system is installed in the HVAC equipment room, the Control Building and the CCB. A new 4" tie-in to the existing fire main supplies a sprinkler system in the TV Monitor Control Building and a hose station in the CCB, as well as the sprinkler line to the air filtration unit charcoal filters. The key to the lock on the valve for this sprayline is kept in the Auxiliary Building Emergency Liquid Clean-up System Control Room which is also known as the TV Monitor & Control Building. Line and grid pressure indication is provided in the Control Building.

The system interfaces with the TMI Unit 2 Radwaste Disposal Miscellaneous Liquids System, Demineralized Water System, the Submerged Demineralizer System, the Processed Water Storage Tank, the BOP Electrical System, Service Air System, the Unit I Liquid Waste Disposal System, Fire Protection System, the Fuel Pool Waste Storage System, and the Unit 2 Radwaste Disposal Reactor Coolant Liquid System.

NOTE: Although there is an interface with the Unit I Liquid Waste Disposal System, the Unit I System will not be used. In this respect Unit II will function independently. Valve ALC-V169 shall remain closed (unless transferring CC-T-1 or -2 to the "B" Spent Fuel Pool) and a spectacle flange is installed down stream of valves ALC-V169, ALC-V122 & ALC-V123.

1.3 System Design Requirements

1.3.1 Process System Design Requirements

1.3.1.1 The process line pipe size is nominally 2" schedule 40 based upon the Epicor II system flow rate of 10-30 gpm. Other line sizes are based on service requirements and function, such as service air, demineralized water, recirculation and sampling.

1.3.1.2 Pumps ALC-P-1 through P-4 have hose connections and are provided with drip trays to collect leakage. Drip trays have nozzles as close to the bottom of the tray as possible and are served by flexible tubing which leads to the nearest floor or equipment drain using the floor slope to induce flow. This tubing will be placed well down into the floor drain.

1.3.1.3 Remote system operations are directed and controlled from outside of the Chemical Cleaning Building from the TV Monitor & Control Building. This area is provided with remote closed circuit television monitoring of the operating areas inside and outside the Chemical Cleaning Building.

1.3.1.4 Process instrumentation consists of pH, and conductivity monitors. Resin bed radiation levels, process line radiation levels, process flow rates, process totalizers, and tank levels are also monitored. Accelerometers for P-1 thru P-4 are provided for equipment protection.

1.3.1.5 The system tank vents are provided with in line heaters, demister filters, and charcoal filters for adsorption of evolved iodine. These units are sloped to drain demisted liquids back into the system tanks.

1.3.1.6 Liquid waste feed to the system will be drawn from the Source Tank (MWHT, RCBT, SDS-T1A/T1B or CC-T-1) by the first EPICOR II pump (ALC-P-1). The Miscellaneous Waste Holdup Tank pump is not used. This provides better system pressure and flow control. Also, liquid waste feed to the system can be drawn from the RCBT, SDS-T1A/T1B or CC-T-1.

1.3.1.7 Since the Chemical Cleaning Building provides a seismically safe containment, the EPICOR II System and major components are considered to be non-Q.C. scope.

1.3.1.8 All system piping is welded stainless steel except for air piping which is welded carbon steel or copper tubing. Instrument tubing systems are 316 SS Tubing. The instrument tubing system is made up using compression fittings. The process system piping is rated at 150 lb. and is designed, installed and inspected in accordance with ANSI B31.1 (Power Piping).

NOTE: Flanged and screwed connections are used as necessary on certain components.

1.3.1.9 Capability is provided to obtain a representative sample of tanks CC-T-1 & 2, and the effluents of Demineralizers ALC-F-1, ALC-K-1 and ALC-K-2, while in a low radiation area in accordance with Regulatory Guide 1.21. Representative sample for CC-T-1 or 2 is here defined as "after recirculating the tank contents for three volume changes". Also the sample line for CC-T-1 & 2 shall be purged to the sample sink for five line volumes prior to drawing the sample, and for ALC-F-1, ALC-K-1 and ALC-K-2 the sample lines shall be recirculated for five line volumes prior to drawing the sample.

NOTE: ALC-F-1 is the first demineralizer, followed in series by demineralizers ALC-K-1 and ALC-K-2.

1.3.1.10 The building sump shall be a covered sump.

1.3.1.11 System blowdown air and demineralized water lines are provided with individual check valves ALC-V060 thru V079 to minimize contamination of these systems.

1.3.1.12 The demineralized water supply header is provided with demineralized water from TMI Unit 2 in the range of 80-90 psig to meet EPICOR II requirements.

1.3.1.13 The System Air supply header shall be provided with a pressure regulator operating in the range of 80-90 psig, and a moisture separator. An air oiler, and an anti-freeze injector are provided for the portion of the System Air header servicing the EPICOR II pumps. Provisions are available to connect the plant Service Air System to the system if necessary. Also two air compressors (ALC-P-7/8) are available for use and tie into the air supply header via ALC-V145.

<u>NOTE</u>: The Plant Service Air System is the preferred air supply.

1.3.1.14 If sampling indicates that the processed water is within limits for discharge, the decontaminated liquid from CC-T-2 can be routed to the TMI Unit 2 Liquid Waste Disposal System, the TMI Unit 2 Spent Fuel Storage Pool, the PWST's or a truck fill hose connection that is provided as an alternate means of discharging decontaminated liquids.

1.3.1.15 All system overflow lines shall discharge to the Chemical Cleaning Building sump. All floor drains also discharge to the sump. The sump pump sends all collected leakage to the Off-Spec Water Receiving Batch Tank (CC-T-1) for recycle through the cleanup system. The sump can be directly processed through the EPICOR II System via existing valving and piping.

1.3.1.16 Since the elevation of the discharge nozzle of tank CC-T-2, and the Chemical Cleaning Building floor were fixed prior to design and construction of EPICOR II, the hydraulic design for draining CC-T-2 is not adequate for complete draining of the tank. However, the system was designed to facilitate draining to the maximum extent possible. Final draining of CC-T-2 is accomplished with the manual drain line (valves ALC-V131 and V132).

1.3.1.17 Three resin traps are installed downstream of the demineralizers.

1.3.1.18 A one micron cartridge type filter is installed downstream of the three resin traps.

1.3.1.19 The system shall have personnel shielding on various components to reduce the radiation levels in the operating areas of the building.

1.3.1.20 A resin trap is installed on the outlet from the casks overflow line to prevent resin carryover into the sump.

1.3.2 Material Handling Design Requirements

1.3.2.1 Normal operation of the Auxiliary Building Liquid Processing System is by remote methods.

1.3.2.2 Demineralized water and service air connections are provided to flush and blowdown the entire system or portions of it to allow system maintenance.

1.3.2.3 4' x 4' casks may be removed from the building by making use of the shield bell designed for this purpose. The shield bell is positioned over the contaminated cask. The shield doors on the bottom of the shield are opened and the cask is drawn up into the bell. The doors are reclosed and the cask is carried, by the crane, to the truck which has a concrete shield vessel for isolating the cask during tranportation to the staging facility. Monitoring of the area is carried on during these activities to assure the safety of personnel. A new cask is positioned in the vacated space. Shielding, process lines, and level instrumentation are repositioned and the unit is returned to service.

NOTE: The transfer bell is no longer routinely used and will only be used if operation of the system results in radiation levels from the demineralizers exceeding limits for unshielded handling.

1.3.2.4 6' x 6' casks are handled in and out of the building without shielding. This is accomplished by remote operation and by establishing appropriate barriers limiting the approach of personnel to the handling operation. Spent resin containers are lifted directly from within substantial shielding barriers in the Chemical Cleaning Building and deposited directly in the transfer cask located on the unmanned truck located immediately outside the building, or loaded unshielded on a transport truck depending on the cask's radiation levels.

1.3.3 Air Handling Design Requirements

1.3.3.1 A ventilation fan is provided to maintain the Chemical Cleaning Building at a negative pressure.

1.3.3.2 The MSA Filtration Unit is designed to meet the requirements of NRC Regulatory Guide 1.140.

1.3.3.3 The moisture separator is provided to remove water vapor droplets from the air.

1.3.3.4 An electric heater is provided within the Filtration Unit to lower relative humidity to 30% with 100% RH inlet air.

1.3.3.5 The prefilter has an average atmospheric air strain efficiency of 85%.

1.3.3.6 The two HEPA filter banks are DOP tested in place to assure an efficiency of 99.97% for removing 0.3 micron particles.

1.3.3.7 The activated charcoal filter is designed to have efficiencies of 99.9% for elemental iodine and 95% for methyl iodide.

2.0 DETAILED DESCRIPTION OF THE SYSTEM

2.1 Components

2.1.1 EPICOR II Pumps (ALC-P-1 through 4 and 6)

Pumps (1-4) are air-driven, positive displacement pumps with a capacity of from 10 gpm to 120 gpm. Each pump is equipped with a pulsation dampener in the process outlet.

Pumps ALC-P-1 thru 4 are utilized in the system to circulate the liquid through the demineralizers, and Pump ALC-P-6 is used for chemical addition to the Off Spec Water Receiving Batch Tank or to supply pre-coating fluid to the prefilter elements. The hoses furnished for the flexible connections to the pumps, filters, demineralizers, and traps have a design pressure of 100 psi.

Air supplied to the pumps passes through an air oiler and an anti-freeze injector to a valve manifold. Pump speed and capacity will be varied by the EPICOR II operator to achieve the optimum flow through the radwaste process system. Pump speed is controlled by throttling the drive air at the Fava Control Panel. Demineralized water and oil free air connections are provided on the suction and discharge side of each pump for flushing and blowdown purposes. Refer to Table 1 for pump details. Pump noise and vibration monitors are present for pumps ALC-P-1 thru 4 and have a read-out on panel ALC-PNL-2 in the TV Monitor & Control Building.

2.1.2 Transfer Pump ALC-P-5

The transfer pump (Table 2) is a single stage horizontal centrifugal pump with a capacity of 200 GPM at 90' head. The pump motor is rated at 10 HP and is powered from MCC 2-33A in the TV Monitor & Control Building. The pump is controlled by push buttons for START/STOP from MCC 2-33A, a hand selector switch for low level control of tank CC-T-1 or CC-T-2 from the panel ALC-PNL-1 in the TV Monitor Control Building and level switches in panel ALC-PNL-1 for tanks CC-T-1 and CC-T-2. The level switches receive their signals from level transmitters ALC-LT-1 and ALC-LT-2 at tanks CC-T-1 and CC-T-2, respectively. CC-T-1&2 also have high level cutouts to ALC-P-5.

Demineralized water is supplied to the pump mechanical seal from a solenoid operated valve, ALC-V136, controlled from the pump motor starting circuit. The valve opens, when the motor is started, by energizing the solenoid. The seal water flow rate is maintained at 1-2 GPM by throttling ALC-V134 when seal water injection is required.

Seal water injection is only required if the pump is handling water which contains grit which could damage the mechanical seal. If the pump handles clean water, it is acceptable to allow the mechanical seal to be lubricated through the pump's internal passages. As long as the water, which pump ALC-P-5 handles, has passed through the one micron filter (ALC-F-5), the water is clean enough (from a grit standpoint) to lubricate the mechanical seal. Thus, as long as filter ALC-F-5 is in use, the demineralized seal water can be turned off with valve ALC-V134 to reduce the total volume of processed water or radwaste.

The pump is used to transfer water from the Clean Water Receiving Tank to the TMI Unit 2 Liquid Waste Disposal System, the Spent Fuel Storage Pool, the PWST's, a hose connection at the truck fill station, or to the Off Spec Water Receiving Batch Tank for recycling through the cleanup system.

The pump may also be used for recirculating and sampling the contents of the Clean Water Receiving Tank and the Off Spec Water Receiving Batch Tank. The sample connection terminates at the Sample System sink. The pump is provided with a discharge pressure gage, and a flow element on the discharge line to Units No. 1, No. 2, the Spent Fuel Pool, the PWST's and the truck fill station. Remote indication of flow (ALC-FI-2) and a flow totalizer (ALC-FQ-2) are located on Panel ALC-PNL-1.

2.1.3 Demineralizer (ALC-F-1)

The demineralizer (Table 3) is the first stage of the Auxiliary Building Emergency Liquid Clean-up system. The demineralizer is used to remove sodium and other radioactive and non-radioactive chemicals.

The demineralized unit is a carbon steel tank approximately 6 feet in diameter and 6 feet high. The top of the tank has four quick disconnect type male fittings; an inlet (pump discharge), an outlet (pump suction), a threaded level probe connection, air bubbler level connection, and a combination vent/overflow connection.

A 1/4" air connection is provided at the top of the liner to allow removal of the plug from the top of the false bottom after final dewatering. The false bottom is filled with vermiculite to absorb water that may tend to accumulate to meet shallow land burial requirements. A manway approximately 24" in diameter is installed on top of the tank. On the manway cover is a four inch inspection port used for resin sampling once the container is spent.

The inlet nipple is connected to a full dispersion manifold in the top of the tank. The outlet nipple (pump suction line) connects to a single layer cotton wound tubular filter manifold which is located at the bottom of the tank.

The level probe maintains tank level between 4" and 6" from the top of the resin by opening and closing solenoid valve (ALC-V185) on the air supply to pump ALC-P-1, which is supplying the tank, starting the pump on low level, and stopping the pump and closing valves ALC-V043 or ALC-V242 on high level. On Hi Hi level 4" from the tank top, an audible alarm is sounded at the EPICOR Monitoring Console, located in the TV Monitor & Control Building, ALC-V255 closes, pump motor operated valve closes. The EPICOR II operator may select either air bubbler or conductivity level control on the Fava Control Panel located in the TV Monitor and Control Building.

The demineralizer tank is vented, via hose connections, to a 2" vent header which leads into the top of the Off Spec Water Receiving Batch Tank (CC-T-1).

A tee is provided in this vent line for a hose connection to a common header which discharges to the CCB sump. The line is provided as a demineralizer overflow line and demineralizer overpressure protection. A loop seal is provided to ensure that all cask gases are routed to tank CC-T-1 and its vent filters, rather than directly into the Chemical Cleaning Building. A level switch (ALC-LS-21) is installed in the loop seal for indication of flow in the header and provides an alarm at panel ALC-PNL-1 in the TV Monitor & Control Building.

The shielding in the ALC-F-1 position consists of a 5 1/8" thick, square lead brick wall (3 1/8" thick on south side) plus a 1/2" of shield-supporting steel. Radiation monitors (ALC-RM-1 and 2) are located inside this shield 180 degrees apart at different elevations to monitor accumulated radiation levels in the demineralizer.

To avoid breakthrough of sodium to the second liner, the batch size through the ALC-F-1 demineralizer is limited.

Remote indication is provided on the Cleanup Panel ALC-PNL-1 for ALC-RM-1 and 2. During system operation, radiation levels as indicated on ALC-RM-1 and 2 should not be allowed to exceed 1 R/HR.

2.1.4 Demineralizer (ALC-K-1, ALC-K-2)

Two demineralizers (Table 4) are installed in series with ALC-F-1 to further remove radioactivity from the waste liquid and polish the effluent.

The demineralizer (ALC-K-1) a 6' x 6' liner, is primarily used to reduce the activity level of the process fluid through ion exchange and filtering. For this reason, the anticipated activity levels are high and the shielding around ALC-K-1 is identical to shielding around the ALC-F-1 demineralizer.

Demineralizer (ALC-K-2) a 4' x 4' liner is primarily used to polish the effluent water from ALC-K-1 and act as a guard in the event of a resin breakthrough from ALC-K-1. For this reason, the anticipated activity levels in ALC-K-2 are lower than ALC-K-1.

Each demineralizer has the same external connections as ALC-F-1. As with ALC-F-1, a 1/4" air connection is provided at the top of the liner to allow removal of the plug from the top of the false bottom after final dewatering. The false bottom is filled with vermiculite to absorb water that may tend to accumulate to meet shallow land burial requirements. The demineralizer outlet line (pump suction line) extends to the bottom of the tank. Filter elements on the end of the line keep resin inside of the demineralizer. The demineralizer resin composition and quantity will be determined on the basis of system samples and operating data.

As with the ALC-F-1, two radiation detectors are located at different elevations 180 degrees apart inside the lead shield. Remote indication is provided in the TV Monitor & Control Building on Panel ALC-PNL-1. During system operation, radiation levels as indicated on ALC-RMI-3 and 4 for ALC-K-1, should not be allowed to exceed 1 R/HR. Radiation levels as indicated on ALC-RMI-5 and 6 for ALC-K-2, should not be allowed to exceed 1R/HR.

2.1.5 Miscellaneous Waste Hold-up Tank (WDL-T-2)

The Miscellaneous Waste Hold-up Tank (Table 5) which has a capacity of 19,518 gallons, can receive liquid from the following sources:

a. Auxiliary Building Sump Tank

b. Neutralizer Tanks

c. Contaminated Drain Tanks

d. Reactor Building Sump

e. Deborating demineralizer back wash outlet

f. Fuel Storage Pool Submersible Pump Discharge

g. Unit No. 1 Miscellaneous Waste System

h. Demineralized Water System

i. Submerged Demineralizer System (SDS)

j. Cond. Polisher Sump

k. Water Treatment Sump

l. Reactor Coolant Bleed Tanks

m. Concentrated Waste Storage Tank

The tank also has connections to the Miscellaneous Waste Tank Pump suction, recirculation, a caustic and sulphuric acid inlet, two nitrogen inlets, a vent, a gas sample connection and a relief valve. The tank is normally nitrogen blanketed, but may be vented to the WDG System. To prevent acid splashing on the inner tank walls, the inlet piping extends into the tank 8 ft. The diameter of the tank is 10'-9-1/4". The Miscellaneous Waste Hold-up Tank is located in the Auxiliary Building elevation 305'.

A temporary tee connection is installed in place of the suction line strainer, WDL-U202B, on the Miscellaneous Waste Tank Pump WDL-P-6B suction line. Connected to this tee is a 2" line which supplies the liquid from the Miscellaneous Waste Holdup Tank to the suction side of EPICOR II Pump ALC-P-1. A 4" guard pipe with a combination of lead and concrete shielding encloses the suction piping run from the Auxiliary Building corridor to the Chemical Cleaning Building penetration. The guard pipe is open to the atmosphere of the Chemical Cleaning Building, which is under a slight negative pressure.

2.1.6 Clean Water Receiving Tank (CC-T-2)

The Clean Water Receiving Tank (Table 6) is a stainless steel atmospheric pressure tank with a capacity of 133,700 gallons located in the Chemical Cleaning Building. The tank receives the processed liquid from the discharge of pump ALC-P-4 via, in order, three resin traps, a one-micron crud filter, radiation monitor, conductivity cell, pH meter, and an inlet flowmeter/totalizer.

An overflow line with a loop seal is provided near the top of the tank. A demineralized water supply is provided for the loop seal. A suction line from the transfer pump (ALC-P-5) penetrates the tank skirt and connects to the bottom of the tank. A connection is also provided for the transfer pump recirculation line. Level indication and high level alarm are provided on panel ACL-PNL-1. A future xenon hold-up tank connection is provided on the vent line. A 2" demineralized water line is also provided on top of the tank for whenever large quantities of demineralized water are required in the tank. This would include preoperational testing or tank cleanup. A drain line is provided off the Transfer Pump (ALC-P-5) suction piping to drain the suction piping and the remaining water in the tank that the transfer pump cannot drain.

The tank has a 2" vent line exhausting to the Chemical Cleaning Building through a two-stage demister filter. The first stage consists of two moisture separators and an HEPA filter. The second stage consists of two charcoal filters and an HEPA filter. A heater in the common 2" vent line is controlled from Power Panel MP-2-33A. The heater is normally energized.

Processed water is stored in the tank until a batch is completed. A representative sample of the processed water can be obtained from the discharge of the transfer pump at the sample sink after recirculating three volumes of the tank and purging the sample lines for five line volumes before drawing the sample. If the sample indicates the water is unsatisfactory for disposal, the water can be pumped to the Off-Spec Water Receiving Batch Tank for temporary storage or routed directly back into the suction line of pump ALC-P-1 for reprocessing through the filter and demineralizers until the quality is acceptable for discharge to the plant or storage tanks. If sampling indicates that the tank's contents are satisfactory for disposal, the water is pumped normally into the TMI Unit 2 Liquid Waste Disposal System, the Spent Fuel Storage Pool, the PWST's or to a tank truck at the truck fill station, however, it may be stored in the Off-Spec Water Receiving Batch Tank, if desired. The Off-Spec Water Receiving Batch Tank should be flushed clean with demineralized water before it is used for clean water storage.

2.1.7 Off-Spec Water Receiving Batch Tank (CC-T-1)

The Off-Spec Water Receiving Batch Tank (Table 7) is a stainless steel tank with a capacity of approximately 86,000 gallons designed for full vacuum to 75 psig. For the Auxiliary Building Clean-up System, the tank will be operated at atmospheric pressure only. The tank can receive the discharge from the Clean Water Receiving Tank Transfer Pump whenever it is desired to either recycle the water for further processing, or store the purified water for future disposition. CC-T-1 may also be used as a source of processed water to supply the NLB pump used for containment decon. This feature allows greater availability of the Clean Water Receiving Tank.

The Tank is piped up to receive the discharge from the sump pump, if desired, but normally the sump is drained by a 2" suction line to the Pump ALC-P-1 (see para. 2.1.8). A suction line at the bottom of the tank can be lined up either to Pump ALC-P-1 for reprocessing the tank's contents through the system or to the Transfer Pump ALC-P-5 for recirculation and sampling, or discharge.

The tank is vented to the building in the same manner as the Clean Water Receiving Tank. An over-flow line with a loopseal is provided near the top of the tank. A demineralized water supply is provided for the loop seal. A connection at the top of the tank receives vents from the prefilter, the demineralizers and the crud filter. Chemicals for iodine fixing or pH adjustment may be added to the tank by pumping through Pump ALC-P-6 to a connection near the top of the tank. Level indication and high level alarm are provided on panel ACL-PNL-1. A future xenon hold-up tank connection is provided on the vent line.

The tank has a 2" vent line exhausting to the Chemical Cleaning Building through a two-stage demister filter. The first stage consists of two moisture separators and a HEPA filter. The second stage consists of two charcoal filters and a HEPA filter. A heater in the common 2" vent line is controlled from Power Panel MP-2-33A. The heater is normally energized.

2.1.8 Chemical Cleaning Building Sump

The Chemical Cleaning Building sump is a stainless steel lined pit with a capacity of (4000) gallons located in the northwest corner of the building. All leakage from the tank overflow, equipment, and floor drains are collected in the sump. One sump pump (Table 8), is installed to permit the transfer of the liquid from the sump to the Off Spec Water Receiving Batch Tank, if desired. The pump is a single stage centrifugal pump with a capacity of 100 gpm. The pump motor is rated at 20 HP and is controlled from a (MAN-OFF-AUTO) selector switch located on MCC2-33A. When in AUTO, the pump is controlled by conductivity type level switch ALC-LS-1 which starts and stops the pump automatically. A High Sump Level Alarm is provided on Cleanup Panel ALC-PNL-1.

The pump is started when the water level in the sump reaches a level that is 48 1/4 inches below the face of the pump mounting. The pump stops when the level of water has been lowered to a level that is 90 3/8 inches below the pump face. The high level alarm is actuated when the water level reaches 36 1/4 inches below the face of the pump mounting. The volume of water removed from pump START to pump STOP is approximately 1600 gallons. There is also a volume of nearly 1700 gallons above the High Alarm before the sump overflows.

The sump is normally drained by a 2" line provided from the sump to 2" Flushing Line just upstream of its entry into the suction line of pump ALC-P-1. This permits the return of the sump water to the clean up system directly from the sump without circulating through the pump CC-P-2A and the Off-Spec Water Receiving Batch Tank CC-T-1. A 3/4" branch connection is provided in this line with "Quick Disconnects" attached to permit ready access for flushing with dimineralized water from an outlet downstream of valve ALC-V015 with a short length of hose.

2.1.9 20 Ton Monorail Hoist System

A 20 ton hoist is provided for removal and replacement of the demineralizers and other large pieces of auxiliary equipment in and out of the building. It is mounted on the monorail which extends from the north side of the Chemical Cleaning Building above the resin traps through the south end of the building, extending 18' outside of the building over the cask loading area. Table 9 provides specifications on the monorail hoist system.

In order to minimize the radiation exposure to personnel during demineralizer removal, the hoist is operated remotely using a remote pendant operating station in the TV Monitor & Control Building. Remote operation is aided through the use of a closed circuit TV system with six cameras. The pendant has six pushbuttons for trolley and hoist operation - one START, one STOP, two for north/south movement of the single speed trolley, and two for the hoist Quad-Speed Control System which are, a 4-step button for creep low, medium and high speed RAISE, and a 4-step button for creep low, medium and high speed LOWER.

There is also a local monorail hoist pendant located on the CCB operating floor. This pendant is used for performing operations where there is little radiation exposure, such as bringing a new liner of resin into the building.

To aid positioning of the hoist remotely for demineralizer replacement, the monorail has visible target markings above the demineralizers, and in the cask loading area all of which can be viewed with the TV cameras.

2.1.10 Resin Filter - ALC-F-4A, B & C

Three Resin Filters are provided downstream of EPICOR pump, ALC-P-4, to prevent resin fines from entering the Clean Water Receiving Tank. If the filters contact radiation level reaches 250 mR/HR on any part of the filter, the system must be shutdown and the filters replaced. Four sides of the filters are shielded by solid concrete blocks 8" thick. The top is shielded with 1/2 inch of lead.

2.1.11 Crud Filter - ALC-F-5

A one micron filter with isolation valves is provided between the resin filter and the Clean Water Receiving Tank. The primary purpose of this filter is to eliminate any cobalt present in the processed water. A vent line connected to the Off-Spec Water Receiving Batch Tank and a drain line to the equipment drain system is provided for draining the filter housing prior to inserting or removing a filter cartridge. The filter is shielded by 3 1/8" lead bricks on three sides, and by a concrete wall on the fourth side.

During removal of the filter, it should be handled as radioactive material. The filter must be replaced whenever the contact radiation level reaches 250 mR/HR. A special lever is provided to aid in removal of the filter cartridge.

2.1.12 Ventilation Heating Unit & Moisture Separator

Heating unit no. ALC-E-H1 (Table 10) is mounted on the inlet of the filtration unit at elevation 304' and consists of a moisture separator (ALC-E-F1) and a 60 KW 480 volt, 3 phase heater. The heater is powered from MCC2-33A.

2.1.13 Ventilation Filter Unit

The filter unit consists of a single housing containing, in order: a prefilter (ALC-E-F2) (not used), a high efficiency particulate air (HEPA) filter (ALC-E-F3), charcoal filter beds (ALC-E-F4) and a final HEPA filter (ALC-E-F5). A manually actuated fire protection water supply is provided for the charcoal beds.

2.1.14 Ventilation Fan Assembly

Fan assembly no. ALC-E-1 (Table 10) is a 30HP, 460 volt, 3 phase, 60 cycle, radial flow centrifugal unit with a capacity of 8000 cfm. The fan, powered from MCC2-33A, is mounted on the outlet of the filter unit and discharges the ventilation exhaust through ducting (monitored by a radiation detector) and out through the roof.

2.1.15 Ventilation Radiation Monitor

The radiation monitor (Table 10) samples air in the fan discharge line isokinetically at a rate of 4 cfm to provide local (at monitor) and remote indication on Panel ALC-PNL-1 of discharge paticulate, iodine and noble gas activity levels. Remote indication of these parameters is recorded on a strip chart recorder. The monitor will provide an alarm at a radiation level of 200,000 CPM, 40,000 CPM, and 100,000 CPM for a particulate, iodine or gaseous activity on the panel in the Control Building. The radiation monitor is powered from MCC2-33A. A splitter block has been provided in the line to the radiation monitor to provide a means of taking grab samples as may be required.

2.1.16 Ventilation Weatherproof Enclosures

The weatherproof enclosure is located at grade level and houses the components discussed in 2.1.12 thru 2.1.15 (above).

2.1.17 Chemical Cleaning Building Radiation Monitors

Four area radiation monitors (ALC-RM-8 thru 11) and an air sampler (ALC-RM-12) are provided in the Chemical Cleaning Building. The four area radiation monitors (ALC-RM-8 thru 11) are provided with remote indication on the Radiation Monitoring Panel ALC-PNL-1 in the Control Building. The air sampler (ALC-RM-12) is located in the HVAC Building, but draws its sample from the Chemical Cleaning Building near ALC-F-1. Remote indication for ALC-RM-12 is also provided on the Radiation Monitoring Panel ALC-PNL-1. The area monitors and air sampler will provide a common alarm at a high radiation level and monitor failure on Panel ALC-PNL-1. These radiation monitors are provided for operator information.

2.1.18 Closed Circuit TV System

A closed circuit TV system is provided to aid in remote handling of the demineralizers and to aid in system surveillance during operation. The system consists of seven TV cameras strategically located in the Chemical Cleaning Building. The TV monitors and necessary controls are mounted on the TV Monitor Console located in the TV Monitor & Control Building. Camera No. 3 has a PAN-TILT control and is mounted to provide a view of ALC-K-2 for remote handling. The PAN-TILT control allows remote movement of the camera to permit scanning a large area of the Chemical Cleaning Building for surveillance during system operation. Camera No. 6 is mounted to provide a view of the EPICOR II pumps ALC-P-1 thru 4. This camera provides the operator with a remote surveillance capacity for viewing this area of the building during system operation.

Camera No. 1 mounted on the monorail support structure outside the Chemical Cleaning Building to allow viewing of the prefilter or demineralizer while being loaded into the transfer cask. Camera No. 2 is mounted directly on the 20 Ton Hoist and provides a direct view of the monorail.

Target markings which can be viewed with this camera are provided on the monorail to aid in the positioning of the Hoist. Cameras No. 4 and No. 5 provide a view of the top area ALC-F-1 and ALC-K-1 to aid in remote handling of these casks and to provide a surveillance capability for these casks during operation of the system. Camera No. 7 has a PAN-TILT control and is mounted on the west wall between ALC-K-1 and ALC-K-2 to provide remote monitoring of potential leak areas.

2.1.19 Major System Valves

Inlet Isolation Valve to EPICOR II System - ALC-V043

One stainless steel, 2", 120V motor operated ball valve is installed on the inlet line from the source tank to the EPICOR II radwaste processing system. The valve is powered from the 120/208V Power Panel MP-2-33A and controlled by a handswitch located on MCC-2-33A, Compartment 3D and a prefilter level probe. Valve position and control power availability indications are provided by red, green and white indicating lights also located on Compartment 3D. The three lights will be on while the valve is in an intermediate position. The valve is provided with a manual override for "close" operation only. Valve ALC-V043 is interlocked with valve ALC-V242 to assure that only one of these two valves can be OPEN at a time. Valve ALC-V043 is interlocked with ALC-F-1 high level to prevent overfilling the demineralizer.

Service Air Regulator - ALC-V109

One 3" pressure regulating valve with a 300# rating is installed on the service air header supply to the EPICOR II system to reduce the pressure to 80 psig.

Process Supply Line Valve (ALC-V255) to Demineralizer (ALC-F-1)

One 2" solenoid valve (ALC-V255) with a 150 # rating at 120°F is installed on the line from ALC-P-1 to ALC-F-1 between manual valves ALC-V191 & ALC-V207, the valve ALC-V255 is normally closed unless energized and is interlocked to close on high level in ALC-F-1. Additionally it closes on loss of electrical power or when system is not running.

Off Spec. Water Supply Isolation Valves to ALC-P-1 - ALC-V086 and ALC-V242

One stainless steel, 2", air operated ball valve, ALC-V242, is installed on the supply line from Off Spec Water Receiving Batch Tank CC-T-1 to the suction of Pump ALC-P-1. The valve allows reprocessing of off specification water. The valve is powered from the 120/208V Power Panel MP-2-33A and controlled by a handswitch located on MCC-2-33A, Compartment 3E. Valve position and power availability indications function in the same manner as for ALC-V043. Valve ALC-V242 is interlocked with Valve ALC-VO 3 to assure that only one of these two valves can be OPEN at a time. Valve A C-V242 is an air operated ball valve which is energized to open. This valve will close on loss of power thus avoiding uncontrolled draining of tanks CC-T-1 or CC-T-2.

Valve ALC-V086 is a stainless steel, 2", 120V motor operated ball valve which is also installed on the outlet line of the Off Spec. Water Receiving Batch Tank CC-T-1. It is controlled by a manual handswitch mounted in MCC-2-33A, compartment 3E. By opening valve ALC-V086 and closing ALC-V242, clean water can be sent from tank CC-T-1 to the suction of the transfer pump (ALC-P-5) for transfer to the Processed Water Storage Tanks or other transfer points.

2.1.20 Sample System

A Sample System is provided to obtain a representative sample of tanks CC-T-1 & 2 and the effluents of Demineralizers ALC-F-1, ALC-K-1 and ALC-K-2.

The samples from the Demineralizers and the sample obtained from the Miscellaneous Waste Holdup Tank are used to determine the isotopic inventory held up on the resin beds. The determination is made by analyzing the influent and effluent isotopic concentrations, the difference of which is held up on the bed. This information is required for shipment of the spent contain- ers to the waste disposal site.

A common collection station shielded by an 8 inch thick solid block wall is located on the Chemical Cleaning Building mezzanine, and is provided for controlled and safe sampling.

The collection station consists of individual sample stations for CC-T-1 & 2, ALC-F-1, A C-K-1 and A C-K-2, and a sample sink.

The sample sink is provided with demineralized water for the sink spray header and bottle washing. The drain from the sink is routed to the Chemical Cleaning Building sump. The sink is also provided with ventilation which consists of a hood and ductwork which is tied into the Chemical Cleaning Building ventilation system.

Recirculation of the sample lines from ALC-F-1, ALC-K-1 and ALC-K-2 back to the suction of ALC-P-2, and the collection of samples is controlled by solenoid valves. The ability to obtain grab samples is provided in the recirculation line for flow verification. Piping for the sample lines is 1/2" stainless steel tubing with compression type connectors.

<u>NOTE</u>: See section 2.1.6 for obtaining a sample from CC-T-1 & 2.

2.1.21 Aux. Building Cleanup System Air Compressors

Rotary air compressors ALC-P-7 and 8 (Table 11) are provided as a backup air supply for the EPICOR II system, while the plant Service Air system is the normal air supply. Either of these air compressors have sufficient capacity for the operation of the Epicor II system. These compressors are located in the ventilation unit's building. These compressors are single stage rotary screw, electrically driven, packaged units (pre-wired and pre-plumbed) with capacities of 115 and 98 CFM at 100 psig (the compressors are not the same model).

The compressors are controlled by local hand switches which allow the choice of either START/STOP (for intermittent air demand) or CONTINUOUS (for continuous air demand) control modes for flexibility. The units are piped up so that they can be used individually when a small volume of air is required or in parallel to handle larger air demands. In all of the operating modes, the air pressure in each unit's reservoir is automatically maintained within preset limits.

2.2 Instruments, Controls, Alarms, and Protective Devices

2.2.1 Cleanup System

The Auxiliary Building Emergency Liquid Cleanup System is normally operated and monitored from control panel ALC-PNL-1 located in the TV Monitor & Control Building which is a separate prefabricated building. The TV Monitor & Control Building is adjacent to the northwest corner of the Chemical Cleaning Building.

Electrical power is supplied to the Auxiliary Building Emergency Cleanup System from 750 KVA Unit Substation USS 2-33 located on the mezzanine floor at elevation 305' in the southeast corner of the Turbine Building for Unit 2. USS 2-33 was originally the power supply to the Control Rod Drive Motors. 480V power from USS 2-33 is supplied to MCC 2-33A located inside the TV Monitor & Control Building. The HVAC system fan and heaters, the transfer pump, building sump pump, and the 20-ton hoist are powered from MCC 2-33A. A 480-120/208 Vac, 25 KVA transformer, supplied from MCC 2-33A, supplies all other system electrical loads from Power Panel MP2-33A, except heat traces and ALC-P-8 which are supplied from the control rod breaker (2-43).

The EPICOR II pumps are controlled through an automatic control unit which provides AUTO/MANUAL on-off switches and indicating lights for the pumps, demineralizer high level alarms, and an ON/OFF switch for the unit. Control power is provided for the EPICOR II solenoid operated air supply valves through these units. The speed of the pumps is controlled by throttling motor operated valves ALC-V260, 261, 262 and 263. A turbine flowmeter (ALC-FI-1) is provided to monitor process flowrates.

Interlocks are provided from pump control panel to valves ALC-V043, ALC-V242 and ALC-V255 such that when the pump is stopped the valves will close, if open.

All process instrumentation monitored in the control center is mounted on Cleanup Panel, ALC-PNL-1. Audible alarms and indicating lights are provided on this panel for CCB Sump High Level, CCB Ventilation System Trouble, CCB Charcoal Filter High Temperature, CCB High Exhaust Radiation Level, CCB Radiation Monitor Failed, Building Radiation Level, and ALC-F-1, ALC-K-1 & 2 Loop Seal Flow. Remote indication is provided for the area radiation monitors and the air sampler on the Radiation Monitoring Panel located adjacent to the Cleanup Panel. A complete instrument list including range and setpoints is provided in Table 12.

2.2.2 Ventilation System

2.2.2.1 Heating Unit & Moisture Separator

The moisture separator is instrumented with a differential pressure indicator and switch, ALC-DPI-11 and ALC-DPS-11. The heating unit (ALC-E-H1) is provided with a temperatue indicating controller and a high temperature switch.

The temperature indicating controller functions to maintain the heaters energized providing a heater outlet air temperature of no more than 146°F. Should the air temperature rise to 160°F, the high temperature switch will automatically deenergize the heaters. If the heaters are to be reenergized, the reset button must be depressed when air temperature at the thermocouple drops below the 160°F temperature switch setpoint.

Indication of operation of the temperature indicating controller and high temperature switches are provided on the switches, both of which are located in the heater control panel near the heaters on the filtration unit.

Manual energizing/deenergizing of the heater control panel occurs at MCC2-33A. The heater panel is also deenergized automatically should the system ventilation fan trip or in any other way fail to maintain minimum flow at the fan discharge flow switch.

A red light on the heater controller panel indicates power available to the heater control panel.

2.2.2.2 Filter Unit

Differential pressure indication is provided for the filter unit's moisture separator (ALC-E-F1). While a differential pressure indication (DPI-11) is provided locally, a differential pressure switch (DPS-11) will actuate a remote "Trouble" alarm warning the operator of a restricted flow condition existing in the moisture separator. (Note: The moisture separator should be replaced when it exhibits a pressure drop of 1" w.g.)

Two differential pressure switches (one not connected) and a differential pressure indicator (DPI-13) are located on the first HEPA filter (ALC-E-F3) in the Filter Unit for indication and alarm: DPS-13 warns of a high differential pressure condition by actuating the Ventilation Unit common "Trouble" alarm at 3" W.G.

The charcoal filter is instrumented with a fire detection system. A prealarm (TS-15-1 set at 250°F) will actuate a local amber light, a remote high temperature alarm and a horn warning of increasing temperature in the charcoal bed. At 300°F, (remote common "Trouble" and local red light) alarms will be actuated from TS-15-2 indicating a Hi Hi temperature condition exists in the bed.

Indication of operability of the fire detection system is provided by an "Abnormal Detection" white light, located on the filtration unit fire detection panel.

Also provided on the charcoal absorber is a differential pressure indicating controller (ALC-DPI-14). This is not connected.

The final stage of filtration in the filtration unit occurs in the last HEPA filer (ALC-E-F5). In addition to being provided with local differential pressure indication (DPI-16), the remote "Trouble" alarm is actuated on a high HEPA filter differential pressure of 3" W.G. by the locally mounted differential pressure switch (DPS-16).

2.2.2.3 Fan Assembly

The fan assembly, as previously noted, is interlocked with the 60 KW heater. A control interlock is provided through the fan and heater circuitry such that the heater may not be energized unless the fan is running. A flow indicating switch (FIS-17) on the discharge of the fan provides a safety interlock: if the filtration unit is operating and the discharge flow of the fan falls below 4,000 cfm, the heater and fan moitor will trip. FIS-17 is also tied into the common, remote panel mounted "Trouble" alarm. The fan is started and stopped from MCC2-33A.

2.2.2.4 Radiation Monitor (Controls)

The Radiation Monitor (ALC-RE-18) is energized and deenergized locally at the monitor cabinet. Separate control switches are provided: one of the unit itself and another for the monitor sample pump. (Note: During operation of the Chemical Cleaning Building Ventilation System, the Radiation Monitor must be energized at all times). A "Power Available" light is provide on the unit.

Local indication of the ventilation exhaust particulate and/or gaseous activity level is provided on the monitor. Remote indication of the ventilation exhaust activity levels is provided on the panel in the control shed. At a level of 200,000 CPM particulate, 40,000 CPM iodine, or 100,000 CPM noble gas the High Radiation alarm will sound on the panel in the control shed.

3.0 PRINCIPLE MODES OF OPERATION

3.1 Startup

3.1.1 Ventilation System

Prior to startup of this unit, the manual dampers ALC-E-D1 and D2 shall be checked open. Ensure that the radiation monitor is energized and operational.

When the fan is started (at MCC2-33A) ensure sufficient air flow exists (approx. 4000 CFM minimum) through the unit before energizing the heaters (Note: Heaters should not energize if insufficient air flow exists). After startup, verify that ventilation unit temperature, flow and activity indications are normal before leaving unit unattended.

NOTE: Start push button will have to be depressed and held until flow increases above lower limit or fan will trip.

3.1.2 Cleanup System

Initial startup of the Auxiliary Building Emergency Cleanup System will be with the Demineralizers empty of liquid. The Chemical Cleanup Building Ventilation System shall be in operation prior to operating the cleanup system.

Before contaminated liquid flow is initiated the line between the source tank and ALC-V043, or the line back to CC-T-1 through valve ALC-V242 is primed with demineralized water. Motor operated valve ALC-V043 or solenoid valve ALC-V242 is then opened and Epicor II pump ALC-P-1 is started by opening the air motor air supply valve (ALC-V185). Liquid waste is pumped from the source tank to the Demineralizer, ALC-F-1, until the Demineralizer ALC-F-1 is full and the pump stops on high tank level. Epicor II Pump ALC-P-2 is similarly operated until Demineralizer ALC-K-1 is full and ALC-P-3 is operated until Demineralizer ALC-K-2 is full. The air supply valves ALC-V011, V028, V025 & V022 for Epicor II pumps ALC-P-1 thru 4 respectively are throttled to maintain a balanced flow of about 10 gpm through the demineralizers.

<u>NOTE:</u> The initial batch quantity will be determined by the efficiency of the demineralizer resin charge and may require a change in resin composition and/or flow rate to effectively process the radioactive waste water.

3.1.3 SDS Polishing Startup

Prior to startup for the SDS Polishing Mode, the 4 x 4 liner and top shielding for ALC-K-1 will have to be removed and replaced with a 6 x 6 liner.

In addition, the resin mixes in ALC-K-1 and ALC-K-2 will have to be changed to suit the SDS Polishing service requirements.

All other Startup procedures are the same as those identified in Section 3.1.2.

3.2 Normal Operation

3.2.1 Ventilation System

During normal operation, the ventilation unit should require little operator action. The unit should be periodically checked to ensure that indication is operable and that temperatures, flows and radiation levels are within the normal ranges.

Increasing differential pressures across the moisture separator and HEPA filters are an indication that the components are retaining dirt, etc. These components should be replaced as required to ensure that flow through the ventilation unit is maximized.

The radiation monitor and recoroer should be checked periodically and reviewed for evidence of trends indicating that increasing levels of activity are being discharged. A trend showing increasing discharge activity levels can be indicative of carryover from the filter unit and should be treated accordingly.

3.2.2 Cleanup System

Once the flow rate is established for the process, the system operates automatically by starting and stopping the pumps (ALC-P-1, 2, 3 and 4) in order to maintain the proper level in the process tanks. Instrumentation is provided on the control panel to monitor system parameters and to balance the system to minimize pump cycling.

Upon completion of processing one batch, Transfer Pump ALC-P-5 is started to recirculate at least three tank volumes of water through the Clean Water Receiving Tank after which a sample is drawn for analysis by the TMI water chemistry laboratory. Water acceptable for discharge will be pumped to the TMI Unit 2 Liquid Waste Disposal System for further sampling and monitored discharge, or to a truck via the truck fill station hose connection or to the Processed Water Storage Tanks. Out of Spec water will be pumped to the Off-Spec Water Receiving Batch Tank for reprocessing. (See para. 2.1.6 and 2.1.7)

NOTE: Normal operation is the same whether the system is being used in the Auxiliary Liquid Cleanup Mode, or in the SDS Polishing Mode.

3.3 Shutdown

3.3.1 Ventilation System

The purpose of the ventilation system is to ensure that all air leaving the Chemical Cleaning Building is filtered and monitored for radiation. Shutdown of the ventilation system will preclude filtration and monitoring of the air and should not be performed unless dictated by other casualty/operational considerations. To shutdown the ventilation unit, deenergize the 60 KW heaters, fan (ALC-E-1) and radiation monitor from their respective breakers in MCC 2-33A.

3.3.2 Cleanup System

The system is shutdown and flow through the process system stopped by closing the air supply valves to Epicor II Pumps, ALC-P-1 through 4. To shutdown the system upon completion of processing a batch, the pumps are secured and the liquid supply valve ALC-V043 or ALC-V086 is closed. Valves ALC-V242 and ALC-V255 close automatically as power is shutdown. Close ALC-V277 to prevent syphoning of the third demineralizer to CC-T-2.

The system is shutdown and the affected unit replaced when radiation monitors on any of the demineralizers indicate the unit has collected a quantity of material which is limited by shipping regulations, or system sampling indicates that the resins are exhausted chemically. To replace one of the units, the tank is emptied of water, the three hoses, the level probe cable and the bubbler unit disconnected from the tank, and the remotely operated hoist used to transport the demineralizer to the outside of the Chemical Cleaning Building to the transfer cask. The replacement unit is then installed, the hoses, the level probe cable and the bubbler line reconnected and the system started as described in paragraph 3.1. Each can has its own level probe which will be discarded with the can.

NOTE: Shutdown is the same whether the system is being used in the Auxiliary Building Liquid Cleanup mode or in the SDS Polishing mode.

3.4 Special or Infrequent Operation

3.4.1 Filter Changeout

When a filter bank requires changing, the Aux. Building Emergency Liquid Clean-up System should be shutdown. The ventilation system shall be in operation during the filter change-out.

3.5 Emergency

3.5.1 Loss of Chemical Building Ventilation System

On loss of the Chemical Cleaning Building Ventilation System, the Auxiliary Building Emergency Liquid Cleanup System shall be shutdown, and the Chemical Cleaning Building sealed.

3.5.2 Loss of Electrical Power

On loss of electrical power to the Chemical Cleaning Building MCC 2-33A, EPICOR II Pumps ALC-P-1, 2, 3 & 4 will automatically stop as the solenoid valves on the air supply lines fail closed on loss of power. Valves ALC-V043 and V086 fail "As Is". Valve ALC-V255 fails closed. Valve ALC-V242 fails closed on loss of power to stop flow from tank CC-T-1. If flow through the system is from the Misc. Waste Holdup Tank, WDL-T-2, operator action is required to close valve WDL-V262B. Power will be lost to Ventilation System 60KW heaters, exhaust fan and radiation monitor. The ventilation unit inlet and outlet dampers should be closed. This same procedure should be followed in the event that only the exhaust fan is lost.

On loss of power to the 2-43 supply, backup air supply and heat traces will not be available.

When electrical power is lost, place all automatically controlled equipment to the manual OFF position. Then, when emergency power is available, restart the system.

3.5.3 Loss of System Air

Loss of System Air will cause the Epicor II Pumps to secure until either the system compressors can be put into service or the Service Air System can be returned to service.

NOTE: Epicor II uses in-plant service air as normal supply air.

3.5.4 Fire

3.5.4.1 Ventilation System

Should they become too hot, the charcoal absorber beds in the ventilation unit could ignite. Upon verification of ignition of the charcoal bed, the manually actuated fire protection sprays should be cut in.

3.5.4.2 Cleanup System

If a fire occurs in the TV Monitor Control Building the sprinkler system will automatically initiate. The Chemical Cleaning Building is provided with a hose station on the mezzanine for manual firefighting.

4.0 HAZARDS AND PRECAUTIONS

Since the system is handling radioactivity contaminated fluids, all appropriate health physics precautions must be observed during operation and maintenance. Under no circumstances will discharges be made to the environment without proper authorization.

The Chemical Cleaning Building Ventilation System will process potentially contaminated air. As such, any operations or maintenance associated with the system should fully incorporate appropriate Health Physics guidelines/requirements. Any solid or liquid ventilation system waste must be sampled and cleared by HP before release to environment.

Ensure that positive verification of charcoal bed fire exists before manual initiation of fire protection spray system since water will damage the charcoal bed.

Flushing connections are provided at various locations in the system and provide a means for reducing the radiation levels in the piping. Flushing should be exercised when maintenance is performed.

TABLE 1

EPCIOR II PUMPS

Pump Details

Identification	ALC-P-1, 2, 3, 4
Number Installed	4
Manufacturer	Warren Rupp Co.
Model no.	SA 2-A
Type	Double opposed diaphragm
Maximum rated capacity at 90 psi air supply	120 GPM at 45 Ft of head
Operating point capacity at 90 psi air supply	20 GPM at 170 Ft of head
Max. air pressure, psi	125
Lubricant	Oil

TABLE 2

TRANSFER PUMP

Pump Details	
Identification	ALC-P-5
Number Installed	1
Manufacturer	Ingersoll Rand
Model No.	3 x 2 x 10 Type HOC, Group 2, ANSI A60
Type	Horizontal Centrifugal
Standard Material Designation	Col. DI
Rated Speed, rpm	1750
Rated Capacity, gpm	200
Rated Total Dynamic Head, Ft	90
Shutoff Head, Ft	121
Design Pressure, Casing, psig	200
Design Temperature, °C	110
Lubricant	SAE 20 or 30 Oil
Motor Details	
Manufacturer	Gould Century Elect. Div.
Type	F-C
Enclosure	TEFC
Rated Horsepower, HP	10
Speed, rpm	1700
Lubricant/Coolant	Grease/air
Power Requirements	480V AC/12.5A, 3 Phase, 60HZ
Power Source	MCC-2-33A

TABLE 3

FILTERS

Resin Filters (Traps)

Tank Details

Identification	ALC-F-4A, B, C
Number Installed	3
Manufacturer	Capolupo & Gundal, Inc.
Installation	Horizontal
Outside diameter/height, ft	10 x 28
Shell material	PVC
Design pressure, psi	100

CRUD FILTERS

Identification	ALC-F-5
Number Installed	1
Manufacturer	Pall Trinity Micro Corp.
Installation	Vertical
Outside diameter/height, inches	7 x 34
Shell thickness, inches	0.165
Shell material	SA-312 TP304
Design pressure, psi	150
Particle size rating	1 micron, nominal

TABLE 4

DEMINERALIZERS

Tank Details	
Identification	ALC-F-1, ALC-K-1, ALC-K-2
Number Installed	3
Manufacturer	EPICOR
Installation	Vertical
Outside diameter/height, ft-in	6'0" x 6'0" (ALC-F-1 & ALC-K-1) 4'0" x 4'0" (ALC-K-2)
Shell thickness	1/4"
Shell material	Carbon Steel
Design pressure, psi	2

TABLE 5

MISCELLANEOUS WASTE HOLD-UP TANK

Tank Details	
Identification	WDL-T-2
Manufacturer	Richmond Engineering Co. Inc.
Capacity - gallons	19,518
Installation	Horizontal
Outside diameter and length, ft-in	10' - 9 1/4"; 32' - 4 5/8"
Shell material	SA-240, 304 S/S
Shell thickness, in.	3/8
Design temperature, °F	150
Design pressure, psig	20
Corrosion allowance, in.	0
Design code	1968 ASME, Sec. III, Class 3
Code stamp required	ASME Code

TABLE 6

* CLEAN WATER RECEIVING TANK

Tank Details	
Identification	CC-T-2
Number Installed	1
Manufacturer	Chicago Bridge & Iron Co.
Capacity - gallons	133,689
Installation	Vertical
Outside diameter & height - ft	25' - 35'
Shell material	304 Stainless Steel
Shell thickness	3/16" to 3/8"
Design pressure	Atmospheric
Corrosion allowance	0
Code stamp required	No

* Rinse Hold Tank for O.T.S.G. Chem. Clean Sys.

TABLE 7

* OFF-SPEC WATER RECEIVING/BATCH TANK

Tank Details

Identification	CC-T-1
Number Installed	1
Manufacturer	Chicago Bridge & Iron Co.
Capacity - gallons	85,978
Installation	Vertical
Outside diameter & height, ft-in.	21'-10" & 39'-0"
Shell material	304 Stainless Steel
Shell thickness	
Design temperature, °F	250°F
Design pressure	Full vacuum to 75 psig
Corrosion allowance	0
Code stamp required	Yes

* Chemical Cleaning Solution Tank for O.T.S.G. Chem. Clean Sys.

TABLE 8

SUMP PUMP
CHEMICAL CLEANING BUILDING

Pump Detail	
Identification	CC-P-2A
Number Installed	1
Manufacturer	Gould
Model No.	3171
Type	Vertical
Rated speed, rpm	3600
Rated capacity, gpm	100
Rated total head, ft	250
Min. Submergence required	1 Foot
Design pressure, casing, psig	150
Design temperature, °F	450
Lubricant	Water
Min. Flow requirements, gpm	
Motor Details	
Manufacturer	General Electric
Type	Vertical Induction
Enclosure	TEFC
Rated Horsepower, HP	20
Speed, rpm	3600
Lubricant/Coolant	Grease/Air
Power Requirements	480V AC, 3 Phase, 60 HZ
Power Source	MCC 2-33A

TABLE 9

MONORAIL HOIST SYSTEM

Number Installed:	1
Manufacturer:	Harnischfeger, Inc., P&H
Model:	#36CS23E
Capacity:	20 ton
Total Lift:	25'-6"
Speed:	
Hoist:	20 FPM maximum (90% load) 10 FPM medium 5 FPM low 1 FPM creep
Trolley:	50 FPM
Control:	
Hoist:	Quad - Speed
Trolley:	Single Speed
Power Supply:	460 V AC, 3 Phase, 60 Hz MCC 2-33A
Control Voltage:	110 V AC

Control Station:

Local and Remote six pushbutton pendant control; deadman type element control

Reeving:	Four part single reeved

TABLE 10

CHEMICAL CLEANING BUILDING VENTILATION SYSTEM NAMEPLATE DATA

MSA Filter Unit

Identification No. ALC-E-H1

60KW Chromolax Heater Unit

480v, 3 Phase, 60 Hz

Cat. Number SCCP-080-3480

Type J 0-800 °F Temperature Controller

Type J 0-800 °F High Limit with Manual Reset

Internal Industrial Fan

Identification No. ALC-E-1

8000 CFM Fan Unit

30 HP

460 volts AC, 3 Phase, 60 Hz

ID Numbr P28G353G-G7-XD

Victoreen 840-3 Off Line Effluent Monitor

3 Channel Readout - gaseous, particulate, both

110 volts, AC, 1 Phase, 60 Hz

Self contained sample/return pump (4 cfm)

TABLE 11

AIR COMPRESSORS

Identification	ALC-P-7	ALC-P-8
Number Installed	1	1
Vendor	Le Roi (Dresser Industries Inc.)	
Type	Single Stage Rotary Screw	
Model No.	30SS	25SS
Capacity (CFM @ PSIG)	115 @ 100 110 @ 125 (Max.)	98 @ 100 95 @ 125 (Max.)
Rated Motor, HP, RPM	30, 1755	25, 1760
Power Source	460V, 3 Phase, 60 Hz MCC 2-33A	460V, 3 Phase, 60 Hz Power Panel PDP-W2

TABLE 12

INSTRUMENTATION AND CONTROL

TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
ALC-AE-1	EPICOR II Sys. influent conductivity cell	Piping	L&N	4909-010-44-088-1-02	0-1000MHO/CM	N/A	
ALC-AI-1	EPICOR II Sys. influent conductivity indicator	ALC-PNL-1	L&N	7075-1-011-120-001	0-1000MHO/CM	N/A	
ALC-AE-3	ALC-K-1 demin. effluent conductivity cell	Piping	L&N	4909-10-44-088-1-02	0-1000MHO/CM	N/A	
ALC-AI-3	ALC-K-1 demin. effluent conductivity indicator	ALC-PNL-1	L&N	7075-1-011-120-001	0-1000MHO/CM	N/A	
ALC-AE-4	EPICOR II Sys. effluent conductivity cell	Piping	L&N	4909-10-44-088-1-02	0-1000MHO/CM	N/A	
ALC-AI-4	EPICOR II Sys. effluent conductivity indicator	ALC-PNL-1	L&N	7075-1-011-120-001-000	0-1000MHO/CM	N/A	
ALC-AE-6	ALC-K-1 demin. effluent pH cell	Piping	L&N	7774-3-1-01	0-14	N/A	
ALC-AI-6	ALC-K-1 demin. effluent pH indicator	ALC-PNL-1	L&N	7075-1-011-120-001	0-14	N/A	
ALC-AE-7	EPICOR II Sys. effluent pH cell	Piping	L&N	7774-3-1-01	0-14	N/A	
ALC-AI-7	EPICOR II Sys. effluent pH indicator	ALC-PNL-1	L&N	7075-1-011-120-001	0-14	N/A	

TABLE 12

INSTRUMENTATION AND CONTROL

TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
ALC-FE-1	CC-T-2 inlet flow turbine flow meter	Piping	Hoffer	HO 3/4 2529-B-F1	2.5-29 GPM	N/A	
ALC-FQI-1	CC-T-2 inlet flow totalizer/indicator	ALC-PNL-1	Hoffer	26ECPRTA	0-99,999,999 GAL 0-999MGPM	N/A	
ALC-FE-2	CC-T-2 discharge flow orifice plate	Piping	Foxboro	OP-FTT	0-100 GPM 0-250" WG.	N/A	
ALC-FT-2	CC-T-2 discharge flow transmitter	ALC-RCK-1	Foxboro	NE 13DM-II H2-A-E	0-100" WG. 4-20 MADC	N/A	
ALC-FY-3	CC-T-2 discharge flow square root converter	ALC-PNL-1	Foxboro	66AT-OJ	4 to 20 MADC	N/A	
ALC-FQ-2	CC-T-2 discharge flow integrator	ALC-PNL-1	Fisher & Porter	52-ET	4-20 MADC 0-10^7 TPM	N/A	
ALC-FI-2	CC-T-2 discharge flow indicator	ALC-PNL-1	Fisher & Porter	51-1371	4-20 MADC 0-100 GPM	N/A	
ALC-FY-4	CC-T-2 discharge flow power supply	ALC-PNL-1	Foxboro	610-AT-OJ	120V 60 Hz 4-20 MADC		
ALC-LI-1	CC-T-1 tank level indicator	ALC-PNL-1	Foxboro	257P-IC	4-20 MADC 0-38 ft		
ALC-LT-1	CC-T-1 tank level transmitter	Local	Foxboro	NE13DM-II H_2-A-E 24"-ABO"	4-20MADC 0-340" H_2O	N/A	

3/83
(Reset)

TABLE 12

INSTRUMENTATION AND CONTROL

TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
ALC-LY-1	CC-T-1 tank level transm. PWR supply	ALC-PNL-1	Foxboro	610AT-34	120V 60 Hz 4-20 MADC	N/A	
ALC-LI-2	CC-T-2 tank level indicator	ALC-PNL-1	Foxboro	257P-1C	4-20MADC 0-35 ft		
ALC-LT-2	CC-T-2 tank level transmitter	Local	Foxboro	NE13DM- 11 H2-A-3 8"-428"	0-414" H_2O 4-20 MADC	N/A	
ALC-LY-2	CC-T-2 tank level transm. PWR supply	ALC-PNL-1	Foxboro	610AT-OJ	120V 60 Hz 4-20 MADC	N/A	
ALC-LS-1	Chem. Clean. Bldg. sump level switch	Local	Warrick	2C1F0	0-35 ft.	36 1/4 in. 48 1/4 in. 90 3/8 in.	Below mntg. face.
ALC-LAH-1	Chem. Clean. Bldg. sump Hi alarm	ALC-PNL-1	ROCHESTER			36 1/4 in.	Below mntg. face.
ALC-PI-1	ALC-P-5 discharge pressure gage	ALC-RCL-1	Arthur Moore	U.S. Gage 1981	0-160PSIG	N/A	Purchased with diaphrgm seal & capillary.
ALC-PI-2	Service air pressure gage	ALC-RCL-1	Arthur Moore	U.S. Gage 1981	0-160PSIG	N/A	
ALC-FI-3	ALC-P-5 seal water flow indicator	Local	Fisher & Porter	10AI152W/5 1-1400KA & 50 WT4000	0-14.9 GPM 0-100%	N/A	
ALC-PI-3	Demin. water header pressure gage	ALC-RCL-1	Arthur Moore	U.S. Gage 1981	0-160 PSIG	N/A	

TABLE 12

INSTRUMENTATION AND CONTROL

TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
ALC-PI-4	CC-P-2A discharge pressure gage	ALC-RCX-1	Arthur Moore	U.S. Gage 1981	0-160 PSIG	N/A	
ALC-RM-1	ALC-F-1 gamma detector (left shield)	Local	Victoreen	847-1	1-10,000 REM/HR	N/A	
ALC-RM-2	ALC-F-1 gamma detector (right shield)	Local	Victoreen	847-1	1-10,000 REM/HR	N/A	
ALC-RM-3	ALC-K-1 gamma detector (left shield)	Local	Victoreen	847-1	1-10,000 REM/HR	N/A	
ALC-RM-4	ALC-K-1 gamma detector (right shield)	Local	Victoreen	847-1	1-10,000 REM/HR	N/A	
ALC-RM-5	ALC-K-2 gamma detector (left shield)	Local	Victoreen	847-1	1-10,000 REM/HR	N/A	
ALC-RM-6	ALC-K-2 gamma detector (right shield)	Local	Victoreen	847-1	1-10,000 REM/HR	N/A	
ALC-RM-7	CC-T-2 inlet flow gamma detector	Local	Victoreen	843-30	1-10E7 CPM	N/A	
ALC-RM-8	Area Monitor - ALC-F-1	Local	Victoreen	847-1	0.1 to 10E7 MR/HR	N/A	
ALC-RM-9	Area Monitor - Mezzanine	Local	Victoreen	857-30	0.1 to 10E5 MR/HR	N/A	
ALC-RM-10	Area Monitor - Tank Area	Field	Victoreen	857-30	0.1 to 10E5 MR/HR	N/A	

TABLE 12

INSTRUMENTATION AND CONTROL

TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
ALC-RM-11	Area Monitor - Sump Area	Field	Victoreen	857-30	0.1 to 10E5 MR/HR	N/A	
ALC-RM-12	CCB Air Sampler	Field	Victoreen	841-2 SYS		N/A	
ALC-RMI-1	ALC-F-1 gamma read-out (left shield)	ALC-PNL-1	Victoreen	856-30 846-2	1-10,000 REM/HR	N/A	
ALC-RMI-2	ALC-F-1 gamma read-out (right shield)	ALC-PNL-1	Victoreen	856-30 846-2	1-10,000 REM/HR	N/A	
ALC-RMI-3	ALC-K-1 gamma read-out (left shield)	ALC-PNL-1	Victoreen	856-30 846-2	1-10,000 REM/HR	N/A	
ALC-RMI-4	ALC-K-1 gamma read-out (right shield)	ALC-PNL-1	Victoreen	856-30 846-2	1-10,000 REM/HR	N/A	
ALC-RMI-5	ALC-K-2 gamma read-out (left shield)	ALC-PNL-1	Victoreen	856-30	1-100 REM/HR	N/A	
ALC-RMI-6	ALC-K-2 gamma read-out (right shield)	ALC-PNL-1	Victoreen	856-30	1-100 REM/HR	N/A	
ALC-RMI-7	CC-T-2 inlet flow gamma read-out	ALC-PNL-1	Victoreen	842-11	1-10E7 CPM	N/A	
ALC-RMI-8	Area Monitor Readout ALC-F-1	ALC-PNL-2	Victoreen	846-2	0.1 to 10E7 MR/HR	N/A	
ALC-RMI-9	Area Monitor Readout-Mezzanine	ALC-PNL-2	Victoreen	856-30	1 to 10E5 MR/H	N/A	

TABLE 12

INSTRUMENTATION AND CONTROL

TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
ALC-RMI-10	Area Monitor Readout-Tank area	ALC-PNL-2	Victoreen	856-30	1 to 10E5 MR/H	N/A	
ALC-RMI-11	Area Monitor Readout-Sump area	ALC-PNL-2	Victoreen	856-30	1 to 10E5 MR/H	10 MR/HR	
ALC-RMI-12	CCB Air Sampler Readout	ALC-PNL-2	Victoreen	841-2 SVS	1 to 10^6 cpm	N/A	
ALC-TI-1	Influent Temp. Indicator	Local					
ALC-TS-10	El. Heater Temp Switch	Filter Unit	Chromalox	C76 AX-1200 106-20-AA		160°F	
ALC-TIC-10	El. Heater Temp Indicator and Control	Filter Unit	Chromalox		0-200F	146°F	
ALC-DPI-11	Moisture Separator DP Indicator	Filter Unit	MSA		0-1" WG. 0-2" WG.	N/A	
ALC-DPS-11	Moisture Separator DP Switch	Filter Unit	DWYER	1824-2	0.5-2" WG.	1.75" WG.	
ALC-DPI-13	HEPA Filter DP Indicator	Filter Unit	MSA		0-4" WG.	N/A	
ALC-DPS-13	HEPA Filter DP Switch	Filter Unit	DWYER	1824-5	1.5-5" WG.	3" WG.	
ALC-TE-15	Charcoal Filter Temp Element	Filter Unit	MSA				
ALC-TS-15-1	Charcoal Filter Temp Switch for Hi Alarm	Filter Unit	MSA			220°F	

TABLE 12

INSTRUMENTATION AND CONTROL

TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
ALC-TAH-15A	Charcoal Temp. Alarm	Filter Unit					
ALC-TAH-15B	Charcoal Temp. Alarm	ALC-PNL-1					
ALC-TS-15-2	Charcoal Filter Temp	Filter Unit	MSA			325°F	
ALC-TAHH-15	ALC-E-F4 Charcoal Adsorber Temp.	Filter Unit					
ALC-DPI-16	HEPA Filter DP Indicator	Filter Unit	MSA		0-4" WG.		
ALC-DPS-16	HEPA Filter DP Switch	Filter Unit	MSA		1.5-5" WG.	3" WG.	
ALC-FE-17	Exhaust Flow Element	Duct	Dietrich	ANR-76	0-0.3" WG. (0-8000 scfm)		
ALC-FIS-17	Exhaust Flow Indicator and Switch	Local	DWYER		0-0.5" WG. 0-0.5" WG.	0.1" WG.	
ALC-RE-18	Exhaust Radiation Detector	Duct	NMC	SC-2X2			
ALC-RI-18	Exhaust Radiation Indicator	Control Building	NMC	AM-221F/CR M-5AMF	10-10^6 cpm	200,000 cpm 40,000 cpm 1[illegible].000 cpm	Particulate Iodine Gas
ALC-RR-19	Exhaust Radiation Recorder	Control Building	Victoreen				
ALC-UA-19	Air Filtration Unit Trouble	ALC-PNL-1	Rochester	(Later)			
ALC-FHS-20	Air Filtration Unit Fan Control	MCC	GE	CR-2940			

TABLE 12

INSTRUMENTATION AND CONTROL

TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
ALC-LS-21	Loop Seal Level High	Local	B/W	2-RH		2-1/2"	
ALC-UA-22	Cap-Gun Rad. Trouble	ALC-PNL-1	Rochester				From RH-1-12
ALC-FE-29	Aux. Blds. Liquid Clean Up Sampling System Flow	Piping				N/A	
ALC-HS-24	Tank CC-T-1&2 Selector Switch Level Interlock	ALC-PNL-1	GE	CR2940 W/UB 200A Contact			
N/A	ALC-F-1 Level controller	Field	CAP-GUN	(Later)	(Later)	High-5" from top of tank Low-12" from top of tank	Controls air supply to ALC-P-1
N/A	ALC-K-1 Level controller	Field	CAP-GUN		(Later)	"	Controls air supply to ALC-P-2
N/A	ALC-K-2 Level controller	Field	CAP-GUN		(Later)	"	Controls air supply to ALC-P-3
N/A	ALC-F-1 Hi Hi Level Alarm	Cap-Gun Control Unit	CAP-GUN			3" from top of tank	
N/A	ALC-K-1 Hi Hi Level Alarm	Cap-Gun Control Unit	CAP-GUN			3" from top of tank	
N/A	ALC-K-2 Hi Hi Level Alarm	Cap-Gun Control Unit	CAP-GUN			3" from top of tank	

TABLE 12

EPICOR II
RADWASTE PROCESSING SYSTEM
AUX. BLDG. EMERGENCY LIQUID CLEANUP MODE

OVERALL OBJECTIVES: (a) Achieve sufficiently high DF's to release processed water at 10 GPM to satisfy tech. spec. criteria.

(b) Process water at 10 GPM.

(c) Minimize personnel exposure.

(d) Process water at the lowest possible cost.

SPECIFIC OBJECTIVES:

Container	Vessel Size	Primary Purpose	Composition	Process Vessel Contact Radiation Level Changeout Criteria	Gallons Processed to Reach Changeout Criteria	Total Number of Containers Required(5)	Projected Shipping Category
#1 First Demin.	4'D x 4'H	1. Na Removal 2. Other Cation Removal 3. Anion Removal	Mixed Cation Resin on top/ Anion on bottom	1,000 R/Hr. (1)	Up to 100,000	50	Large Quantity (6) or Type B
#2 Second Demin.	4'D x 4'H	Cation Polishing Anion Polishing	Mixed Cation Resin Anion Resin	400 R/Hr. (2)	Up to 150,000	15	Type B or LSA > Type A (6)
#3 Third Demin.	6'D x 6'H	Water Polishing	Mixed Resin	20 R/Hr. (3)	Up to 250,000	7	LSA > Type A
#4 Strainer	2'H x 1 1/2'W x 1 1/2'L	Guard Bed Catch Resin Fines	Strainer	2-3 R/Hr. (4)	150,000	-	LSA
#5 Post Filter	2' x 1 1/2' x 1 1/2'	Colloids Removal	1 Micron Cartridge	2-3 R/Hr.	150,000	2	LSA

NOTE: (1) The 1,000 R/Hr. limit is based upon the 1,300 curie limit of the LL-60-150/TVA shipping cask projected for use.

(2) The 400 R/hr. limit is based upon a level of margin required to prevent inadvertent contamination of the 6' x 6' demin. causing this larger demin. to become a large quantity versus an LSA shipment. This change is shipping category could be caused by excessive strontium loading occurring during breakthrough of the cation polishing first demin.

(3) The 20 R/hr. limit is based upon a handling limit to control personnel exposure and a LSA category shipping limit (25 R/hr.).

(4) The 2-3 R/hr. limit is a handling limit.

(5) The total number of containers is based upon processing the 285,000 gallons of water existing on July 24, 1979. This value will change as the stored water from daily inleakage increases.

(6) A large quantity category will result since the linear will contain greater than 0.3 mc/gm of activity.

(7) Table updated to conclusion of original EPICOR II design objectives, namely the completion of processing accident generated Auxiliary and Fuel Handling Building water.

TABLE 14

EPICOR II
RADWASTE PROCESSING SYSTEM
(SDS POLISHING MODE)

OVERALL OBJECTIVES: (a) Polish the Submerged Demineralizer System effluent water sufficiently to satisfy tech. spec. criteria.

(b) Process water at 10 GPM.

(c) Minimize personnel exposure.

(d) Process water at the lowest possible cost.

SPECIFIC OBJECTIVES:

Container	Vessel Size	Primary Purpose	Composition	Process Vessel Contact Radiation Level Changeout Criteria(1)	Gallons Processed to Reach Changeout Criteria	Total Number of Containers Required (2)	Projected Shipping Category
#1 First Demin.	6'D x 6'H	Na Removal Other Cation Removal Anion Removal	Cation (top)/ Anion (bottom)	≤ 20R/Hr	Up to 50,000	55	LSA > Type A
#2 Second Demin.	6'D x 6'H	Anion Removal Cation Removal	Mixed Resin	< 1 R/Hr	200,000	15	LSA or LSA > Type A
#3 Third Demin.	4'D x 4'H	Polishing Guard Bed	Mixed Resin	< 1 R/Hr	200,000	10	LSA
#4 Strainer	2'H x 1 1/2'W x 1 1/2'L	Catch Resin Fines	Strainer	< 1 R/Hr	150,000	-	LSA
#5 Post Filter	2' x 1 1/2' x 1 1/2'	Colloids Removal	1 Micron Cartridge	< 1 R/Hr	150,000	2	LSA

NOTE: (1) Process Vessels will not be changed out on radiation levels. Values shown are the anticipated dose rates when chemical analysis indicates change out.

(2) Reflects usage projecting through 1983.

THREE MILE ISLAND - UNIT #2

SYSTEM DESCRIPTION

OF THE

SUBMERGED DEMINERALIZATION SYSTEM

(SDS)

TABLE OF CONTENTS

FOR

SUBMERGED DEMINERALIZATION SYSTEM

Section		Page

APPENDICES

1.0 Introduction

1.1 System Functions

The Submerged Demineralizer System (SDS) is a temporary liquid radwaste processing system designed to reconcentrate the fission products contained in the waters in the Reactor Building Sump and the Reactor Coolant System, reducing the fission product levels to a level acceptable for final treatment through the Epicor II System. To accomplish this decontamination process, the SDS has been designed to perform the following basic functions:

a) To decontaminate, by demineralization, the contaminated waters contained in the Reactor Containment Building and the Reactor Coolant System at TMI-2 to a level acceptable for processing through Epicor II.

b) To transfer the decontaminated waste water from the Submerged Demineralization System to the Epicor II System or recycle back to the SDS feed tanks for further processing to further reduce radionuclide concentrations in the water.

c) To provide a location in the spent fuel pool for temporary storage of the spent high activity ion exchange vessels to take advantage of the shielding provided by the pool water.

d) To provide for the underwater loading of the spent vessels into their transport casks and the preparation for shipment of these casks.

e) To provide the capability to control, monitor and treat gaseous effluents prior to release to the atmosphere to meet the imposed requirements of Appendix B of the TMI-2 Interim Recovery Technical Specifications.

f) To provide for the installation, testing, operation, and maintenance of the Submerged Demineralization System in compliance with "as low as reasonably achievable" radiation doses to personnel.

g) To process the radioactively contaminated waters independent from the operation of TMI Unit 1.

Decontamination and decommissioning of the SDS will be treated in a separate document.

1.2 References

1.2.1 Epicor II System Description

1.2.1.1 B&R Dwg. M-006

1.2.1.2 B&R Dwg. M-013

1.2.1.3 B&R Dwg. M-015

1.2.1.4 B&R Dwg. M-208

1.2.2 <u>Fuel Pool Waste Storage System Description</u>

1.2.2.1 B&R Dwg. M-014

1.2.2.2 B&R Dwg. M-127

1.2.2.3 B&R Dwg. M-128

1.2.2.4 B&R Dwg. M-131

1.2.2.5 B&R Dwg. M-174

1.2.3 <u>Radwaste Disposal System Description</u>

1.2.3.1 Reactor Coolant Liquid System Description

1.2.3.2 Miscellaneous Liquids System Description

1.2.4 <u>SDS Technical Evaluation Report</u>

1.2.5 <u>SDS Design Criteria</u>

1.2.6 <u>SDS Process Control Program</u>

1.2.7 <u>Reference Drawings</u>

Burns & Roe Drawing 2076	Chem-Nuclear Dwg. 527-D-A-5001
Burns & Roe Drawing 2027	Chem-Nuclear Dwg. 527-D-A-5002

Burns & Roe Drawing 2045	Chem-Nuclear Dwg. 527-0-A-5004
Burns & Roe Drawing E-032	Chem-Nuclear Dwg. 527-0-A-5006
Burns & Roe Dwg. 2007 Sht 2 of 2	Chem-Nuclear Dwg. 527-D-A-5009
Burns & Roe Dwg. 2012 Sht 2 of 2	Chem-Nuclear Dwg. 527-0-A-5011
Burns & Roe Dwg. 2014 Sht 2 of 3	Chem-Nuclear Dwg. 527-D-A-5013
Burns & Roe Dwg. 2026	Chem-Nuclear Dwg. 527-0-L-5026
Burns & Roe Dwg. M043	Chem-Nuclear Dwg. 527-D-L-5027
Burns & Roe Dwg. M323	Chem-Nuclear Dwg. 527-0-L-5031
Bechtel Dwg. 2-M74-SDS01	Chem-Nuclear Dwg. 527-0-L-5032
Bechtel Dwg. 2-M74-PW01	Chem-Nuclear Dwg. 527-D-L-5033
GPUSC Drawing 2R-950-21-001	Chem-Nuclear Dwg. 527-D-L-5034
GPUSC Drawing 2E-950-02-001	

GPU Nuclear, Recovery Support Engr. Dwg. RSE-027

1.3 Summary Description of the System

The Submerged Demineralizer System (SDS) is a temporary liquid radwaste processing system located in the TMI-2, "B" Spent Fuel Pool and the area immediately adjacent to the spent fuel pool. The system is designed to reconcentrate the fission products contained in the Reactor Containment Building Sump and the Reactor Coolant System by the process of ion exchange.

The Submerged Demineralizer System utilizes a number of other systems to perform its various functions. These include:

1) The Surface Suction System as described in Appendix 12;

2) The WG-P-1 pump as described in the Fuel Pool Storage System Description. This pump and piping can be used as an alternate feed source from the Reactor Building sump to the feed tanks;

3) The upper Feed Tank System located in the "A" spent fuel pool as a storage source of the feed water to the SDS;

4) The Reactor Coolant Bleed Tanks and installed plant piping as depicted and described in Reference 1.2.2,

5) The Epicor-II System as described in Epicor II System Description as a polishing and sodium removal subsystem; and

6) The Processed Water Storage Tank System

7) The Spent Fuel Cooling System piping.

8) The miscellaneous Waste Hold-up Tank and associated piping.

9) Fuel Handling Building HVAC, Electrical, and Instrument Air Systems

The Surface Suction System will be utilized as the primary means of delivering water from the Reactor Building Sump via penetration 626, through the SDS prefilter and final filter to the (4) four 15,000 gallon upper storage tanks located in the "A" spent fuel pool.

The pump is operated from the control panel (CN-PNL-1) which is located on the SDS cask support platform spanning the "B" spent fuel pool. This panel is located in close proximity to the SDS Filter Manifold which contains the valves for operation of the filter system and the pressure and differential pressure instrumentation which provide an indication of flow from the surface suction pump and the mechanical condition of the filters.

The filling operation of the four 15,000 gallon feed tanks is monitored by a digital level indication provided at control panel (CN-PNL-1), level instruments WG-LI-1 & WG-LI-2 are also available. The feed tanks will be filled to approximately 84% of capacity (54,535 gallons). A high level alarm will sound at 89% (57,094 gallons) and a high high alarm will sound at 90% (57,549 gallons) closing inlet valve WG-AV-02 (when in the automatic control mode) which is interlocked with the level switch (WG-LSH-01) on the bubbler in the WG-U-2 stand pipe.

SDS process flow is filtered prior to storage in the tank farm. The purpose of the filters is for removal of gross size particles from the process stream to prevent plugging of the ion exchange beds and preclude solids deposition in the SDS Feed Tanks.

The four 15,000 gallon tanks (WG-T-2A through WG-T-2D) are tied together and function as one 60,000 gallon storage system connected with the WG-U-2 standpipe containing the SDS Submerged Feed Pump (527-G-01).

The tank farm, optionally may be filled by utilizing the WG-P-1 pump located at the 280' elevation of the Auxiliary Building. This pump takes suction in the Reactor Building sump via the Reactor Building sump suction line. This method of feed from the sump to the tank farm is an alternative method that could be employed should the requirement present itself.

The submerged SDS feed pump, located in the WG-U-2 standpipe, delivers water from the feed tank system to the SDS ion exchangers via the Feed Manifold and Ion Exchange Manifold. The SDS feed pump automatically trips on pump down of the feed tanks at 5% of tank level when in the auto mode; a stop button is provided on the WG task panel for manual shutdown.

The process water can be directed to either zeolite train "1" or zeolite train "2" or both trains simultaneously. Our present plans are to process through one train at a time during initial operations. As experience with operation of the system is obtained, we may elect to process through both trains simultaneously. Process sampling capability is provided to enable determination and evaluation of bed performance based on influent and effluent sampling.

From the train 1 or train 2 exchangers the process fluid is directed into a common line which directs the flow to either cation exchanger "A" or cation exchanger "B". This feature allows the final vessel to be removed from operation by switching to the standby vessel without shutting the system down for change out.

The ion exchanger and filter vessels are contained in secondary containment boxes located approximately 15 feet below the surface of the pool water. The containment boxes have slotted openings in the containment box lids. This feature fulfills a two-fold purpose; 1) it allows the lids to close around the remote handling tools and 2) it allows pool water to flow into the top of the containment box, over and around the liquid disconnect coupling and out through the bottom of the containment box, into a common header for transport to the pool cleanup ion exchangers. The effluent of the leakage containment ion exchangers is returned directly to the pool.

From the effluent of the cation vessels the water passes through a 0.45 micron (3 micron absolute) filter which has been placed in the process stream to trap small resin fines which could be carried through the resin retention screens contained in each ion exchange vessel. The filter contains a differential pressure indicator (CN-DPI-PF01) to provide indication of particulate build up.

From the effluent of the resin trap post filter the SDS processed water is sent through a common header which allows it to be directed to either of three storage tank systems. These tank systems are:

1) The Reactor Coolant Bleed Tanks

2) The Miscellaneous Waste Hold-Up Tank

3) The Monitor Tanks

From these tanks the SDS processed water will either be recycled back through SDS or undergo further processing via the EPICOR II System located in the Chemical Cleaning Building.

The EPICOR-II system is described separately in "EPICOR-II SYSTEM DESCRIPTION." The function of EPICOR-II in the SDS Processing scenario is to remove sodium which is a prerequisite to the removal of antimony (Sb-125). This sodium removal will be performed in the first EPICOR-II 6x6 liner. The next EPICOR-II liner will be used to polish the remaining residual radionuclides from the water. After processing the SDS, the EPICOR II effluent is sampled prior to being pumped to the Processed Water Storage Tanks (two 500,000 gallon tanks) and retained for future disposition.

The Submerged Demineralizer System contains, as an integral part of the System, an MSA off gas unit. This unit consists of a 1000 cfm blower taking suction through a roughing filter, two HEPA filters and a charcoal absorber filter. In addition, an inline bypass filter has been installed to pre-treat air coming from the Fuel Pool Waste Storage System Feed Tanks and Feed Pump Standpipe. The off gas system also contains an off gas separator tank with a demister for the removal of entrained moisture in the off gas stream prior to treatment by the off gas unit.

The off gas separator tank is a 590 gallon tank located in the Unit 2 "B" spent fuel pool surge chamber. The off gas separator tank is piped to a stand pipe, also located in the surge chamber, which contains the off gas bottoms sump pump (527-G-02). Moisture from various operational functions performed during system operations, i.e., vessel filling operations, dewatering operations, sampling operations, leakage collection from the manifold boxes, and water removed by the integral demister is collected in the tank with tank level indication displayed on CN-LI-VA03. Automatic level control instrumentation initiates the sump pump at a preset level and transfers the collected water back to the WG-U-2 feed tank stand pipe. The sump pump may also be started manually. The off gas system discharges into the fuel handling building HVAC System.

Included in the system installation are two (2) 12,000 gallon monitor tanks which are installed in the FHB model room on the 305′ elevation. These tanks will be used for either storing processed water to be used in flushing of the system prior to vessel change out or for storing SDS Processed Water. The monitor tanks system includes pumps (SDS-P1A & SDS-P1B) and level instrumentation (SDS-LE1 & LE3, SDS-LT1 & LT3) The system may be operated locally or remotely from the SDS operating area located on the 347′-6" elevation of the fuel handling building. The design of the Monitor Tank System is such that it could be used for temporary hold-up of the SDS effluent should processing dictate that this would be advisable. The monitor tanks are accessed from the effluent of the resin filter by installed valving. The Monitor Tank System is further explained in the Monitor Tank System Description, Appendix 14 of this document.

1.4 System Performance Characteristics

The basic water processing strategy utilizing SDS for the decontamination of the Reactor Building Sump Water (625,000 gallons) the Reactor Coolant System (90,000 gallons) and water accumulated in RCBT's or MWHT incorporates the SDS in combination with EPICOR II. The clean-up or reconcentration of fission products is accomplished by demineralization and is enhanced by filtration of gross size particulate matter in the SDS filtration sub system. Filtration is considered necessary for protection of the ion exchange beds and to preclude buildup of solids in the SDS feed tanks.

Water is delivered to the prefilter and final filter at a flow rate of 10 to 30 gpm, 70° to 90°F, and then into the SDS feed tanks. The water will be transferred in 50,000 gallon batches. Analysis of sump water samples performed by Oak Ridge National Laboratories and GPU studies of filter loading and particule settling characteristcs indicate that little particulate matter should be encountered taking suction on the water surface. Based on these studies and analysis, the projected filter usage for the major portion of the sump is one (1) prefilter and two (2) final filters. Several additional filters could be expected to be required as the surface suction pump approaches the Reactor Building floor.

The expected radionuclide concentrations contained in the Reactor Building sump water and the Reactor Coolant System are represented in Appendix 8.

The actual demineralization process would begin in the first zeolite exchanger vessel in the SDS system. This section of the system is divided into two (2) parallel trains containing three (3) vessels in series. Either train may be operated individually or both trains simultaneously. The residence time necessary for proper ion exchange in the zeolite media dictates a nominal flow rate of 5 gpm per train in this section. For protection of downstream EPICOR II organic ion exchange media, the process fluid temperature is limited to 125°F.

To accomplish these goals, we intend to use a homogeneous mixture of Ionsiv IE-96 and Linde A zeolite in all three SDS liners. Ionsiv IE-96 is the designation for IE-95 zeolite in the sodium form. In this form it has a high capacity and selectivity for Cs, and will provide for some removal of Sr. Linde A has a high capacity and selectivity for Sr. Combining these two zeolites in the three SDS vessels will load most of the cesium and strontium in the first in-line vessel. The exact percentage mixture of these two types of zeolite will vary as influent concentrations change. It is anticipated that the first vessel can be loaded to about 60,000 curies Cs, and about 2,000 curies Sr. The remaining two vessels will contain any breakthrough and further polish the water.

An administrative limit of 60,000 curies of cesium, based on the DOE task force recommendation has been placed on the zeolite liners, strontium will be limited to 6,000 curies per liner, or Sr effluent of less than 1 uCi/ml.

Downstream of the zeolite exchanger vessels are the cation exchanger vessels. This section of the system is divided into (2) parallel trains containing one (1) vessel each. The design mode of operation is to use one cation vessel at a time with the other being an installed spare. It is our intention to use a vessel loading similar to that used in the zeolite vessel. However, if necessary to further remove resin fines from the process stream, a submerged resin fine filter may be employed in this location.

Extensive sampling will be performed at each point in the system where a decontamination factor can be expected. Basically, this amounts to influent and effluent samples at each ion exchanger vessel. The projected radionuclide concentrations at each sample point are specified in the SDS TER.

The EPICOR II system will be utilized as a polishing unit and for the removal of sodium which is key to the removal of trace quantities of ruthenium, recalcitrant species of cesium and strontium and primarily antimony. EPICOR II 6 x 6 liners for the removal of sodium are expected to be changed out at 25,000 gallons. This assumes a resin utilization factor of 80% and less than 10% sodium breakthrough. The RCBT's or the monitoring tanks will be utilized as hold up tanks and monitoring station to attempt to limit EPICOR II liner radionuclide concentrations to less than 1 μ ci/gm. This will allow EPICOR II liners to be buried in shallow land burial facilities without solidification. The processing logic plan which depicts the decision making logic is shown in Figure 2. Table 1 shows the various vessels, their sizes, function, projected exchanger media, and number of liners expected to be generated.

1.5 System Arrangement and Interfaces

The Submerged Demineralizer System is housed in the TMI Unit II Fuel Handling Building. The majority of the system components are located within the "B" spent fuel pool which will be flooded with water to afford radiation shielding for submerged components. Components that are not submerged are shielded with lead, steel and/or concrete. The SDS Monitor Tanks are located in the model room (El. 305'). The remaining components are located in the "A" spent fuel pool (see Figure 1) or in the proximity of the Unit II spent fuel pools.

1.5.1 "A" Spent Fuel Pool SDS Components

The Unit II fuel handling building adjoins the Reactor Building and is located directly north of the Reactor Building. The "A" spent fuel pool is nearest the reactor building and measures approximately 24 feet wide, 65 feet long, and 41'-6" deep. The "A" fuel pool contains six tanks, which were installed shortly after the accident, for water storage. Two of the six tanks have a capacity of 25,000 gallons each and are located in the lower portion of the pool. The remaining four tanks have a capacity of 15,000 gallons each and are interconnected to have a total capacity of 60,000 gallons. These four tanks constitute the feed tanks for the SDS system.

The entire "A" spent fuel pool is covered with 3 feet thick concrete shield blocks. The "A" spent fuel pool will not be filled during SDS operation. The feed tanks can be filled with Containment Building Sump Water using either the Reactor Building sump surface suction pump or the WG-P-1 pump both of which are tied directly to the feed tanks. The normal mode of filling the tanks would be to fill the tanks after filtering the water through the SDS prefilter and final filter which are submerged in the "B" spent fuel pool.

Interconnected with the feed tanks and located north of the feed tanks at the northwest corner of the "A" spent fuel pool is the WG-U-2 standpipe which serves as the well for pumping the liquid from the feed tanks. The feed pump which is located in the standpipe is connected to the feed manifold which is a few feet to the southeast of the standpipe and sits atop of the concrete shield blocks. The piping between the feed pump and the feed manifold all enter the feed manifold on the west side of the manifold. The piping connecting the feed manifold to the SDS process trains in the "B" spent fuel pool connect to the east side of the manifold and run east to the edge of the "A" pool before turning north to the "B" spent fuel pool. All piping above the concrete shield blocks are shielded with lead bricks.

1.5.2 <u>"B" Spent Fuel Pool SDS Components</u>

The Unit II "B" Spent Fuel Pool is directly north of and connected to the "A" spent fuel. The "B" Spent Fuel Pool is approximately 24 feet wide, 32 feet 6 inches long, and 41 feet 6 inches deep. The channel that connects the "A" and "B" pools has been sealed. Immediately north of the"B" pool proper are two small pools. The one on the west side is connected to the "B" pool by a large transfer canal and is called the cask pit. The cask pit is 10 feet wide, 10 feet long, and 43' 6" deep. On the east side of the cask pit is the surge chamber which is 10 feet wide, 10 feet long, and 17 feet deep. The surge chamber is connected to the cask pit by underwater piping.

The SDS cask support platform is located at the extreme south end of the "B" spent fuel pool. The cask support platform spans the pool in the east-west direction, sits on the pool curbing and is not submerged during operation. The cask support platform supports the RCS clean-up manifold, the filter manifold, the SDS effluent post-filter and the CN-PNL-1 control panel. The RCS clean-up manifold is located on the southeast corner of the cask support platform. All liquid process piping interconnecting with the feed tank system or SDS feed system enters or exits the "B" pool under the cask support platform at the east end of the RCS clean-up manifold. Under the RCS clean-up manifold the piping traverses the air space between the cask support platform and the water in a lead filled annulus called the RCS pipe chase. The piping exits the pipe chase underwater and travels to the various underwater components. At each place where the piping must come to the surface it does so via a shielded pipe chase since the shielding effect of the water and air is not adequate.

The filter manifold is located on the north side of the cask support platform midway between the east and west pool sides. The filter manifold provides the valving and instrumentation for the prefilter and final filter located just north of the filter manifold, underwater in the filter support rack.

Immediately west of the filter manifold is the post-filter unit which filters SDS cation exchanger effluent prior to transfer to processing by EPICOR II and/or storage.

Directly south of the post-filter is the CN-PNL-1 control panel. Directly west of the post-filter, off of the cask support platform, located on the west pool curb is the high rad filter glove box. This glove box is used for sampling the filtration process and is connected to the prefilter and final filter through the filter manifold. The glove box has glove ports on the west side.

All operating stations on the cask support platform are accessed by the stairs on the southwest corner of the cask support platform just south of the high rad filter glove box and west of the CN-PNL-1 control panel.

The remainder of the area in the "B" spent fuel pool proper, north of the cask support platform contains the majority of the submerged components of the processing trains and the underwater storage racks for depleted ion exchangers and filter canisters. Four basic structures, resting on the pool floor, make up the processing and storage units. They are the filter support rack, the main process stream ion exchanger support rack, the pool clean-up ion exchanger rack, and the storage racks.

As mentioned previously, the filter support rack is located immediately north of the cask support platform midway between the east and west pool sides. Running along the east side of the "B" spent fuel pool between the north edge of the cask support platform and the north edge of the pool is the ion exchanger support rack which contains the two parallel trains of three each zeolite vessels and the two parallel cation vessels.

Just south of the north edge of the pool, midway between the pool sides, is located the pool cleanup exchanger rack which contains two ion exchanger vessels for maintaining clean pool water.

Each of these three racks rests on the bottom of the pool. Each rack has an operating platform which is a few feet above the water level to provide operator access. Remote handling tools for coupling and decoupling vessels are provided for changeout operations. Each rack has its own underwater lighting. Underwater storage for sixty (60) spent vessels is as follows: 1) the main storage rack runs along the west side of the pool between the cask support platform and the north edge of the pool. This storage rack has three rows each having eight storage locations for a total of twenty-four slots, 2) four storage locations are provided on the pool floor in the space between the filter support rack and the pool cleanup exchanger rack (leakage containment ion exchanger rack) and eight locations are located on the pool floor in the space west of the ion exchanger support rack and east of the filter and leakage containment racks (total of 12), 3) four moveable spent exchanger racks of six locations each can be placed on top of the main storage rack giving twenty-four space for storage. The total of items 1, 2 and 3 is sixty storage spaces. Eight additional storage spaces can be provided by utilizing processing locations.

Personnel access to the filter support rack and leakage containment rack operating platforms is by moveable personnel bridges which span the gap from the west pool curb to the west side of the working platforms. Access to the ion exchanger support rack operating platform is from the east pool curb.

Immediately north of the ion exchanger support rack, the ion exchanger manifold is located on the pool wall that separates the "B" spent fuel pool from the surge chamber. The exchanger manifold is divided into two sections. The east portion is more heavily shielded and contains valving and instrumentation for feed water to the first zeolite in either zeolite train. The west two-thirds of the manifold contains all remaining valving and instrumentation for the ion exchanger process flow control.

Directly west on the same elevation is the leakage containment pump which circulates pool water through the leakage containment ion exchangers. The pump discharges underwater in the channel between the cask pit and the "B" spent fuel pool.

The shipping cask support platform sits on the floor along the south end of the cask pit. It supports the shipping cask to be used for transporting spent SDS ion exchanger and filter vessels. The dewatering station rests on the east side of the shipping cask support platform and is anchored to the concrete between the cask pit and the surge chamber. Personnel access to the dewatering station operating platform is from the east side. The yoke hanger assembly sits on the curb along the north side of the cask pit. The ion exchanger handling tools and the retrieval tool hang into the cask pit from hangers installed on the south side of the yoke hanger assembly.

The off-gas separator skid is located in the surge chamber. This unit consists of the off-gas separator tank and the off-gas bottoms pump standpipe. The off-gas separator tank has an integral moisture separator which separates the entrained moisture from gaseous releases vented through the tank. The tank communicates with the off-gas bottoms pump standpipe in which the off-gas bottoms sump pump resides. When the off-gas separator tank is filled, the off-gas bottoms pump transfers the contents of the separator tank back to the feed tank standpipe for reprocessing. SDS processing component vents and drains are listed in Table 2.

The surge chamber is covered with concrete shield blocks, a layer of lead bricks and steel deck plate. Off-gas piping and drains penetrate the shield plugs to connect to the off-gas separator skid. On the top of the surge chamber cover are located 1) the high rad feed sample glove box, 2) the intermediate level sample glove box, 3) the beta monitor manifold, 4) the annunciator panel, 5) the radiation monitor panel, and 6) the off-gas separator level instrument panel.

The high rad feed sample glove box is used to sample the feed water to the first zeolite vessel in either of the processing trains. A provision to sample effluent from the first zeolite vessel in the high rad feed sample glove box is also provided if activity levels of the feedwater passing through this vessel exceed 1 μCi/ml. The intermediate level sample glove box is utilized to sample all ion exchange vessel effluents starting with the first zeolite in each train. Both of these glove boxes are located on the north side of the surge chamber cover facing each other. Both glove boxes are accessed from the middle of the surge chamber cover area. The high rad feed glove box is located on the west side and faces west. The beta monitor manifold is located between the intermediate level glove box and the ion exchanger manifold. This manifold monitors the process stream at selected points for gross breakthrough and can indicate major activity trends in the process stream.

On the south side of the surge chamber cover are located the annunciator panel, the rad monitor panel and the off-gas separator tank level indicator. The majority of the system alarms and diagnostics are located here. They are discussed in detail in Section 2.2 of this document.

Located on the east pool curb adjacent to the ion exchanger manifold is the SDS off-gas blower and air filtration unit. The unit maintains a negative pressure on all vented SDS components and provides suction on the off-gas separator system. The blower exhaust is routed via ducting south along the east Fuel Handling Building wall to where it ties into the existing Fuel Handling Building ventilation system. Off-gas system influent gamma radiation is monitored by CN-RE-VA-06 mounted on off-gas piping upstream of the filters.

Installed immediately downstream of the blower, the off-gas sampling unit (PING-1A) continuously monitors the off-gas effluent for airborne radioactivity.

A chemistry laboratory is located on the floor space immediately north of the "B" spent fuel pool on the west side of the Fuel Handling Building.

Operator and supervision work area is provided on the south end of the new fuel storage pit cover which is located on the east side of the Fuel Handling Building, north of the "B" spent fuel pool.

Under the floor space occupied by the chemistry laboratory, at the next lower floor level (305' elevation, 42' below the fuel pool operating level) is located the SDS monitor tank system. This system consists of two 12,000 gallon tanks, each 8 feet in diameter and 32 feet high with associated pumps (2) and all related piping to effect recirculation, sampling and transfer of the contents to storage tanks, back to SDS feed tanks for reprocessing, to SDS for use as flush water, or as staging tanks for EPICOR II processing.

Flushing connections are provided on all of the manifolds and glove boxes. Flush water can be processed water or demineralized water. Flushing is accomplished by attaching rubber hose from the flushing water supply station to the flush connection on the component to be flushed; a portable turbine flowmeter is also placed in-line with the flushing operation. Flush water stations and air purge stations are located within close proximity of all components which may require water flush or air purge. All flush and purge connections are made via Hansen quick disconnent couplings.

1.5.3 SDS Interfaces to Other Systems

1.5.3.1 Electrical

All SDS electric power is tied into the Unit II BOP electrical systems at distribution panel PDP-6A, which is located at the 347'6" elevation of the Fuel Handling Building, and motor control center 2-42B located at the 328' Elevation of the Auxiliary Building.

1.5.3.2 HVAC

The SDS MSA off-gas unit exhaust ducting penetrates the 347'-6" elevation at an existing penetration. The ducting ties into existing Fuel Handling Building ventilation ducting immediately below that penetration at elevation 341'-2".

1.5.3.3 Demineralized Water

The SDS demineralized water header is tied into the plant system at valve DW-V-272 located under the east curb of "B" spent fuel pool curb. An additional check valve, CN-V-DW-357, and isolation valve, CN-V-DW-355, were added just downstream of DW-V-272 to protect the plant demineralized water system.

1.5.3.4 Service Air

The service air tie-in to the SDS service air header is at the plant service air valve, SA-V-154, located adjacent to the demineralized water system valve addressed in Section 1.5.3.3.

1.5.3.5 Instrument Air

The SDS instrument air tie-in is at the plant instrument air valve, IA-V-175, located on the west side of the fuel pool curb.

1.5.3.6 EPICOR II

SDS effluent water can be transferred to EPICOR II from either the Reactor Coolant Bleed Tanks (RCBT), the Miscellaneous Waste Holdup Tank (MWHT) or the Monitor Tanks. The SDS effluent may be directed to any of these tanks by selecting the appropriate valving on the SDS transfer line at the 347'6" operating elevation of the Fuel Handling Building. The SDS interface to the MWHT is through valve SF-V-234 located under the east curb of the "B" spent fuel pool. The SDS interface to the RCBT's is through a spent fuel cooling line connection in the northeast corner of the cask pit. This line connects to valve SF-V-158 at the 305' elevation. Double isolation valves in the SDS transfer line at the 347'6" elevation precede the plant isolation valves. The SDS interfaces with the Monitor Tanks through installed SDS piping downstream of Isolation Valve CN-V-FF-6B.

1.5.3.7 Processed Water Storage Tanks (PWST)

EPICOR II effluent is transferred to the PWST using the EPICOR II transfer pump. The PWST's are tied to EPICOR II at valve ALC-V-006. SDS effluent can also be transferred to the PWST"s from the monitor tanks or from the RCBT's. The PWST system is tied to the monitor tanks at valve PW-V-39 which is located in the Unit I/Unit II corridor.

1.5.3.8 WG-P-1 and Surface Suction Pumps

The pumps that can be used to pump the Reactor Building sump water to the SDS feed tanks are tied to the SDS system upstream of the Filter Manifold. WG-P-1 is part of the WG-6 task (Fuel Pool Waste Storage System) and is described in Reference 1.2.2 of this document. The surface suction system is described in Apendix 12 of this document.

1.6 System Design Requirements

1.6.1 General Design Requirements

1.6.1.1 The design basis considers the guidance in the following documents:

1.6.1.1.1 U.S.N.R.C. Reg. Guide 1.143, July 1978

1.6.1.1.2 U.S.N.R.C. Reg. Guide 1.140, March 1978

1.6.1.1.3 U.S.N.R.C. Reg. Guide 8.8

1.6.1.1.4 U.S.N.R.C. Code Guide 8.10

1.6.1.1.5 U.S. Code of Federal Regulations 10CFR20 App. B

1.6.1.1.6 U.S. Code of Federal Regulations 10CFR50 as imposed by Reg. Guide 1.143

1.6.1.1.7 U.S.N.R.C. Reg. Guide 1.21 June 1974

1.6.1.1.8 ANSI/ASME N45.2.15

1.6.1.2 The process shall function in such a manner as to limit releases to the environment and limit plant personnel exposures levels to levels which are "as low as is reasonably achievable" in accordance with 10CFR Part 50, 10CFR Part 20, Regulatory Guide 8.8 and TMI II Recovery Technical Specifications.

1.6.1.3 <u>Capacity</u>

1.6.1.3.1 The processing rate through the filters shall be 10 to 30 gpm. The sand filters are designed to operate as shown on Figure 3. Other filters are designed for operation with up to 20 psid above clean filter differential pressure.

1.6.1.3.2 Process flow rate is 5 gpm per train 10 gpm total through the zeolite beds and 10 gpm total through the cation vessels. Process flow rate is a function of residence time, and can be varied depending on the choice of resins.

1.6.1.3.3 Storage capacity of spent vessels is 60 vessels (not including the processing stations).

1.6.1.4 The system is designed to facilitate decontamination and decommissioning to the maximum extent possible.

1.6.1.5 SDS pressure components are considered "Important to Safety".

1.6.2 Process Piping Design Requirements

1.6.2.1 Piping is designed to ANSI B31.1 in accordance with the requirements of Regulatory Guide 1.143. Welded construction has been utilized to the maximum extent possible with butt weloing utilized in anticipated high radiation level areas to minimize "crud" traps.

1.6.2.2 The piping system has been designed for 150 psi 100°F service and utilizes schedule 40, type 304 stainless steel pipe and fittings.

1.6.2.3 All instrument tubing systems communicating with process meoia utilize type 304 welded stainless steel tubing and fitting. Process instrumentation generally is not fitted with isolation block valves as the instrumentation is designed to be maintenance free over the service life of the system.

1.6.2.4 Pressure sensing instruments communicating with high activity process fluids utilize liquid filled diaphragm isolation oevices with filled capillary tubes communicating with the actual pressure indicating device. This minimizes the possibility of contaminated fluids entering the pressure indicator. The device may be removed remotely for calibration or replacement.

1.6.2.5 Valving in the process stream is contained in enclosed, shielded manifold boxes which are ventilated by the Off Gas handing unit and have sumps which empty into either the Off Gas Separator Tank or Feed Standpipe. Shielded access ports in the box are provided for inspection and maintenance of the valves. Valves are operated remotely utilizing reach rods (valve handle extensions) which protrude through the shielding plugs. Process valving is of the top entry type to facilitate maintenance and repair.

1.6.2.6 The process line pipe size is normally 1" based on the SDS Design flow rate of 5 to 10 gpm. Other line sizes are based on service requirements and function.

1.6.2.7 Piping runs which are not submerged or are not contained in manifold box are shielded as necessary to yield maximum exposure rates of 1 mr/hr general areas. In service radiation surveys are conducted to insure that these limits are met. Additional local shielding is added where required to elimate streaming and crud buildup dose rates.

1.6.3 <u>Ion Exchange Vessel and Filter Vessel Requirements</u>

1.6.3.1 Vessels are designed, fabricated and tested to the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, 1977 addendum through Winter '78.

1.6.3.1.1 The high integrity type 316L vessels will also be code stamped.

1.6.3.2 Filter vessels and lower activity ion exchange vessels are designed to 150 psi, 100°F using type 304 stainless steel.

1.6.3.3 Zeolite ion exchange vessels are designed to 350 psig, 400°F using type 316L stainless steel.

1.6.3.4 Zeolite vessels are designed to allow ease of removal of ion exchange media for future disposal.

1.6.3.5 All vessels utilize Hanson quick disconnect fitting to allow remote connection and disconnection.

1.6.4 <u>Monitor Tank Requirements</u>

1.6.4.1 Monitor tanks are designed, built, and erected to API 650, Appendix J except material is type 304L stainless steel.

2.0 Detailed Description of the System

2.1 Components

2.1.1 Submerged Demineralization System Pumps

2.1.1.1 Submerged S.D.S. Feed Pump (CN-P-IXD1). The feed pump (CN-P-IXD1) is located in the standpipe (WG-U-2) associated with the four 15,000 gallon waste storage tanks (located in the Unit #2 "A" fuel pool). It provides the capability to transfer liquid waste from the upper level waste storage tanks (WG-T-2A through 2D), through the SDS System for processing.

The pump is provided with a recirculation line, equipped with an orifice, which prevents inadvertent operation of the pump at a shutoff head. The recirculation line taps off of the pump discharge line in the feed pump manifold, and empties back into the twelve inch standpipe. The flow orifice provides for recirculation flowrate of 15 gpm at a 208 foot head.

The pump is a submersible centrifugal Goulds pump with a capacity of 30 gpm at 200 ft. total dynamic head. A pressure gage, temperature element and flow meter are installed on the pump discharge piping. The pressure gage and flow meter provide a means of monitoring pump performance.

The feed pump motor is rated at five HP and is powered from a 480 VAC MCC panel (PDP-6A). The pump is controlled from a local control panel located near the feed pump standpipe (WG-U-2), above the "A" fuel pool. Pump operation is controlled with a start pushbutton, a stop pushbotton, and an auto/manual key switch, all located on the local control panel. The start and stop pusnbuttons control pump operation when the auto/manual key switch is in either position. When the auto/manual key switch is in auto, a low level switch which senses standpipe level, will stop the feed pump on a low level (50%) in the standpipe (WG-U-2).

2.1.1.2 Monitor Tank Transfer Pumps (P1A & P1B)

These pumps are two identical, electrical, mechanical seal centrifugal Goulds pumps arranged in parallel. The system is designed to operate using one pump, the second pump is an installed spare. The pumps provide the capability to transfer processed water to either the 12' standpipe (WG-U-2) for reprocessing, the influent to Epicor II system, the Process Water Storage Tanks or the SDS flush header. In addition the pump discharge can be directed back to the monitor tanks which allows these contents to be recirculated prior to chemical analysis and sampling. The pump is rated at 50 GPM with a total dynamic head of 111 feet.

Pump operation is controlled by start/stop pushbuttons located locally at the pump starter on the 305' elevation and remotely in control panel (SDS-LCP1) on the 347' elevation. A selector switch is also installed which aligns the monitor tank transfer pump to a particular monitor tank to allow the system to automatically trip the transfer pump in the event a monitor tank low low level condition is experienced.

2.1.1.3 Off Gas Separator Bottoms Pump (CN-P-VA04)

This pump, during normal operation, will automatically maintain the level in the off gas separator tank within a preset band (78" to 18"). In an automatic mode, pump operation will be controlled by an electrical switch associated with the off gas separator tank level indicator. The switch energizes the pump motor controller when the tank level reaches 78". The pump then operates, removing the separator tank contents, until the tank level reaches eighteen inches, and the level switch de-energizes the pumps motor controller.

The off gas bottoms pump takes a suction on the off gas moisture separator tank well, and transfers the water to the feed tank standpipe (WG-U-2) for processing through the Submerged Demineralizer System.

The off gas bottoms pump is a submersible centrifugal Goulds pump powered by a 5 HP motor. It is capable of producing 30 gpm at a 55 ft. head. The pump, tank, and well are located in the "B" spent fuel pool surge tank.

The control panel for the pump is mounted on a skid located above the surge tank. An on/off/auto key switch is provided on the panel to allow manual operation of the pump. During normal operation, the switch will be placed in the automatic position. The pump is powered from the SDS power panel (PDP-6A).

2.1.1.4 Off Gas Blower (CN-E-VA05)

Submerged Demineralizer System Components (except for the monitor tanks which vent directly to the Fuel Handling Building Ventilation System) are maintained under a slight vacuum by the off gas blower. The blower is designed to exhaust 1000 cfm at a nominal differential pressure of 12" of water vacuum. This amount of differential pressure allows for worst case pressure losses through the filters due to a dirty prefilter and dirty charcoal and HEPA filters of 0.5 and 2.0" of water vacuum, respectively, while maintaining adequate vacuum in the off gas header. The off gas blower is a fifteen inch, radial flow, centrifugal type with single inlet unit. Suction and discharge pressure gages are provided to monitor blower performance. The motor is a 5 HP., 460 volts, 3 phase, 60 Hz unit powered from the

SDS Motor Control Center. The blower is mounted on the off gas unit skid which is located near the east wall of the "B" spent fuel pool. The blower is controlled with start/stop pushbuttons located next to the off gas blower. The blower discharges to the Fuel Handling Building HVAC system.

2.1.1.5 Leakage Containment System Pump (CN-P-LC06)

The leakage containment pump is designed to maintain an inward flow of fuel pool water into the leakage containment boxes which surround the SDS filters and demineralizers. The pump discharges the pool water, and any leakage from the vessel fittings, to a pair of parallel of ion exchangers and then to the fuel pool.

The leakage containment pump is a centrifugal pump which is mounted on the catwalk between the "B" fuel pool and the cask handling pool. The pump is driven by a three HP motor which is powered from the SDS motor control center. It is controlled with stop/start pushbuttons mounted on a pump control panel located next to the pump. The pump takes suction on a common header containing throttle valves which, through the use of manometers located on the ion exchange rack operators platform where the remote reach rods are also located, allow the flow through each containment box to be throttled to 10 gpm per box in use. The design total flow through the pump is 100 gpm and is delivered as 50 gpm per leakage containment ion exchanger. The pump developes 120 gpm at 55 ft. total dynamic head.

2.1.1.6 RCS Manifolo, Hi Rad Filter Manifold and High Rad Sample Glove Box Sump Pumps (CN-P-FL07, CN-P-SA08 and CN-P-RC09)

These pumps are mounted locally in the Hi Rao filter Manifold, Hi Rad Filter Sample Glove Box and the RCS Manifold. They provide the capability to transfer liquid waste from the sumps of these components to the feed tank standpipe (WG-U-2). The remaining SDS component sumps, unlike those above, oo not need a similar arrangement since they gravity drain to the off gas separator tank or WG-U-2 standpipe (Feed Manifold only).

The sump pumps CN-P-SA08 and CN-P-RC09 are ioentical nutating pumps with a capacity of 0.5 gpm at 81 feet of dynamic heao. The sump pump CN-P-FL07 is a magnetic drive 2 gear pump with a capacity of 0.5 gpm at 95 psig.

The pumps will be operated automatically to maintain level in these sumps within a preset band. This is accomplisheo by level switches in each sump which energizes the pump when the water level reaches 2 inches and oe-energizes the pump when the water is removed. They are powered from panel MP-CN-1 which also has a breaker to allow them to be de-energizeo manually.

2.1.2 Submerged Demineralization System Tanks

2.1.2.1 Off Gas Separator Tank (CN-T-VA02)

The moisture separator tank provides the capability of removing large amounts of liquid from ventilation and drainage lines associated with the Submerged Demineralization System. Drain lines throughout the SDS (except for the monitor tanks, the feed manifold and components discussed in 2.1.1.6 above which have a separate drain arrangement) combine into a common drain header that empties directly into the moisture separator tank. Ventilation lines from various SDS components (see Table 2) combine to join a common header. The tank is a vertically mounted stainless steel tank located (along with the off gas bottoms pump standpipe) in the spent fuel pool surge tank. It is 36 inches in diameter, ten foot in length and has a capacity of 590 gallons.

The separator tank is vented to the off gas header. A demister assembly is located in the top of the tank to remove moisture from the tank's ventilated gases. The demister assembly has been tested in accordance with USAEC report MSAR-61-45. It will be capable of removing 99 percent of all free droplets of water, down to one micron in diameter, without any visible carryover.

A three inch drainline runs from the bottom of the tank to the off gas bottoms pump standpipe (DN-U-VA01). The standpipe is 16 inches in diameter and 16 feet long. It houses the off gas bottoms pump (DN-P-VA04).

The separator tank has a Barton type level instrument associated with it. The meter reads from zero percent to 100 percent full scale. The instrument also has a level control switch, which controls off gas bottoms pump operation, and a high level switch, which activates an alarm on high tank levels.

2.1.2.2 Submerged Demineralization System Monitor Tanks (SDS-T-1A & SDS-T-1B)

The Monitor Tanks are two 12,000 gallon tanks designed for collection and temporary storage of liquids that have been processed through the Submerged Demineralizer System. They have also been installed with the intent to utilize them as a storage location for SDS Flush Water. The Monitor Tanks along with other components which comprise this system are described further in Appendix 14. The Monitor Tanks can be operated in the batch, continuous feed, or bypass mode. In the batch mode the liquids are stored in the tanks until an accurate sample of the tank's contents are analyzed, and the disposition (based on sample results) of the processed liquid is determined. Based on the sample results, the contents may be discharged to: 1) the feed pump standpipe (WG-U-2) for reprocessing, 2) to the processed water storage tanks, 3) to the SDS flush water supply header or 4) to the EPICOR II System. In the continuous feed mode the tanks are used as surge tanks between the SDS and EPICOR II Systems. To maintain tank level approximately constant, flow rate in and out of the tank is kept identical. In the bypass mode the SDS Processed Water bypasses the Monitor Tanks by being transferred to either the Reactor Coolant Bleed Tanks or the Miscellaneous Waste Holdup Tank. In this mode the Monitor Tanks are used only as a source of SDS Flush Water.

The tanks are vertically mounted, stainless steel tanks, located in the northwest corner of the Fuel Handling Building Model Room. The monitor tanks are atmospheric tanks built to API-650, Appendix J, and meet the design criteria set forth in Regulatory Guide 1.143.

The tanks are vented directly through a vent line to the Fuel Handling Building Ventilation System. The influent line to each tank is equipped with an automatic isolation valve, which stops influent liquid flow when the level detector, associated with the tank, senses a high level (364").

Associated with each tank is a Foxboro type level detector. Its meter indication ranges from 0 to 400 inches full scale. These level detectors also provide high/low level signals to shut the tank influent automatic isolation valve on high level and to stop the monitor tank transfer pump on low level (6"). In addition, these signals also feed the SDS alarm panel to alert the operator in the event that any of these conditions exist. Prior to transferring of processed liquids stored in the monitor tanks, the tank contents are recirculated using one of the two monitor tank transfer pumps through eductors to insure proper mixing. The valves and piping are set up to allow either tank to be recirculated using either pump or it is possible to set up simultaneous, independent recirculation of both tanks.

2.1.3 Filtration/Demineralization Units

2.1.3.1 Submerged Demineralizer System Prefilter and Final Filter

The prefilter and final filter are the first process vessels of the Submerged Demineralizer System. They are used to remove debris and suspended solids from the untreated Radioactive Waste Water. The SDS utilizes two types of prefilter and final filter vessels. This allows for either a Cuno Cartridge or sand filtration media to be employed. A description of each type is discussed below.

2.1.3.1.1 Cuno Cartridge Prefilter

The cuno cartridge prefilter unit is a stainless steel, type 304, vessel, with approximately 10 cubic feet of volume. The vessel, including the male half of the quick disconnect, is 4 feet, 5 1/2 inches in height and 2 feet outside diameter. The top of the vessel has four male Hansen disconnect fittings; an inlet nozzle, an outlet nozzle, a vent nozzle, and a dewatering nozzle.

Within the vessel is an enclosed area, constructed of 16 gage perforated plate. This cylindrical column constitutes the initial filtering unit of the prefilter vessel. The inlet nozzle consists of an open ended pipe equipped with (2) two internal ball check valves. The nozzle is located outside of the enclosed area, between the perforated plate and the prefilter vessel wall. The inlet nozzle extends down into the vessel approximately one-half the height of the vessel. The inlet Hansen quick disconnect is a non-check valve design to prevent plugging from debris in the waste water. The inlet nozzle is equipped with two ball check valves which prevent a reverse flow of water out of the vessel when the vessel is disconnected from the process stream.

Contained within the enclosed cavity formed by the perforated plate is a network of fifteen, 125 micron cuno filter cartridges. The opening at the upper end of each filter seals around a nozzle which empties into an outlet header. The opening at the lower end of the filter is plugged. The cartridges are supported by springs (on the bottom) which aid in sealing the upper opening around the outlet nozzles.

The prefilter assembly is also equipped with a dewatering leg and a vent nozzle. The dewatering leg consists of a 1/2 inch stainless steel pipe, extending from the bottom center of the filter, around the outside of the perforated plate, and out the top of the vessel. It terminates with the male half of a Hansen quick disconnect. The vent consists of a short nipple (with the male half of a Hansen quick disconnect attached to the end) welded around an opening in the top of the vessel.

2.1.3.1.2 Cuno Cartridge Final Filter

The Cuno Cartridge Final Filter Vessel shell is identical to the cuno cartridge prefilter vessel shell. It is a Stainless steel, type 304 vessel with approximately ten cubic feet of volume. The vessel, including the male half of the quick disconnects, is 4 feet 5 1/2 inches in height and two feet outside diameter. The top of the tank has four male quick disconnect fittings, an inlet nozzle, an outlet nozzle, a vent nozzle, and a dewatering nozzle

Arranged within the filter are three concentric circles of 10 micron "Cuno" filters totaling thirty cartridges. The cartridges are mounted in the final filter in the same manner as they are mounted in the prefilter. A spring on the bottom seals the "cuno" filter against the effluent header nozzles.

The final filter inlet nozzle is a short nipple with the male half of a Hansen quick disconnect welded to it. The other end of the nipple is welded around an opening in the top of the vessel. The filter vent nozzle is constructed the same as the inlet nozzle.

The outlet nozzle is a short run of pipe extending from the filter effluent header, through the top of the vessel and ending with a male quick disconnect. The dewatering leg is a 1/2 inch pipe which runs from the bottom center of the vessel, up through the vessel, 8 inches from the vessel centerline. The line penetrates the top of the vessel, and ends with a male quick disconnect.

The flow path through the filter is as follows: the water enters the vessel through the inlet nozzle and flows down and around the Cuno filters. The water then passes through the cartridge and leaves the vessel through the outlet nozzle.

Because plugging of the inlet Johnson screens occurred in the sand filters, all sand filters of the 304 stainless steel type after the initial pair have the spray headers modified. The spray ring on these headers has three 0.5 inch holes drilled on the top side to allow flow if the Johnson screens plug.

Also a special series of 316L vessels fabricated by Buffalo Tank Company were procured which have specially designed spray headers to allow high flow rates. These vessels are identical to other 316L zeolite ion exchanger vessels in every respect except for spray header design. The spray headers in these vessels do not contain Johnson screens. These vessels are for use as sand filters and leakage containment ion exchangers where unrestricted flows of greater than 10 GPM are required.

2.1.3.1.3 Sand Prefilter and Final Filter

The sand prefilter and final filter consist of two layers of sand contained in a stainless steel, type 304 vessel, identical in size to the cuno cartridge prefilter and final filter vessels (4 feet, 5 1/2 inches in height and 2 feet in diameter).

The vessel is equipped with four nozzles on the top. Three nozzles terminate with the male half of a 1 1/2 inch Hansen quick disconnect. The fourth is a three inch fitting with a screwed pipe cap closure. The filtration media consist of 200 pounds of 0.85 millimeter sand and 700 pounds of 0.45 millimeter sand in two separate layers. Approximately 6 pounds of 2 millimeter borosilicate glass with a nominal boron concentration of 22 percent is added uniformly to the sand filled protion of the filter, for reactivity control. These filters remove suspended solids in a range of 20 to 30 microns in size.

The inlet nozzle is a short run of pipe, which extends from the quick disconnect, down into the vessel, and empties into a spray ring. The ring is a 1 1/2 inch pipe rolled into a 12 inch diameter ring, located horizontally near the top of the vessel.

There are six 5/16 inch diameter holes drilled through the bottom of the ring. The holes are covered by a one inch long 3/4 inch diameter, .007 inch screen cup (Johnson screen), which is welded around the hole.

The vent nozzle is a short nipple welded around a hole in the top of the vessel. A three inch in diameter, .007 inch screen cup is welded around the hole on the inside of the vessel as a sand retaining device.

The outlet line from the vessel serves two purposes. It is the normal outlet line, and it serves as a dewatering leg. The outlet line is a 1 1/2 inch straight pipe which extends from just off the vessel bottom, up through the center of the vessel and penetrates the top of the vessel. The bottom end of the pipe is enclosed within a screened area, which act as a sand retaining screen.

The fourth nozzle on the vessel is used as an access opening. It is a three inch nozzle welded around an opening in the top of the vessel. The nipple is capped with a three inch screwed pipe cap.

The influent water enters the vessel through the inlet nozzle. Water sprays out into the sand media from the spray ring holes. The water is forced down through the media, and up through the outlet line where it leaves the vessel.

Both the prefilter and the final filter, when installed in the system, will set inside a secondary containment located underwater at the south end of the "B" fuel pool. The purpose of the secondary containment is to collect any leakage which might be present from the fittings associated with the vessel, and to provide support for the filter vessel.

Pressure instruments have been installed in the system to monitor filter performance. There are pressure gages located on the influent and effluent lines to allow the operator to monitor the pressure the filter is subjected to, and the pressure drop across each filter. Allowable sand filter differential pressure is shown on Figure 3.

2.1.3.2 Submerged Demineralization System Post Filter

The post filter is the third filtration unit in the SDS. The filter is used to remove any resin fines which escape through the resin retention screens contained in each ion exchanger vessel. It is located at the south end of the Fuel Pool deck just east of the high Rad Filter Glove Box. In the system, the post filter is positioned on the effluent side of the cation vessels.

The post filter unit consists of a filter housing which contains a replaceable cartridge filter. The housing is constructed of 3/16 inch 304 stainless steel, and is 7 inches in diameter by 25 7/16 inches in height and mounted on a 16 inch high support. The top of the housing is equipped with a lid to allow for installation and replacement of the filter. Consistent with the remainder of the SDS system the housing is designed for 150 psig and 100°F. The filter is mounted inside the housing and is 21 5/16 inches in height by 6 3/4 inches in diameter. It is constructed of epoxy impregnated cellulose fiber media with stainless steel supports. It is built with a particle removal capability of 0.45 micron nominal at a 98% efficiency and 3.00 micron absolute. The filter is designed for a clean filter pressure drop of 12 psig at 20 GPM and a maximum flow rate of 150 GPM. The filter is located within a lead shield.

Differential pressure, flow and radiation detection instrumentation have been installed in the system to monitor filter performance. The differential pressure gage is used to indicate the pressure drop across the filter, the turbine flow meter is used to monitor effluent flow rate and total volume processed. The radiation detector is positioned next to the filter to monitor the radioactive loading on the filter. At a differential pressure of 25 psig and/or a filter radiation level of 2R/hr, the filter is considered depleted and will be changed-out.

2.1.3.3 Leakage Containment Ion Exchange Vessels

Leakage containment ion exchange beds are contained in a standard vessel, identical in size to the sand filtration unit vessels, (4 feet, 5 1/2 inches in height and 2 feet in diameter).

These vessels are equipped (as are the filtration vessels) with four nozzles on the top. Three nozzles terminate with the male half of a 1 1/2 inch Hansen quick disconnect. The fourth is a three inch fitting with a screwed pipe cape closure.

The inlet nozzle is a short run of pipe, which extends from the quick disconnect, down into the vessel, and empties into a spray ring. The ring is a 1 1/2 inch pipe rolled into a 12 inch diameter ring, located horizontally near the top of the vessel.

There are six 5/16 inch diameter holes drilled through the bottom of the ring. The holes are covered by a one inch long 3/4 inch diameter, .007 inch screen cup (Johnson screen), which is welded around the hole.

The vent nozzle is a short nipple welded around a hole in the top of the vessel. A three inch in diameter, .007 inch screen cup is welded around the hole on the inside of the vessel as a sand retaining device.

The outlet line from the vessel serves two purposes. It is the normal outlet line, and it serves as a dewatering leg. The outlet line is a 1 1/2 inch straight pipe which extends from just off the vessel bottom, up through the center of the vessel and penetrates the top of the vessel. The bottom end of the pipe is enclosed within a screened area, which act as a sand retaining screen.

The fourth nozzle on the vessel is used as an access opening. It is a three inch nozzle welded around an opening in the top of the vessel. The nipple is capped with a three inch screwed pipe cap.

The influent water enters the vessel through the inlet nozzle. Water sprays out into the sand media from the spray ring holes. The water is forced down through the media, and up through the outlet line where it leaves the vessel.

The leakage containment ion exchangers will also be enclosed by a secondary containment, however, the containments will not have covers on them like the zeolite vessel containments. They will be located at the center of the north end of the "B" fuel pool.

The ion exchange vessels are provided with pressure gages on the influent and effluent lines. The gauges are used by the operator to monitor pressure drops across the ion exchange medias. Curie loading will be calculated from sampling results of the influent and effluent samples from each vessel in the process train. Because flow restriction caused by plugged Johnson Screens occurred in leakage containment vessels, the 304 stainless steel vessels have modified spray headers. The spray ring on these headers has three 0.5 inch holes drilled on the top side to allow flow if the Johnson Screens plug. The modified Buffalo Vessels addressed in Section 2.1.3.1.3, also may be used as leakage containment vessels.

2.1.3.4 Zeolite and Cation Ion Exchange Vessels

The zeolite and cation ion exchange beds are 4 feet, 5 1/2 inches in height and 2 feet in diameter. These vessels are high integrity 316L stainless steel, designed to withstand 350 psig at 400°F and have 3/8" thick walls.

Each of these vessels are equipped with five (5) nozzles on the upper head. Three of these are 1 1/2 inch nominal pipe size fitted with the male half of a 1 1/2 inch Hansen quick disconnect fitting. The other two are 3 inches (nominal pipe size) and closed with standard, gasketed bolt-on flanges.

The inlet nozzle is a short nipple extending from the Hansen coupling into the vessel then leading to a spider-type inlet spray header. There are four spray outlets each terminating in a 3" OD Johnson screen, 1 1/2 inches in length with a gap size of 0.006 inches. At the inlet to each screen a 0.32 inch drilled passage assures the proper distributing at each outlet.

The vent nozzle is a short 1 1/2 inch (NPS) nipple extending through the top of the vessel. A three inch diameter, .007 inch screen cup is welded around the pipe on the inside of the vessel as a resin retaining measure and the outside end is provided with a 1 1/2 inch male Hansen fitting.

The outlet line consists of three 1 1/2 inch (NPS) segments, two of these are straight stainless steel pipe segments and the third is a 24 inch long flexible convoluted stainless steel hose connecting the pipe segments. The flexible portion allows for differential heating of the vessel components. The bottom pipe segment extends from 1/6 inch from the bottom of the liner, through an inverted 6 inch OD Johnson screen (0.007 gap) to mate with the hose. The screen is welded to the outlet pipe segment and the vessel head to form a sealed area and thus act as a resin retainer to prevent zeolite escape from the bed.

The two 3 inch nozzles on the vessel head are used for general vessel access and loading and unloading the ion exchanger media. Each is constructed of a short 3 inch schedule 160 pipe welded to the vessel head and provided with a standard ANSI flanged closure. Each blind flange is drilled and tapped for a 1/4 inch NPT vent connection. Stainless steel, 1/4" flexible tubing is attached to the one blind flange for venting vessels of radiolysis gases during storage. A 3/4" OD Johnson .007 inch screen cup, one inch in length is welded to the inner side of each blind flange to prevent resin fines from entering the vent line.

These vessels will be located (when installed in the system) in secondary containments that are the same as those used with the prefilter and final filter. The leakage containment pump takes a suction off the bottom of all the containments and draws any leakage from the vessel fittings along with pool water down through the containment to the pump and discharges through the leakage containment ion exchangers back into the pool. These vessels are located along the east wall of the "B" fuel pool.

2.1.4 Manifold Containments

2.1.4.1 Hi Rad Filter Manifold Containment

A majority of the valves, instruments, and piping runs, associated with the prefilter and final filter form the filter manifold which is housed in a shielded, ventilated containment. This manifold is located on the cask support platform at the south end of the "B" fuel pool.

The containment is 3 feet, 6 inches wide, 6 feet 10 inches long and 1 foot 10 inches deep. It is constructed from 3/16 inch thick stainless steel plates and frames. Shielding is provided on the outside of the containment, on the top and sides. The bottom of the containment is sloped to one end for drainage. Any collected fluids will energize CN-LE-FL06, activate the local alarm and initiate sump pump 527-G-07, which pumps the water back to the WG-U-2 standpipe. The containment box is ventilated and maintained at a negative pressure by the SDS Off Gas System. The intake and exhaust connections are 2 inch lines located at opposite sides of the containment box. Access ports are provided in manifold containments for maintenance of the valves and instruments and are shielded with lead blocks. Valve operation will be performed using reach rods which protrude through the top shield. All reach rods for manifold containments utilize lead collars under the lead block which cover the six inch diameter access holes. This feature prevents streaming at the valve stems.

2.1.4.2 Feed Pump Manifold Containment

Valves, piping, and instruments associated with the feed pump are housed in a ventilated containment. This manifold is located in the northwest corner of the "A" fuel pool, next to the SDS feed tank standpipe (WG-U-2).

The containment is approximately 4 feet 9 inches long, 2 feet 2 inches wide, and 1 feet 9 inches deep. It is constructed of 3/16 inch stainless steel plates and support frames. Lead shielding is provided on the sides and top of the containment. A carbonsteel block, 5 inches thick, 4 feet 9 inches long, and 2 feet 2 inches wide, is used as a top and shield for the containment. Ventilation intake and exhaust lines are provided at opposite ends of the containment. The containment is ventilated and maintained at a negative pressure by the SDS off gas system. The bottom of the containment is sloped to one end for drainage toward the drain line which gravity drains to the feed pump standpipe (WG-U-2).

The containment houses a pressure instrument, temperature detector and a flow element. The feed pump discharge valve, feed pump recirculation valve, and manifold flushing valves are operated from this containment.

2.1.4.3 Ion Exchange Manifold Containment

The ion exchange manifold containment houses valves, piping, and instruments associated with the ion exchange process train. The manifold is located on the walkway between the "B" fuel pool, and the "B" spent fuel pool surge tank.

The containment is 13 feet 3 inches long, 3 feet 6 inches wide and 2 feet 4 inches deep. It is constructed of 3/16 inch stainless steel plating and reinforced with stainless steel supports.

The containment is divided into two sections, a high level section and a low level section. Piping runs and associated equipment, subjected to waste which has not been processed through a zeolite train, are located in the high level area.

The south end of the containment box has an external shielded chimney which overchanges the "B" fuel pool wall and descends to the water surface and is partially submerged underwater. With the exception of sampling and flushing lines, piping enters the containment underwater (into this dropoff) for shielding considerations.

A one inch thick carbon steel plate covers the low level area and a five inch thick carbon steel plate covers the high level area. The sides and top of the containment are shielded with lead according to the radiation levels estimated to exist.

The containment is ventilated and maintained at a negative pressure by the SDS Off Gas System. Liquid leakage and gravity drains to the moisture separator tank. The air intake nozzle is located in the low level end; and the exhaust is in the high level end of the manifold.

2.1.4.4 Reactor Coolant System Cleanup Manifold

The RCS cleanup manifold was developed in order to establish tie-in points in the SDS System which can enable it to process the Reactor Coolant System via a direct tie-in through mini-decay heat or another appropriate system. The RCS cleanup manifold is located on the south-east corner of the SDS cask support platform.

The RCS cleanup manifold is four feet wide, four feet long and two feet high. The manifold is ventilated and maintained at a negative pressure by the SDS Off Gas System, and sump liquid accumulations are pumped to the WG-U-2 standpipe by an automatic level controlled sump pump. The manifold is shielded and the valves are operated from outside of the containment using reach rods. Valve and instrument access holes and reach rod shielding is accomplished using the techniques described for the other manifolds.

2.1.5 Off Gas and Liquid Separation System

2.1.5.1 Off Gas Heater

The 9 KW off gas heater is provided to decrease the relative humidity of the gases to insure proper operation of the prefilter, HEPA filters and charcoal adsorption bed.

During normal operation, the off gas heater cycles on and off automatically to control the air temperature downstream of the heater at 122°F by means of a temperature element sensor. This temperature element sensor also supplies the signal which activates a high temperature alarm which alerts the operator in the event heater effluent air temperature reaches 200°F. To further protect the heater the unit is also equipped with both an Auto and Manual Reset heater effluent high temperature cutout which interrupts power automatically to the heater at 285 $\pm$ 15°F and 320 $\pm$ 15°F, respectively.

Temperature element sensors are also installed on the off gas unit at the heater influent and charcoal adsorber effluent. These indications allow the operator to monitor the heater performance relative to maintaining relative humidity less than 70% leaving the adsorber stage. A temperature rise in excess of 11°F ensures that this condition is present even if air entering the unit is at 100% relative humidity. A flow indicator, also mounted on the heater influent line, allows the operator to verify that air flow between 650 to 1000 CFM is present for heater operation.

An interlock is installed in the heater controller which prevents heater operation if the off gas blower circuitry is deenergized.

2.1.5.2 Off Gas System Filters

Exhaust gases, from components ventilated by the Vent and Drain System, will pass through four filters in the off gas System before being exhausted to the plant vent stack. The four filters consist of a roughing filter, two HEPA filters, and a charcoal adsorber.

All four filters are equipped with differential pressure detectors. These instruments allow the operator to monitor filter loading, and determine when a filter needs replacing due to crud buildup. Test connections are also provided on the influent and effluent side of each filter. The HEPA and charcoal filters will be DOP and Freon tested, respectively, after the off gas filtering units are installed in the SDS. These filter types will be retested when replaced. Testing is performed in accordance with Regulatory Guide 1.140.

In addition, an inline bypass filter has also been installed to pretreat air coming from the fuel pool waste storage system feed tanks and feed pump standpipe. This was incorporated to reduce contamination of the SDS off gas header created by airborne radioactivity coming off these interfacing system components.

The roughing filter is a waterproof, fiberglass type filter, compatible with the air stream. The filter is designed to withstand a pressure drop of 8 inches W.G., either new, wet or loaded with dust, for at least 15 minutes without damage. At a differential pressure of 0.5 inches W.G. or a radiation level of 100 mR/hr at contact with the filter housing, the filter will be replaced.

There are two HEPA filters installed in the off gas unit designed to be 99.97 percent efficient for particles down to 0.3 microns in size. The filters are 24 inches by 24 inches square and 11 1/2 inches deep. The filter medium is principally inorganic fiber. Organic fibers will not exceed 5 percent. At a differential pressure of 2 inch W.G. or a radiation level of 100 mR/hr at contact with the filter housing, the filter will be replaced. The system also utilizes a charcoal adsorber bed for the removal of radioactive iodine. This adsorber filter has the same replacement requirements as those of the HEPA filters.

The bypass filter is an inline filtration arrangement which is enclosed in a 4 3/4 inch diameter by 13 1/2 inch high housing. The filter is designed for a removal rating of 0.20 micron nominal and 0.60 micron absolute. At a radiation level of 6 R/hr on contact with the filter housing the filter will be replaced.

2.1.5.3 Stored Vessel Venting Manifold

A venting manifold is provided for exhausting gases generateo in the stored ion exchange vessels after these vessels have been dewatereo. This manifold consists of a 1" diameter stainless steel pipe approximately 26' long containing 60-3/8" nipples, with caps, on 4" centers. It is located above the spent vessel storage racks on the west side of fuel pool "B", level with the floor elevation, running north and south. On the south end of the manifold it ties into a 2" diameter stainless steel pipe (L527-80-2) which connects to the off-gas filtration unit. The north end of the manifold contains a Dollinger Air Filter which provides an air sweep for the prevention of gas build-up in the venting manifold. The vessels are connecteo to the manifolo by a 1/4" diameter flexible stainless steel hose 25'-6" long. Provisions are also made for connecting a non-dewatered vessel into the manifold. This is accomplished by inserting a 0-400 psi pressure gauge and ball valve on the vent manifold nipple and then connecting the vessel vent line to the gauge.

2.1.6 Major System Valves

2.1.6.1 Submerged Ion Exchange Manifold Influent Automatic Isolation Valve (CN-V-IX24)

The automatic isolation valve is a 1 1/2 inch solenoid operated ball valve. It is located in the high activity area of the submerged ion exchange manifold containment, at the north end of the "B" fuel pool.

The valve incorporates an automatic shutdown function to preclude the consequences of adverse conditions from occuring which might damage equipment and/or cause injury to personnel. Feed Isolation Valve (CN-V-IX-24) is controlled from the Feed Shutdown System Relay Panel (RP-1). The "Auto-Trip" selector switch in the "Auto" position energizes the Feed Isolation Valve Solenoid Valve (CN-UY-IX24) admitting air to CN-V-IX24 to open, providing a trip signal is not present. Trip signals from Off-Gas Header Influent Pressure High High Switch (CN-PISH-VA28), IX Manifold Effluent in Line Radiation High (CN-RSH-IX04), or Leakage Containment System Influent Radiation High (CN-RSH-LC05) deenergize CN-UY-IX24, and IX Manifold General Area Radiation High (CN-RAH-IX03) deenergizes CN-UY-IX24 on an adjustable 5 to 50 second time delay. Instantaneous closure is affected by placing the "Auto-Trip" selector switch in the "Trip" position, or upon loss of power to either RP-1 or the solenoid valve or upon loss of air to the solenoid valve.

2.1.6.2 Monitoring Tank Fill Isolation Valves

The Monitor Tank fill isolation valves, SDS-V-002A and SDS-V-002B, are designed to automatically isolate the monitoring tanks if the tanks are filled above a pre-set level.

2.1.7 Dewatering Station

The dewatering station is located in the cask pit at the north end of the Unit 2 Spent Fuel Pool. It consists of two containment boxes positioned underwater, one for filter vessels and one for ion exchange vessels, along with associated piping, valves and instrumention. Shielding is provided by the Spent Fuel Pool water and by utilizing lead shielding on pipe runs above water going to the off gas separator tank. The dewatering containment boxes are not connected to the leakage containment system.

The purpose of the dewatering station is to dewater filter and ion-exchange vessels by the use of air or nitrogen in preparation for shipment.

The dewatering process involves passing a constant air or nitrogen flow through the spent vessel for a fixed amount of time. When nitrogen is used as a dewatering gas, the nitrogen is supplied by a 200 ft^3, 2200 psig bottle. To preclude overpressurization of the system the nitrogen supply is connected to the dewatering station through special piping equipped with a relief valve.

The spent filter and ion-exchange vessels can be dewatereo prior to storage in Spent Fuel Pool "B" or shipment to interim storage elsewhere on Three Mile Island. When it is decioeo to move the vessels from the Spent Fuel Pool "B", they will be dewatered and then loaded underwater into an appropriate shipping cask prior to removal.

2.1.8 Remote Operating and Manipulating Tools

2.1.8.1 Hansen Connect/Disconnect Tools

The Hansen Connect/Disconnect tools are fabricated from stainless steel and are mounted on the Ion Exchanger, Filter, Leakage Containment and Dewatering Station racks.

Operation is achieved by a mechanism that disengages a 1 1/2" stainless steel female Hansen coupling, ano couples it to a 1 1/2" male Hansen attached to the Ion Exchanger or Filter vessel.

Each vessel has three (3) nozzles associated with SDS operation: inlet, outlet and vent, and each nozzle has a separate tool to connect the appropriate hose to the corresponding vessel nozzle. The coupling operation is performed from approximately twenty (20) feet away from the vessel from the operators work platform located at each station. The platforms are located approximately (2) two feet above the pool water level. A quarter ton electric hoist is provided on a monorail overhead for ease of lifting, and lowering the tools into position.

These tools provide the means of remotely coupling and uncoupling filter and exchanger vessel connections while keeping radiation exposure to the operator to a minimum.

The Dewatering Station utilizes two (2) tools per vessel, an inlet air connection and an outlet connection that directs effluent to the off gas separator tank.

2.1.8.2 Exchanger and Filter Vessel Lifting and Positioning Tools

2.1.8.2.1 Unspent Vessel Tool: The unspent vessel lifting tool is constructed from stainless steel. It consists of two (2) J-hooks which pivot and are attached to a lifting shaft. The hooks are aligned with the vessel by a guide arm that fits into a notch in the vessel upper skirt. The tool also has a set of guide arms to position the vessel properly in the containment box. These arms have guides of two different sizes that mate with slots of corresponding sizes in the containment boxes and storage racks, to insure correct orientation of the vessel nozzles when placed in a containment box; additionally the Tool and Fuel Pool deck are marked with arrows which are positioned in the same direction.

The bottom of the containment boxes also utilize a guide assembly which mates with the bottom of the vessel to keep the vessel from rotating or tipping after the handling tool is released.

The Fuel Handling Building Overhead Crane is used to manipulate the lifting tool.

The J-hooks are engaged manually into lifting lugs welded to the vessel upper skirt at the pool curb prior to lowering the vessel into the pool. Disengagement occurs once the vessel is positioned and its weight is released from the tool. The weight of the hook itself allows the hook to drop clear of the lifting lug and the tool can be removed.

A spring actuated locking mechanism located on the J-hooks keeps the vessel from inadvertently disengaging the hooks if the vessel is accidently bumped. The locking device is unlatched manually from above the water surface by means of a pull cable.

This tool is used only for loading unspent Exchanger and Filter vessels into containment boxes. The manual latching requirement precludes the use of the tool for the movement of spent vessels. When not in use it is stored in the cask pit on the yoke hanger assembly.

2.1.8.2.2 Spent Vessel Tool: The spent vessel tool is basically identical to the unspent tool with the following differences:

a) This tool is used to move spent vessels from containment box to containment box, or to a storage rack, or to the Dewatering Station for dewatering, or to the Shipping Cask for removal from the pool.

b) The lifting shaft is longer to prevent inadvertent lifting of a spent vessel too near the surface of the pool. The shaft is long enough such that when the crane hook is at its top travel, the vessel will remain submerged and property shielded.

c) The J-hooks are engaged and disengageo using air operated cylinders. The locking mechanism is spring loaded and must be unlatched manually.

This tool is also stored in the cask pit on the yoke hanger assembly when not in use.

2.1.8.2.3 Alternate Spent Vessel Tool

Operating experience with SDS necessitated oesign and fabrication of an alternate spent vessel lifting tool for two reasons; 1) leakage containment vessels are not highly loaded and are removed from the pool for resin changeout, and 2) in the deep storage location, delatching problems tended to off center some vessels since the storage locations, unlike the processing locations, do not have guide assemblies in the bottom.

The original spent vessel tool could not be used to remove leakage containment vessels since it was desinged to prevent lifting of highly loaded vessels from the pool and out of the water shielding. The original tool also centered inside the container cubicle and not on the vessel thus making retrieval of an off center vessel impossible.

The alternate retrieval tool is identical to the original tool except in length and the method of centering on the vessel. The length is shorter to allow retrieval of leakage containment ion exchangers and the tool has been redesigned to center on the center nozzle of the vessels; allowing retrieval of off center vessels.

Because the vessel movement tools have become bent during use all vessel handling tools have replaceable spool pieces at the bottom end, which when they are bent may be replaced. The bottom end of the tool can also be replaced if damaged. The alternate spent vessel tool bottom assembly can be removeo from the short version and placed on the long version for handling of highly loaded vessels safely.

2.1.8.3 Recovery Tool

The recovery tool is fabricated from stainless flanged pipe sections which serve to allow the length of the tool to be altered necessary by adding or deleting pipe sections.

The tool is manipulated by the Fuel Handling Building Overhead Crane or can be attached to one of the 1/4 ton hoists located on each rack for Hansen tool manipulation.

There are three (3) attachments associated with the recovery tool, two (2) types of J-hooks and a flexible hose handling attachment.

This tool is a general recovery tool to be used for miscellaneous recovery and manipulation which may arise during the course of operation.

2.1.8.4 Moveable Spent Vessel Rack Lifting Device

The moveable spent rack lifting device is constructed from carbon steel with stainless steel locking pins. The pins are engaged and disengaged by air actuated cylinders.

The device is manipulated using the Fuel Handling Building overhead crane and is used to lift and position the four (4) moveable spent storage racks.

2.1.8.5 Vessel Nozzle Plugging Tool

The nozzle plugging tool is constructed of stainless steel. It consists of a mechanism for remotely placing a plug in the 1 1/2" male Hansen on the vessels. Once the plug is in place, the tool releases and disengages from the plug.

This tool is manipulated using the Fuel Handling Building Overhead Crane and is operated manually.

2.1.8.6 Pressure Instrument Diaphragm Removal Tool

The diaphragm removal tool is fabricated from carbon steel bar stock and is manipulated manually. It is used to remotely loosen the diaphragm of the Ashcroft pressure indicators located in manifold boxes and glove boxes for maintenance, removal or replacement.

2.1.8.7 Vent Hose Handling Tools

The vent hose handling tools consist of four specific tools each of which are twenty-four feet in length, constructed of stainless steel pipe and having different end fitting. Their function is to allow stored spent ion exchanger vessels vent hoses to be raised and lowered out of Fuel Pool "B", thus allowing these vessels to be vented. This venting operation is necessary to eliminate any pressure buildup inside these vessels due to radiological decomposition of water held by the spent zeolite. A description of each tool type and their function is presented below:

(a) <u>Single J-hook Tool</u>

This tool is used to lift the spent ion exchanger vessel vent hose from its position on top of the vessel to above the Fuel Pool "B" water level. From this location the vent hose is manually connected to the SDS vent header and the valve on the vent hose cycled. The tool consists of a stainless steel pipe with a J-hook eno fitting.

(b) <u>Double J-hook Tool</u>

This tool is used to assist in guiding the vent hose in place on top of the spent ion exchanger vessel as it is lowered into Fuel Pool "B". The tool consists of a stainless steel pipe with two J-hooks each in opposite direction as an end fitting. This design allows the vent hosc to be held securely during this lower operation.

(c) <u>Inverted Y Tool</u>

This tool is used to position and hold the vent hose in place on top of the spent ion exchanger vessel as the vent hose is [illegible] Fuel Pool "B". The tool consists of a stainless steel pipe with an inverted Y end fitting.

(d) Retainer Clip Tool

This tool is used to hold the vent hose as it is lowered into Fuel Pool "B" and to clip the vent hose retainer clip on the top of the spent ion exchanger vessel. The tool consists of a stainless steel pipe with a threaded male end fitting which mates to the retainer clip on the vent hose.

All of these tools are manipulated by the operator manually. In the case of the Retainer Clip Tool it is supported by the Fuel Handling Building overhead crane during the lower operation of the vent hose.

2.1.9 Sampling Devices

Sampling of the SDS process stream is accomplished by utilizing three sample boxes. These devices provide central locations where intermediate and high level radioactive samples can be taken for evaluating the system performance. They are:

1. Hi Rad Filter Sample Glove Box
2. Hi Rad Feed Sample Box
3. Intermediate Level Sample Glove Box

In addition, samples can also be taken at other SDS locations which handle low levels of radioactive water and, thus, do not require special boxes. These locations are:

1. Leakage Containment Pump Area.
2. Monitor Tank Pump Area.

2.1.9.1 Process Stream Sampling

The process stream water is sampled at various stages of treatment using centralized sample boxes. These sample box containments are designed to be completely sealed. A negative pressure greater than 0.25 inches of water is maintained inside the sample boxes by the SDS Off-Gas System. Each sample box is also equipped with a differential pressure gauge and a low differential pressure alarm. All sample boxes are double wall construction with lead shot between the walls to provide shielding during sampling activities. Additional lead sheet has been added to the exterior of each box to further reduce occupational exposures where required. The sampling boxes and the locations which they monitor in the process stream are discussed separately below.

2.1.9.1.1 Hi Rad Filter Sample Glove Box

This sample box is located on the west wall at the southwest corner of the "B" Fuel Pool. There are two sample points inside the glove box; the influent of the prefilter and the effluent of the final filter. These two sample points incorporate a continuous loop sampling design. Throttling of the process stream is required using CN-V-FL-3 for the prefilter influent sample and CN-V-FL-6 for the final filter effluent sample. Since flow does not continuously go through the sample line, it is necessary to recirculate through the lines prior to taking a sample. To prevent the sample box sump from overflowing, a sump pump is installed which transfers the waste water to the SDS Feed Tank Standpipe.

2.1.9.1.2 Hi Rad Feed Sample Box

This sample box is located on the surge tank cover at the north end of the "B" Fuel Pool. The box contains only one sample point which is used to obtain influent samples to the first zeolite in each processing train. Provisions are also provided to allow samples to be taken from the first zeolite vessel effluent in each processing train if activity levels of the feedwater passing through these vessels exceed 1μCi/cc. This information coupled with other data is necessary for calculating the ion exchanger vessel loading and efficiency. Since flow does not continuously go through the sample line, it is necessary to recirculate through the lines prior to taking a sample. The sump in this box is designed to gravity drain to the off-gas separator tank.

2.1.9.1.3 Intermediate Level Sample Glove Box

This sample box is located on the surge tank cover, next to the beta monitor manifold, at the north end of the "B" Fuel Pool. The box contains eight (8) sample points which provide the capability to monitor individual ion exchanger bed performance. The samples are taken from the following system points:

1. Train #1, Zeolite "A" Effluent.
2. Train #1, Zeolite "B" Effluent.
3. Train #1, Zeolite "C" Effluent.
4. Train #2, Zeolite "A" Effluent.
5. Train #2, Zeolite "B" Effluent.
6. Train #2, Zeolite "C" Effluent.
7. Trains #1 and #2, Cation Influent.
8. Trains #1 and #2, Cation Effluent.

Flow for this sample box comes from a diverter valve in the beta monitor manifold. After placing this valve in the sample position, it is necessary to first recirculate process fluid through the sample line prior to taking a sample. Samples are collected in a common, replaceable sample bomb. The sump in this box is designed to gravity drain to the off-gas separator tank.

2.1.9.2 Other Sampling

The remaining SDS sample locations, due to the low level of radioactive water which they handled, do not employ special lead shielded sample boxes; although the monitor tanks employ a special plexiglass enclosure to reduce the potential for airborne activity and provide shielding from beta radiation. These components are the monitor tanks, which contain SDS effluent water, and the leakage containment system which keeps the Fuel Pool water from becoming contaminated. These areas are discussed separately below.

2.1.9.2.1 Leakage Containment System

The leakage containment sample points are located on the ion exchange platform in the north end of the "B" Fuel Pool. Since the water being processed is pool water and potential leakage from various SDS components, it does not require an enclosed manifold or special sample box. There are two sample points in the leakage containment system, the leakage containment ion exchangers influent and effluent. The influent sample point will provide an indication of component leakage and the effluent sample will provide an indication of containment ion exchanger removal efficiency.

2.1.9.2.2 Monitor Tank System

The monitor tanks and pumps are located in the Fuel Handling Building Model Room at the 305' elevation. The monitor tanks are sampled locally at the discharge of the respective pump. The monitor tank contents are recirculated via the pumps through installed eductors in each tank and then sampled. The sample is a "grab sample" taken from a spigot. These tanks will contain only SDS processed water used for flushing SDS components or as staging tanks for EPICOR II processing.

2.1.9.2.3 Spent Vessel Gas Sampling

Gas sampling of the spent ion exchange vessels is provided by gas sampling stations mounted on the handrail on the west side of the spent fuel pool "B" above the stored vessel venting manifold. There are two (2) stations constructed from 1/4" diameter stainless steel tubing and containing a 0-60 psi Ashcroft pressure gauge and a 300 cc stainless steel sample cylinder. Gas sampling is accomplished by disconnecting the vessel vent line from the stored vessel venting manifold and connecting it to the gas sampling station where the gas is collected in the 300 cc sample cylinder.

2.2 Instruments, Controls, Alarms and Protective Devices

2.2.1 Instrumentation and Controls

Instrumentation and controls are located on the 347'6" elevation of the Unit II Fuel Handling Building except for local start capability for the Monitoring Tank Transfer Pumps P1A and P1B, local Monitor Tank Level Indication SOS-L1-1A and SDS-L1-3A and SDS Monitor Tank Transfer Pumps Discharge Flowmeter readout.

Radiation monitoring is performed at the Radiation Monitoring Panel (RMP-1) and the packaged Off Gas Radiation Monitor (Eberline PING-1A). The RMP-1 contains linear ratemeters and a multi-point recorder for the seven Beta detectors (CN-RE-IX04, -LC05,-PM07,-PM08,-PM09,-PM10, and-PM11) and the two gamma detectors (CN-RE-IX03 and CN-RE-VA06). Only channels CN-RE-IX09 and CN-LC05 are recorded by the Multi-Point Recorder.

The Beta detectors are G-M tubes monitoring the process water through teflon tubing windows located in the Beta monitor manifold. A nylon window is used on the suction of the containment water pump and nylon tubing on the exchanger manifold effluent. The high voltage and 12 VDC required to power these units is distributed through fan-out connectors in the radiation monitoring panel. The pulse discriminator output provides a positive six volt square pulse for every negative input pulse from the G-M tube that exceeds the discriminator threshold level. The output of the pulse discriminator is connected to the input of the linear ratemeter/alarm where it is displayed as a count-rate. The gamma detectors consist of a G-M tube, selfcontained high voltage power supply, pulse amplifier, low voltage regulator, and line driver with output to an electronic readout/alarm channel. CN-RE-IX03 is the area monitor detector mounted on top of the radiation monitoring panel (RMP-1). CN-RE-VA06 is the off-gas detector mounted on the off-gas header before the off-gas heater.

Both channels are recorded on the multi-point recorder (CN-RR-RR16).

Measurement of the off-gas effluent beta particulate, iodine 129 and noble gases is accomplished through the packaged PING-1A sample system. Ambient background radiation is also measured and subtracted from the activity in the air measurement providing higher sensitivity to the radiation level in the process stream. Sample intake goes through a filter paper on which any particulate is deposited, then through a charcoal cartridge which traps the iodines, then into the gas chamber and is exhausted back into the off-gas ducting. Local indication and recording are provided on the PING-1A.

Start/Stop control for the Surface Suction Pump (SWS-P-1) is located on SDS Control Panel CN-PNL-1 with stop capability on the local panel on the east wall of the Fuel Handling Building. Control for pump WG-P-1 is also located on CN-PNL-1 with "Remote-Local" selector switch. Filling of the 60,000 gallon tank farm is controlled from CN-PNL-1, where controls are located for WG-AV-01 and WG-AV-02 as well as various alarms and digital feed tank farm level indication. Tandem bubblers provide local feed tank farm level indication. The open/close/auto switches for WG-AV-01 and WG-AV-02 are located on CN-PNL-1. Level Switch High (WG-LSH-1) is interlocked with WG-AV-02 to close on high level if WG-AV-02 is in the auto position.

The SDS Feed Pump, (CN-P-IX01), Off-Gas Bottoms Pump (CN-P-VA04), Leakage Containment Pump (CN-P-LC06), and the MSA Off-Gas Blower (CN-P-VA05) are all controlled from their respective local starters. The Feed Pump has an "Auto/Manual" key-operated override switch. In the "Auto" position, low level in the Feed Standpipe as sensed by CN-LCL-IX10 will deenergize the Feed Pump. In the "Manual" position, this shutdown is bypassed.

The Off-Gas Bottoms Pump has an "Auto/Off/On" key-operated selector switch. In "Auto", CN-LC-VA03 will function to start the pump on high level in the Off-Gas Separator and stop the pump on low level.

The MSA Off-Gas Blower and Leakage Containment pumps have simple "Start/Stop" push buttons.

The feed pump discharge flow is measured and totalized by CN-FQI-IX01 which is a vortex shedding type flowmeter with totalizer. It then passes the Feed Isolation Valve (CN-V-IX24) which is controlled from the Feed Shutdown System Relay Panel (RP-1). The "Auto-Trip" selector switch in the "Auto" position energizes the Feed Isolation Valve Solenoid Valve (CN-UY-IX24) admitting air to CN-V-IX24 to open providing a trip signal is not present. Trip signals from Off-Gas Header Influent Pressure High High Switch (CN-PISH-VA28) or IX Manifold General Area Radiation High (CN-RAH-IX03) deenergize CN-UY-IX24 on a 5 to 50 second time delay. Trip signals from IX Manifold Effluent in Line Radiation High (CN-RSH-IX04) or Leakage Containment System Influent Radiation High (CN-RSH-LC05) deenergize CN-UY-IX24 on a 5 to 50 second time delay. Instantaneous closure is affected by placing the "Auto-Trip" selector switch in the "Trip" position.

Downstream of CN-V-IX24 are two (2) vortex shedding type flowmeters with totalizers to measure the flow into either Ion Exchange Train. The vortex flow meters have a local readout.

Local Pressure instrumentation is located throughout the process in areas such as the inlet and outlet of each exchanger of filter. Many of these pressure indicators are unnecessary for system operation but provide indication of individual exchanger performance. The pressure gauges are weatherproof and liquid filled such that the process pressure is sensed through a remote diaphram.

Feed temperature is measured in the feed manifold (CN-TI-FX01) and in the RCS cleanup manifold (CN-TI-RC07). Measurement is made with thermocouples with hot junctions welded to the feed lines. The thermocouple is connected directly to the input of a digital readout temperature indicator. The indicator and housing are on a support stand mounted on top of the manifold.

The SDS System is flushed using deionized or low activity processed water whose flow is measured through a hand held flow totalizer. The flow is controlled with the off-on action of solenoid valve CN-V-DW-339.

The system is started by setting the total gallons desired with the dial on the batch register and pressing the start button. This will energize CN-V-DW39 allowing water to flow through the meter. The register will count down the gallons of water to zero where it will de-energize CN-V-DW-339, shutting off water flow.

The Leakage Containment System surrounding all of the Ion Exchangers, Pre and Final Filters have flow orifices with manometer readout to indicate positive flow into each containment from the pool water. The Leakage Containment Pump has a local pressure gauge on its discharge and inlet.

An Off-Gas System maintains a negative pressure on the five SDS manifolds and three sampling glove boxes. Each manifold or glove box as well as the Off-Gas Header Influent has a Pressure Differential Indicator/Switch. Pressure differential is sensed through a 1/4-inch pipe nipple and 3/8-inch O.D. tubing connected to the low pressure side of a pressure differential indicator/switch (high pressure side vented to atmosphere). The sensed pressure differential is indicated on a 0 to 1 inch of water scale (0 to 15 inches of water on the Off-Gas Header Influent). A low pressure (high vacuum) switch actuates a local audible horn at .25 inches of water for the filter, feed and RCS manifolds and the Hi Rad Filter Sample Glove Box. A remote alarm and flashing alarm window on Annunicator Panel No. 1 is actuated by low pressue switches at .25 inches of water for the Ion Exchangers and Beta Monitor Manifolds and the Hi Rad Feed and Intermediate Sample Glove Boxes. The Off-Gas Header Influent Presure High Switch actuates a remote alarm and flashing alarm window on Annunicator Panel No. 1.

The Off-Gas Filtration unit has a 9 KW heater on the inlet sized to dehumidify air from 100% to less than 70% relative humidity at rated flow. The heater has an on-off controller with temperature indication from a thermocouple mounted near the heater. Protective thermodiscs de-energize the heater at 285°F and 320°F as does a fan interlock, should the off-gas blower be secured or a loss of power occur. The off-gas blower is started and stopped through a local controller. Filter differential pressures, inlet and outlet temperatures, flow indication, and inlet and outlet pressure indication are provided locally.

The controls and instrumentation of the SDS Monitor Tanks consist of controls for the transfer pumps and inlet valves and indication for tank level, pump discharge flow and pressure. The SDS Monitoring Tank Transfer Pumps P1A and P1B can be started and stopped locally on the 305' elevation of the Fuel Handling Building or remotely at the SDS Feed and Monitor Tank Panel (SDS-LCP1) on the 347'6" elevation. Run/Stop indication is provided both locally and remotely. A selector switch permits the operator to choose the correct monitor tank/transfer pump alignment which in turn aligns the appropriate tank's low-level switch to trip the pump.

Pump discharge pressure is displayed locally and on SDS-LCP1 via a pressure transmitter. A local readout flowmeter/totalizer is located on the common pump discharge. Level indication for T-1A and T-1B are readouts locally on SDS-LCP2 and remotely on SDS-LCP1.

SDS Monitor Tank Inlet Valves SDS-V002A and B are controlled from SDS-LCP1. The valves close automatically on a high level in their respective tanks. The valves can only be opened if the high level alarm has cleared.

Local presure and/or flow indication is provided in each of the three (3) sampling glove boxes.

2.2.2 Alarms

Annunicator panel No. 1

All field contacts are closed during normal operation and will open for alarm condition. The alarms work as follows:

A sensing voltage of 120 VAC is applied through the individual annunicator points via a field contact. Opening of the field contact (signaling an alarm condition) will remove the 120 VAC causing that point-light to flash and sound the horn. Depressing the "Acknowledge" push button will silence the horn and change the light to a steady-on condition. Closing the field contact (process return to normal) will turn off the light. The annunciator point is then reset for another sequence. Depressing "Lamp Test" push button will illuminate all point lights.

Annunciator Panel No. 1 includes the following alarm points:

ALARM	ACTUATED BY
1. Feed Valve Closed	
2. Exchanger Manifold Low Diff. Pressure	CN-DPSL-VA04
3. Hi Rad Samples Low Diff. Pressure	CN-DPSL-VA11
4.* Beta Monitor Sample Return Low Flow	CN-FSL-M18
5. Off Gas System High Pressure	CN-PISH-VA28
6.* Beta Monitor Manifold Low Diff. Pressure	CN-DPSL-VA10
7. Inter-Rad Samples Low Diff. Pressure	CN-DPSL-VA09
8. Off Gas Filter Unit High Temperature	CN-TSH-VA04
9. Off Gas Separator High Level	CN-LSH-VA03
10. SDS Monitor Tank T-1A Level Hi/Lo	SDS-LSHL-1
11. SDS Monitor Tank T-1B Level Hi/Lo	SDS-LSHL-3
12. Leakage Containment Pump Low Pressure	CN-PSL-LC17

* Not in use

SDS Control Panel (CN-PNL-1)

The SDS Control Panel alarms function in an identical way to Annunicator Panel No. 1. SDS Control Panel CN-PNL-1 includes the following alarm points:

ALARM	ACTUATED BY
1. Lower Waste Storage Tanks Level Hi	WG-LSH-3
2. Upper Waste Storage Tanks Level Hi Hi	WG-LSH-1
3. Pump WG-P-1 Seal Leakage	WG-PS-17
4. Pump WG-P-1 Flow Outlet Temp Hi	WG-TSH-15
5. Upper Waste Storage Tanks Level Hi	WG-LSH-1A

Radiation Monitoring Panel

The Radiation Monitoring Panel Common Alarm (CN-RAH-IX04) is located on top of the Panel. It consists of a bell alarm, alarm light and a silence and test pushbutton. The alarm is actuated when the field contacts open (deenergized state) from the following alarm points:

ALARM	ACTUATED BY
1. IX Manifold General Area Rad. Hi	CN-RSH-IX03
2. Off Gas Header Influent Rad. Hi	CN-RSH-VA06
3. "A" Zeolite Beds Effluent Rad. Hi	CN-RSH-PM07
4. "B" Zeolite Beds Effluent Rad. Hi	CN-RSH-PM08
5. "C" Zeolite Beds Effluent Rad. Hi	CN-RSH-PM09
6. Cation Beds Influent Rad. Hi	CN-RSH-PM10
7. Cation Beds Effluent Rad. Hi	CN-RSH-PM11
8. Leakage Containment System Influent Rad. Hi	CN-RSH-LC05
9. IX Manifold Effluent in Line Rad. Hi	CN-RSH-LX04

Off Gas Sampler

The Off Gas Sampler contains Alert and High Level Alarm and Normal light. The Alert and High Alarms have identical circuits with adjustable trip points and inputs from the Particulate, Iodine and Gaseous readouts. Exceeding the trip point energizes the lamp on the front panel and changes the state of the alarm relay. Relay logic is reversible and alarms may be locking or non-locking, selectable by internal switches. The reset of a locked alarm is accomplished by pushing the lit alarm light. In addition to the above, the High Alarms activate a flashing light and sound a bell.

The Off Gas Sampler contains the following alarm points:

ALARM	ACTUATED BY
1. Off Gas Particulate Sample Rad. Hi	CN-RSH-VA12
2. Off Gas Charcoal Sampler Rad. Hi	CN-RSH-VA13
3. Off Gas Ion Chamber Sampler Rad. Hi	CN-RSH-VA14

A failed alarm consisting of a NORMAL light being deenergized is actuated when the count rate drops below one count per minute. The alarms ~re disabled during the use of the check source.

Local Annunicators

Local annunicators with audible horns include the following alarm points:

ALARM		ACTUATED BY
1.	Filter Manifold Containment DP Lo	CN-DPSL-VA01
2.	Hi Rad. Filter Sample Box DP Lo	CN-DPSL-VA02
3.	Feed Manifold Containment DP Lo	CN-DPSL-VA03
4.	RCS Manifold Containment DP Lo	CN-DPSL-VA12
5.	Filter Manifold Containment Sump Level Hi	CN-LS-FL06
6.	Hi Rad Filter Sample Glove Box Sump Level Hi	CN-LSH-SA07
7.	RCS Manifold Containment Sump Level Hi	CN-LSH-RC09

All field contacts are closed during normal operation and will open for alarm condition. A sensing voltage of 120 VAC is applied through field contact.

Opening of the field contact (signaling an alarm condition) will interrupt the 120 VAC causing the annunicator bullseye light to flash and sounding an audible horn. Depressing the "Silence/Test" push button will silence the horn and change the light to a steady-on condition. Closing the field contact (process return to normal) will turn off the light. The annunicator point is then reset for another sequence. Depressing the "Silence/Test" push button will illuminate the bullseye light.

There are two independent valves, one for each tank, located on the influent lines to the monitor tanks. They are 1 1/2 inch motor operated ball valves. The actuators associated with these valves are interlocked with the monitor tank level transmitters. Position switches are provided on each valve actuator with indication on the SDS control panel. These valves may be opened simultaneously to avoid hydraulically shocking the SDS ion exchangers and generating fines during monitor tank switch-over.

Associated with the valve is an open/close hand switch, each inlet valve can be opened manually using its associated hand switch. Closure of the valves can be accomplished manually; at any time, using the hand switch. The valves will close automatically if the tank level is high.

3.0 Submerged Demineralizer System Modes of Operation

3.1 Off Gas System

3.1.1 System Start-Up

Prior to operating any portion of the Submerged Demineralization System, the Vent and Drain System comprising the Off Gas System and the liquid separation module must be operating. A prerequisite for the operation of these systems is operation of the Fuel Handling Building HVAC system.

3.1.2 System Operation

During normal operation, the off gas filtration unit is designed to require little operator action. The unit should be periodically checked to ensure that temperatures, flows and radiation levels are within the normal ranges.

Increasing differential pressure across the roughing filter, charcoal filter, or the HEPA filters is an indication that the filters are retaining dirt and other airborne particulate. These components should be replaced as required to insure that flow through the ventilation unit is adequate.

The off gas moisture separator tank level should be monitored periodically to insure that the level control system is functioning properly. During initial component venting (i.e. venting of the prefilter and final filter), or other operations during which large amounts of liquids are dumped into the Vent and Drain System, moisture separator tank level should be monitored more frequently.

3.1.3 System Shutdown

The purpose of the Ventilation System is to ensure that all ventilated gases, from the Submerged Demineralizer System components, are filtered and monitored for radiation. Shutdown of the Off Gas System will preclude filtration and monitoring of the air, and should not be performed unless dictated by other casualty/operational considerations. To secure the Off Gas System, secure the off gas blower and then place the system in a normal shutdown line-up.

3.2 Feed Tank Filling Operation

3.2.1 Fill Operation Start-Up

The feed tank filling operation involves SDS, the feed tank system and TMI-2 equipment. Prior to system operation, system operators will be required to have in operation the SDS Off Gas System and the Leakage Containment System.

These support systems must be in operation at the onset of and throughout the duration of, the fill operation. After system operators have completed the line up to fill the feed tanks, they will start the temporary surface suction pump, or the WG-P-1 pump or the waste transfer pumps, and commence filling these tanks. Initially, all system parameters will be continuously monitored until proper operation of the system has been verified.

3.2.2 Normal Operation

The feed tank filling operation will be a batch filling process (the tanks will be filled, the water processed, and then the tanks refilled). During normal filling operation, no water will be processed through the Submerged Demineralizer System.

System parameters will be periodically monitored while filling the feed tanks. SDS filters will be replaced if instruments indicate they are expended. Changing out a filter requires the filling operation to be secured.

Periodic sampling will be performed to provide an indication of the approximate chemical and radionuclide content of the liquid stored in the tanks, and an indication of the performance and loading of the filters.

A fill completion time calculated from the fill rate and volume should be used as a back-up method of feed tank level determination.

3.2.3 Securing the Filling Operation

When the feed tanks have been filled to the desired level, (50,000 gallons) the operators will secure the temporary surface suction pump, SWS-P-1 the waste transfer pump, WG-P-1, or WDL-P-5B which takes suction from the RCBT's and secure the appropriate valve lineup. The transfer line from SWS-P-1 shall be back flushed prior to Reactor Building Entries.

3.3 Processing the Filtered Water

3.3.1 Processing System Start Up

Throughout the duration of the processing, the SDS Off Gas System and Leakage Containment System will be in operation.

The ion exchange vessels will be filled and vented prior to installation into the system. Line venting will be accomplished on initial system start-up, and will not be repeated on subsequent restarts. With all vessels installed in the system, the operators will align the system for operation. The submersible feed pump will be started after the submerged ion exchange manifold and the transfer lines to Epicor II via the RCBT or MWHT are aligned for operation.

Throttle valves will be adjusted to provide the proper flow rates through the system. Initial system operation will utilize one (1) train of ion exchangers at flow rate of 5 gpm.

The system will be surveyed for indication of leakage or radiation streaming on system start ups, and during initial operation.

System sampling will be conducted in accordance with approved procedures. During initial operation data will be recorded from all system instrumentation to establish baseline data points, for future reference and system trouble shooting. When sufficient operating experience has been gained, the data points necessary to support the Process Control Program will be recorded each shift.

3.3.2 Processing System Operation

Once the flow rate is established, the system functions with little operator action. Instrumentation is provided on the system monitoring panels and at various locations throughout the system as described in previous chapters to monitor system parameters. Operators will insure that proper system flow rates are maintained.
Periodic sampling (at various sample points) will be performed to verify bed performance and decontamination factors.

3.3.3 Processing System Shutdown

When it has been determined that a process demineralizer is expended or the batch depleted, the operator will secure the feed pump and flush the system with demineralized water, or processed water.
The expended exchanger in the train is then removed, and stored in storage racks in the "B" Fuel Pool. Expandable plugs are installed in each Hansen connector and the vessel is connected to the storage vent header.

3.4 Special Evolutions

3.4.1 Cation Vessel Change Out

Vessels in the cation position are presently being moved to the 1C or 2C position as the 1A or 2A vessel is removed and the other vessels are moved forward. However, replacement of a vessel located in the forth (4) exchange position can be performed without securing the process evolution. When it is determined a cation vessel needs to be replaced in the forth bed position, the standby vessel is valved into the system. The spent vessel is then isolated. The vessel is then flushed and removed from the system; it is stored and a new vessel is installed in its place.

3.4.2 Leakage Containment Ion Exchanger Vessel Replacement

There are two leakage containment ion exchangers arranged in parallel in the system. Both ion exchangers are in service simultaneously. When it is determined that the ion exchangers must be replaced. The SDS is shutdown and both leakage containment vessles are replaced. After both vessels are replaced the system will be returned to normal operation utilizing both vessels.

3.4.3 Ventilation Filter Replacement

When the roughting, HEPA or charcoal filter in the off gas unit requires replacement, the Submerged Demineralization System will first be shutdown. After a suitable period, the ventilation system will then be shutdown and the filter replaced. When the bypass filter requires replacement, the filter will be valved out and changed without shutting down the Submerged Demineralization or ventilation systems.

On loss of the SDS Off Gas System, the SDS will be shutdown and system components sealed until the off gas system is restored to service. Unit II Control Room notified. Appropriate radiation control procedures will be instituted.

3.5 Transfer of Water from SDS to EPICOR II

There are three major pathways available for the SDS effluent to be transferred.

The first pathway utilizes the Reactor Coolant Bleed Holdup Tanks (WDL-T-1A, 1B, 1C) as the hold-up tanks for transferring SDS effluent. This scheme uses existing piping on the 347' elevation of the Fuel Handling Building to transfer water through the Spent Fuel Cooling System to the Radwaste Disposal System. In the Radwaste Disposal System, the effluent can be directed to the Reactor Coolant Bleed Holdup Tanks for eventual EPICOR II processing or for transfer to other locations within the plant.

The second pathway utilizes the submersible pump connection on the 347' level of the Fuel Handling Building, leads directly to WDL-T-2 (Miscellaneous Waste Holdup Tank). From this tank, the water can be directed to EPICOR II for processing or to other locations within the plant. This particular pathway presents the possibility of using the Miscellaneous Waste Holdup Tank as surge capacity between SDS and EPICOR II for direct series processing. WDL-T-2 represents approximately 19,000 gallons of surge capacity which would allow SDS to run a maximum of 33 hours (at 10 GPM) while EPICOR II is shut down for liner change out or for maintenance.

The third pathway utilizes the SDS line to the Monitor Tank System. This system is capable of collecting and monitoring decontaminated liquid effluent from the SDS and transferring it to the EPICOR II System, the Processed Water Storage Tanks or back to SDS for recycle of the water through the system. The Monitor Tank System is also intended to be used as a source of flush water for the SDS.

Source Tank	Receiving Tank
WDL-T-1A, 1B, 1C	EPICOR II
	WDL-T-2
	DH-T-1
	Unit I Tanks
	MDCT
	WDL-T-1A, 1B, 1C
	Tank Farm
WDL-T-2	EPICOR II
	WDL-T-1A, 1B, 1C
	Unit I Tanks
	WDL-T-5
	WDL-T-8A, 8B
	Tank Farm
SDS-T-1A, 1B	EPICOR II
	PW-T-1, 2
	SDS Recycle
	SDS Flush
	WDL-T-1A, 1B, 1C
	WDL-T-2

3.6 Staffing Levels

3.6.1 System Operations

During system operation, the staffing levels will be as follows:

1.	Operations Department	Two (2) Operators
2.	Chemistry Department	One (1) Chemistry Technician
3.	Radcon Department	One (1) Health Physics Technician

In addition, during vessel movement evolutions, a fuel handling building crane operator will be supplied by the Maintenance Department.

These manpower levels are subject to change as a result of lessons learned from the initial operation of the system.

3.6.2 System Outages

During outages, the system will be routinely surveyed by at least one operator and one health physics technician.

4.0 Abnormal Operating Conditions and Emergency Events

4.1 Types of Events Considered

Design and operating parameters of the SDS have included consideration of abnormal operating conditions and emergency events which might arise. The following are noted as situations which may occur:

Abnormal Operating Conditions

Loss of SDS Off-Gas System

Leakage of the SDS into the Spent Fuel Pool

Loss of Instrument Air

Loss of Electric Power

Emergency Events

Fire

Vessel Drop in the Spent Fuel Pool

Cask Drop

Man in the Spent Fuel Pool

4.2 Abnormal Operating Conditions

4.2.1 Loss of SDS Off-Gas System

4.2.1.1 Design Criteria to Mitigate Effects

Upon failure of the off-gas system such that flow through the system is lost, CN-V-IX-24 automatically closes. This action interrupts process flow through the SDS, thereby precluding processing operations with the off-gas system not functioning. This design feature has been incorporated to enable control over the possible generation of airborne radionuclide particulates and gases.

4.2.1.2 Response

Upon loss of the SDS Off-Gas System, the SDS will be shut down and its components isolated until the off gas system is restored to service. The Unit II Control Room will be notified immediately. Any unnecessary personnel will be evacuated from the area until such time as Health Physics personnel determine the area is safe. Self-contained breathing apparatus or respirators will be used by remaining essential personnel, if required, during implementation of corrective action.

4.2.2 Leakage from SDS Into the Spent Fuel Pool

4.2.2.1 Design Criteria to Mitigate Effects

The SDS has been designed to minimize the possibility of leakage. Metallic piping has been designed and fabricated using all welded construction to the maximum extent possible. Process components, the ion exchange vessels, are located within containment enclosures to restrict the spread of radioactive contamination within the Spent Fuel Pool in the event that a Hansen coupling to a vessel should leak. Radiation detector RE-LC-05 is provided to detect such a leak. Valve enclosures are drained as described in Table 2 to control radioactive liquids should a valve leak occur; airborne radioactive contamination is controlled by ventilating the valve enclosures to the off-gas system. Area radiation monitors will provide indication and alarm of increases in the general area radiation levels.

4.2.2.2 Response

If a leak in the submerged piping of the SDS is either detected or suspected, the processing operations will be suspended. The Unit II Control Room will be notified immediately. Area radiation monitoring, in addition to the monitoring in place, will commence. Continuous air samples will be taken to determine the existence of increased airborne radiation levels. Should it be necessary, personnel will be evacuated from the area. Causative factors will be defined; corrective action will be planned and implemented.

4.2.3 Loss of Instrument Air

4.2.3.1 Design Criteria to Mitigate Effects

CN-V-IX-24 automatically shuts upon loss of instrument air causing termination of the feed to SDS.

Response

Any loss of system air will be reported to the Unit II Control Room. Since this abnormal operating condition does not require immediate corrective action, an action plan will be developed and implemented to correct the causative factor.

4.2.4 Loss of Electric Power

4.2.4.1 Design Criteria to Mitigate Effects

Upon loss of electric power SDS processing will be automatically terminated; feed pump operation will be terminated, off-gas system operation will be terminated, CN-V-IX-24 will close.

4.2.4.2 Response

Implement those actions that may be necessary for loss of the SDS off-gas system.

4.3 Emergency Events

4.3.1 Fire

4.3.1.1 Design Criteria to Mitigate Effects

Many of the SDS components remain submerged while in operation. Futhermore, the use of flammable substances has been minimized in the above-water portion of the system. Fire fighting equipment is available in the SDS operating area. The probability for fire in the area of the "B" Spent Fuel Pool, the location of the SDS, is extremely low.

4.3.1.2 Response

Upon detection of fire in the Fuel Handling Building, processing operatins of the SDS will be terminated and the system shut down. Unnecessary personnel will be evacuated from the area. If possible, personnel in the area will fight the fire with available fire fighting equipment. The Station Fire Brigade will be assembled.

4.3.2 Vessel Drop in the Spent Fuel Pool

4.3.2.1 Design Criteria to Mitigate Effects

SDS vessel handling will be done only underwater. Movement of the vessels will occur under stringent observation of operators. Vessel handling tools are of the original vendor design as modified by GPU engineering in accordance with ANSI/ASME N45.2.15. Testing and periodic maintenance are performed in accordance with approved procedures. The SDS vessels have been designed with sufficient strength to discourage rupture if dropped within the pool. If component (vessel or piping) damage were to occur, such that small amounts of radioactive water is released to the Spent Fuel Pool, the pool and its cleanup systems will limit dispersal of radionuclides and provide cleanup capability for the contaminated pool water. Crane operators will receive training prior to handling the spent vessels.

4.3.2.2 Response

SDS processing operations will be terminated. The operator will immediately notify the Unit II Control Room in the event of a dropped vessel. An immediate visual inspection of system components and instrumentation will then be made to note any indication of possible damage. If damage has occured to any system components, the operator will take corrective action as necessary.

4.3.3 Cask Drop

Cask drop analysis is provided in the SDS TER, Section 7.5. This analysis yields the conclusion that, while the unlikely probability exists that a cask drop could result in a significant cleanup effort, the public health and safety is not compromised.

4.3.3.1 Design Features to Mitigate Effects

Should a cask drop occur, the Fuel Handling Building Ventilation System will be operated to limit radionuclide dispersion to the atmosphere to within Technical Specification limits. The cask handling procedures strictly limit the area above which the shipping casks will be handled and ensure that a cask drop will not damage essential plant hardware.

4.3.3.2 Response

SDS processing operations will be terminated. All unnecessary personnel will be immediately evacuated from the area in order to minimize personnel exposure. Any injured personnel will be removed from the area via proper emergency techniques. The Unit I and Unit II Control Rooms shall then be notified, in addition to Health Physics personnel. The Control Room will periodically announce that unnecessary personnel are to remain clear of the accident site. Once the damage and/or danger is assessed, follow-up actions will be initiated to recover from the effects of this accident.

4.3.4 Man in the "B" Spent Fuel Pool

4.3.4.1 Design Criterie to Mitigate Effects

SDS operation will be performed with full-time Health Physics support. These personnel have knowledge of required actions in the event of gross contamination of the worker due to falling in the Fuel Pool. Eye wash stations are available in the operating area. Plant showers and other services necessary to decontaminate workers are available.

4.3.4.2 Response

If a man falls into the "B" Spent Fuel Pool, processing and equipment handling will be stopped and the man will be retrieved from the pool. Unit II Control Room and Health Physics personnel will be notified.

5.0 Maintenance

5.1 Maintenance Approach

The SDS has been designed specifically to be virtually maintenance free; however, some minimal maintenance requirements are expected. To provide ALARA radiation exposure during maintenance all system piping, glove boxes and manifolds are provided with flush connections. All components will be flushed prior to maintenance work. Maintenance requirements for the SDS can be categorized into the following broad general areas:

1. Instrument maintenance and calibration.
2. Pump maintenance.
3. Valve maintenance.
4. Hansen coupling maintenance.
5. Off gas filter system maintenance.

The maintenance approach for each of these areas is described below.

5.1.1 Instrument Maintenance and Calibration Approach

Instrumentation calibration will be performed on a routine basis in accordance with the normal site calibration frequency in accordance with AP 1027 Preventive Maintenance. Maintenance on electronic portions of instrumentation outside the pressure boundary will be performed in accordance with vendors manuals as required and will generally present no special requirements. Pressure indicating devices which communicate with the process fluid are of the isolation diaphram and filled capillary tube type and are located within the various manifold boxes. These instruments would normally not require maintenance and are intended to be replaced remotely should problems develop.

5.1.2 Pump Maintenance

5.1.2.1 Feed Pump and Off Gas Bottoms Pump

The SDS feed pump and off gas bottoms submerged pumps are intended to be replaced rather than repaired.

5.1.2.2 SDS Manifold and Glove Box Sump Pumps

The manifold and glove box pumps will be replaced rather than repaired.

5.1.2.3 Pool Clean-Up System Pump

The pool clean-up system pump is located in an accessible area on the pool curb and is not expected to become contaminated. Normal plant maintenance practices will be utilized should repair become necessary.

5.1.2.4 Leakage Containment System Pump

The leakage containment system pump is located in an accessible area at the north end of the "B" Fuel Pool and just west of the ion exchanger manifold. It is not expected to become highly contaminated during SDS operation. Normal plant maintenance practices will be utilized should repair become necessary.

5.1.2.5 Monitor Tank Transfer Pumps

The monitor tank system transfer pumps are located in an accessible area of the model room. They are not expected to become highly contaminated as they are planned to handle SDS flush water. Normal plant maintenance practices will be utilized should repair become necessary.

5.1.3 Valve Maintenance

All key system valves communicating with contaminated process fluid are located within the various manifold boxes. These valves are accessible through ports in the manifold box covers. The valves are of the top entry type for use of maintenance. The manifold boxes can be flushed and drained to minimize surface contamination prior to commencing maintenance activities. Existing generic plant maintenance procedures will be used where possible. Special procedures will be developed for equipment which is unique to the SDS.

5.1.4 Hansen Coupling Maintenance

The female Hansen couplings, which are part of the flexible hoses connecting the system to the vessels, contain "O" rings which could become worn or damaged through continued use. These may be replaced underwater either manually or through the use of remote tools. Experience with the system will dictate frequency of replacement.

5.2 Corrective Maintenance

Prior to performing any maintenance activity on SDS components associated with the pressure boundary or other contaminated portions, the system will be flushed using either demineralized water or low activity processed water. The system will then be drained and the necessary surveys and swipe samples taken to determine the appropriate work procedure to maintain ALARA conditions.

When work is to be accomplished within the manifold boxes, a survey and swipe samples will be taken in the box and the box will be flushed if contamination is detected. Photographs which were taken of the boxes prior to installation of the covers will be used as required to determine work space and component location.

For removal of isolation diaphrem type pressure instruments a special tool as described in Section 1.8 will be utilized to allow the remote removal and replacement of the instrument.

The feed pumps have been supplied with special shielded sleeves as described on drawing 5270-A-5012. The pumps will be pulled into these sleeves and sealed; then new pumps installed.

5.2.1 Retesting Requirements

Repairs, maintenance and system modifications which violate the integrity of the pressure boundary will require post-maintenance testing at normal operating pressure and temperature. This will be accomplished using low level processed water or demineralized water.

Replacement of the off gas system HEPA or charcoal filters will require the performance of a DOP or Freon 2 Test, respectively, to verify filter efficiency, in accordance with Regulatory Guide 1.140.

5.3 Preventive Maintenance and Inservice Inspection

5.3.1 Preventive Maintenance

The pool clean-up system pump will be checked to ensure that oil is visible in the oil reservoir at regular intervals.

Periodic surveys of the manifold boxes will be performed to determine leak integrity of valve stem packing. This will be accomplished when the system is shut down for vessel change out and can be performed by removing a valve access plug and taking a swipe sample of the drain sump.

5.3.2 Inservice Inspection

Inservice inspection consists of periodic physical inspection of components.

Valves, pumps, instrument connections, motors and other active components will be routinely inspected to determine degradation and to spot potential problem areas. Instrument readings will be taken daily and compared to previous data to develop trend information which may indicate system degradation or potential problem areas. This information will be evaluated by the engineering staff and corrective measures recommended as deemed appropriate.

6.0 Acceptance Testing

The SDS testing can be subdivided into three general categories:

1. Construction Testing
2. "Cold" Functional Testing
3. "Hot" Functional Testing.

6.1 Construction Testing

Construction testing will consist of fluid system flushing, flow verification and pressure testing and continuity testing and alarm set point checks of all electrical and instrument circuits. Additionally, all instruments (which were purchased initially with factory calibration certification) will be recalibrated. DOP and Freon 2 testing has been performed on the off gas HEPA and charcoal filters, respectively in accordance with Regulatory Guide 1.140. Initial equipment mechanical checkout, including vibration testing, lubrication checks and initial run in have been completed. Vessels will be required to pass a hydrostatic test in accordance with the ASME Boiler and Pressure Vessel Code, Division 1. The test criteria for the HEPA and charcoal filters is that they meet a 99.95 percent efficiency for removing the test media employed.

6.2 "Cold" Functional Testing

The system will be aligned in its normal operating mode and filled with demineralized water. System operating procedures will be proof tested (red lined) and baseline data will be taken from system instrumentation. This information will be compared with the design points to verify system performance to be in accordance with the design. The system will be required to perform to the design points specified in this document (Appendix 7). The system will be required to perform operations which are described in Section 3 of this document. Set points, alarm points and system trip points will be verified. Tank level indication will be verified. Remote tool operability will be demonstrated. Filter and ion exchanger handling operations will be demonstrated.

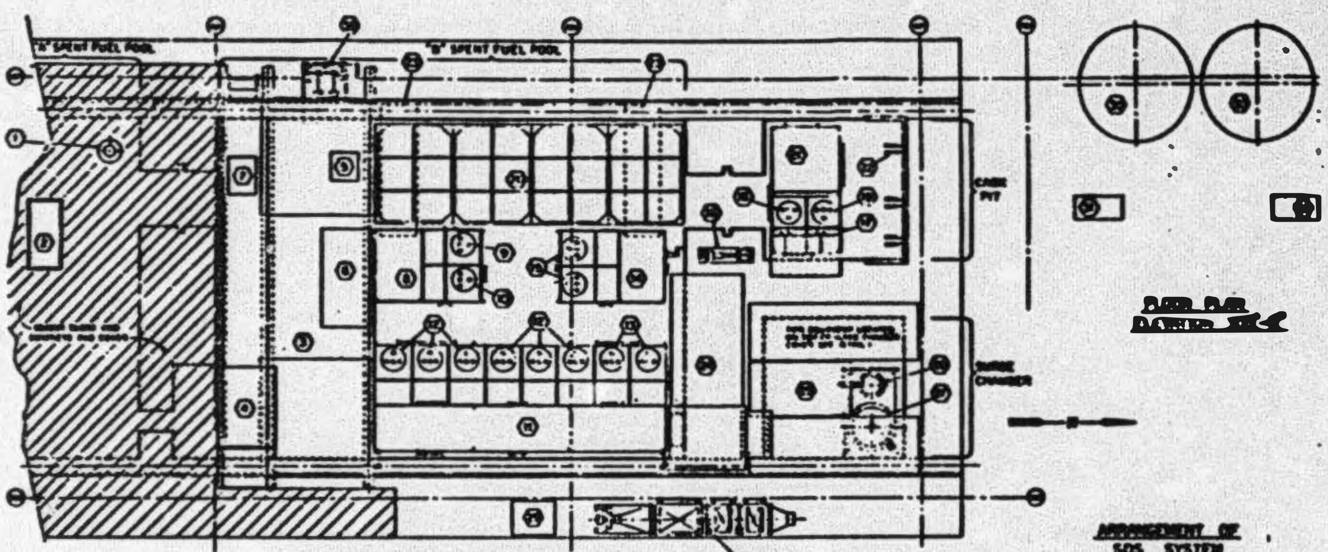
6.3 "Hot" Functional Testing

The initial operation of the system is planned to be used as a part of the system testing program. The initial processing will utilize water contained in the Reactor Coolant Bleed Tanks which is of low specific activity. This information will allow additional data to be taken including surveys of pipe and tank shielding areas to determine potential "shine" areas. Instrument readings will be taken and some DF (decontamination factor) verification can be expected.

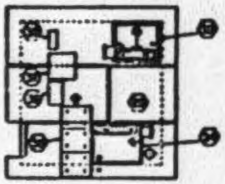
6.4 Ancillary Testing

The following ancillary testing has also been performed both on and off site

1. Dewatering testing of ion-exchange columns.
2. Dewatering testing of filter vessels.
3. Ion-exchanger column testing.
4. Distribution header testing of ion-exchange vessels.
5. Channeling testing of ion-exchange vessels.
6. Polishing system column testing.
7. Filter loading testing.



FLOOR PLAN ELEVATION 347'-6"



DETAIL 1

1	FEED PUMP STAND PIPE
2	FEED PUMP MANIFOLD
3	CASK SUPPORT PLATFORM
4	RCS CLEAN-UP MANIFOLD
5	SDS EFFLUENT POST FILTER
6	FILTER MANIFOLD
7	CONTROL PANEL CR-PNL-1
8	FILTER SUPPORT RACK
9	PRE-FILTER
10	FINAL FILTER
11	EXCHANGER SUPPORT RACK
12	ION EXCHANGER
13	CATION EXCHANGER
14	LEAKAGE CONTAINMENT SUPPORT RACK
15	LEAKAGE CONTAINMENT ION EXCHANGER
16	LEAKAGE CONTAINMENT PUMP

17	DEWATERING STATION SUPPORT RACK
18	ION EXCHANGER DEWATERING STATION
19	FILTER DEWATERING STATION
20	SPENT EXCHANGER STORAGE RACK
21	SHIPPING CASK SUPPORT PLATFORM
22	TOOL HANGER
23	MOVEABLE PERSONNEL BRIDGE
24	EXCHANGER MANIFOLD
25	SURGE CHAMBER COVER
26	OFF-GAS PUMP STAND PIPE
27	OFF-GAS SEPARATOR
28	OFF-GAS FILTER UNIT
29	OFF-GAS SAMPLING
30	MONITORING TANK
31	MONITORING TANK PUMP
32	HI-RAD FILTER GLOVE BOX

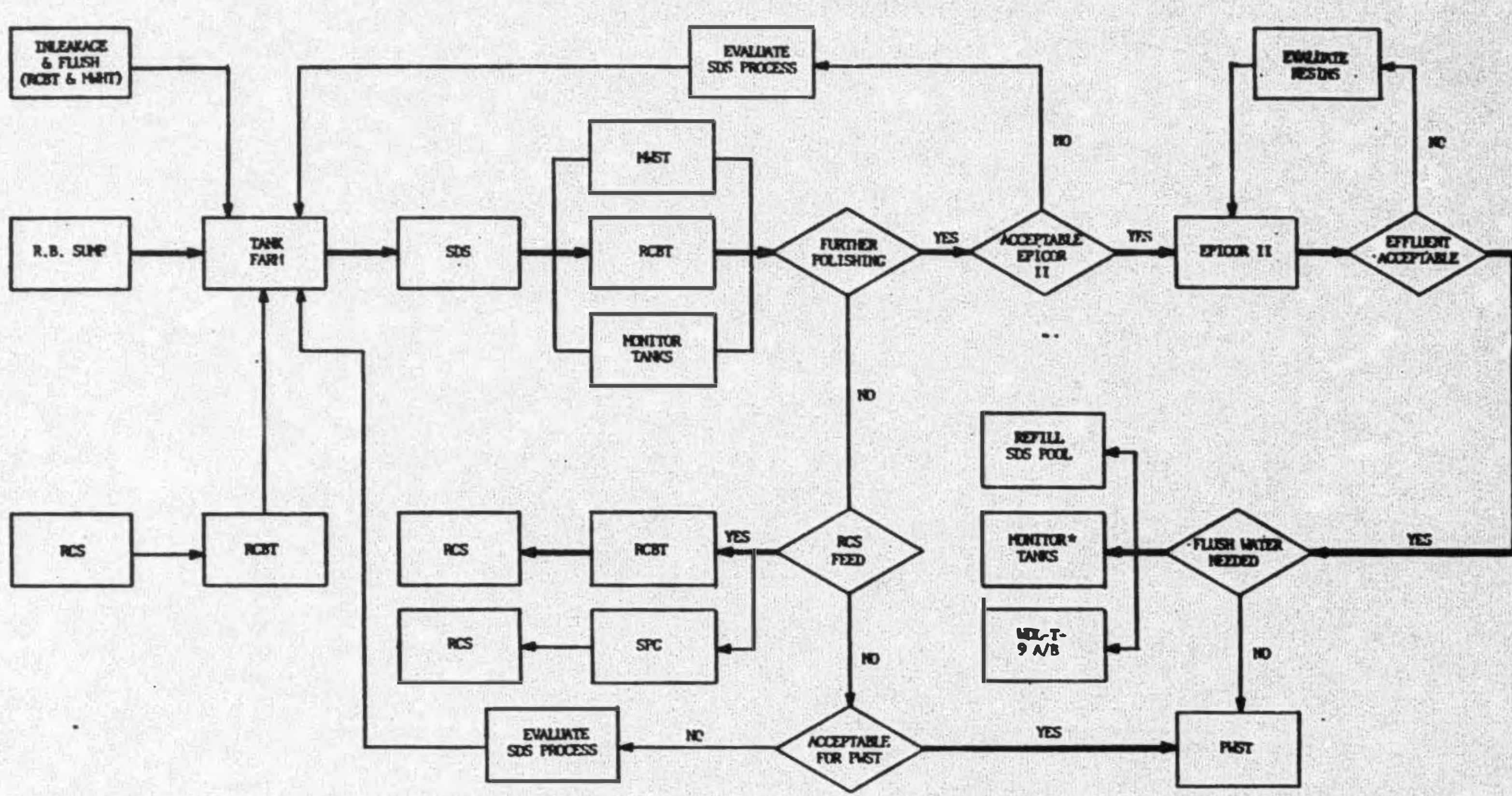
33	HI-RAD FEED SAMPLE GLOVE BOX
34	INTERMEDIATE LEVEL SAMPLE GLOVE BOX
35	BETA MONITOR MANIFOLD
36	ANNUNCIATOR PANEL
37	RAD MONITOR PANEL
38	OFF-GAS SEPARATOR LEVEL INSTR. PANEL

ARRANGEMENT OF SDS SYSTEM

FIGURE 1

TABLE 1

PROCESSING LOGIC PLAN



*NOTE: IF ONE MONITOR TANK IS BEING USED TO TEMPORARILY STORE THE SDS EFFLUENT, FLUSH WATER WILL BE ADDED TO THE SPARE TANKS.

Table 1

LINER RADIONUCLIDE LOADING CRITERIA

BASIS: (1) Non-Proprietary Ion-Exchange Material
(2) 600,000 Gallons Sump Water
(3) 90,000 Gallons RCS Water

SYSTEM	VESSEL POSITION	SIZE	FUNCTION	EXCHANGER	CHANGEOUT CRITERIA	REASON FOR CHANGEOUT	CURIES DEPOSITED	No. of LINERS
SDS	1	2 x 4	Cs Removal & Sr removal	IE-95/ Linde A	60,000 Ci(Cs)	- Zeolite Radiation Stability - Shipping Cask Limit	60,000 Curies (Total Cs) 2,000 Curies Sr	12-15
SDS	2	2 x 4	Same as SDS No. 1	IE-95/ Linde A	Same as SDS No. 1	- Same as SDS No. 1	N/A	1/train
SDS	3	2 x 4	Same as SDS No. 1	IE-95/ Linde A	Same as SDS No. 1	- Same as SDS No. 1	N/A	1/train
SDS	4	2 x 4	Same as SDS No. 1	IE-95/ Linde A	Same as SDS No. 1	- Same as SDS No. 1	N/A	1/train
EPICOR-II	5	6 x 6	Na Removal	Strong Acid Cation Mixed Cation/ Anion	25,000 Gals. or 20 Ci γ-emitter Na break	- Minimize Na Breakthrough - Operational Convenience - Liner handling limit (Bare Pick) - Shipping considerations	<20 Curies γ-emitters	20-30
EPICOR-II	6	6 x 6	Polishing	Organic Cation/Anion	20 Ci γ-emitter	Liner Handling limit Shipping Considerations	<20 Curies γ-emitters	<5
EPICOR-II	7	4 x 4	Polishing Backup	Organic Cation/Anion	20 Ci γ-emitter	Same as EPICOR-II 6	<20 Curies γ-emitters	<5

Appendix No. 1

to

Submerged Demineralizer System

System Design Description

Title

S.D.S. Pumps/Blowers

APPENDIX 1

SDS PUMPS/BLOWERS

Pump Details

Identification	CN-P-IX01
Noun Name	Feed Pump
Manufacturer	Goulds Pump Inc.
Model No.	VIS (3 x 6 ALC - 45TG)
Type	Submersible/Centrifugal
Standard Material Designation	Stainless Steel
Rated Speed	3500 RPM
Rated Capacity	30 GPM
Rated Total Dynamic Head	240 Ft.
Design Temperature	100°F
Lubricant	Water

Motor Details

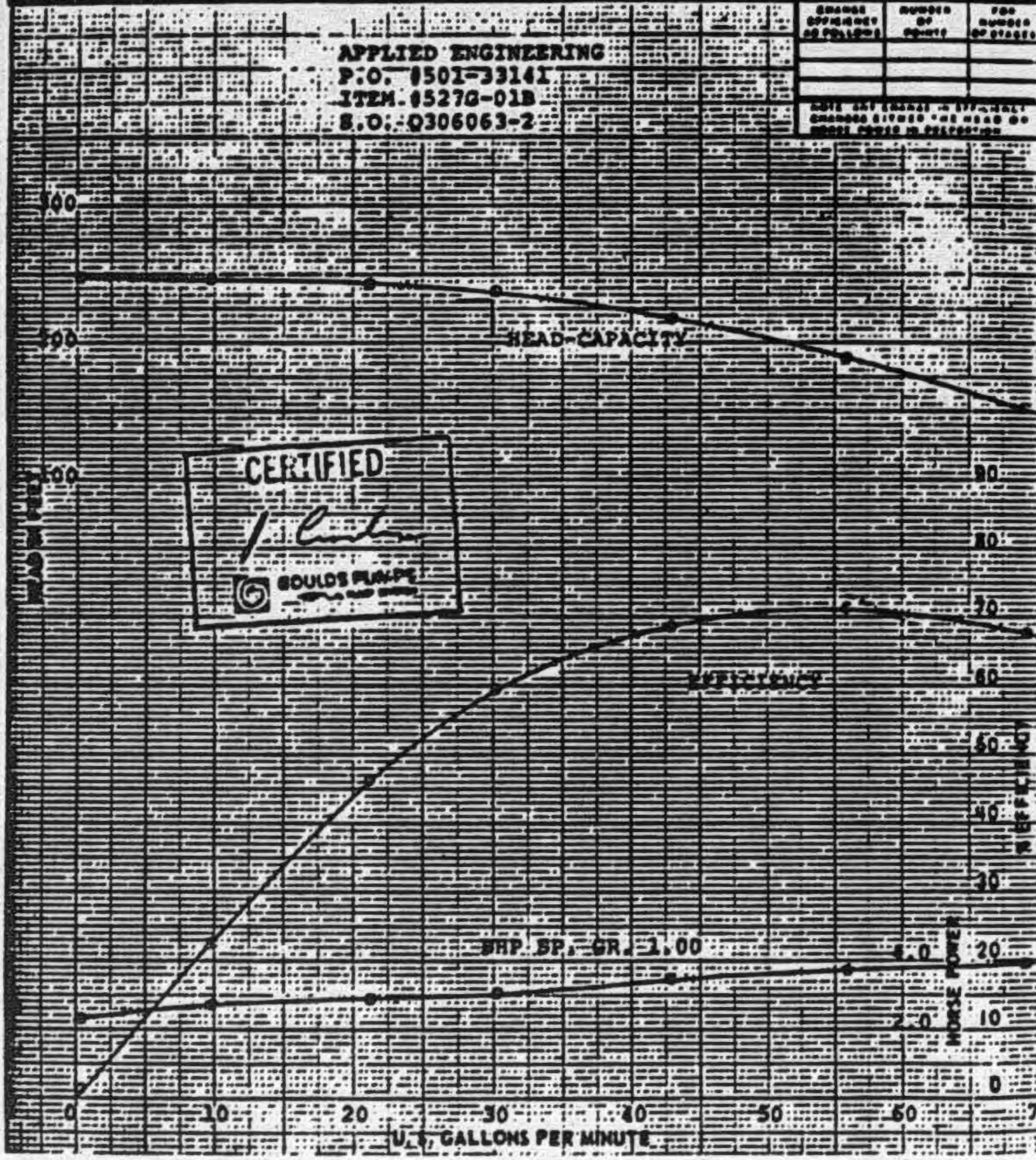
Manufacturer	Franklin
Type	Submersible
Enclosure	Hermetically Sealed
Rated Horse Power	5 HP
Rated Speed	3500 RPM
Lubricant/Coolant	Water Cooled
Power Requirements	460 Volts, 3 phase 60 Hz, 5.9 Amps
Power Source	SDS POP 6A

Reference

Drawing No.	DS-527-G-01, Rev. 1

CURVES SHOW APPROXIMATELY THE CHARACTERISTICS WHEN PUMPING CLEAR NON-AERATED WATER. NO GUARANTEE IS MADE EXCEPT FOR THE RATED POINT

NOTE: NO COLUMN LOSSES ARE INCLUDED



APPENDIX 1 SDS SDD CNP-1X01

IMPELLER CLOSED	**GOULDS PUMPS** VERTICAL PUMP DIVISION	PERFORMANCE FOUR STAGE
3 3/4" DIA.		3 X 6ALC — DEEP WELL TURBINE PUMP
SP —		AS RUN — R.P.M.
DATE 1-28-80 BY JC	INDUSTRY, CALIFORNIA	CURVE SHEET NO. T-80-040

Appendix 1 (Cont'd)

SDS PUMPS/BLOWERS

Pump Details

Identification	SDS-P-1A and SDS-P-1B
Noun Name	Monitor Tank Transfer Pumps
Manufacturer	Goulds Pumps Inc.
Model No.	3196 "ST"
Type	Double Mechanical Seal - Centrifugal
Standard Material Designation	Stainless Steel
Rated Speed	3500 RPM
Rated Capacity	50 GPM
Rated Total Dynamic Head	111 Ft.
Design Temperature	500°F
Lubricant	Water

Motor Details

Manufacturer	Reliance
Type	P
Enclosure	ODP
Rated Horse Power	5 HP
Rated Speed	3500 RPM
Lubricant/Coolant	Oil/Air
Power Requirements	460 Volts, 3 Phase 60 Hz, 6.6 Amps
Power Source	SDS-STR-1 and SDS-STR-2

Reference

Drawing No.	2-M080A, Rev. 0

APPENDIX 4 SDS SDD SDS SDS-P-1A & SDS-P-1B

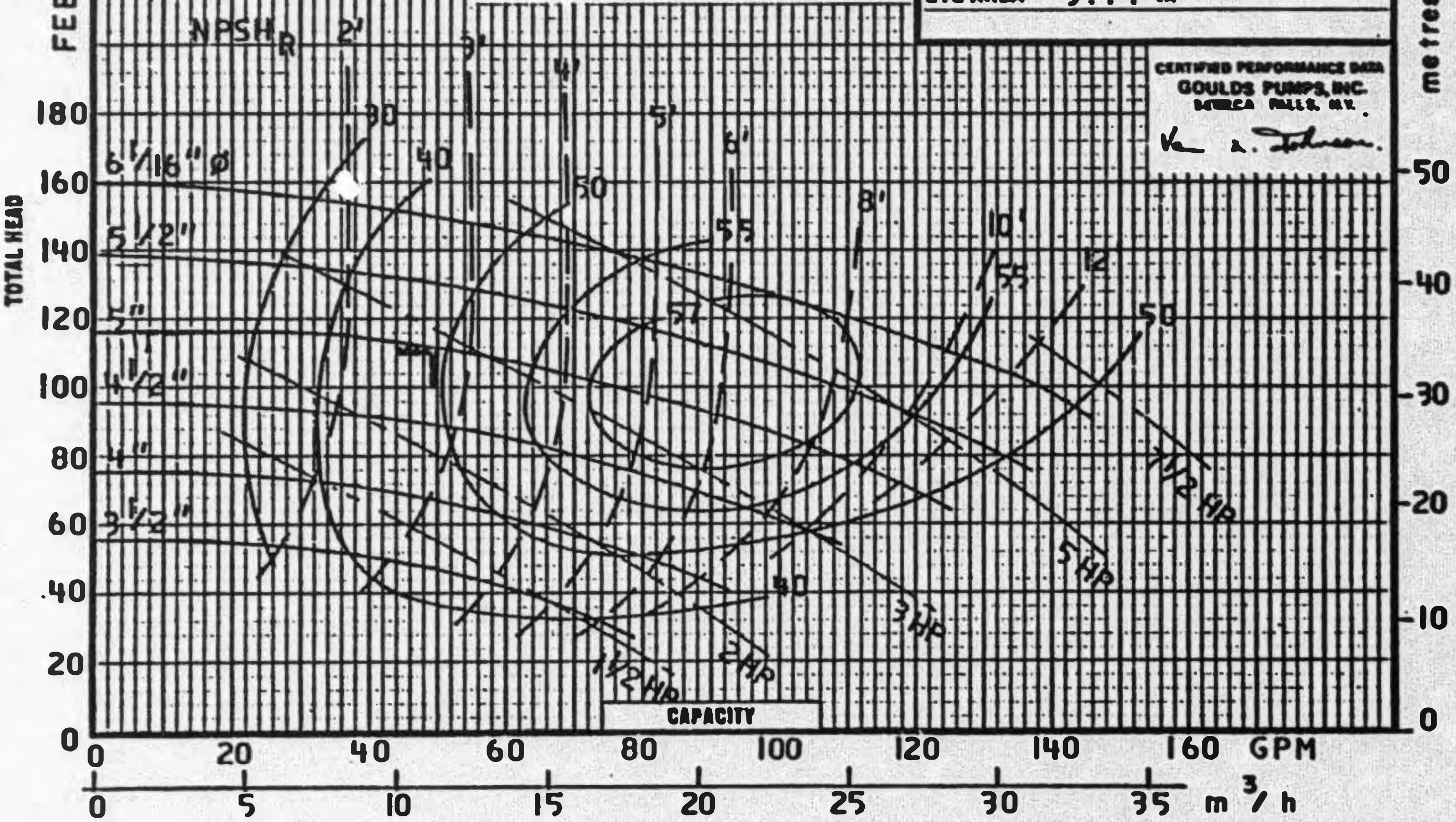
DATE 1-12-70 REV. DATE 3-17-78 ISSUE #3 B.E.F.

GOULDS PUMPS, INC.	CENTRIFUGAL PUMP CHARACTERISTICS	RPM 3500 CDS 2075-3

GOULDS SER. NO. QUOTE 08006-2
CUSTOMER BECHTEL/METROPOLITAN EDISON
P.O. NO. TUA BPC-1013.0
ITEM NO. SDS-P1A & P1B
SERVICE DEMINERALIZED WATER TRANSFER

MODEL	3196 ST		
SIZE	1 x 1 1/2 - 6		
IMP. DWG.	76777	ST'EL	76781
PATTERN	56088		56206
EYE AREA	3.14 in²		

CERTIFIED PERFORMANCE DATA
GOULDS PUMPS, INC.
SENECA FALLS, N.Y.



QUOTE 08006-2
9

Appendix 1 (Cont'd)

SDS PUMPS/BLOWERS

Pump Details

Identification	CN-P-LC06
Noun Name	Leakage Containment System Pump
Manufacturer	Goulds Pumps Inc.
Model No.	3196 MT-A-60
Type	Centrifugal
Standard Material Designation	316 S.S.
Rated Speed	1750 RPM
Rated Capacity	120 GPM
Rated Total Dynamic Head	55 Ft.
Design Temperature	100°F
Lubricant	Water

Motor Details

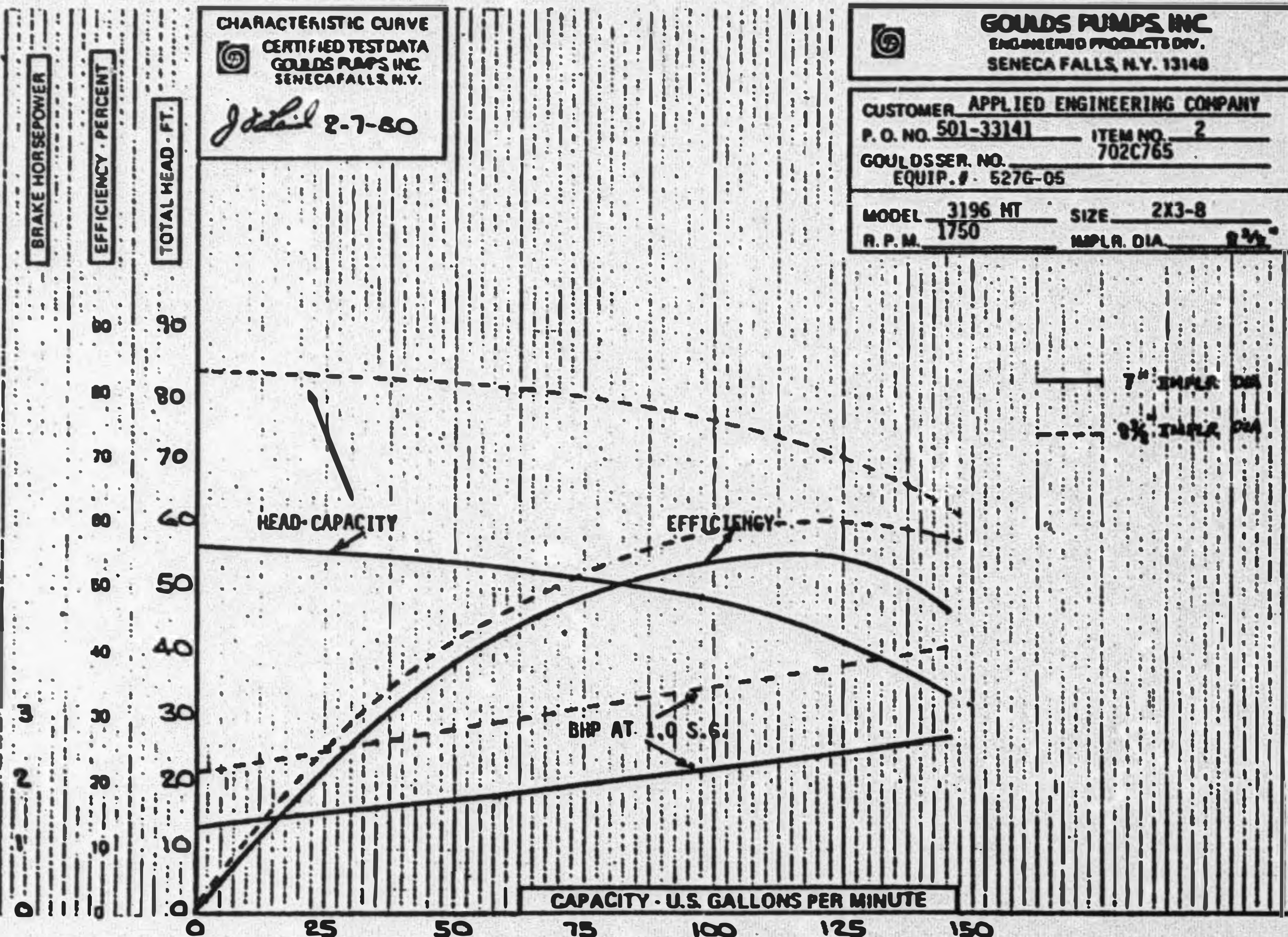
Manufacturer	Westinghouse
Type	Type S
Enclosure	TEFC
Rated Horse Power	3 HP
Rated Speed	1750 RPM
Lubricant/Coolant	Oil/Air
Power Requirements	460 Volts, 3 Phase 60 Hz, 4.8 Amps
Power Source	SDS-PDP 6A

Reference

Drawing No.	DS-527-G-05, Rev. 2

A-26845

APPENDIX 1 SDS SDD GN-P-9007



Appendix 1 (Cont'd)

SDS PUMPS/BLOWERS

Pump Details

Identification	CN-P-VA04
Noun Name	Off Gas Bottom Pump
Manufacturer	Goulds Pumps Inc.
Model No.	WP 3870
Type	Submersible
Standard Material Designation	400 Series Stainless Steel
Rated Speed	3450 RPM
Rated Capacity	30 GPM
Rated Total Dynamic Head	65 Ft.
Design Temperature	100°F
Lubricant	Water

Motor Details

Manufacturer	Franklin
Type	Submersible
Enclosure	Hermetically Sealed
Rated Horse Power	1 HP
Rated Speed	3450 RPM
Lubricant/Coolant	Oil
Power Requirements	460 Volts, 3 Phase 60 Hz, 3.5 Amps
Power Source	SDS-POP 6A

Reference

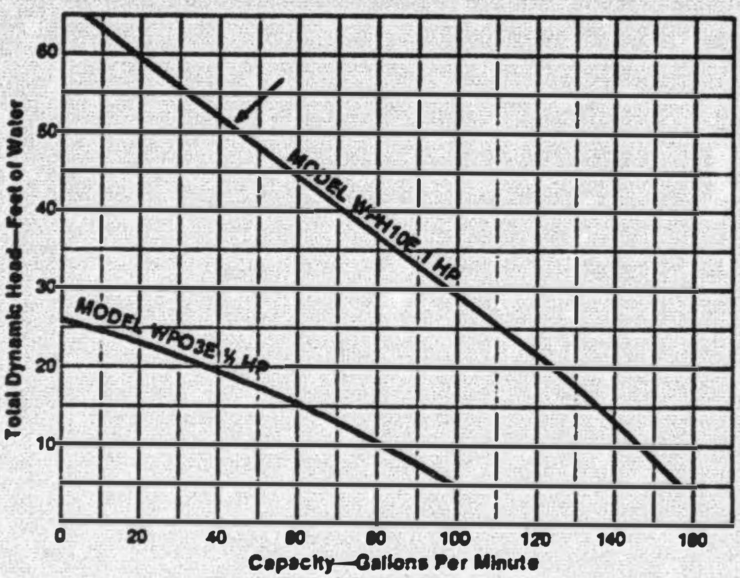
Drawing No.	DS-527-G-02, Rev. 2

SPECIFICATIONS

Order No.	HP	Volts	Phase	RPM	Solids	Max. Amps	Wt.
WPO311E	1/3	115	1	1750	¾"	2.4	56

Order No.	HP	Volts	Phase	RPM	Solids	Max. Amps	Wt.
WPH1012E	1	230	1	3450	¾"	11.0	70
WPH1032E	1	208/230	3	3450	¾"	7	70
WPH1034E	1	460	3	3450	¾"	3.5	70

PERFORMANCE RATING (GPM)

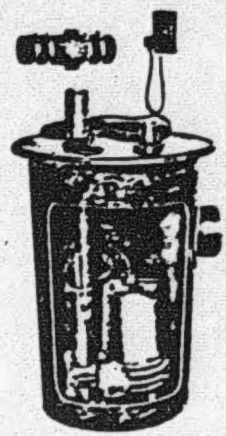


WP03 (⅓ HP)	TDH	GPM
Total Dynamic Head Feet to Water	5	100
	10	[illegible]
	15	62
	20	36
	25	3

WPH10 (1 HP)	TDH	GPM
Total Dynamic Head Feet to Water	10	147
	20	124
	30	[illegible]
	40	71
	50	45
	60	15

Model 3870 Packaged Effluent Ejector System

Goulds packaged effluent ejector system offers both ease of ordering and installation. A single ordering number specifies a complete system designed for most residential and commercial sump and effluent pump applications. The ease of installation is enhanced by plug-in power cords for the pump and level control switch which eliminates the need for additional wiring. (Except for 1 H.P. units which have bare leads for connection to magnetic contactor.



Capacities to 155 GPM
Heads to 65 feet
¾" Solids Handling Capability
2" NPT Discharge Connection

Package Includes:

- Submersible Sewage Pump (WPO311E)or (WPH1012E)
- Mercury Level Control Switch (ALS2-5 for ⅓ H.P. package) (ALS2-7 for 1 H.P. package)
- Magnetic Contactor (ALS3-1 with 1 H.P. units only).
- Polyethylene Basin (ALS7-1801P)
- Basin Cover (ALS8-1822S)
- Check Valve (ALS9-2)

Order No. SWP0311E 115 Volts, 95 Lbs.
Order No. SWPH1012E 230 Volts, 109 Lbs.

GOULDS PUMP , INC.
SENECA FALLS NEW YORK 13148

APPENDIX 1
SDS SDO
ON-P-VA09

Form No. A-478A-WS

Appendix 1 (Cont'd)

SDS PUMPS/BLOWERS

Pump Details

Identification	CN-E-VA05
Noun Name	Off Gas Blower
Manufacturer	Buffalo Forge Corp.
Model No.	5E
Type	Radial Flow Centrifugal Type "E"
Standard Material Designation	Sheet Steel
Rated Speed	3510 RPM
Rated Capacity	1000 CPM
Rated Static Pressure	12" W.G.
Design Temperature	104°F
Lubricant	Oil

Motor Details

Manufacturer	Westinghouse
Type	K
Enclosure	TEFC
Rated Horse Power	5 HP
Rated Speed	3510 RPM
Lubricant/Coolant	Oil/Air
Power Requirements	460 Volts, 3 Phase 60 Hz, Amps
Power Source	SDS-PDP 6A

Reference

Manual	MSA Off Gas Air Filtration System Instuction Manual

"E" and "RE" BLOWERS and EXHAUSTERS

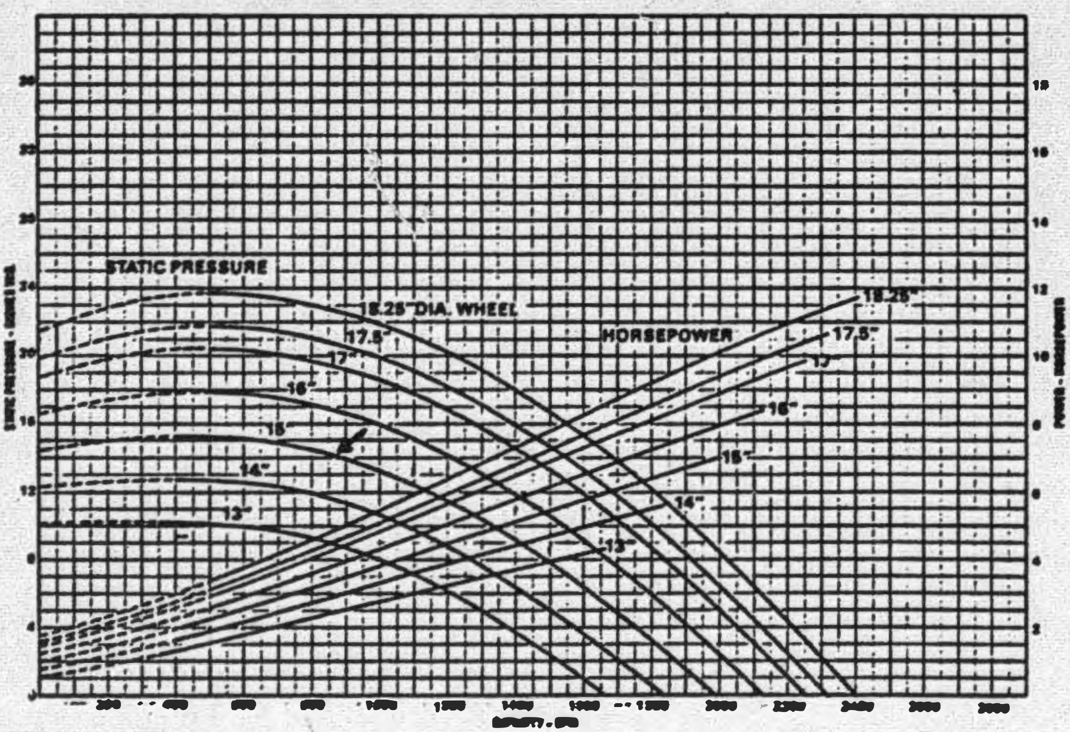
CAPACITIES and STATIC PRESSURES

SIZE 5 E BLOWER FABRICATED STEEL (F.S.)

Ratings are for standard air at .075 lbs per cubic feet density at 70°F 29.92" Hg. Performance data in the tables and curves is for standard wheel diameters which are carried in stock. When suitable, select a stock size for fastest delivery. Special wheel diameters to meet intermediate ratings can be determined upon request to your Buffalo Sales Engineer.

Capacity	3500 R.P.M.							
	18.25" Wheel		17.5" Wheel		15.5" Wheel		13.0" Wheel	
C.F.M.	S.P.	B.H.P.	S.P.	B.H.P.	S.P.	B.H.P.	S.P.	B.H.P.
400	23.5	3.0	20.3	2.8	15.1	1.9	10.2	1.3
500	23.6	3.4	20.4	2.9	15.2	2.2	10.1	1.5
600	23.5	3.7	20.3	3.3	15.1	2.5	10.0	1.7
700	23.3	4.2	20.1	3.7	14.9	2.9	9.7	2.0
800	23.0	4.6	19.8	4.0	14.5	3.2	9.2	2.3
900	22.5	5.0	19.3	4.5	14.0	3.5	8.7	2.6
1000	22.0	5.5	18.6	4.9	13.3	3.8	8.0	2.8
1100	21.0	6.0	17.7	5.3	12.3	4.2	7.1	3.1
1300	19.0	6.9	16.6	6.1	10.4	4.9	5.0	3.5
1500	16.7	7.9	13.3	6.9	7.9	5.5	2.4	4.0

3500 R.P.M. PERFORMANCE CHART



APPENDIX 1 SDS SDD CN-E-VA05

Appendix 1 (Cont'd)

SDS PUMPS/BLOWERS

Pump Details

Identification	CN-P-FL07
Noun Name	High Rad Filter Manifold
Manufacturer	Cole Parmer Instrument Company
Model No.*	C-7144-70
Type	2-Gear Magnetic Drive
Standard Material Designation	316 Stainless steel/Teflon/Ryton
Rated Speed	3000
Rated Capacity	0.50 GPM at 95 psig
Rated Static Pressure	300 psi
Design Temperature	180°F
Lubricant	Water

Motor Details

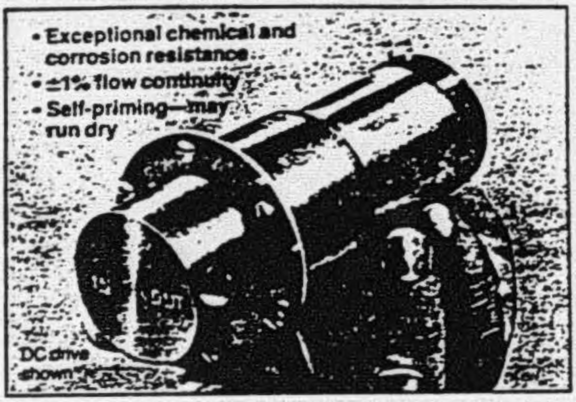
Manufacturer	Cole Parmer Instrument Company
Type	Induction
Enclosure	TEFC
Rated Horse Power	0.18 HP (135 watts)
Rated Speed	3000
Lubricant/Coolant	Oil/Air
Power Requirements	115 Volts, 2 Phase 60 Hz, 1.3 Amps
Power Source	MP-CN-1

Reference

Drawing No.	DS-527-G-06, Rev. 3 DS-527-G-07, Rev. 3 DS-527-G-08, Rev. 1

AC, DC, and air motor magnetic drive pumps

Seal-less pumps operate at temperatures from −100°F to +275°F



Magnetically coupled gear pumps are designed for metering non-abrasive fluids at temperatures from −100 to +275°F. Dry lift 6 feet of water, and when the gears are wetted self-prime up to 26 inches of Hg. Because the pump is magnetically coupled to the motor, there are no shaft seals to wear, leak or generate heat. This makes it ideal for most systems, especially those that cannot tolerate contamination. Gear pump design produces a steady, pulse-free flow at the outlet. Flow continuity is ±1%, as long as the differential pressure, fluid viscosity and line voltage remain constant.

Construction is of high-grade 316 stainless steel, Teflon® and carbon to make pumps exceptionally chemical and corrosion resistant, and to insure long, maintenance-free service life. Advanced pump head design provides excellent low-to-high pressure and flow performance, and permits safe operation with system pressures up to 600 psi.

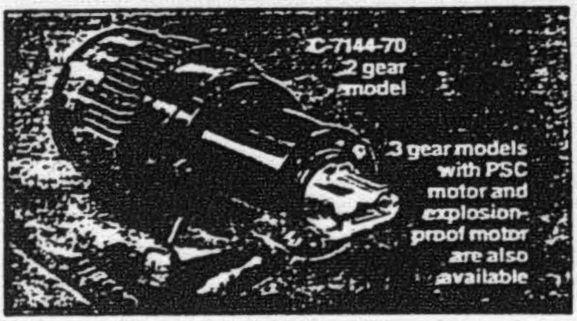
Pumps are compact and very lightweight—many models weigh less than 1½ lbs. Side ports are ⅛" (F)NPT. Each pump is fully factory tested prior to shipment and includes installation, operation, and maintenance instructions. (Service kits available.)

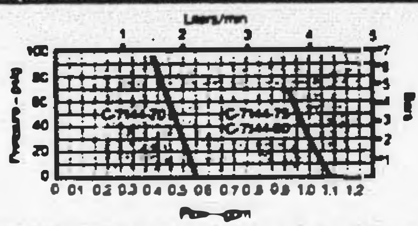
Teflon—Reg TM E.I. DuPont de Nemours & Co.

Catalog number	Power requirements	Motor type	Maximum motor rpm	Amps	Flow ml/min	Maximum pressure	Price	Service kits Cat. no.	Service kits Price
C-7144-50	115 VAC, 60 Hz; 115 VDC	Variable speed universal AC/DC	9,600	1.1	0-800	100 psi	$322.00	C-7144-47	$37.50
C-7144-55	115/230 VAC, 50/60 Hz	Explosion proof	3,150	2.3	265	175 psi	468.00	C-7144-47	37.50
C-7144-60	115/230 VAC, 50/60 Hz	Induction TEFC	3,150	1.6	265	175 psi	282.00	C-7144-47	37.50
C-7144-65	—	Air motor	8,000	—	0-500	175 psi	328.00	C-7144-47	37.50
C-7144-40	0 to 24 VDC	Brush	10,000	0-0.5	0.25-6	40 psi	228.00	C-7144-42	37.50
C-7144-45	0 to 24 VDC	Brush	10,000	0-0.5	1.5-30	45 psi	228.00	C-7144-47	37.50
C-7144-43	0 to 24 VDC	Brush	10,000	0-0.5	50-600	60 psi	228.00	C-7144-47	37.50
C-7144-48	0 to 24 VDC	Brush	10,000	0-0.5	84-630	175 psi	250.00	C-7144-47	37.50

Magnetic drive 2 and 3 gear pumps...

with patented suction-shoe design





Uniquely designed suction shoe acts as a sealing member to separate the inlet side from the pressure side of the pump. The major design advantage is its size: the suction shoe is a fraction of the size of a conventional cavity plate housing. This makes the pump lighter and more compact, and—most importantly—permits the use of a third gear. The 3-gear model doubles the flow of the 2-gear model, while occupying the same amount of space. Gears and suction shoes are all contained within a stepped magnet cup which is pressurized by the surrounding fluid. The fluid forces the gears together from all angles for efficient pressure loading.

Construction is of 316 cast stainless steel for a durable, corrosion resistant housing; gears and suction shoes are of Ryton® for outstanding chemical resistance, high thermal stability, and a low coefficient of friction. All other parts that contact the working fluid are of Teflon® and stainless steel—selected to provide maximum corrosion resistance and minimum wear.

An internal by-pass valve permits recirculation of the fluid at the preset pressure, preventing system over-pressure and motor overload. By-pass valve is externally adjustable—even while the pump is operating. Magnetic coupling provides leak-proof, contamination-free service and reduces maintenance. Driven magnet is Ryton®-coated to prevent thermal shock and contamination. Pumps are all field-servicable—see table below for service kits.

Pump dry lift capabilities: 3 feet of H_2O; vacuum down to the vapor pressure of the fluid being pumped. Differential pressure to 95 psig, system pressure to 300 psig.

Teflon—Reg TM E.I. DuPont de Nemours & Co   Ryton—Reg TM Phillips Petroleum Co

Catalog number	Number of gears	Power requirements	Motor type	Maximum motor rpm	Amps range	Capacity	Price	Service kits Cat. no.	Service kits Price
C-7144-70	2 gears	115 VAC, 50/60 Hz	Induction TEFC	3000	1.6-0.8	½ gpm to 100 psi	$177.00	C-7144-72	$45.00
C-7144-75	3 gears	115/230 VAC, 50/60 Hz	Explosion proof	3400	2.3-1.05	1 gpm to 60 psi	390.00	C-7144-77	65.00
C-7144-80	3 gears	115/230 VAC, 50/60 Hz	Induction TEFC	3400	2.3-1.50	1 gpm to 60 psi	236.00	C-7144-77	65.00

Appendix 1 (Cont'd)

SDS PUMPS/BLOWERS

Pump Details

Identification	CN-P-SA08, CN-P-RC09
Noun Name	High Rad Filter Sample, and RCS Manifold Sump Pumps
Manufacturer	Gormann-Rupp Industries
Model No.	20501-000
Type	Nutating
Standard Material Designation	Polypropylene and Polyphenosulfide
Rated Speed	1550
Rated Capacity	0.50 GPM
Rated Static Pressure	80.85 Ft.
Design Temperature	180°F
Lubricant	Water

Motor Details

Manufacturer	Gormann-Rupp Industries
Type	PSC
Enclosure	TEFC
Rated Horse Power	0.18 HP (135 Watts)
Rated Speed	1550
Lubricant/Coolant	Oil/Air
Power Requirements	115 Volts, 2 Phase 60 Hz, 1.3 Amps
Power Source	MP-CN-1

Reference

Drawing No.	DS-527-G-06, Rev. 3 DS-527-G-07, Rev. 3 DS-527-G-08, Rev. 1

Appendix No. 10

to

Submerged Demineralizer System

System Design Description

Title

S.D.S Valve List

VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-FL-1	1 1/2"	Filter Manifold Influent Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1 1/2"-3023-1-1	527-L-5002
CN-V-FL-2 (V-527-6)*	1 1/2"	Filter Manifold Influent Check	150# Swing Check BW 316 SS Alloyco Fig. 476	527-L-5010
CN-V-FL-3 (V-526-9)*	1 1/2"	Filter Influent Sample Throttle	300# Ball Valve SW 316 SS ITT Grinnell 1 1/2"-3023-1-1	527-L-5002
CN-V-FL-4 (V-527-11)*	3/4"	Filter Manifold Flush Isolation	300# Ball Valve SW 316 SS ITT Grinnell 3/4"-3023-1-1	527-L-5002
CN-V-FL-5 (V-527-13)*	1 1/2"	Pre-Filter Inlet Isolation	175# Diaphragm Valve SW 304 SS ITT Grinnell Fig. 2471	527-L-5009
CN-V-FL-6 (V-527-14)*	1 1/2"	Final Filter Outlet Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1 1/2"-3023-1-1	527-L-5002
CN-V-FL-7	1 1/2"	Prefilter Vent	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-FL-8	1 1/2"	Prefilter Outlet	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-FL-9	1 1/2"	Prefilter Inlet	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003

*(Print No.)

3/83
(Reset)

VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-FL-10 (V-527-18)*	3/4"	Final Filter Vent Isolation	300# Ball Valve SW 316 SS ITT Grinnell 3/4"-3023-1-1	527-L-5002
CN-V-FL-11 (V-527-19)*	3/4"	Pre-Filter Vent Isolation	300# Ball Valve SW 316 SS ITT Grinnell 3/4"-3023-1-1	527-L-5002
CN-V-FL-12 (V-527-20)*	3/4"	Filter Flush Line Check	150# Swing Check BW 316 SS Alloyco Figure 476	527-L-5010
CN-V-FL-13	1 1/2"	Final Filter Vent	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-FL-14	1 1/2"	Final Filter Outlet	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-FL-15	1 1/2"	Final Filter Inlet	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-FL-16 (V-527-24)*	3/4"	Filter Manifold Flush Isolation	300# Ball Valve SW 316 SS ITT Grinnell 3/4"-3023-1-1	527-L-5002
CN-V-FL-17	1/2"	Pressure Instrument Isolation Between Pre-Filter and Final Filter	300# Ball Valve SW 316 SS ITT Grinnell 1/2"-3023-1-1	527-L-5002
CN-V-FL-18	1 1/2"	Pool Skimmer Suction Check	150# Swing Check SW 316 SS Ladish 5261-0607-15A	527-L-5010

*(Print No.)

3/83
(Reset)

VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-FL-19	3/4"	Pool Skimmer Pump Vent and Prime Isolation	150# Globe Stainless Steel Alloyco Figure 114	
CN-V-FL-20	3/8"	Filter Manifold Flush and Drain Connection	Whitey Ball Valve SS 436	
CN-V-IX-20 (V-527-1)*	1"	Feed Pump Discharge	200# Diaphragm Valve ITT Grinnell Fig. 2471 SW 304 SS Ethylene Propylene Diaphragm	527-L-5009
CN-V-IX-21 (V-527-2)*	3/4"	Feed Pump Recirc. Isolation	300# Ball Valve SW 316 SS ITT Grinnell 3/4"-3023-1-1	527-L-5002
CN-V-IX-22 (V-527-3)*	1"	Feed Manifold Flush Line Check	150# Swing Check BW 316 SS Alloyco Figure 476	527-L-5010
CN-V-IX-23 (V-527-4)*	1"	Feed Manifold Flush Connection Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	527-L-5002
CN-V-IX-24 (V-527-21)*	1"	IX Manifold Supply Line Auto. Isolation	300# Ball Valve with Pneumatic Actuator SW 316 SS 1"-3023-1-1	Valve: 527-L-5002 Actuator: 527-L-5011
CN-V-IX-25 (V-527-22)*	1"	Train #1 Ion Exchangers Inlet Isolation	200# Diaphragm Valve ITT Grinnell Fig. 2471 SW 304 SS Ethylene Propylene Diaphragm	527-L-5009
CN-V-IX-26 (V-527-23)*	1"	Train #2 Ion Exchangers Inlet Isolation	200# Diaphragm Valve ITT Grinnell Fig. 2471 SW 304 SS Ethylene Propylene Diaphragm	527-L-5009

*(Print No.)

3/83
(Reset)

VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-IX-27 (V-527-25)*	1"	Train #1 Ion Exchangers Outlet Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	527-L-5002
CN-V-IX-28 (V-527-28)*	1"	Train #2 Ion Exchangers Outlet Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	527-L-5002
CN-V-IX-29 (V-527-29)*	1"	Cation Exchanger "A" Inlet Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	527-L-5002
CN-V-IX-30 (V-527-30)*	1"	Cation Exchanger "A" Outlet Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	527-L-5002
CN-V-IX-31 (V-527-31)*	1"	Cation Exchanger "B" Inlet Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	527-L-5002
CN-V-IX-32 (V-527-32)*	1"	Cation Exchanger "B" Outlet Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	527-L-5002
CN-V-IX-33	1"	Train #1 IX Flush Line Check	150# Swing Check BW 316 SS Alloyco Fig. 476	527-L-5010
CN-V-IX-34 (V-527-49)*	1"	Train #1 IX Flush Line Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	527-L-5002

*(Print No.)

3/83
(Reset)

VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-IX-35	1"	Train #2 IX Flush Line Check	150# Swing Check BW 316 SS Alloyco Fig. 476	527-L-5010
CN-V-IX-36 (V-527-50)*	1"	Train #2 IX Flush Line Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	527-L-5002
CN-V-IX-37	1"	Cation "A" Flush Line Check	150# Swing Check BW 316 SS Alloyco Fig. 476	527-L-5010
CN-V-IX-38 (V-527-51)*	1"	Cation "A" Flush Line Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	527-L-5002
CN-V-IX-39	1"	Cation "B" Flush Line Check	150# Swing Check BW 316 SS Alloyco Fig. 476	527-L-5010
CN-V-IX-40 (V-527-52)*	1"	Cation "B" Flush Line Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	527-L-5002
CN-V-IX-41	1 1/2"	Train No. 1 IX "A" Inlet	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-IX-42	1 1/2"	Train No. 1 IX "A" Outlet	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-IX-43	1 1/2"	Train No. 1 IX "B" Inlet	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-IX-44	1 1/2"	Train No. 1 IX "B" Outlet	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-IX-45	1 1/2"	Train No. 1 IX "C" Inlet	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-IX-46	1 1/2"	Train No. 1 IX "C" Outlet	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-IX-47	1 1/2"	Train No. 2 IX "A" Inlet	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-IX-48	1 1/2"	Train No. 2 IX "A" Outlet	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-IX-49	1 1/2"	Train No. 2 IX "B" Inlet	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-IX-50	1 1/2"	Train No. 2 IX "B" Outlet	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-IX-51	1 1/2"	Train No. 2 IX "C" Inlet	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-IX-52	1 1/2"	Train No. 2 IX "C" Outlet	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-IX-53	1 1/2"	Cation IX "A" Inlet	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-IX-54	1 1/2"	Cation IX "A" Outlet	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-IX-55	1 1/2"	Cation IX "B" Inlet	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-IX-56	1 1/2"	Cation IX "B" Outlet	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-IX-57	RESERVED			
CN-V-IX-58 (V-527-213)*	1 1/2"	Cation Effluent First Isolation to Utility Piping	150# Ball Valve SW 316 SS ITT Grinnell 1 1/2"-3015-1-8	527-L-5002
CN-V-IX-59	1 1/2"	Cation Effluent Second Isolation to Utility Piping	150# Ball Valve SW 316 SS ITT Grinnell 1 1/2"-3015-1-8	527-L-5002
CN-V-IX-60	RESERVED			
CN-V-IX-102	2"	First Isolation to MWHT	1000# Ball Valve SW 304 SS Watts S-8501-LL	527-L-5002
CN-V-IX-103	2"	Second Isolation to MWHT	1000# Ball Valve SW 304 SS Watts S-8501-LL	527-L-5002
CN-V-IX-104	2"	First Isolation to RCBT	150# Ball Valve SW 316 SS ITT Grinnell 2"-3015-1-1	527-L-5002

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-IX-105	2"	Second Isolation to RCBT	150# Ball Valve SW 316 SS ITT Grinnell 2"-3015-1-1	527-L-5002
CN-V-LC-106 (V-527-204)*	1/2"	Containment Pump Discharge Pressure Instrument Isolation	1000# Ball Valve SW 304 SS Watts S-8501-LL	527-L-5002
CN-V-LC-107 (V-527-26)*	1"	Final Filter Leakoff Isolation	200# Diaphragm Valve ITT Grinnell Fig. 2471 SW 304 SS Ethylene Propylene Diaphragm	527-L-5009
CN-V-LC-108 (V-527-27)*	1"	Pre-Filter Leakoff Isolation	200# Diaphragm Valve ITT Grinnell Fig. 2471 SW 304 SS Ethylene Propylene Diaphragm	527-L-5009
CN-V-LC-109 (V-527-65)*	1"	Train #1 IX "A" Leakoff Isolation	200# Diaphragm Valve ITT Grinnell Fig. 2471 SW 304 SS Ethylene Propylene Diaphragm	527-L-5009
CN-V-LC-110 (V-527-66)*	1"	Train #1 IX "B" Leakoff Isolation	200# Diaphragm Valve ITT Grinnell Fig. 2471 SW 304 SS Ethylene Propylene Diaphragm	527-L-5009
CN-V-LC-111 (V-527-67)*	1"	Train #1 IX "C" Leakoff Isolation	200# Diaphragm Valve ITT Grinnell Fig. 2471 SW 304 SS Ethylene Propylene Diaphragm	527-L-5009
CN-V-LC-112 (V-527-68)*	1"	Train #2 IX "A" Leakoff Isolation	200# Diaphragm Valve ITT Grinnell Fig. 2471 SW 304 SS Ethylene Propylene Diaphragm	527-L-5009

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-LC-113 (V-527-69)*	1"	Train #2 IX "B" Leakoff Isolation	200# Diaphragm Valve ITT Grinnell Fig. 2471 SW 304 SS Ethylene Propylene Diaphragm	527-L-5009
CN-V-LC-114 (V-527-70)*	1"	Train #2 IX "C" Leakoff Isolation	200# Diaphragm Valve ITT Grinnell Fig. 2471 SW 304 SS Ethylene Propylene Diaphragm	527-L-5009
CN-V-LC-115 (V-527-71)*	1"	Cation IX "A" Leakoff Isolation	200# Diaphragm Valve ITT Grinnell Fig. 2471 SW 304 SS Ethylene Propylene Diaphragm	527-L-5009
CN-V-LC-116 (V-527-72)*	1"	Cation IX "B" Leakoff Isolation	200# Diaphragm Valve ITT Grinnell Fig. 2471 SW 304 SS Ethylene Propylene Diaphragm	527-L-5009
CN-V-LC-117 (V-527-57)*	1 1/2"	Leakoff IX "A" Inlet Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1 1/2"-3021-1-8	527-L-5002
CN-V-LC-118 (V-527-58)*	1 1/2"	Leakoff IX "B" Inlet Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1 1/2"-3021-1-8	527-L-5002
CN-V-LC-119 (V-527-59)*	1 1/2"	Leakoff IX "A" Outlet Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1 1/2"-3021-1-8	527-L-5002
CN-V-LC-120 (V-527-60)*	1 1/2"	Leakoff IX "B" Outlet Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1 1/2"-3021-1-8	527-L-5002

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-LC-121 (V-527-63)*	1"	Leakoff IX "A" Flush Line Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1"-3021-1-8	527-L-5002
CN-V-LC-122 (V-527-64)*	1"	Leakoff IX "B" Flush Line Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1"-3021-1-8	527-L-5002
CN-V-LC-127 (V-527-85)*	3"	Leakoff Containment Pump Suction Line	Check Alloyco Fig. 376	
CN-V-LC-213 (V-527-61)*	3/4"	Leakoff IX "A" Vent Isolation	300# Ball Valve SW 316 SS ITT Grinnell 3/4"-3021-1-8	527-L-5002
CN-V-LC-214 (V-527-62)*	3/4"	Leakoff IX "B" Vent Isolation	300# Ball Valve SW 316 SS ITT Grinnell 3/4"-3021-1-8	527-L-5002
CN-V-LC-130	1/2"	LCIX "A" Effluent Pressure Gauge Isolation	Ball Valve SW 304 SS	527-L-5002
CN-V-LC-131	3/8"	LC Pump Discharge PI Isolation	V-Stem Globe Valve Whitey SS1VS6	527-L-5014
CN-V-LC-132	3/8"	LC Pump Discharge PI High Point Vent	V-Stem Globe Valve Whitey SS1VS6	527-L-501[illegible]
CN-V-LC-133	1/4"	LCIX "A" Effluent Sample Valve	Parker CPI Regulating Type	
CN-V-LC-134	1/4"	LCIX "B" Effluent Sample Valve	Parker CPI Regulating Type	
CN-V-LC-135	1/4"	LC Pump Suction Pressure Gauge Isolation	Parker CPI Regulating Type	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-LC-136	1/4"	LC Pump Discharge Sample Valve	Parker CPI Regulating Type	
CN-V-LC-291	1/2"	LCIX "B" Effluent Pressure Gauge Isolation	Ball Valve SW 304 SS	527-L-5002
CN-V-PM-166 (V-527-42)*	1/4"	Train #1 IX "A" Outlet Sample Isolation	Ball Valve Whitey SS-43S4	
CN-V-PM-167 (V-527-43)*	1/4"	Train #1 IX "B" Outlet Sample Isolation	Ball Valve Whitey SS-43S4	
CN-V-PM-168 (V-527-44)*	1/4"	Train #1 IX "C" Outlet Sample Isolation	Ball Valve Whitey SS-43S4	
CN-V-PM-169 (V-527-45)*	1/4"	Train #2 IX "A" Outlet Sample Isolation	Ball Valve Whitey SS-43S4	
CN-V-PM-170 (V-527-46)*	1/4"	Train #2 IX "B" Outlet Sample Isolation	Ball Valve Whitey SS-43S4	
CN-V-PM-171 (V-527-47)*	1/4"	Train #2 IX "C" Outlet Sample Isolation	Ball Valve Whitey SS-43S4	
CN-V-PM-172	1/4"	Cation Exchangers Outlet Sample Isolation	Ball Valve Whitey SS-43S4	
CN-V-PM-173 (V-527-114)*	1/4"	Train #1 IX "A" Outlet Flow Diversion	3-Way Ball Valve Whitey SS-43XS4	527-L-5014
CN-V-PM-174 (V-527-115)*	1/4"	Train #2 IX "A" Outlet Flow Diversion	3-Way Ball Valve Whitey SS-43XS4	527-L-5014
CN-V-PM-175 (V-527-116)*	1/4"	Train #1 IX "B" Outlet Flow Diversion	3-Way Ball Valve Whitey SS-43XS4	527-L-5014
CN-V-PM-176 (V-527-117)*	1/4"	Train #2 IX "B" Outlet Flow Diversion	3-Way Ball Valve Whitey SS-43XS4	527-L-5014
CN-V-PM-177 (V-527-118)*	1/4"	Train #1 IX "C" Outlet Flow Diversion	3-Way Ball Valve Whitey SS-43XS4	527-L-5014

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-PM-178 (V-527-119)*	1/4"	Train #2 IX "C" Outlet Flow Diversion	3-Way Ball Valve Whitey SS-43XSA	527-L-5014
CN-V-PM-179 (V-527-120)*	1/4"	Cation Exchangers Influent Flow Diversion	3-Way Ball Valve Whitey SS-43XSA	527-L-5014
CN-V-PM-180 (V-527-121)*	1/4"	Cation Exchangers Effluent Flow Diversion	3-Way Ball Valve Whitey SS-43XSA	527-L-5014
CN-V-PM-181 (V-527-88)*	1/4"	Cation Exchangers Influent Sample Isolation	Ball Valve Whitey SS-43SA	527-L-5014
CN-V-PM-183 (V-527-96)*	1/4"	Train #1 - IX "A" EFF Sample Throttle	Needle Valve Whitey SS-1RSA	527-L-5014
CN-V-PM-184 (V-527-95)*	1/4"	Train #1 - IX "B" EFF Sample Throttle	Needle Valve Whitey SS-1RSA	527-L-5014
CN-V-PM-185 (V-527-93)*	1/4"	Train #1 - IX "C" EFF Sample Throttle	Needle Valve Whitey SS-1RSA	527-L-5014
CN-V-PM-186 (V-527-94)*	1/4"	Train #2 - IX "A" EFF Sample Throttle	Needle Valve Whitey SS-1RSA	527-L-5014
CN-V-PM-187 (V-527-92)*	1/4"	Train #2 - IX "B" EFF Sample Throttle	Needle Valve Whitey SS-1RSA	527-L-5014
CN-V-PM-188 (V-527-91)*	1/4"	Train #2 - IX "C" EFF Sample Throttle	Needle Valve Whitey SS-1RSA	527-L-5014
CN-V-PM-189 (V-527-89)*	1/4"	Cation Exchangers Influent Sample Throttle	Needle Valve Whitey SS-1RSA	527-L-5014
CN-V-PM-190 (V-527-90)*	1/4"	Cation Exchangers Influent Sample Throttle	Needle Valve Whitey SS-1RSA	527-L-5014
CN-V-PM-191 (V-527-150)*	1/4"	Train #1&2 IX's "A" Beta Monitor Flush Stop	Angle Pattern Ball Valve Whitey SS-43S4-A	527-L-5014

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-PM-192 (V-527-149)*	1/4"	Train #1&2 IX's "B" Beta Monitor Flush Stop	Angle Pattern Ball Valve Whitey SS-43S4-A	527-L-5014
CN-V-PM-193 (V-527-148)*	1/4"	Train #1&2 IX's "C" Beta Monitor Flush Stop	Angle Pattern Ball Valve Whitey SS-43S4-A	527-L-5014
CN-V-PM-194 (V-527-147)*	1/4"	Cation Exchangers Influent Beta Monitor Flush Stop	Angle Pattern Ball Valve Whitey SS-43S4-A	527-L-5014
CN-V-PM-195 (V-527-146)*	1/4"	Cation Exchangers Effluent Beta Monitor Flush Stop	Angle Pattern Ball Valve Whitey SS-43S4-A	527-L-5014
CN-V-PM-196 (V-527-143)*	1/4"	Beta Monitor Flush Header Isolation	Ball Valve Whitey SS-43S4	527-L-5014
CN-V-PM-197 (V-527-144)*	1/4"	Beta Monitor Flush Header Check	Check Valve Nupro SS-4C-1	
CN-V-PM-198 (V-527-200)*	1/4"	Train #1&2 IX's "A" Beta Monitor Flush Line Check	Check Valve Nupro SS-4C-1	
CN-V-PM-199 (V-527-199)*	1/4"	Train #1&2 IX's "B" Beta Monitor Flush Line Check	Check Valve Nupro SS-4C-1	
CN-V-PM-200 (V-527-198)*	1/4"	Train #1&2 IX's "C" Beta Monitor Flush Line Check	Check Valve Nupro SS-4C-1	
CN-V-VA-201 (V-527-33)*	3/4"	Train #1 IX "A" Vent Isolation	300# Ball Valve SW 316 SS ITT Grinnell 3/4"-3023-1-1	527-L-5002
CN-V-VA-202 (V-527-34)*	3/4"	Train #1 IX "B" Vent Isolation	300# Ball Valve SW 316 SS ITT Grinnell 3/4"-3023-1-1	527-L-5002

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-PM-229 (V-527-197)*	1/4"	Cation Exchangers Influent Beta Monitor Flush Line Check	Check Valve Nupro SS-AC-1	
CN-V-PM-231	1/4"	Train #1A IX's High Level Sample Isolation	Ball Valve Whitey SS-43S4	
CN-V-PM-232	1/4"	Train #2A IX's High Level Sample Isolation	Ball Valve Whitey SS-43S4	
CN-V-VA-203 (V-527-35)*	3/4"	Train #1 IX "C" Vent Isolation	300# Ball Valve SW 316 SS ITT Grinnell 3/4"-3023-1-1	527-L-5002
CN-V-VA-204 (V-527-36)*	3/4"	Train #2 IX "A" Vent Isolation	300# Ball Valve SW 316 SS ITT Grinnell 3/4"-3023-1-1	527-L-5002
CN-V-VA-205 (V-527-37)*	3/4"	Train #2 IX "B" Vent Isolation	300# Ball Valve SW 316 SS ITT Grinnell 3/4"-3023-1-1	527-L-5002
CN-V-VA-206 (V-527-38)*	3/4"	Train #2 IX "C" Vent Isolation	300# Ball Valve SW 316 SS ITT Grinnell 3/4"-3023-1-1	527-L-5002
CN-V-VA-207 (V-527-39)*	3/4"	Cation IX "A" Vent Isolation	300# Ball Valve SW 316 SS ITT Grinnell 3/4"-3023-1-1	527-L-5002
CN-V-VA-208 (V-527-40)*	3/4"	Cation IX "B" Vent Isolation	300# Ball Valve SW 316 SS ITT Grinnell 3/4"-3023-1-1	527-L-5002

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-VA-209 (V-527-53)*	1"	Train #1 Ion Exchangers Piping Vent	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	527-L-5002
CN-V-VA-210 (V-527-54)*	1"	Train #2 Ion Exchangers Piping Vent	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	527-L-5002
CN-V-VA-211 (V-527-55)*	1"	Cation IX "A" Piping Vent	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	527-L-5002
CN-V-VA-212 (V-527-56)*	1"	Cation IX "B" Piping Vent	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	527-L-5002
CN-V-VA-215	1 1/2"	Train No. 1 IX "A" Vent Connection	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-VA-216	1 1/2"	Train No. 1 IX "B" Vent Connection	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-VA-217	1 1/2"	Train No. 1 IX "C" Vent Connection	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-VA-218	1 1/2"	Train No. 2 IX "A" Vent Connection	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-VA-219	1 1/2"	Train No. 2 IX "B" Vent Connection	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-VA-220	1 1/2"	Train No. 2 IX "C" Vent Connection	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-VA-221	1 1/2"	Cation "A" Vent Connection	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-VA-222	1 1/2"	Cation "B" Vent Connection	2200# Two Way Check Quick Disconnect Coupling Hansen #12-HK	527-L-5003
CN-V-VA-223 (V-257-193)*	2"	Feed Manifold Vent Intake	300# Ball Valve BW 316 SS ITT Grinnell 2"-3021-1-8	527-L-5002
CN-V-VA-224 (V-257-195)*	2"	Filter Manifold Vent Intake	300# Ball Valve BW 316 SS ITT Grinnell 2"-3021-1-8	527-L-5002
CN-V-VA-225	2"	Tank Farm Vent Isolation	150# Ball Valve SW 316 SS ITT Grinnell 2"-3015-1-8	527-L-5002
CN-V-VA-226	3/4"	Off Gas Vent Header Drain	300# Ball Valve BW 316 SS ITT Grinnell 3/4"-3021-1-8	527-L-5002
CN-V-VA-227 (2D-950-29-008)*	1/4"	Vessel Vent Hose Filter Bypass		527-L-5014
CN-V-VA-228	10"	Exhaust Header Inlet Isolation	Butterfly Hills McCanna 15056-T-56	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-VA-231	6"	Pressure Control Valve	Diaphragm Activated Butterfly Mosser Industries Ass'y No. 25 AL 1110-P	
CN-V-VA-232	RESERVED			
CN-V-VA-233	2"	Spare	300# Ball Valve BW 316 SS ITT Grinnell 2"-3021-1-8	
CN-V-VA-234	RESERVED			
CN-V-VA-235	1"	Feed Tank Off Gas Filter Inlet Isolation	150# Tufline Plug Valve SW 316 SS 89731L	
CN-V-VA-236	1"	Feed Tank Off Gas Filter Outlet Isolation	150# Turbine Plug Valve BW 316 SS 89731L	
CN-V-VA-237 (V-527-123)*	2"	Beta Monitoring Manifold Vent Exhaust	300# Ball Valve BW 316 SS ITT Grinnell 2"-3021-1-8	527-L-5002
CN-V-VA-238 (V-527-122)*	2"	Beta Monitoring Manifold Vent Intake	300# Ball Valve BW 316 SS ITT Grinnell 2"-3021-1-8	527-L-5002
CN-V-VA-239 (V-527-83)*	2"	IX Manifold Vent Exhaust	300# Ball Valve BW 316 SS ITT Grinnell 2"-3021-1-8	527-L-5002

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-VA-240 (V-527-206)*	2"	IX Manifold Vent Intake	300# Ball Valve BW 316 SS ITT Grinnell 2"-3021-1-8	527-L-5002
CN-V-VA-241 (V-527-108)*	3/8"	Hi Rad Filter Sample Box Pump Discharge Check to Waste Vent Isolation	Check Nupro SS-4C-1/3	
CN-V-VA-242 (V-527-189)*	2"	Intermediate Sample Box Vent Exhaust Isolation	300# Ball Valve BW 316 SS ITT Grinnell 2"-3021-1-8	527-L-5002
CN-V-VA-243 (V-527-188)*	2"	Intermediate Sample Box Vent Inlet Isolation	300# Ball Valve BW 316 SS ITT Grinnell 2"-3021-1-8	527-L-5002
CN-V-VA-244 (V-527-203)*	2"	Hi Rad Feed Sample Box Vent Intake Line Isolation	300# Ball Valve BW 316 SS ITT Grinnell 2"-3021-1-8	527-L-5002
CN-V-VA-245 (V-527-261)*	1"	Off-Gas Bottom Pump Discharge Isolation	Ball Valve	527-L-5002
CN-V-VA-246 (V-527-151)*	2"	Hi Rad Feed Sample Box Vent Exhaust Isolation	300# Ball Valve BW 316 SS ITT Grinnell 2"-3021-1-8	527-L-5002
CN-V-VA-247 (V-527-260)*	1"	Off-Gas Bottoms Pump Flush Connection Isolation	Ball Valve SW 304 SS	527-L-5002
CN-V-VA-248 (V-527-207)*	2"	Hi Rad Filter Sample Box Vent Intake	300# Ball Valve BW 316 SS ITT Grinnell 2"-3021-1-8	527-L-5002

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-VA-249 (V-527-208)*	2"	Hi Rad Filter Sample Box Vent Exhaust	300# Ball Valve BW 316 SS ITT Grinnell 2"-3021-1-8	527-L-5002
CN-V-VA-250 (V-527-77)*	2"	Filter Manifold Vent Exhaust Isolation	300# Ball Valve SW 316 SS ITT Grinnell 2"-3021-1-8	527-L-5002
CN-V-VA-251 (V-527-194)*	2"	Feed Manifold Vent Exhaust Isolation	300# Ball Valve BW 316 SS ITT Grinnell 2"-3021-1-8	527-L-5002
CN-V-VA-252	1"	Off-Gas Bottoms Pump Flush Connection Check Valve	Ball Check Valve	
CN-V-VA-253	3/8"	Filter Manifold Sump Pump Influent Check	Check	
CN-V-VA-295 (V-527-242)*	2"	RCS Manifold Vent Intake	300# Ball Valve SW 316 SS ITT Grinnell 2"-3015-1-8	527-L-5002
CN-V-VA-296 (V-527-243)*	2"	RCS Manifold Vent Exhaust	300# Ball Valve BW SS 2"-3012-1-8	
CN-V-VA-335 (V-527-252)*	3/8"	RCS Sump Pump Discharge Check	Check	
CN-V-VA-336	3/8"	Filter Manifold Sump Pump Discharge Check	Check	
CN-V-VA-337 (V-527-128)*	3/8"	Filter Manifold Drain Line Check	Check Nupro 1/3 psi	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-VA-338 (2D-950-29-008)*	1/4"	Vessel Vent Hose Filter Bypass	Needle	527-L-5014
CN-V-VA-339	1/4"	Vessel Vent Hose Filter Bypass	Needle	527-L-5014
CN-V-VA-340	1/4"	Vessel Vent Hose Filter Bypass	Needle	527-L-5014
CN-V-VA-341	1/4"	Vessel Vent Hose Filter Bypass	Needle	527-L-5014
CN-V-VA-342	1/4"	Vessel Vent Hose Filter Bypass	Needle	527-L-5014
CN-V-VA-343	1/4"	Vessel Vent Hose Filter Bypass	Needle	527-L-5014
CN-V-VA-344	1/4"	Vessel Vent Hose Filter Bypass	Needle	527-L-5014
CN-V-VA-345	1/4"	Vessel Vent Hose Filter Bypass	Needle	527-L-5014
CN-V-VA-346	3/4"	Vessel Vent Inlet Isolation	Ball	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION	
ON-V-SA-255 (V-527-7)*	3/4"	Filter Influent Sample Inlet Isolation	300# Ball Valve SW 316 SS ITT Grinnell 3/4"-3023-1-1	527-L-5002	
ON-V-SA-256 (V-527-8)*	3/4"	Filter Influent Sample Outlet Isolation	300# Ball Valve SW 316 SS ITT Grinnell 3/4"-3023-1-1	527-L-5002	
ON-V-SA-257 (V-527-10)*	3/4"	Filter Effluent Sample Inlet Isolation	300# Ball Valve SW 316 SS ITT Grinnell 3/4"-3023-1-1	527-L-5002	
ON-V-SA-258 (V-527-12)*	3/4"	Filter Effluent Sample Outlet Isolation	300# Ball Valve SW 316 SS ITT Grinnell 3/4"-3023-1-1	527-L-5002	
ON-V-SA-259 (V-527-164)*	1/4"	Sample Flask Inlet Stop	Angle Pattern Ball Valve SS-43S4-A Whitey	527-L-5014	
ON-V-SA-260 (V-527-156)*	1/4"	Sample Flask Flush	Angle Pattern Ball Valve SS-43S4-A Whitey	527-L-5014	Cation Ion Exchange Effluent
ON-V-SA-261 (V-527-172)*	1/4"	Sample Flask Outlet Stop	Angle Pattern Ball Valve SS-43S4-A Whitey	527-L-5014	
ON-V-SA-262 (V-527-180)*	1/4"	Sample Flask Spigot Isolation	Angle Pattern Regulating Valve SS-1KS4-A Whitey	527-L-5014	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION	
CN-V-SA-263 (V-257-165)*	1/4"	Sample Flesh Inlet Stop	Angle Pattern Ball Valve SS-43S4-A Whitey	527-L-5014	
CN-V-SA-264 (V-527-157)*	1/4"	Sample Flask Flush	Angle Pattern Ball Valve SS-43S4-A Whitey	527-L-5014	Train #2 Exchanger "C"
CN-V-SA-265 (V-527-173)*	1/4"	Sample Flask Outlet Stop	Angle Pattern Ball Valve SS-43S4-A Whitey	527-L-5014	Effluent
CN-V-SA-266 (V-527-181)*	1/4"	Sample Flask Spigot Isolation	Angle Pattern Regulating Valve SS-1KS4-A Whitey	527-L-5014	
CN-V-SA-267 (V-257-166)*	1/4"	Sample Flask Inlet Stop	Angle Pattern Ball Valve SS-43S4-A Whitey	527-L-5014	Train #1 Ion Exchanger "A"
CN-V-SA-268 (V-527-158)*	1/4"	Sample Flask Flush	Angle Pattern Ball Valve SS-43S4-A Whitey	527-L-5014	Effluent
CN-V-SA-269 (V-527-174)*	1/4"	Sample Flask Outlet Stop	Angle Pattern Ball Valve SS-43S4-A Whitey	527-L-5014	
CN-V-SA-270 (C-527-182)*	1/4"	Sample Flask Spigot Isolation	Angle Pattern Regulating Valve SS-1KS4-A Whitey	527-L-5014	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION	
CN-V-SA-271 (V-527-167)*	1/4"	Sample Flask Inlet Stop	Angle Pattern Ball Valve SS-43S4-A Whitey	527-L-5014	
CN-V-SA-272 (V-527-159)*	1/4"	Sample Flask Flush	Angle Pattern Ball Valve SS-43S4-4 Whitey	527-L-5014	Train #1 Ion Exchanger "B" Effluent
CN-V-SA-273 (V-527-175)*	1/4"	Sample Flask Outlet Stop	Angle Pattern Ball Valve SS-43S4-A Whitey	527-L-5014	
CN-V-SA-274 (V-527-183)*	1/4"	Sample Flask Spigot Isolation	Angle Pattern Regulating Valve SS-1KS4-A Whitey	527-L-5014	
CN-V-SA-275 (V-527-168)*	1/4"	Sample Flask Inlet Stop	Angle Pattern Ball Valve SS-43S4-A Whitey	527-L-5014	
CN-V-SA-276 (V-527-160)*	1/4"	Sample Flask Flush	Angle Pattern Ball Valve SS-43S4-A Whitey	527-L-5014	Train #2 Ion Exchanger "A" Effluent
CN-V-SA-277 (V-527-176)*	1/4"	Sample Flask Outlet Stop	Angle Pattern Ball Valve SS-43S4-A Whitey	527-L-5014	
CN-V-SA-278 (V-527-184)*	1/4"	Sample Flask Spigot Isolation	Angle Pattern Regulating Valve SS-1KS4-A Whitey	527-L-5014	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION	
CN-V-SA-279 (V-527-169)*	1/4"	Sample Flask Inlet Stop	Angle Pattern Ball Valve SS-43S4-A Whitey	527-L-5014	
CN-V-SA-280 (V-527-161)*	1/4"	Sample Flask Flush	Angle Pattern Ball Valve SS-43S4-A Whitey	527-L-5014	Train #2 Ion Exchanger "B"
CN-V-SA-281 (V-527-177)*	1/4"	Sample Flask Outlet Stop	Angle Pattern Ball Valve SS-43S4-A Whitey	527-L-5014	Effluent
CN-V-SA-282 (V-527-185)*	1/4"	Sample Flask Spigot Isolation	Angle Pattern Regulating Valve SS-1KS4-A Whitey	527-L-5014	
CN-V-SA-283 (V-527-170)*	1/4"	Sample Flask Inlet Stop	Angle Pattern Ball Valve SS-43S4-4 Whitey	527-L-5014	
CN-V-SA-284 (V-527-162)*	1/4"	Sample Flask Flush	Angle Pattern Ball Valve SS-43S4-A Whitey	527-L-5014	Train #1 Ion Exchanger "C"
CN-V-SA-285 (V-527-178)*	1/4"	Sample Flask Outlet Stop	Angle Pattern Ball Valve SS-43S4-A Whitey	527-L-5014	Effluent
CN-V-SA-286 (V-527-186)*	1/4"	Sample Flask Spigot Isolation	Angle Pattern Regulating Valve SS-1KS4-A Whitey	527-L-5014	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-SA-287 (V-527-155)*	1/4"	Removable Sample Cylinder Inlet Isolation	Ball Valve SS-43S4 Whitey	527-L-5014
CN-V-SA-288	1/4"	Removable Sample Cylinder Inlet Stop	Angle Pattern Shutoff Valve SS-16DKM4-F4-A Whitey	527-L-5014
CN-V-SA-289	1/4"	Removable Sample Cylinder Outlet Stop	Angle Pattern Shutoff Valve SS-16DKM4-F4-A Whitey	527-L-5014
CN-V-SA-290 (V-527-190)*	1/4"	Removable Sample Cylinder Outlet Isolation	Ball Valve SS-43S4 Whitey	527-L-5014
CN-V-SA-292 (V-527-154)*	1/4"	Sample Flask Flushing Header Stop	Ball Valve SS-43S4 Whitey	527-L-5014
CN-V-SA-293 (V-527-153)*	1/4"	Sample Flask Flushing Header	Check Nupro SS-AC-1	527-L-5014
CN-V-SA-294 (V-527-152)*	1/4"	Sample Flask Flushing Connection Isolation	Ball Valve SS-43S4 Whitey	527-L-5014
CN-V-SA-303 (V-527-41)*	3/4"	IX Train Influent Sample Isolation	300# Ball Valve SW 316 SS 3/4"-3023-1-1	527-L-5002
CN-V-SA-304 (V-527-98)*	1/2"	Filter Influent Sample Outlet Stop	Ball Valve Whitey SS-45F8	527-L-5014
CN-V-SA-305 (V-527-99)*	1/2"	Filter Influent Sample Inlet Stop	Ball Valve Whitey SS-45F8	527-L-5014

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-SA-306 (V-527-104)*	3/8"	Filter Effluent Sample Inlet Stop	Ball Valve Whitey SS4AF6	527-L-5014
CN-V-SA-307 (V-527-103)*	3/8"	Filter Effluent Sample Outlet Stop	Ball Valve Whitey SS4AF6	527-L-5014
CN-V-SA-308 (V-257-86)*	1/2"	Leakoff IX'ers Influent Sample Spigot	300# Ball Valve BW 316 SS ITT Grinnell 1/2"-3021-1-8	527-L-5002
CN-V-SA-309 (V-527-87)*	1/2"	Leakoff IX'ers Effluent Sample Spigot	300# Ball Valve SW 316 SS ITT Grinnell 1/2"-3021-1-8	
CN-V-SA-310 (V-527-110)*	3/8"	Hi Rad Feed Influent Sample Stop	Ball Valve Whitey SS-4AF6	
CN-V-SA-311 (V-527-109)*	3/8"	Hi Rad Feed Influent Sample Stop	Ball Valve Whitey SS-4AF6	
CN-V-SA-312 (V-527-111)*	3/8"	Hi Rad Feed Sample Spigot	Ball Valve Whitey SS-4AF6	
CN-V-SA-313	3/4"	Off Gas Sample System Influent Isolation	Ball Valve Whitey SS-65F12	
CN-V-SA-314	3/4"	Off Gas Sample System Effluent Isolation	Ball Valve Whitey SS-65F12	
CN-V-SA-315	3/8"	Off Gas Sampler Grab Sample Isolation	Ball Valve Powell 4026-TSE	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-SA-316	3/8"	Off Gas Sampler Grab Sample Bypass	Ball Valve Powell 4026-TSE	
CN-V-SA-317	3/8"	Off Gas Sampler Grab Sample Isolation	Ball Valve Powell 4026-TSE	
CN-V-SA-318 (V-527-171)*	1/4"	Cation IX'ers Influent Sample Flask Inlet Stop	Angle Pattern Ball Valve Whitey SS-43S4-A	
CN-V-SA-319 (V-527-163)*	1/4"	Cation IX'ers Influent Sample Flask Flush Stop	Angle Pattern Ball Valve Whitey SS-43S4-A	
CN-V-SA-320 (V-527-179)*	1/4"	Cation IX'ers Influent Sample Flask Outlet Stop	Angle Pattern Ball Valve Whitey SS-43S4-A	
CN-V-SA-321 (V-527-187)*	1/4"	Cation IX'ers Influent Sample Flask Spigot Isolation	Angle Pattern Regulating Valve Whitey SS-1KS4-A	
CN-V-SA-322	3/8"	Off-Gas Sampler Filter Inlet	Ball Valve Powell 4026-TSE	
CN-V-SA-323	1/4"	Train #1A & 2A IX Hi Rad Sample	Parker CPI Regulating Type Valver	
CN-V-SA-324	RESERVED			
CN-V-SA-325 (V-527-101)*	1/2"	Filter Influent Sample Manifold Vent Isolation	Ball Valve Whitey SS-45F8	
CN-V-SA-326 (V-527-106)*	3/8"	Filter Effluent Sample Manifold Vent Isolation	Ball Valve Whitey SS-45F8	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-SA-327 (V-527-201)*	3/8"	Off Gas Sampler Fresh Air Purge	Ball Valve Powell 4026-TSE	
CN-V-SA-328 (V-527-102)*	1/2"	Filter Influent Sample, Sample Line Vent Check	Swing Check Valve Alloyco Fig. 370	
CN-V-SA-329 (V-527-107)*	3/8"	Filter Effluent Sample, Sample Line Vent Check	Check	
CN-V-SA-330 (V-527-100)*	3/8"	Filter Influent Sample Spigot	Ball	527-L-5002
CN-V-SA-331 (V-527-105)*	3/8"	Filter Effluent Sample Spigot	Ball	527-L-5002
CN-V-SA-332 (V-527-112)*	3/8"	Hi Rad Feed Sample Manifold Vent Isolation	Ball	527-L-5002
CN-V-SA-333 (V-527-113)*	3/8"	Hi Rad Feed Sample Manifold Vent Check	Check	
CN-V-DW-338 (V-527-227)*	1/2"	Flush Line Inlet Isolation	Globe	
CN-V-DW-339	1/2"	Flush Line Inlet Auto Isolation	Solenoid	
CN-V-DW-340 (V-527-231)*	1/2"	Flush Line Inlet Pressure Instrument Isolation	Ball	527-L-5002
CN-V-DW-341 (V-527-228)*	1/2"	Flush Line Inlet Stop	Ball	527-L-5002
CN-V-DW-342 (V-527-229)*	1/2"	Flush Line Inlet Check	200# Check Valve Powell 1847	
CN-V-DW-343 (V-527-31)*	1/2"	Dewatering Air Control Valve	300# Globe SS Alloyco 2210-A	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-DW-344 (V-527-230)*	1/2"	Dewatering Air Pressure Instrument Isolation	Ball Valve Threaded 316 SS ITT Grinnell 1/2"-3025-1-1	
CN-V-DW-345 (V-527-221)*	1/2"	Dewatering Air Stop Valve	Ball Valve Threaded 316 SS 1/2"-3025-1-1	
CN-V-DW-346 (V-527-222)*	1/2"	Dewatering Air Check	300# Check Valve Powell 1847	
CN-V-DW-347 (V-527-223)*	1/2"	IX Dewatering Air Inlet Stop	150# Ball Valve BW 316 SS ITT Grinnell 1/2"-3013-1-1	
CN-V-DW-348 (V-527-225)*	3/4"	IX Dewatering Outlet Stop	150# Ball Valve BW 316 SS ITT Grinnell 3/4"-3013-1-1	
CN-V-DW-349 (V-527-224)*	1/2"	Filter Vessel Dewatering Air Inlet Stop	150# Ball Valve BW 316 SS ITT Grinnell 1/2"-3013-1-1	
CN-V-DW-350 (V-527-226)*	3/4"	Filter Vessel Dewatering Outlet Stop	150# Ball Valve BW 316 SS ITT Grinnell 3/4"-3013-1-1	
CN-V-DW-351	1 1/2"	IX Vessel Inlet Quick Disconnect	2200# Two Way Check Quick Disconnect Hansen #12-HK	527-L-5003
CN-V-DW-352	1 1/2"	IX Vessel Outlet Quick Disconnect	2200# Two Way Check Quick Disconnect Hansen #12-HK	527-L-5003

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-DW-353	1 1/2"	Filter Vessel Inlet Quick Disconnect	2200# Two Way Check Quick Disconnect Hansen #12-HK	527-L-5003
CN-V-DW-354	1 1/2"	Filter Vessel Outlet Quick Disconnect	2200# Two Way Check Quick Disconnect Hansen #12-HK	527-L-5003
CN-V-DW-355	1"	Demin Water Supply (SS)	Globe Valve 5500W IXMY9 OSH23 Dresser Hancock	
CN-V-DW-356	3/4"	Service Air Supply (CS)	Globe Valve Dresser Hancock 5500W	
CN-V-DW-357	1"	Demin. Water Supply (SS)	Check Valve Alloyco 374	
CN-V-DW-358	1"	Demin. Water Utility Piping Isolation	Globe Valve Ladish 7271-0107-10	
CN-V-DW-359 (V-527-239)*	1"	Demin. Water Utility Station #1 Isolation	Ball Valve Watts S8500LL	
CN-V-DW-360 (V-527-241)*	3/4"	Demin. Water Utility Station #2 Isolation	Ball Valve Watts S8500LL	
CN-V-DW-361 (V-527-238)*	1"	Demin. Water Utility Station #3 Isolation	Ball Valve Watts S8500LL	
CN-V-DW-362 (V-527-212)*	2"	Demin. Water Utility Piping Isolation	300# Ball Valve 316 SS ITT Grinnell 2"-3015-1-8	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-DW-363 (V-527-240)*	3/4"	Demin. Water Utility Piping Isolation	Ball Valve Watts S8500LL	
CN-V-DW-364	1/4"	Dewatering Station Tool Vent Pressure Gage Isolation	Ball Valve Whitey SS-43S4	
CN-V-DW-365	1/4"	Dewatering Station Tool Vent Valve	Ball Valve Whitey SS-43S4	
CN-V-DW-366	3/4"	Service Air Supply First Isolation to Air Manifold	Globe Valve	
CN-V-DW-367	3/4"	Service Air SDS Piping Isolation	Globe Valve	
CN-V-DW-368 (V-527-232)*	3/4"	Air Supply at Filter Manifold	Brass Globe Valve Crane 229C	
CN-V-DW-369 (V-527-237)	1/2"	Air Supply at Hose Reel	Brass Globe Valve Crane 229C	
CN-V-DW-370 (V-527-236)*	1/2"	Air Supply at Dewatering Station	Brass Globe Valve Crane 229C	
CN-V-DW-371	1/2"	Air Supply at IX Manifold	Brass Globe Valve Crane 229C	
CN-V-DW-372	1"	Demin. Water Isolation to SDS	150# Tufline Plug Valve Model 89731L	
CN-V-DW-373	3/4"	Plant Service Air Supply Check to SDS	Check	
CN-V-DW-374	3/4"	Service Air Supply Solenoid Isolation to Air Isolation	Globe Valve	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-DW-375	3/4"	Plant Service Air Supply Check to SDS	300# Cast Bronze 4872K5 McMaster Carr	
CN-V-DW-376		Air Operation of SDS Handling Tools	3-Way Ball Valve	
CN-V-DW-377	3/4"	Air Manifold Connection #1 Isolation		
CN-V-DW-378	3/4"	Air Manifold Connection #2 Isolation		
CN-V-DW-379	3/4"	Air Manifold Connection #3 Isolation		
CN-V-DW-380	3/4"	Air Manifold Connection #4 Isolation		
CN-V-DW-381	3/4"	Air Manifold Connection #5 Isolation		
CN-V-DW-467	1/4"	Inlet to Sample Bomb	S.S. Whitey Needle Valve SS22RSA	
CN-V-DW-468	1/4"	Sample Bomb Bypass	S.S. Whitey Needle Valve SS22RSA	
CN-V-DW-469	1/4"	Outlet from Sample Bomb	S.S. Whitey Needle Valve SS22RSA	
CN-V-DW-470	1/4"	Sample System Isolation	S.S. Whitey Needle Valve SS22RSA	
CN-V-DW-471	1/4"	Sample Bomb Inlet	S.S. Whitey Shut Off Valve 14DKM4SS	
CN-V-DW-472	1/4"	Sample Bomb Outlet	S.S. Whitey Shut Off Valve 14DKM4SS	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
ON-V-RC-360 (V-527-262)*	1"	RCS Manifold Influent Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	527-L-5002
ON-V-RC-361 (V-527-251)*	1"	RCS Manifold Influent Check	150# Swing Check Valve BW 316 SS	
ON-V-RC-362 (V-527-263)*	1"	Dual Flow Operation Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	527-L-5002
ON-V-RC-363 (V-527-247)*	1"	Filter Manifold RCS Supply Stop	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	527-L-5002

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
ON-V-RC-364 (V-527-244)*	1"	RCS Manifold Influent "Tie-In" Connection Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	527-L-5002
ON-V-RC-365 (V-527-253)*	1"	RCS Manifold Influent "Tie-In" Connection Check	150# Swing Check Valve SW 316 SS	
ON-V-RC-366 (V-527-264)*	1"	Filter Bypass Line Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	527-L-5002
ON-V-RC-367 (V-527-265)*	1"	RCS Return From Filter Manifold	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	
ON-V-RC-368 (V-527-250)*	1"	RCS Return From Filter Manifold	150# Swing Check Valve BW 316 SS	
ON-V-RC-369 (V-527-245)*	1"	Ion Exchange Manifold RCS Influent Throttle	200# Diaphragm Valve SW 304 SS ITT Grinnell Fig. 2471 Ethylene Propylene Diaphragm	527-L-5009
ON-V-RC-370 (V-527-249)*	1"	RCS Manifold Effluent Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	527-L-5002
ON-V-RC-371 (V-527-255)*	1"	RCS Manifold Effluent Check	150# Swing Check Valve BW 316 SS	
ON-V-RC-372 (V-527-248)*	1"	RCS Manifold Ion Exchange Return Stop	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	527-L-5002
ON-V-RC-373 (V-527-254)*	1"	RCS Manifold Filter Return "Tie-In" Flange Check	150# Swing Check Valve BW 316 SS	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-RC-374 (V-527-246)*	1"	RCS Manifold Filter Return "Tie-In" Flange Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	527-L-5002
CN-V-RC-375 (V-527-269)*	1"	RCS Manifold IX Return "Tie-In" Flange Check	150# Swing Check Valve BW 316 SS	
CN-V-RC-376 (V-527-268)*	1"	RCS Manifold IX Return "Tie-In" Flange Isolation	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	527-L-5002
CN-V-RC-377	3/8"	RCS Manifold Flush & Drain Isolation	Ball Valve SS-43S6 Whitey	
CN-V-PF-61	1 1/2"	Post Filter Inlet Isolation	300# Ball Valve BW 316 SS ITT Grinnell 1 1/2"-3021-1-8	
CN-V-PF-62	1 1/2"	Post Filter Outlet First Isolation to Monitor Tank	300# Ball Valve BW 316 SS ITT Grinnell 1 1/2"-3021-1-8	
CN-V-PF-63	3/4"	Post Filter DP Instrument Isolation	1500# SW Velan Globe Valve C/N 374 B	
CN-V-PF-64	3/4"	Post Filter DP Instrument Isolation	1500# SW Velan Globe Valve C/N 374 B	
CN-V-PF-65	3/4"	Post Filter Process Drain Isolation	150# Ball Valve SW 316 SS ITT Grinnell 3/4"-3015-1-8	
CN-V-PF-66	3/4"	Post Filter Vent First Isolation	150# Ball Valve SW 316 SS ITT Grinnell 3/4"-3015-1-8	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
ON-V-PF-67	3/4"	Post Filter Vent Second Isolation	150# Ball Valve SW 316 SS ITT Grinnell 3/4"-3015-1-8	
ON-V-PF-68 (V-527-270)*	1 1/2"	Post Filter Outlet Second Isolation to Monitor Tank	150# Ball Valve SW 315 SS ITT Grinnell 1 1/2"-3015-1-8	
ON-V-PF-69	1 1/2"	Post Filter Effluent to Turbine Flow Meter	300# Ball Valve BW 316 SS ITT Grinnell 1 1/2"-3021-1-8	
ON-V-PF-70	1 1/2"	Post Filter Effluent from Turbine Flow Meter	300# Ball Valve BW 316 SS ITT Grinnell 1 1/2"-3021-1-8	
ON-V-PF-71	1 1/2"	Post Filter Effluent Turbine Flow Meter Bypass	300# Ball Valve BW 316 SS ITT Grinnell 1 1/2"-3021-1-8	
ON-V-PF-72	1"	Post Filter Flush Isolation	Tufline Plug Valve 8972AL	
ON-V-PF-73	1/2"	Post Filter Effluent to Monitor Tanks Vacuum Breaker	1/2" MPT Vacuum Breaker McMaster Carr c/N 4817K4	
ON-V-PF-74	1/2"	Post Filter Atmospheric Vent	Ball Valve SS-8BK Whitey	
SDS-V-002A	1 1/2"	Monitor Tank "A" Isolation Valve	150# Ball Valve SW 316 SS ITT Grinnell 1 1/2"-3015-1-1	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
SDS-V-002B	1 1/2"	Monitor Tank "B" Isolation Valve	150# Ball Valve SW 316 SS ITT Grinnell 1 1/2"-3015-1-1	
SDS-V-003	2"	Monitor Tanks Outlet Cross Connect Valve	150# Ball Valve SW 316 SS ITT Grinnell 2"-3015-1-1	
SDS-V-004A	2"	Monitor Pump 1A Suction	150# Ball Valve SW 316 SS ITT Grinnell 2"-3015-1-1	
SDS-V-004B	2"	Monitor Pump 1B Suction	150# Ball Valve SW 316 SS ITT Grinnell 2"-3015-1-1	
SDS-V-005A	3/4"	Monitor Pump 1A Suction Instrument Isolation	150# Ball Valve SW 316 SS ITT Grinnell 3/4"-3015-1-1	
SDS-V-005B	3/4"	Monitor Pump 1B Suction Instrument Isolation	150# Ball Valve SW 316 SS ITT Grinnell 3/4"-3015-1-1	
SDS-V-006A	3/4"	Monitor Pump 1A Discharge Instrument Isolation	150# Ball Valve SW 316 SS ITT Grinnell 3/4"-3015-1-1	
SDS-V-006B	3/4"	Monitor Pump 1B Discharge Instrument Isolation	150# Ball Valve SW 316 SS ITT Grinnell 3/4"-3015-1-1	
SDS-V-007A	2"	Monitor Pump 1A Discharge Check Valve	Check Valve Ladish 5261-0607-20A	

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(Reset)

VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
SDS-V-007B	2"	Monitor Pump 1B Discharge Check Valve	Check Valve Ladish 5261-0607-20A	
SDS-V-008A	2"	Monitor Pump 1A Discharge Valve	150# Ball Valve SW 316 SS ITT Grinnell 2"-3015-1-1	
SDS-V-008B	2"	Monitor Pump 1B Discharge Valve	150# Ball Valve SW 316 SS ITT Grinnell 2"-3015-1-1	
SDS-V-009A	1"	Monitor Pump 1A Sample Isolation Valve	150# Ball Valve SW 316 SS ITT Grinnell 1"-3015-1-1	
SDS-V-009B	1"	Monitor Pump 1B Sample Isolation Valve	150# Ball Valve SW 316 SS ITT Grinnell 1"-3015-1-1	
SDS-V-010A	3/4"	Monitor Pump 1A Sample Valve	Globe Valve Ladish 7271-0714-07	
SDS-V-010B	3/4"	Monitor Pump 1B Sample Valve	Globe Valve Ladish 7271-0714-07	
SDS-V-011	1 1/2"	Monitor Tanks Discharge Cross Connect	150# Ball Valve SW 316 SS ITT Grinnell 1 1/2"-3015-1-1	
SDS-V-012A	1 1/2"	Monitor Tank "A" Recirc. Check Valve	Check Valve Ladish 5201-0607-15A	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
SDS-V-012B	1 1/2"	Monitor Tank "B" Recirc. Check Valve	Check Valve Ladish 5201-0607-15A	
SDS-V-013A	1 1/2"	Monitor Tank "A" Recirc.	150# Ball Valve SW 316 SS ITT Grinnell 1 1/2"-3015-1-1	
SDS-V-013B	1 1/2"	Monitor Tank "B" Recirc.	150# Ball Valve SW 316 SS ITT Grinnell 1 1/2"-3015-1-1	
SDS-V-014	2"	Monitor Pump Discharge to Epicor	150# Ball Valve SW 316 SS ITT Grinnell 2"-3015-1-1	
SDS-V-018	2"	Monitor Pump Discharge to PWST, Second Isolation Valve	150# Ball Valve SW 316 SS ITT Grinnell 2"-3015-1-1	
SDS-V-23A	3/4"	Monitor Tank "A", Level Indication Valve	150# Ball Valve SW 316 SS ITT Grinnell 3/4"-3015-1-1	
SDS-V-23B	3/4"	Monitor Tank "B", Level Indication Valve	150# Ball Valve SW 316 SS ITT Grinnell 3/4"-3015-1-1	
SDS-V-024A	1 1/2"	Monitor Tank "A" Drain First Isolation Valve	150# Ball Valve SW 316 SS ITT Grinnell 1 1/2"-3015-1-1	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
SDS-V-024B	1 1/2"	Monitor Tank "B" Drain First Isolation Valve	150# Ball Valve SW 316 SS ITT Grinnell 1 1/2"-3015-1-1	
SDS-V-025A	1 1/2"	Monitor Tank "A" Inlet	150# Ball Valve SW 316 SS ITT Grinnell 1 1/2"-3015-1-1	
SDS-V-025B	1 1/2"	Monitor Tank "B" Inlet	150# Ball Valve SW 316 SS ITT Grinnell 1 1/2"-3015-1-1	
SDS-V-026A	2"	Monitor Tank "A" Inlet	150# Ball Valve SW 316 SS ITT Grinnell 2"-3015-1-1	
SDS-V-026B	2"	Monitor Tank "B" Outlet	150# Ball Valve SW 316 SS ITT Grinnell 2"-3015-1-1	
SDS-V-028	2"	Monitor Pump Discharge to Epicor Check Valve	Check Valve Ladish 5261-0607-20A	
SDS-V-031	2"	Monitor Pump Discharge to FWST Check Valve	Check Valve Ladish 5261-0607-20A	
SDS-V-032	2"	Monitor Tank Demin. Water Isolation	150# Ball Valve SW 316 SS ITT Grinnell 2"-3015-1-1	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
SDS-V-033	2"	Monitor Tank Demin. Water Supply Check Valve	Check Valve Ladish 5261-0607-20A	
SDS-V-034A	1 1/2"	Monitor Tank "A" Drain Second Isolation Valve	150# Ball Valve SW 316 SS ITT Grinnell 1 1/2"-3015-1 1	
SDS-V-034B	1 1/2"	Monitor Tank "B" Drain Second Isolation Valve	150# Ball Valve SW 316 SS ITT Grinnell 1 1/2"-3015-1-1	
SDS-V-036	3/4"	Monitor Pump Discharge Header Vent	150# Globe Valve Ladish 7271	
SDS-V-037	3/4"	Monitor Pump Discharge Header Vent	150# Globe Valve Ladish 7271	
SDS-V-038	1"	Monitor Pump Discharge Header Drain	150# Globe Valve Ladish 7271	
SDS-V-039	2"	Monitor Pump Discharge to PWST First Isolation	150# Ball Valve SW 316 SS ITT Grinnell 2"-3015-1-1	
SDS-V-050	2"	Monitor Pump Discharge to Feed Standpipe Check Valve	150# Check Valve SW 316 SS Alloyco Fig. 370	
SDS-V-051	1"	Monitor Pump Discharge to Feed Standpipe First Isolation Valve	150# Ball Valve SW 316 SS ITT Grinnell 1"-3015-1-1	
SDS-V-052	1"	Monitor Pump Discharge to Feed Standpipe Second Isolation Valve	150# Ball Valve SW 316 SS ITT Grinnell 1"-3015-1-1	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
SDS-V-053	1"	Monitor Tank Discharge to Feed Standpipe Check Valve	Check Valve	
SDS-V-054	1 1/2"	Monitor Tank System Drainline Isolation	150# Ball Valve SW 316 SS ITT Grinnell 1 1/2"-3015-1-8	
SDS-V-055A	3/4"	Monitor Tank 1A Sample Flush Valve	300# Ball Valve SW 316 SS ITT Grinnell 3/4"-3013-1-8	
SDS-V-055B	3/4"	Monitor Tank Pump 1B Sample Flush Valve	300# Ball Valve SW 316 SS ITT Grinnell 3/4"-3013-1-8	
SDS-V-056	2"	Monitor Tank Pump Discharge to PWST Isolation	Ball Valve ITT Grinnell	
SDS-V-057	2"	Monitor Tank Pump Discharge Discharge to Epicor II Isolation	Ball Valve ITT Grinnell	
SDS-S-1A	2"	Strainer, Monitor Tank Pump SDS-P-1A Suction	Wye Type Strainer 316 SS Mueller Steam Specialty Co.	
SDS-S-1B	2"	Strainer, Monitor Tank Pump SDS-P-1B Suction	Wye Type Strainer 316 SS Mueller Steam Specialty Co.	

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Appendix No. 16

to

Submerged Demineralizer System

System Design Description

Title

Liner Recombiner and

Vacuum Outgassing System

March, 1983

1.0 INTRODUCTION

1.1 System Functions

The TMI Vacuum Outgassing and Drying is a temporary system designed to vacuum pump water, air, or other gas contained within spent SDS vessels after bulk dewatering is accomplished. The water will be removed in order to retard the production of hydrogen and oxygen gas due to radiolysis.

1.2 References

1.2.1 Catalyst Recombiner and Vacuum Outgassing System Safety Evaluation

1.2.2 SDS System Description

1.2.3 SDS TER

1.2.4 TMI-2 Recovery QA Plan

1.3 Summary Description of the System

The TMI Vacuum Outgassing and Drying System is a temporary system located on the southwest corner of the new fuel storage pit cover (SDS operators platform). This system is classified as I.T.S. and is designed to remove water from an SDS spent liner by vacuum pumping causing the water to come off as vapor. The vacuum system discharges into the SDS offgas system.

The Vacuum Outgassing and Drying system consists of a two stage vane type vacuum compressor rated at 10SCFM with a suction filter for capturing particulate and an after filter for removing oil from the pump discharge. A knockout drum located upstream of the suction filter protects the pump from slugs of water.

A diaphragm type sampling pump is supplied for gas sampling the SDS liners. All this equipment including the interconnecting piping is assembled on a skid which measures 16" wide x 48" long x 65" high. SDS vessel interface will be accomplished using a long handle tool which connects to a Hansen fitting on the SDS vessel located in the Dewatering Station. The tool is then connected to a flex hose then to the vacuum system piping. A six nipple manifold piped to the vacuum system is located on the west side of the "B" fuel pool for pumping vessels located in storage.

1.4 System Performance Characteristics

The vacuum system is capable of generating an ultimate vacuum of 0.1 mm Hg absolute or better when operating with room temperature suction consisting of nitrogen, air, or water vapors, or a combination of these gases while discharge pressure is held at + 1 psig.

The compressor is capable of continuous room temperature operation at 10 to 20 mm Hg with pure water vapor as the suction, and with a ballast flow of less than 2 CFH of dry air to protect the pump from moisture contamination of the lubrication system. The vacuum system contains a knockout drum with level indication in order to protect the vacuum pump from slugs of water. On a high level alarm, the compressor is cut off automatically. Suction flow is filtered to remove particulate matter 0.2 microns or larger from the stream. Discharge from the pump is filtered to assure that oil vapors or water globules will not enter and contaminate the SDS offgas system. A means of sample taking is provided via a small sample pump and removable sample cylinder. SDS vessels can be backfilled with argon or nitrogen for sample taking or other operations.

1.5 System Arrangement and Interfaces

The TMI Vacuum Outgassing and Drying System is located on the 347'-6" elevation of the TMI Unit II Fuel Handling Building. The main equipment is contained on a skid 16" wide, 48" long, and 65" high. All the equipment and instruments to support the vacuum system operation are located on this skid. Piping for SDS vessel interface runs to the SDS dewatering station and connects via a flex hose to the outgassing tool. Piping for the vacuum manifold interface runs west along the north fuel pool curb, then turns south along the curb to the west "B" pool curb across the curb to the "B" pool edge.

The vacuum manifold consists of a pipe with six pipe nipples and isolation valves for connection to SDS vessel vent hoses while the vessels are in storage locations.

The Outgassing tool consists of a long handled manipulator with a female 1 1/2" Hansen quick disconnect at the vessel end and a male Hansen at the other.

The flex hose interface to the vacuum system piping connects at this point. The tool has three valves which isolate it from the vacuum system and/or the atmosphere.

Recombiner catalyst can be added to the SDS vessel through this tool.

Shielding is provided on the knockout drum and the suction filter since they are potential crud traps.

1.5.1 Vacuum System Interfaces at Other System

1.5.1.1 Electrical

Vacuum System power is supplied from terminal box CN 141 which is powered from miscellaneous power panel MP-CN-2 located on the 347' elevation of the Fuel Handling Building. This is the only power supply required for system operation.

1.5.1.2 Instrument Air

The vacuum system instrument air is tied into the SDS supply along the north pool curb down stream of IA-V-175.

1.5.1.3 HVAC

The vacuum system exhaust ties into the SDS offgas system at the 3/4" threaded nipple which originally contained temperature indicator CN-TI-VA03.

1.6 System Design Requirements

1.6.1 General Design Requirements

1.6.1.1 The design basis considers the guidance in the following documents:

1.6.1.1.1 U.S.N.R.C. Reg. Guide 1.143,

1.6.1.1.2 U.S.N.R.C. Reg. Guide 1.140,

1.6.1.1.3 U.S.N.R.C. Reg. Guide 8.8,

1.6.1.1.4 U.S. Code of Federal Regulations 10CFR20 Appendix B, and

1.6.1.1.5 U.S. Code of Federal Regulations 10CFR50 as imposed by Reg. Guide 1.143.

1.6.1.2 The process shall function in such a manner as to limit releases to the environment and limit plant personnel exposure levels to levels which are "as low as reasonably achievable" in accordance with 10 CFR Part 50, 10 CFR Part 20, Regulatory Guide 8.8, and TMI-II Recovery Technical Specifications.

1.6.1.3 System performance shall be capable of operation at approximately 20 mm of mercury for extended periods of time while removing water at rates up to 22 lbs. per day.

1.6.2 Piping Design Requirements

1.6.2.1 Piping is designed to the requirements of ANSI B 31.1 and Reg. Guide 1.143. Piping one inch and above is socket welded stainless steel. Tubing and compression fittings are used for sizes below one inch.

1.6.2.2 Piping design is $^{-}15$ psig to $^{+}50$ psig and 32° to 200°F. The vacuum system skid utilizes schedule 80 pipe. The tool and manifold interconnecting pipe is schedule 40.

1.6.2.3 Upstream piping is nominally 1 1/2" to maximize the rate of water vapor removed from the SDS liners. Downstream piping is nominally 1".

1.6.3 Filter Requirements

1.6.3.1 There are three filters associated with the operation of the vacuum system. Two .2 micron suction filters (one for the main pump and one for the sample pump) and one after filter.

1.6.3.2 A long handle tool will be utilized to connect to the SDS liner for initial bulk vacuum pumping.

2.0 DETAILED DESCRIPTION OF THE SYSTEM

2.1 Components

2.1.1 Vacuum System Pumps

2.1.1.1 Main Vacuum Pump (CN-P-VS-01)

The main vacuum pump is located on the vacuum system skid. It is an industrial rated vane type oil lubricated pump with a nominal displacement of 10 CFM and an ultimate vacuum capability of approximately 5×10^{-3} mm Hg. The pump will operate continuously in the range of 20 mm Hg which is anticipated that the bulk of the operation will take place. The pump is provided with an external ballast line containing a flow meter through which it is possible to flow up to approximately 2 SCFM of instrument air. This feature assures that condensate within the pump will not mix with and dilute the oil causing loss of lubrication. The ultimate vacuum capability of the pump cannot be reached with the ballast line in place. The pump is controlled by a 15 amp circuit breaker and an on/off switch. There is also a selector switch to switch between the main vacuum pump and the sample pump (CN-P-VS-02) to avoid simultaneous operation. Pump operation is automatically cut-off if a high level alarm (CN-LS-VS-02) is actuated.

2.1.1.2 Sample Pump (CN-P-VS-02)

The sample pump is located on the vacuum system skid in parallel with the main vacuum pump. This pump is a diaphragm type pump capable of operating at a moderate vacuum. It has a displacement of .25 CFM. This type of pump was chosen to assure that samples will not be contaminated. Samples cannot be obtained during vacuum pumping since the sample pump is not rated for the vacuum of the main pump. Liners will be backfilled with a carrier gas (argon or nitrogen) in order to obtain a sample.

2.1.2 Vacuum System Tanks

2.1.2.1 Suction Knockout Drum

The main inlet piping to the vacuum system skid contains a small tank or knockout drum. It is equipped with baffles and level indication such that should liquid enter the unit it would be separated out and retained in the bottom of the tank. The lower level indicator will indicate when approximately three inches of water has collected in the bottom of the tank. An indicator light will illuminate in this condition. Should water liquid level continue to rise, the main vacuum pump is automatically cut off. High level is approximately half way up the drum. One half (1/2) inch of lead is attached to the drum in the unlikely event a slug of contaminated liquid enters the drum.

There is a drain at the base of the knockout drum for removing liquid if required.

2.1.3 Filtration Units

2.1.3.1 Main Suction Filter (CN-F-VS-01)

This filter is located between the knockout drum and main vacuum pump. Filter elements are approximately 2 5/8 inches OD by approximately 10 inches long. The filter housings are carbon steel with nickel lining. Filter cartridges are rated at .2 microns nominal. One inch of shielding is provided on this filter.

2.1.3.2 After Filter (CN-F-VS-02)

The filter downstream of the main vacuum pump is of lighter construction, with housing of stainless steel. The filter element has the same dimensions as the suction filter, however, is a special coalescing filter designed specifically to remove traces of oil from the stream. It has a .9 micron nominal rating. The filter housing is equipment with a drain in order to remove condensate.

2.1.3.3 Sample Suction Filter (CN-F-VS-03)

This filter and housing is exactly the same as the main suction filter.

2.1.4 Vacuum System Manifold

The vacuum system manifold consists of a six nipple header providing for six 1/4 inch SDS vent hoses to be connected simultaneously. Three nipples are provided with vacuum pressure gauges so that liner pressure can be monitored. This manifold is located along the west "B" pool curb and is hard piped to the vacuum system skid.

2.1.5 Vacuum System Tool

The vacuum system tool is a long handled tool constructed of stainless steel. Its function is basically the same as the SDS Hansen connect/disconnect tools presently used for SDS operations. The function of the tool is two-fold; First, it provides the means for vacuum pumping at a maximum flow rate while assuring that at least minimum shielding is maintained between the operator and the liner. Second, the tool provides the means for adding the catalyst while not directly exposing the operator to the liner internal atmosphere. This is accomplished by the use of two valves in series. The operating procedure controls the opening and closing of these two valves such that they are not opened simultaneously.

The tool contains a female Hansen fitting on the bottom for attachment to SDS liners. A 1 1/2 inch pipe then runs up to the water surface with a couple bends to prevent radiation streaming. The tool then branches into a male Hansen for attachment to the vacuum system and an opening to the atmosphere.

2.1.6 Sampling System

The sampling system consists of an inlet filter (Section 2.1.3.3), a sample diaphragm type pump (Section 2.1.1.2), and a 300 ml sample cylinder. Before a sample can be drawn, the SDS liner must be brought up to atmospheric pressure via the argon/nitrogen supply, by venting to atmosphere or by backfilling with instrument air. The pump motor is electrically interlocked with the main pump motor so that simultaneous operation of pumps is prohibited.

2.1.7 Instrument Air System

The plant instrument air is utilized mainly as ballast flow through the main vacuum pump to preclude condensation in the pump oil. The ballast flow is controlled by a needle valve (CN-V-VS-444) and the flow rate is read off CN-FI-VS-02. Instrument air can also be used to backfill the vacuum system piping and/or SDS liner being pumped.

2.1.8 Inert Gas Supply

The vacuum system is supplied with the capability for an inert gas supply of argon and nitrogen for liner sampling or just for liner or system backfill. The system utilizes a commercial manifold and regulator with a pressure relief valve in line for system protection.

2.2 Instruments, Controls, Alarms, and Protective Devices

2.2.1 Instrumentation and Controls

Vacuum system instrumentation consists of upstream vacuum/pressure gauges and downstream pressure gauges. The main vacuum instrumentation consists of two vacuum pressure transducers one in the knockout drum (CN-PT-VS-01) for monitoring pressure upstream of the suction filter and the other (CN-PT-VS-02) downstream of the suction filters. Both instruments readout on CN-PI-VS-08 which has a digital display and a selector switch to choose between the two. The range of the instruments is .01 to 100 mm Hg. They will be used to monitor upstream pressure during system operation and also to determine change-out of the suction filter.

There are other upstream gauges which are vacuum/pressure type reading from 0-30 inches of mercury and 0-30 psig. They are located on the vacuum manifold and at the dewatering station vent connection. Their function is to provide a means to monitor pressure of the vacuum pumped vessels once they are isolated.

Downstream of the pump at the after filter there is a pressure differential gauge to determine after filter change-out and a pressure gauge utilized to check the downstream pressure and set the backpressure regulator when required.

The instrument air system has a pressure gauge (CN-PI-VS-07) and a pressure switch (CN-PS-VS-01). The pressure switch is connected to an audible alarm and a panel light. Its set pressure is five psig.

The knockout drum contains two level switches (CN-LS-VS-01 low level and CN-LS-VS-02 high level) which indicate the presence of liquid in the drum. On low level (about three inches of water), a light on the instrument panel illuminates. On high level (about halfway up the drum), the main vacuum pump will be automatically cut off.

The vacuum system controls consist of a 15 and 2 amp circuit breaker, a selector switch to choose either the main vacuum pump or the sample pump, and a motor starter switch for each pump.

2.2.2 Alarms

2.2.2.1 Knockout Drum Level

The Knockout Drum contains low level and high level indication. The low level indication is a light on the instrument panel which will illuminate upon approximately three inches of liquid in the knockout drum. The high level alarm will cut off the main vacuum pump upon approximately half of the knockout drum filling with liquid.

2.2.2.2 Loss of Instrument Air

Loss of instrument air will trigger an audible alarm on the instrument panel while at the same time switching off the light indicating instrument air pressure. No automatic action is performed.

3.0 VACUUM SYSTEM MODES OF OPERATION

3.1 Main Vacuum Pumping

3.1.1 System Start-up

Normal system start-up will require that the SDS Offgas System is operating before the vacuum system is started. Oil in the main pump is always checked prior to start-up and during operation to preclude lubrication problems.

3.1.2 Vacuum System Operation

Once the main vacuum pump is started and the system begins to operate, little operator attention is required. Oil level and filter delta pressures will be periodically monitored to assure readings are in the normal range. Also periodic adjustment of the ballast flow or bypass flow may be required to keep moisture out of the pump oil and the after filter. Bulk pumping will be accomplished through the 1 1/2 inch line on the vacuum tool. When water levels have decreased sufficiently, the recombiner catalyst will be added to passify the H_2/O_2 gas generation.

3.1.3 Vacuum System Shut Down

Once the spent SDS liner is pumped sufficiently, the system can be shut down and disconnected from the liner.

4.0 ABNORMAL OPERATING CONDITIONS AND EMERGENCY EVENTS

4.1 Loss of SDS Offgas System

In the event that the SDS Offgas System is lost, the vacuum system will be shut down by operator action.

4.2 High Level in the Knockout Drum

If for any reason liquid does enter the knockout drum and get to high level, the main vacuum pump will be automatically cut off. In order to prevent this occurrence, each and every liner that is scheduled for vacuum drying will first be redewatered as a requirement in the operating procedure.

4.3 Loss of Instrument Air

The vacuum system only requires air to preclude moisture from condensing in the main pump. In the event air is lost, the system will be shut down by operator action.

4.4 Loss of Power

System operation will be automatically terminated during a loss of power incident.

5.0 MAINTENANCE

The vacuum system has been designed and components chosen such that maintenance is required only for filter change-out and main vacuum pump oil addition or change.

6.0 ACCEPTANCE TESTING

The vacuum system testing can be broken down into three general categories:

1. Construction testing

2. "Cold" functional

3. "Hot" functional

6.1 Construction Testing

Construction testing will consist of a pneumatic test of the upstream piping installed for connection to the vacuum system skid.

6.2 "Cold" Functional Testing

The vacuum system will be attached to an unspent SDS liner and the system will be started for normal operation. System performance will be checked along with instruments and controls to determine the set points. Also, this will be a tryout for the operating procedure.

6.3 "Hot" Functional Testing

This test will utilize a radioactive SDS liner hooked to the vacuum system for normal operation. Although none is expected, particular attention will be afforded the upstream piping to detect activity if any drawn out of the liner. This is the only part of system operation that was not tried previously in other testing performed on the vacuum system and components.

6.4 In Service Testing

Testing required after any system pressure boundary work will be at the service pressure of the system unless engineering requires other pressures or conditions.

Vacuum System Drawing List

1. Westinghouse Hanford Co. Drawings

H-3-48562 4 sheets	Rev. 2	TMI Vacuum Outgassing and Drying System
H-3-48563 2 sheets	Rev. 1	TMI Vacuum Outgassing and Drying System Manifold
H-3-48564	Rev. 3	TMI Vacuum Outgassing and Drying System Interface
H-3-48566	Rev. 3	P&ID - TMI Vacuum Outgassing and Drying System
H-3-48567	Rev. 2	TMI Vacuum Outgassing and Drying System Knockout Drum
H-3-48568	Rev. 1	TMI Vacuum Outgassing and Drying System Frame
H-3-48569 2 sheets	Rev. 1	TMI Vacuum Outgassing and Drying System Lead Shielding
H-3-48570 2 sheets	Rev. 2	TMI Vacuum Outgassing System Electrical
H-3-48582	Rev. 2	TMI Vacuum Outgassing System Electrical Enclosure

2. Rockwell Hanford Operations Drawing

H-2-80231		Catalyst - Loading/Vacuum Outgassing Tool

3. GPUN Drawing

2D-950-21-003	Rev. 0	P&ID SDS Liner Vacuum Outgassing and Drying System

Vacuum System Pumps

1. **Pump Details**

Identification	CN-P-VS-01
Noun Name	Main Vacuum Pump
Manufacturer	Lammert Sargent Welch
Model Number	Labine 10310-B
Type	2 Stage Vain Type
Standard Material Designation	Cast Iron
Rated Speed	1140 RPM
Rated Capacity	10 SCFM
Lubricant	Oil

Motor Details

Manufacturer	Franklin Elec.
Type	N/A
Rated HP	3/4
Rated Speed	1125 RPM
Lubricant/Coolant	Air
Power Requirements	115 VAC
Power Source	Vacuum System Instrument Panel

2. **Pump Details**

Identification	CN-P-VS-02
Noun Name	Sample Pump
Manufacturer	Gast MFG. CORP.
Model Number	DOA-P102-AA
Type	Diaphragm
Rated Speed	

Rated Capacity	.25 SCFM
Lubricant	None

<u>Motor Details</u>

Manufacturer	N/A
Type	N/A
Rated HP	1/8
Rated Speed	
Lubricant/Coolant	Air
Power Requirements	120 VAC
Power Source	Vacuum System Instrument Panel

VACUUM SYSTEM FILTERS

1)	Identification	CN-F-VS-01 and 03
	Manufacturer/Model	Pall/MEN-9001-G-24
	Shell Material	Carbon Steel with Nickel Plating Inside
	Design Pressure/Temperature	150 lbs/-20° to 225°F
	Filter Rating	.45 um
	Cartridge	MCS-1001-UV
2)	Identification	CN-F-VS-02
	Manufacturer/Model	Pall/VCS-1001-G-160
	Shell Material	304 Stainless Steel
	Design Pressure/Temperature	150 lbs./-20° to 225°F
	Filter Rating	Oil Coalescing
	Cartridge	MDS-1001-SU

SDS VACUUM SYSTEM
INSTRUMENTS

GPU #	SERVICE	LOCATION	SUPPLIER	MODEL	SCALE	SET POINT	REMARKS
CN-V-VS 400	Instrument Air Isolation	Down Stream of Plant Valve IA-V-175	Parker CPI	6Z-V6LJ-SS			3/8" Ball Valve SS
CN-V-VS 401	Vacuum System Outlet Isolation	Tie-in to Existing SDS Offgas Unit	WATTS REG. Co.	Model LL Type S8501			1" Ball Valve SS
CN-V-VS 402	Pressure Instrument Isolation	Manifold	Nupro	SS-4-H-4			1/4" Globe Valve SS
CN-V-VS 403	Same	Same	Same	Same			Same
CN-V-VS 404	Same	Same	Same	Same			Same
CN-V-VS 405	Vacuum Manifold Inlet	Same	Same	SS-8-BW-TW			1/2" Globe Valve SS
CN-V-VS 406	Same	Same	Same	Same			Same
CN-V-VS 407	Same	Same	Same	Same			Same
CN-V-VS 408	Same	Same	Same	Same			Same
CN-V-VS 409	Same	Same	Same	Same			Same
CN-V-VS 410	Same	Same	Same	Same			Same

SDS VACUUM SYSTEM
INSTRUMENTS

GPU #	SERVICE	LOCATION	SUPPLIER	MODEL	SCALE	SET POINT	REMARKS
CH-V-VS 411	Liner Inlet To Vacuum System Isolation	Vacuum System Tool	Worcester Valve	11/2 5966T R13 1000			1 1/2" Ball Valve SS
CH-V-VS 412	Atmospheric Isolation	Same	Same	Same			Same
CH-V-VS 413	Vacuum System Tool Isolation	Same	Same	Same			Same
CH-V-VS 414	Liner Vent Hose To Vacuum System Isolation	Dewatering Station	Nupro	SS-8-BW-TW			1 1/2" Globe Valve SS
CH-V-VS 415	Knockout Drum Inlet	Vacuum System Skid	Jamesbury	21-3400-MT			1 1/2" Ball Valve SS
CH-V-VS 416	Suction Filter Inlet	Same	Same	Same			Same
CH-V-VS 417	Main Vacuum Pump Inlet	Same	Same	Same			1" Ball Valve SS
CH-V-VS 418	Main Vacuum Pump Outlet Check Valve	Same	Nupro	SS-16C-4-1/3			1" Check Valve SS
CH-V-VS 419	After Filter Inlet	Same	Jamesbury	21-3400-MT			1" Ball Valve SS
CH-V-VS 420	After Filter Outlet	Same	Same	Same			Same
CH-V-VS 421	Vacuum System Exhaust Pressure Regulator	Same	Fairchild	10113 BP			3/8" Regulating Valve

SDS VACUUM SYSTEM
INSTRUMENTS

GPU #	SERVICE	LOCATION	SUPPLIER	MODEL	SCALE	SET POINT	REMARKS
CN-V-VS 430	Sample Filter Inlet	Vacuum System Skid	Nupro	SS-8-BK			1/2" Globe Valve SS
CN-V-VS 431	Sample Pump Outlet	Same	Whitey	SS-16-DKM4-F4-A			1/4" Angle Globe Valve SS
CN-V-VS 432	Sample Cylinder Inlet	Same	Same	Same			Same
CN-V-VS 433	Sample Cylinder Outlet	Same	Same	Same			Same
CN-V-VS 434	Sample System Outlet	Same	Same	Same			Same
CN-V-VS 435	Sample System Outlet Check Valve	Same	Nupro	SS-8C-1/3			1/2" Check Valve SS
CN-V-VS 436	Sample Pump Outlet Pressure Instrument Isolation	Same	Nupro	SS-8-BK			1/2" Globe Valve SS
CN-V-VS 437	Sample Cylinder Bypass	Same	Same	Same			Same
CN-V-VS 440	Instrument Air Inlet To The Vacuum Skid	Same	Jamesbury	21-3600-TT			1/2" Ball Valve
CN-V-VS 441	Instrument Air Regulator	Same	Fisher	67AFR260		6 psig	1/4" Pressure Regulating Valve
CN-V-VS 442	Instrument Air Pressure Relief	Same	Crosby	JRU-C		20 psig	Pressure Relief Valve

SDS VACUUM SYSTEM
. INSTRUMENTS

CPU #	SERVICE	LOCATION	SUPPLIER	MODEL	SCALE	SET POINT	REMARKS
CH-V-VS 443	Instrument Air Inlet To Main Pump Gas Ballast	Vacuum System Skid	Part of CH-FI-VS-01	N/A			Needle Valve
CH-V-VS 444	Instrument Air Inlet To Vacuum System Backfill	Same	Part of CH-FI-VS-02	N/A			Same
CH-V-VS 445	Instrument Air Inlet To Main Pump Gas Ballast	Same	Nupro	SS-8C-1/3			1/2" Check Valve SS
CH-V-VS 446	Instrument Air Inlet To Vacuum System Backfill	Same	Same	Same			Same
CH-V-VS 447	Instrument Air Inlet To After Filter	Same	Same	SS-8-BK			1/2" Globe Valve SS
CH-V-VS 448	Instrument Air Inlet Knockout Drum	Same	Same	Same			Same
CH-V-VS 449	Instrument Air Inlet To Sample System	Same	Same	Same			Same
CH-V-VS 450	Inert Gas Pressure Relief	Inert Gas Manifold	Crosby	JRU-C		30 psig	Pressure Relief Valve
CH-V-VS 451	Inert Gas Inlet To Knockout Drum	Vacuum System Skid	Nupro	SS-8-BK			1/2" Globe Valve
CH-V-VS 452	Inert Gas Inlet To Vacuum System Tool	Same	Same	Same			Same
CH-V-VS 453	Inert Gas Inlet To Sample System	Same	Same	Same			Same

SDS VACUUM SYSTEM
INSTRUMENTS

CFU #	SERVICE	LOCATION	SUPPLIER	MODEL	SCALE	SET POINT	REMARKS
CN-V-VS 460	Knockout Drum Pressure Transducer Isolation	Vacuum System Skid	Nupro	SS-8-BK			1/2" Globe Valve SS
CN-V-VS 461	Knockout Drum Drain	Same	Same	SS-4-H-4			1/4" Globe Valve SS
CN-V-VS 462	Suction Filter Outlet Pressure Indicator Isolation	Same	Same	SS-8-BK			1/2" Globe Valve SS
CN-V-VS 463	After Filter Inlet PDI Isolation	Same	Same	Same			Same
CN-V-VS 464	After Filter Outlet PDI Isolation	Same	Same	Same			Same
CN-V-VS 465	After Filter Drain	Same	Whitey	SS-16-[illegible]-F4-A			1/4" Angle Globe Valve SS
CN-V-VS 466	Instrument Air Pressure Switch Isolation	Same	Nupro	SS-4-H-4			1/4" Globe Valve SS
CN-V-VS 467	Main Vacuum Pump Oil Fill	Same	Jamesbury	21-3600-TT			1/2" Ball Valve

SDS VACUUM SYSTEM
INSTRUMENTS

CPU #	SERVICE	LOCATION	SUPPLIER	MODEL	SCALE	SET POINT	REMARKS
CH-FI-VS 01	Instrument Air Inlet To Main Vacuum Pump Gas Ballast Flow	Vacuum System Skid	AMETEX	20-7050	0-100%	2 SCFM	Flow Indicator
CH-FI-VS 02	Instrument Air Inlet To System Backfill Flow	Same	Fisher & Porter	10A1251-M-X	0-100%	4 SCFM	Same
CH-LS-VS 01	Knockout Drum Low Level Switch	Same	De-Level	Kit 24577	N/A	N/A	Indicator Light on Panel
CH-LS-VS 02	Knockout Drum High Level Switch	Same	Same	Same	N/A	N/A	Main Vacuum Pump Cutoff
CH-PI-VS 01	After Filter Differential Pressure Indicator	Same	Orange Research	SST Diaphragm 1502-D6-1-C-25-L	N/A	N/A	After Filter Changeout Indicator
CH-PI-VS 01	Vacuum Manifold Inlet	Manifold	Marsh Gauge	J-4812	30 in.-30 psig	N/A	Vacuum Pressure Gauge
CH-PI-VS 02	Same	Same	Same	Same	Same	Same	Same
CH-PI-VS 03	Same	Same	Same	Same	Same	Same	Same
CH-PI-VS 04	Same	Same	Same	Same	Same	Same	Same
CH-PI-VS 05	Liner Vent Hose To Vacuum System Inlet	Dewatering Station	Same	Same	Same	Same	Same
CH-PI-VS 06	After Filter Effluent Pressure	Vacuum System Skid	Same	J-4840	0-15 psig	Same	Pressure Gauge

SDS VACUUM SYSTEM
INSTRUMENTS

GPU #	SERVICE	LOCATION	SUPPLIER	MODEL	SCALE	SET POINT	REMARKS
CH-FI-VS 01	Instrument Air Inlet To Main Vacuum Pump Gas Ballast Flow	Vacuum System Skid	AMETEK	20-7050	0-100%	2 SCFH	Flow Indicator
CH-FI-VS 02	Instrument Air Inlet To System Backfill Flow	Same	Fisher & Porter	10A1251-M-X	0-100%	4 SCFH	Same
CH-LS-VS 01	Knockout Drum Low Level Switch	Same	De-Level	Kit 24577	N/A	N/A	Indicator Light on Panel
CH-LS-VS 02	Knockout Drum High Level Switch	Same	Same	Same	N/A	N/A	Main Vacuum Pump Cutoff
CH-PI-VS 01	After Filter Differential Pressure Indicator	Same	Orange Research	SST Diaphragm 1502-D6-1-C-25-L	N/A	N/A	After Filter Changeout Indicator
CH-PI-VS 01	Vacuum Manifold Inlet	Manifold	Marsh Gauge	J-4812	30 in.-30 psig	N/A	Vacuum Pressure Gauge
CH-PI-VS 02	Same	Same	Same	Same	Same	Same	Same
CH-PI-VS 03	Same	Same	Same	Same	Same	Same	Same
CH-PI-VS 04	Same	Same	Same	Same	Same	Same	Same
CH-PI-VS 05	Liner Vent Hose To Vacuum System Inlet	Dewatering Station	Same	Same	Same	Same	Same
CH-PI-VS 06	After Filter Effluent Pressure	Vacuum System Skid	Same	J-4840	0-15 psig	Same	Pressure Gauge

THREE MILE ISLAND NUCLEAR STATION UNIT 2
RECOVERY PROGRAM
SOLID WASTE STAGING FACILITY
SYSTEM DESCRIPTION

Revision 1

TABLE OF CONTENTS
FOR
SOLID WASTE STAGING FACILITY

SYSTEM DESCRIPTION

OF

SOLID WASTE STAGING FACILITY (SWSF)

1.0 INTRODUCTION

The Solid Waste Staging Facility (SWSF) performs no active function. The facility is a passive system for temporary staging of nuclear radioactive waste prior to preparation for shipment and disposal to approved offsite burial grounds. The SWSF has been designed and will be operated in such a manner as to provide assurance that:

A. The health and safety of the public will be protected.

B. Occupational exposures will be as low as reasonably achievable (ALARA)

C. There will be no significant adverse impact on the environment.

2.0 DESIGN DESCRIPTION

2.1 Facility Function

2.1.1 The SWSF is used for the collection and temporary staging of the nuclear waste (solidified and/or Dewatered Resins) generated in processing the fluids during the Recovery cleanup operations at TMI Unit 2.

2.1.2 The SWSF is located as shown on Figure 1, South and East of Unit 2 Natural Draft Cooling Towers within the area protected by the Flood Control Dikes.

Space was allocated to accomodate six (6) modular structures; two (2) modules "A" and "B" are completed, the remaining space is available for additional modules as, or if, required.

2.1.3 Figure 2 shows the typical layout of the SWSF system.

2.1.3.1 Each Module is designed with Sixty (60) Cells forming the compartments for storing the radioactive waste generated during processing.

2.1.3.2 Each Cell is designed to stage the radioactive waste contained in either One (1) 6 ft. diameter by 6 ft. high liner, or Two (2) 4 ft. diameter by 4 ft. high liners, or Eighteen (18) 55 gallon, type DOT.17H Drums.

2.1.3.3 Each Module is designed to accomodate any combination of the radioactive waste containers as follows:

Container	Total Quantity	Wt of One Filled Container lb.
6 ft. dia. x 6 ft. H Liners	60 (1 per cell)	14,000
or		
55 gallon drums	1080 (18 per cell)	800
or		
4 ft. dia. x 4 ft. H Liners	120 (2 per cell)	4,500

2.1.3.4 A floor drainage system is incorporated into the module design which discharges into a common sump located between Modules "A" and "B". The total capacity of the sump is approximately 2750 gallons.

2.2 References

2.2.1 U.S. NRC Regulatory Guide 1.143, July 1978, Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants.

2.2.2 Design Criteria/Input Record. GAI W.O. #04-4283-070

2.2.3 Gilbert Associates, Inc. (GAI) Drawings:

2.2.3.1	Excavation and Grading Plan.	E-774-151.
2.2.3.2	Plant Layout	E-012-006 E-014-004.
2.2.3.3	Structural.	E-430-006 E-430-007 E-430-008 E-430-011 E-430-012 E-430-013 E-430-014 E-430-015
2.2.3.4	Building Services—Piping	E-311-873 E-311-874
2.2.3.5	Electrical	SS-308-417 B-256-031 E-266-011

2.3 Design Basis

2.3.1 The SWSF is designed to comply with the requirements of RG.1.143, July, 1978. The facility is designed to provide a controlled, but ready access for material handling operations and to ensure that the operator exposures are as low as reasonably achievable (ALARA).

2.3.2 The facility is designed to maintain the dose rates in accordance with 10 CFR Part 20 and to meet the requirements of 40 CFR Part 190 at the site boundary and beyond.

2.3.3 The shielding thickness was calculated to limit the contact dose rates at the outer surfaces of the module walls and the top of the cell covers to within 0.5 mr/hr and 2.5 mr/hr, respectively. The analysis was based on the types of waste defined in Attachment 1. No credit was taken for the structure being partially underground.

2.3.4 Quality Assurance requirements for the design, operation and construction of the SWSF are consistent with those specified in Regulatory Guide 1.143.

2.4 Summary System Description

2.4.1 The concrete structure and individual cell covers provide the necessary shielding from the radioactive waste housed in the SWSF Module Storage Cells.

The cell covers with gaskets protect the waste containers from the elements and the ingress of precipitation. Slots and weep holes in the upper module structure are provided to direct rainwater to external drainage ditches. A drainage piping system prevents any spillage/leakage of fluids from accumulating in the cells (i.e., floor drain hub in each cell), the system manifold discharges into a common sump.

2.4.2 The sump compartment, a radwaste seismic concrete structure houses the pump, valves, piping, instrumentation, etc., necessary to perform the functions and control the disposal of any effluent which may collect in the sump. The compartment is divided into two levels, the upper operator level is shielded by a thick concrete floor from the sump. Access to the upper compartment is via a manhole in the concrete slab roof. Access to the sump is via a
removable ladder at the sump plug opening and a permanently 1
installed ladder into sump.

2.4.3 The flow diagram Figure 3 shows the pumping system for the sump effluent. All operations are local/manual. The local alarms and sump level indication are housed in a weatherproof instrumentation panel mounted outside adjacent to the sump compartment on Module "A" structure.

The sump pump, Solenoid Valve #WS-5 and three-way valve #WS-1 (extension spindle) are located in the lower sump while the electrical distribution and control panels, valves, etc. are mounted in the operators compartment.

Sump level is measured by a variable capacitance sensor (SWS-LE-01) which transmits the signal to local and remote (Unit-2 Control Room) alarms.

Sump influent flow alarms are provided. The sensing elements (conductivity) Nos. SWS-CE-07 and SWS-CE-08 are mounted in the Module "A" and "B" drain system manifolds. These sensing elements are temporarily out of service with the installation of the loop 1
seal for the SWSF Drain System and will be until the completion of EPICOR II venting and shipping program.

2.4.3.1 Sump Pumping Operations (See Figure 3)

The SWSF sump is controlled and disposal of the effluent will be in accordance with Unit-2 Chemistry Procedure #1899 and Operating Procedure #2104.4.100. The sump compartment is posted as a radiological controlled area and surveillance is required prior to entry, to ensure operator exposure will be as low as reasonably achievable (ALARA).

On receipt of the alarm signal (approximately 50% sump level) in Unit-2 Control Room, the above procedures are put into effect and the sequence of operations are as follows:

2.4.3.1.1 Recirculation Mode (Sump effluent mixing to obtain representative sample for analysis).

A. All valves to be checked closed.

B. Operate three-way Valve WS-1 to route pump discharge returned to sump.

C. Start pump.

2.4.3.1.2 Sampling Mode (during Recirculation Mode)

NOTE: Radiologically monitor the collection of the sample with the appropriate instrument.

A. Solenoid Valve WS-5 open.

B. Valve WS-7 open.

C. Collect sample.

D. WS-5 and WS-7 closed.

E. Stop pump.

2.4.3.1.3 Discharge Mode (Only after sample analysis is completed).

A. All valves to be checked closed.

B. Connect hose to the tank truck (or portable vehicle) connection for effluent disposal.

C. Operate three-way Valve WS-1 to route pump discharge to truck discharge manifold.

D. Valve WS-4 (WS-3) open.

E. Start pump.

F. Stop pump, disconnect tank truck (or portable vehicle) connection, and allow contents of hose to drain back into sump.

G. Valve WS-4 (or WS-3) closed.

H. Operate three-way Valve WS-1 for recirculation mode and secure.

2.4.3.2 Loop Seal for SWSF Drain System

The loop seal for the SWSF drain system, which was installed for the EPICOR II venting and shipping program, creates a seal trap in the embedded drain system to prevent the loss of nitrogen gas during inerting of cells. The basic procedure for installing a loop seal is as follows.

A. All valves to be checked closed.

B. Ensure plugs are installed in bottom of WS-9 and WS-10 (See Figure 3). 1

C. Place water supply hose into 4" Sch. 40 galvanized steel fill pipe.

D. Start pump.

E. Fill drain system until water in fill pipe is two (2) inches from top of fill pipe or until water approaches within 1" of the lip of the drain opening.

F. Stop pump.

2.4.4 Major Equipment

A. Sump Pump (1.): Gould Model 3171 1 x 1-1/2 -6

Capacity	50 gpm
TDH	100 ft.
Fluid	Radioactive waste water/resin slurry pH approx. 7.
Materials	Cast iron/bronze fittings
Impeller	Open type
Discharge Conn.	Flanged above mtg. plate
Service	Intermittent 5 yr. life

B. Solenoid Valve (1):

1/2" nom. bore. 120 volt AC

C. Instrumentation: See Table 1.

2.4.5 Facility General Arrangement: See typical layout Figure 2. The general arrangement, layout and details of the SWSF systems are shown in the drawings referenced in Section 2.2.[illegible].

2.4.6 Instrumentation and Controls

2.4.6.1 The SWSF has three (3) instrument loops as follows:

A. A level instrument string provides the alarm and level indication both local and remote. In addition, this loop provides a sump pump permissive at greater than 10 percent level.

B. The other two (2) instrument strings are conductivity flow loops providing local alarms. One loop senses input from the drain discharge manifolds from Module "A" and the other from [illegible]

2.4.6.2 Instrument Setpoint Index. See Table 2.

2.4.7 System Interfaces

There are six interfaces associated with this facility:

1. Processing Systems: Access road to and from waste and fluid processing facilities for transportation of materials and equipment.

2. Material Handling System: Facility will accept radioactive waste containers from the processing systems and are compatible with the transportation and lifting equipment, i.e., transfer shield and site cranage (Manitowoc 4000 W mobile crane or equivalent).

3. Cooling Water Pump (CWP) House: 480 V, 3 ø 200 A feeder cable from Bus 2-61 shall provide power for the following:

   A. 460 volts to the sump pump.

   B. 480 volt welding receptacle.

   C. 25 KVA, 240-120V power center to energize lighting, convenience receptacles, instrumentation, and control devices.

   NOTE: No permanent heat tracing required for sump compartments.

4. Control Room: Sump level alarm.

5. Chemistry Laboratories: Sump effluent samples for chemistry and radiological analysis prior to disposition.

   NOTE: The sump pump discharge is not directly connected to any plant systems, a local hose station is provided.

6. Sampling, purging, and analysis of the 49 EPICOR-11 prefilters in preparation for shipment from "THREE MILE ISLAND". 1

2.4.8 Operations-Radwaste Handling

The major operations performed at the SWSF is handling the radioactive waste containers while loading/unloading the individual cells in accordance with the types of containers specified in Section 2.1.3. Unit 2 Procedures (See Table 3), specifically written for these operations are strictly adhered to, using the Manitowoc Mobile Crane or equivalent and appropriately shielded equipment. 1

Each cell has an individual concrete cover 8'3" square x 3'0" deep. (Dwg. #8-430-015) weighing approximately Fourteen (14) tons. Only One (1) cover may be removed at any time from the cells containing radioactive waste containers within a module system. The maximum load handled by the lifting system is approximately 36 tons (It is the blockhouse used for EPICOR prefilter venting).

1

1

2.4.9 Maintenance

Most operations including Maintenance requires a RWP.

Inner surfaces of the cells and the sump are epoxy coated to ease decontamination of the facility.

2.4.10 Acceptance Testing.

2.4.10.1 Mechanical. Dwgs. #E-311-873 and E-311-874

A. Module "A" and "B" Drain Piping Systems.

(i) Leak Test in accordance with ANSI B31.1.1977.

Criteria: Static Head. (Fill System, water level top of drain hubs)

Holding Period. 10 minutes minimum.

Acceptance. No visual leakage.

(ii) Flow verification, allow leak test water to drain to sump.

Criteria: No visible fluid in system.

B. Sump Pump "A" and associated piping.

Initial Service Leak Test in accordance with ANSI B31.1, 1977.

Criteria: Pump discharge pressure

Acceptance. No visual leakage, all welded joints leaktight.

2.4.10.2 Electrical/Instrumentation: Dwgs. #B-256-031, B-248-011 and SS-261-011

A. Continuity and Megger tests were performed for all circuits.

B. Instrument and Control were tested and calibrated in accordance with MTX 507.

C. Sump Pump "A", tested in accordance with Electrical Preoperational Test Procedure WG-E01.

D. Solenoid Valve #WS-V05, tested in accordance with Electrical Preoperational Test Procedure WG-E02.

Table 1

Solid Waste Staging Facility Instrumentation

Instrument Designator	Model or Type	Locations	Functions
SWS-LE-01	Drexelbrook 700-2-57	Mod A Sump	Sump Level Sensor
SWS-LT-11	Drexelbrook 408-6230	Mod A Opr. Floor	Sump Level Transmitter
SWS-LI-01	370-1104-401	Mod A Opr. Floor	Sump Level Indication
SWS-LI-01A	International Instr. 1151	Mod A Top Panel	Sump Level Indication
SWS-LSL-01	SETCON 401-100x	Mod A Top Panel	Sump Level Switch Low (Pump Permissive)
SWS-LSH-01	SETCON 401-100x	Mod A Top Panel	Sump Level Switch High
SWS-LAH-01	PANALARM	Mod A Top Panel	Sump Level Alarm High
SWS-LAH-01A	PANALARM	CR Panel 17E-2A	Sump Level Alarm High
SWS-CE-07	Level Lance 14-115V	Sump	Influent Flow Conductivity Element
SWS-CAH-07	PANALARM	Mod A Top Panel	Influent Flow Alarm
SWS-CE-08	Level Lance 14-115V	Sump	Influent Flow Conductivity Element
SWS-CAH-08	PANALARM	Mod A Top Panel	Influent Flow Alarm

ble 2

Instrument Setpoint Index

Instrument Tag No.	Instrument Description	Component Type	Setpoint Descrip.	Action
SWS-LSL-01 (GAI: LB-S-4)	Solid Waste Staging Facility Sump Level Switch Low (Sump Pump Permissive)	Current Switch	10% level (5.6 ma) Increasing	Contact Closure
SWS-LSH-01 (GAI: LB-S-3)	Solid Waste Staging Facility Sump Level Switch High	Current Switch	42% level (11.2 ma) Increasing	Contact Closure
SWS-CE-07 (GAI: CE-S-7)	Solid Waste Staging Facility Sump Influent Flow Module 'A' Conductivity Element	Conductivity Element	Maximum Sensitivity	Contact Closure
SWS-CE-08 (GAI: CE-S-8)	Solid Waste Staging Facility Sump Influent Flow Module 'B&C' Conductivity Element	Conductivity Element	Maximum Sensitivity	Contact Closure

Table 3

OPERATING PROCEDURES

Proc. No.	Description
2104.4.53	Transfer Spent Filters 4' x 4' liner from FHB to SWSF.
2104.4.68	Stacking 4' x 4' liners at SWSF.
2104.4.73	Removal of 6' x 6' liners from Interim Staging Facility and transfer to SWSF.
2104.4.100	SWSF sump pumping operation.
2104.4.103	EPICOR II 4' x 4' liner transfer and shipping cask loading
2104.4.107	On-site transfer of Radioactive 6' x 6' resin liners from EPICOR II to SWSF/Ship.
2104.4.108	On-site transfer of Radioactive 6' x 6' resin liners from SWSF to Transporter/Ship.
2104.4.118	On-site transfer of Radioactive 4' x 4' resin liners from EPICOR II to SWSF/Ship.
2104.4.119	On-site transfer of Radioactive 4' x 4' resin liners from SWSF to Transporter/Ship.
2104.4.120	Transfer of Solidified Resin Liners from Unit II to SWSF.

Attachment 1

Shielding Analysis - Types of Waste

Types of waste considered are given below. A 3 month decay period was used in the analysis.

1) Natural Circulation Evaporator with Solidification

   Waste Form: 55 gallon drums (solidified)

   Design Basis for Cell: C-D waste @VR* = 4.5, η** = .6

   18 drums per storage cell

   C-D waste analysis is given below

or 2) Forced Circulation Evaporator/Crystallizer with Solidification

   Waste Form: 55 gallon drum (solidified)

   Design Basis for Cell: C-D waste @ VR = 22, η = .6

   18 drums per storage cell

or 3) Epicor II Charcoal Filter

   Waste Form: Activated Charcoal in 4 ft. diameter x 4 ft. high liner

   Design Basis for Cell: 2500 R/hr on contact

   Two liners per cell

or 4) Epicor II Demineralizer Resins

   Waste Form: Dewatered Resins in 4 ft. diameter x 4 ft. high liner

   Design Basis for Cell: B-C waste @ VR = 543

   B-C waste analysis is given below

*VR - volume reduction

** η - Packaging efficiency: ratio of volume of waste to total container volume.

A) **Quantities; C-D Waste**

83,000 gallon - Reactor Coolant Bleed Tank - A

83,000 gallon - Reactor Coolant Bleed Tank - B

250,000 gallon - Reactor Building Sump

B) **Isotopic Analysis (μCi/ml) - Design Basis; C-D Waste**

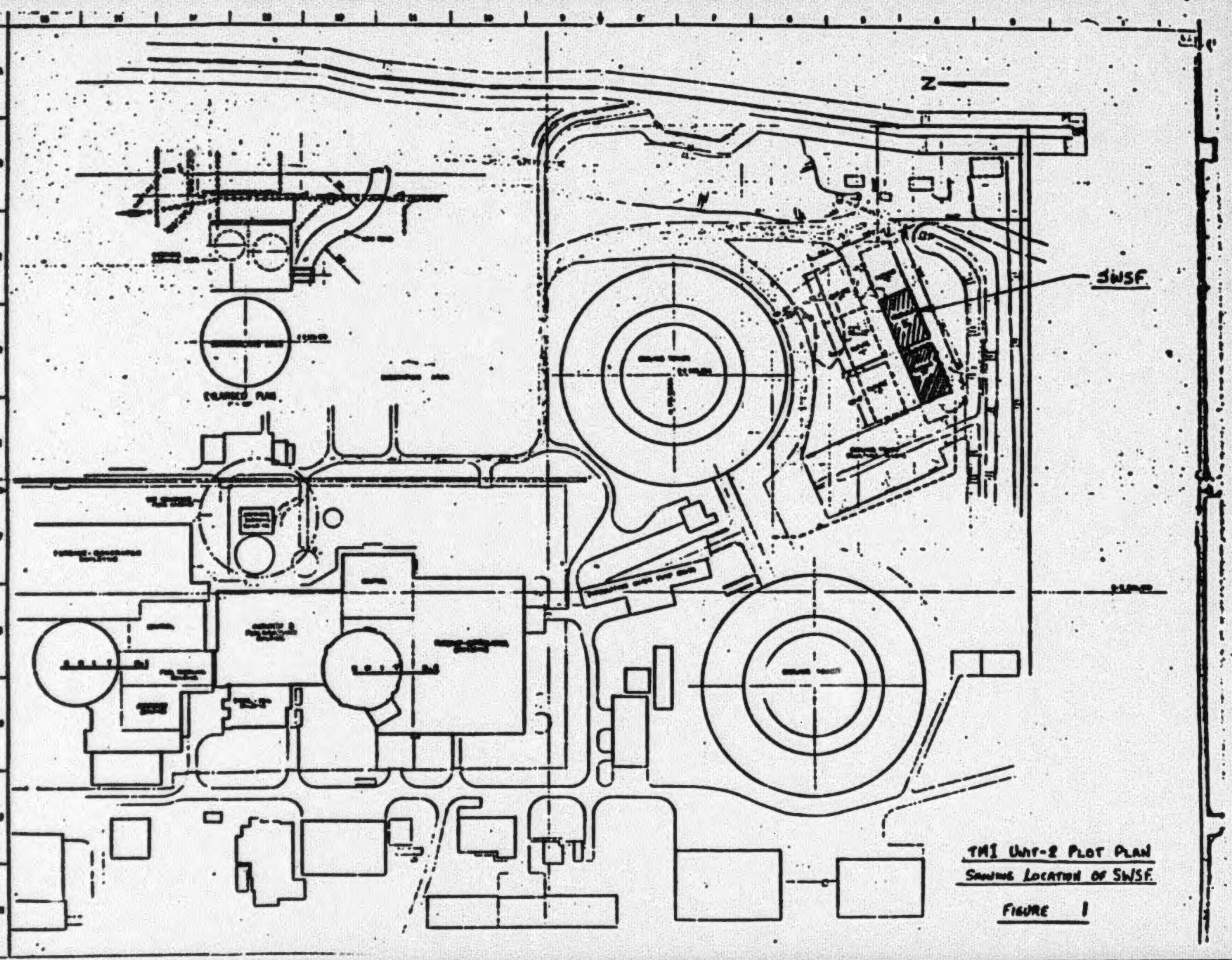
Isotope μCi/ml

Mo 99 - 180	Cs 136 - 120	Ce 144 - 100
I 131 - 8200	Ba 140 - 290	H 3-1.2
I 132 - 20	La 140 - 160	
Cs 134 - 82	Sr 89 - 1400	
Cs 137 - 330	Sr 90 - 120	

C) **Isotopic Analysis (μCi/ml) - Design Basis; B-C Waste**

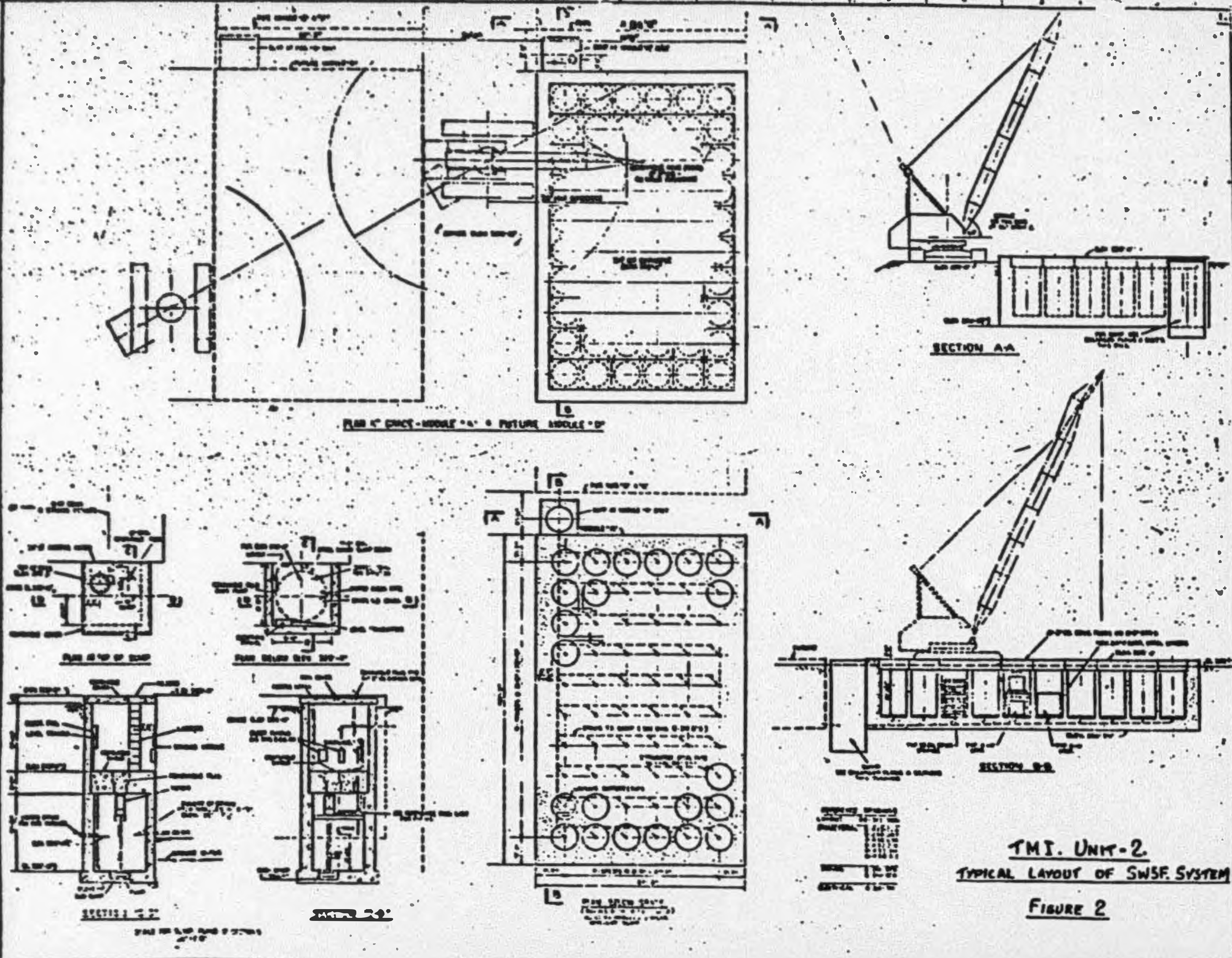
B-C Waste

Isotope	μCi/ml	Isotope	μCi/ml
Ba 133	2 E - 1	Ba 140	7.5 E - 1
Co 60	1.4 E - 4	La 140	2.4 E + 0
Cs 134	1.6 E - 1		
Mo 99	2.7 E - 1		
I 131	2.3 E + 1		
Bi 207	2.2 E - 2		
Co 58	1.2 E - 3		
Cs 137	7 E - 1		



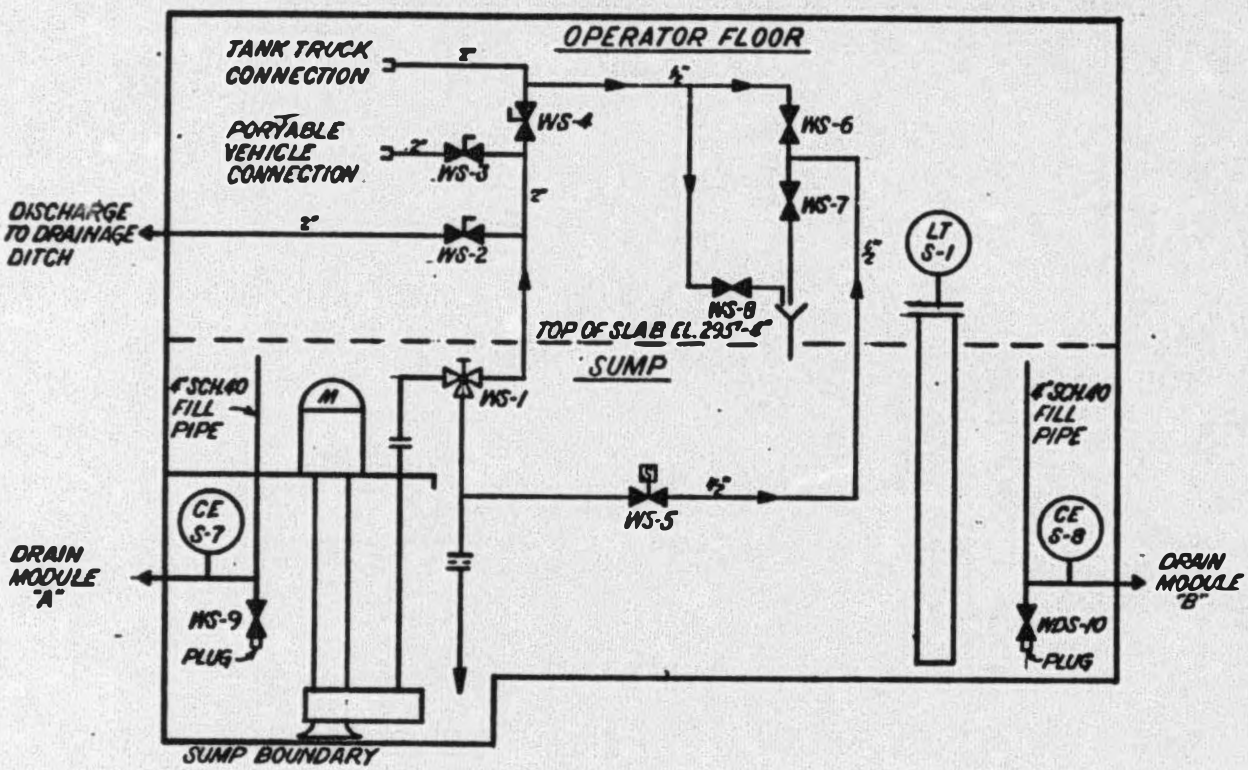
TMI UNIT-2 PLOT PLAN
SHOWING LOCATION OF SWSF

FIGURE 1



TMI. Unit-2.
Typical Layout of SWSF System

Figure 2



SUMP MODULE A & B FLOW DIAGRAM

FIGURE 3

Revision 1