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DIVISION

SYSTEM DESCRIPTION

FOR

Submerged Demineralizer System

COG ENG JO Bohaliell DATE 8/18/86

RTR KJ Hofstetter DATE 8/20/86

COG ENG MGR. RF Warren DATE 8/20/86

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Rev.	SUMMARY OF CHANGE	Approval	Date
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1	Updated per GPUNC Letter 4410-83-L-0018		4/83
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SD 3527-005

THREE MILE ISLAND - UNIT #2

SYSTEM DESCRIPTION

OF THE

SUBMERGED DEMINERALIZATION SYSTEM

(SDS)

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FOR

SUBMERGED DEMINERALIZATION SYSTEM

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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, the Reactor Coolant System and other liquid waste systems (WDL, etc.), 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 RCS Manifold 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 Radwaste Disposal System Description

1.2.3.1 Reactor Coolant Liquid System Description

1.2.3.2 Miscellaneous Liquids System Description

1.2.3 SDS Technical Evaluation Report

1.2.4 SDS Design Criteria

1.2.5 SDS Process Control Programs

1.2.6 Reference Drawings

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-D-A-5004
Burns & Roe Drawing E-032	Chem-Nuclear Dwg. 527-D-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-D-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-D-L-5026
Burns & Roe Dwg. M043	Chem-Nuclear Dwg. 527-D-L-5027
Burns & Roe Dwg. M323	Chem-Nuclear Dwg. 527-D-L-5031

Bechtel Dwg. 2-M74-SDS01
Bechtel Dwg. 2-M74-PW01
GPUSC Drawing 2R-950-21-001
GPUSC Drawing 2E-950-02-001
GPU Nuclear, Recovery Support Engr. Dwg. RSE-027
Chem-Nuclear Dwg. 527-D-L-5032
Chem-Nuclear Dwg. 527-D-L-5033
Chem-Nuclear Dwg. 527-D-L-5034

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, the Reactor Coolant System and other liquid systems such as WDL, etc. 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 Reactor Building Basement Jet Pump System (SWS-P-1) as described in Appendix 12;

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

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

4) The Processed Water Storage Tank System

5) The Spent Fuel Cooling System piping.

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

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

8) The Fuel Transfer Canal Draining System as described in Appendix No. 18

9) The Fuel Transfer Canal Shallow End Drainage System as described in Appendix No. 19

10) The Early Defueling DWC Reactor Vessel Filtration System as described in Appendix No. 20

The Reactor Building Basement Jet Pump System (SWS-P-1) 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 SDS ion exchange trains.

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 Reactor Building Basement Jet pump and the mechanical condition of the filters.

SDS process flow is filtered prior to processing through the ion exchange trains. The purpose of the filters is for removal of gross size particles from the process stream to prevent plugging of the ion exchange beds.

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 sump water and RCS processing operations. 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" sand filter "A" or "cation" sand filter "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, if desired.

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 system, 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. During some phases of the cleanup, the post filter may be bypassed, and replaced by a sand filter in the cation position.

From the effluent of the resin trap post filter or "cation" sand filter, the SDS processed water is sent through a common header which allows it to be directed to the Fuel Transfer Canal, Spent Fuel Pool "A" or any of the following tanks:

1) The Reactor Coolant Bleed Tanks

2) The Miscellaneous Waste Hold-Up Tank

3) The SDS Monitor Tanks

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

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 or second EPICOR-II liner. The last 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. 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 indicates the tank level and by operator action transfers the collected water to the RCS Manifold. 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), the Fuel Transfer Canal 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.

Water is delivered to the prefilter and final filter at a flow rate of 5 to 30 gpm, 70° to 90°F, and then into the SDS ion exchange trains.

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 6,000 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" sand filters. 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" sand filter at a time with the other being an installed spare.

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 permit 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. Most components that are not submerged are shielded with lead, steel and/or concrete as necessary.. The SDS Monitor Tanks are located in the model room (El. 305').

1.5.1 "B" Spent Fuel Pool SDS Components

The Unit II "B" Spent Fuel Pool is directly north of and connected to the "A" spent fuel pool. 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 (not currently used - replaced by "cation" sand 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 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 effluent prior to transfer to processing by EPICOR II and/or storage, if not jumpered out of service.

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" sand filters.

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 to the RCS manifold for processing or transfer to storage tanks. 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 1μCi/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, 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.

1.5.2 SDS Interfaces to Other Systems

1.5.2.1 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.

1.5.2.2 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".

1.5.2.3 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.

1.5.2.4 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.

1.5.2.5 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.

1.5.2.6 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 to the RCBT's inlet header upstream of WDL-V-191. 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-PF-68.

1.5.2.7 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.

1.5.2.8 Reactor Building Basement Jet Pump (SWS-P-1)

The pump currently in use for removal of water from the Reactor Building sump ties in to the RCS manifold at valve CN-V-RC-364. The Reactor Building Basement Jet Pump system is described in Appendix 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

1.6.1.1.9 US NRC Regulatory Guide 3.4

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 5 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 7.5 gpm per train, 15 gpm total through the zeolite beds, and 15 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 <u>Process Piping Design Requirements</u>

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 welding 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 media 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 devices 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 the Off Gas Separator Tank. 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.

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 Early CUNO-type filter vessels and lower activity APCO ion exchange vessels are designed to 150 psi, 100°F using type 304 stainless steel. Subsequent filter vessels are the same design as zeolite ion exchange vessels.

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 Monitor Tank Requirements

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 Reactor Building Basement Jet Pump (SWS-P-1)

See Appendix 12

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 RCS manifold, 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 be used to maintain the level in the off gas separator tank within a preset band (80" to 18"). Pump operation will be controlled by an electrical switch. The separator tank is pumped down by operator action. The pump operates 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 RCS manifold for processing through the Submerged Demineralizer System or for transfer to other storage tanks.

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 manual 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 paralle 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 Manifold, 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 Rad 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 offgas separator tank. The remaining SDS component sumps, unlike those above, do not need a similar arrangement since they gravity drain to the off gas separator tank.

The sump pumps CN-P-SA08 and CN-P-RC09 are identical rotating pumps with a capacity of 0.5 gpm at 81 feet of dynamic head. 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 accomplished by level switches in each sump which energizes the pump when the water level reaches 2 inches and de-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-energized manually. These pumps must not be operated during offgas separator tank pump down.

2.1.1.7 FTC Drain/Processing Pump (FCC-P-1)

See Appendix 18.

2.1.1.8 FTC Shallow End Drainage Pump (DWC-P-1)

Note: Uses old IIF Processing Pump.

See Appendix 19.

2.1.1.9 DWC Reactor Vessel Filtration System Pumps (DWC-P-2A & B) Early Defueling

See Appendix 20.

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, 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 (CN-U-VA01). The standpipe is 16 inches in diameter and 16 feet long. It houses the off gas bottoms pump (CN-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.

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 processed water storage tanks, 2) the SDS flush water supply header 3) the RCS manifold 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.

2.1.3.1.3 Sand Prefilter, Final Filter, and Cation Sand Filter

The sand filters 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, final filter, and cation sand 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.

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 and APCO 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.

2.1.3.2 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.

The SDS post filter may be bypassed during processing operations and its function assumed by a sand filter, similar to those previously discussed, installed in one of the cation positions.

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 ion exchange 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 Ion Exchange Vessels

The zeolite 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 1/8 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 to the off gas separator tank. 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 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 overhangs 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.

2.1.4.3 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 the reactor coolant bleed tanks. 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 offgas separator tank 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 ± 15°F and 320 ± 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.

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.

2.1.5.3 Stored Vessel Venting Manifold

A venting manifold is provided for exhausting gases generated in the stored ion exchange vessels after these vessels have been dewatered. 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 connected to the manifold 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 dewatered prior to storage in Spent Fuel Pool "B" or shipment to interim storage elsewhere on Three Mile Island. When it is decided 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.

Also see Appendix 16, Liner Recombiner and Vacuum Outgassing System.

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, and 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 <u>Exchanger and Filter Vessel Lifting and Positioning Tools</u>

2.1.8.2.1 <u>Unspent Vessel Tool</u>: 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 disengaged 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 design 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 removed 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 al ow 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) Single J-hook Tool

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 end fitting.

(b) Double J-hook Tool

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 hose to be held securely during this lower operation.

(c) Inverted Y Tool

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 lowered into 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 off gas separator tank.

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 1 µci/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 the Liner Recombiner and Vacuum Outgassing System (Appendix 16).

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 SDS-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 gamma detector CN-RE-IX03. Only channels CN-RE-IX09 and CN-LC05 are recorded by the Multi-Point Recorder. It should be noted that the Beta Manifold is in place but has not been used to date or is its use planned in the future.

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).

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 Reactor Building 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. This switch may be temporarily reconfigured to remotely start and stop the Temporary RV Filtration System. Control for pump WG-P-1 is also located on CN-PNL-1 with "Remote-Local" selector switch.

The 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 Off-Gas Bottoms Pump has an "Auto/Off/On" key-operated selector switch. This pump is used in the manual position and tank contents are pumped out by operator action.

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

After filtration by the pre and final filters, the influent water 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 RCS cleanup manifold (CN-TI-RC07). Measurement is made with a thermocouple with a hot junction welded to the feed line. 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 pressure 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
A_6	New Fuel Pit Level Hi	FCC-LSHL-5
B_1	IIF Level Hi	RC-LIS-103
B_2	IIF Level Lo	RC-LIS-103
B_6	New Fuel Pit Level Lo	FCC-LSHL-5

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 are 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. RCS Manifold Containment DP Lo	CN-DPSL-VA12
4. Filter Manifold Containment Sump Level Hi	CN-LS-FL06
5. Hi Rad Filter Sample Glove Box Sump Level Hi	CN-LSH-SA07
6. 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.

Control Room Panel (SPC-PNL-3)

The following IIF alarms are located on SPC-PNL-3 in the main control room:

ALARM	ACTUATED BY
21. IIF Level Hi	RC-LIS-103
22. IIF Level Lo	RC-LIS-103
23. Bubbler Air Supply Pressure Lo	RC-PSL-105
FCC Level Hi/Lo	FCC-LIS-103

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 System Operation

3.2.1 Filter Operation Start-Up

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 processing operation. After system operators have completed the line up to filter the influent water, they will start the Reactor Building Jet pump (SWS-P-1), or other applicable pumps. Initially, all system parameters will be continuously monitored until proper operation of the system has been verified.

3.2.2 Normal Operation

The filtration operation will be a batch process (the water will be filtered and the water processed.

System parameters will be periodically monitored while filtering the influent water. SDS filters will be replaced if instruments indicate they are expended. Changing out a filter requires the filtration operation to be secured.

Periodic sampling will be performed to provide an indication of the approximate chemical and radionuclide loading of the filters.

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 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. In some processing schemes this arrangement will differ.

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 completed, the operator will secure the feed pump and flush the system with demineralized water, or processed water.

The expended exchanger in the train, if any, 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

Replacement of a vessel located in the fourth (4) exchange position can be performed without securing the process evolution. When it is determined a cation vessel needs to be replaced in the fourth 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 roughing, 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 two 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 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
	MDCT
	WDL-T-1A, 1B, 1C
WDL-T-2	EPICOR II
	WDL-T-1A, 1B, 1C
	WDL-T-5
	WDL-T-8A, 8B
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	One (1) Operator
2.	Chemistry Department	One (1) Chemistry Technician as needed
3.	Radcon Department	One (1) Health Physics Technician as needed

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 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 Criteria to Mitigate Effects

SDS operation will be performed with as required 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, the man will be retrieved from the pool and processing and equipment handling will be stopped. 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 if necessary. 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 Jet Pump (SWS-P-1) & Off Gas Bottoms Pump

The SDS Jet 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 if necessary. 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 diaphram 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.

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 catagories:

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 was aligned in its normal operating mode and filled with demineralized water. System operating procedures were proof tested (red lined) and baseline data was taken from system instrumentation. This information was compared with the design points to verify system performance to be in accordance with the design. The system was 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 were verified. Tank level indication was verified. Remote tool operability was demonstrated. Filter and ion exchanger handling operations was 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.

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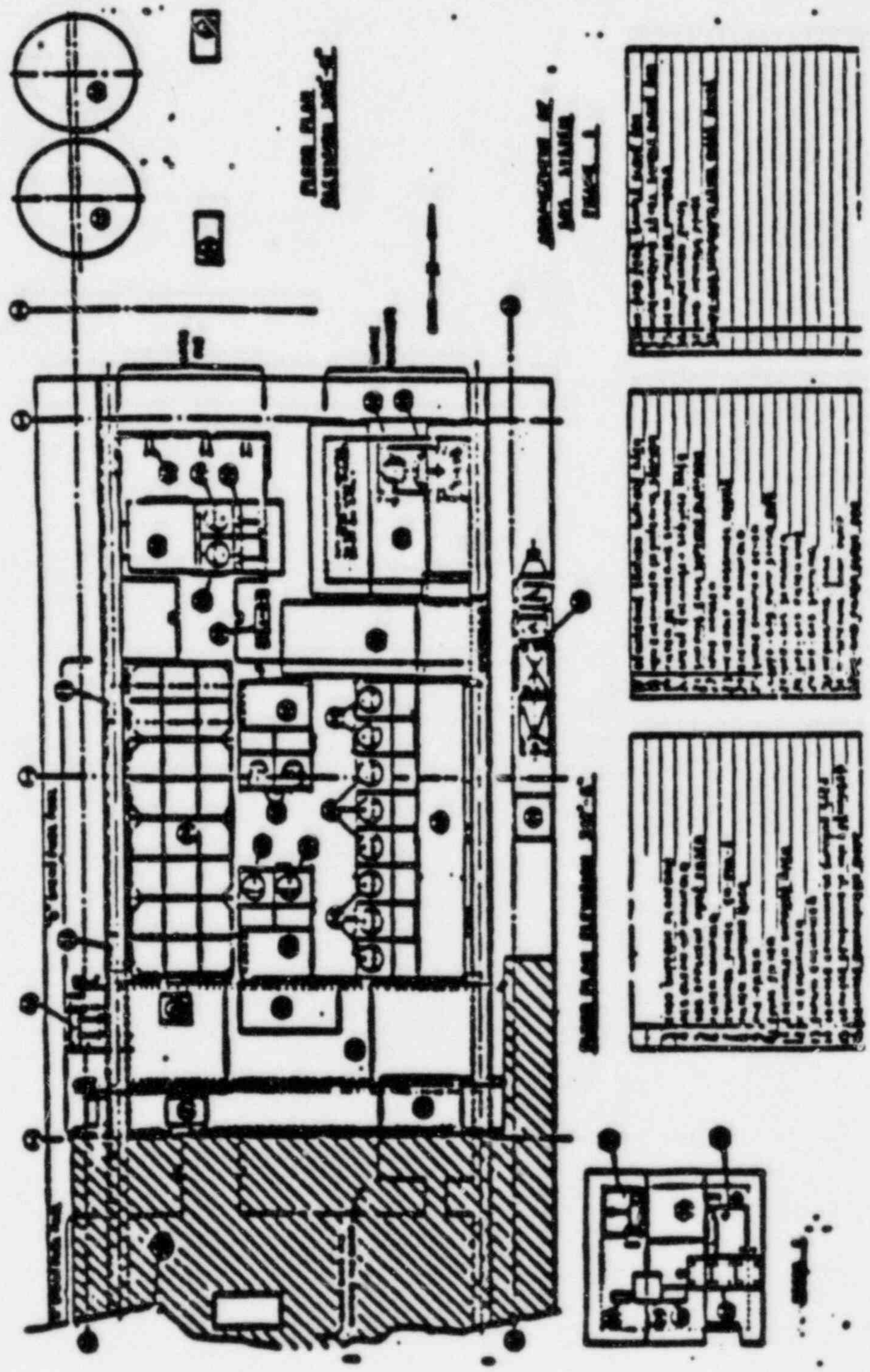
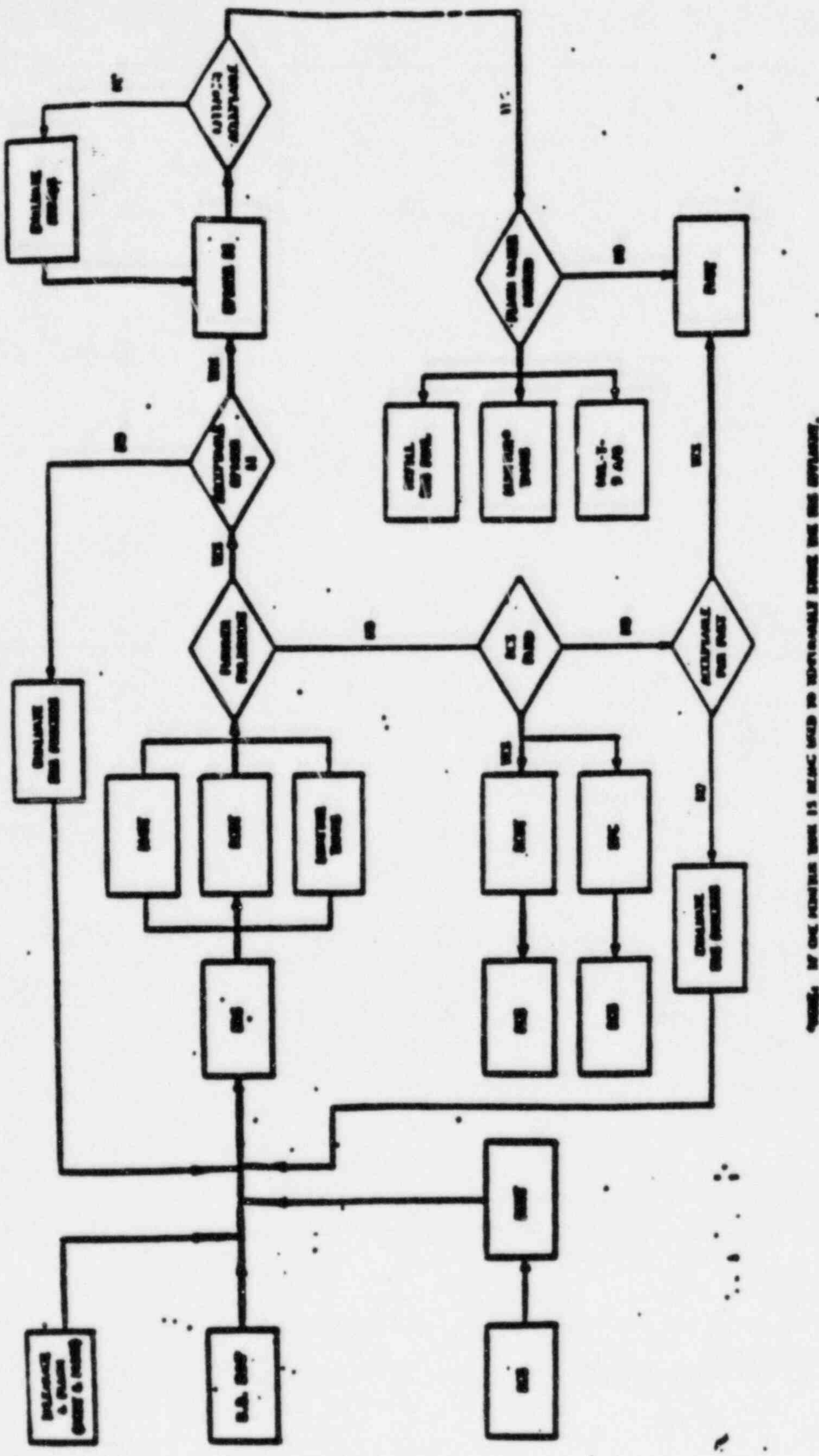


Fig. 2

PROCESSING LOGIC PLAN



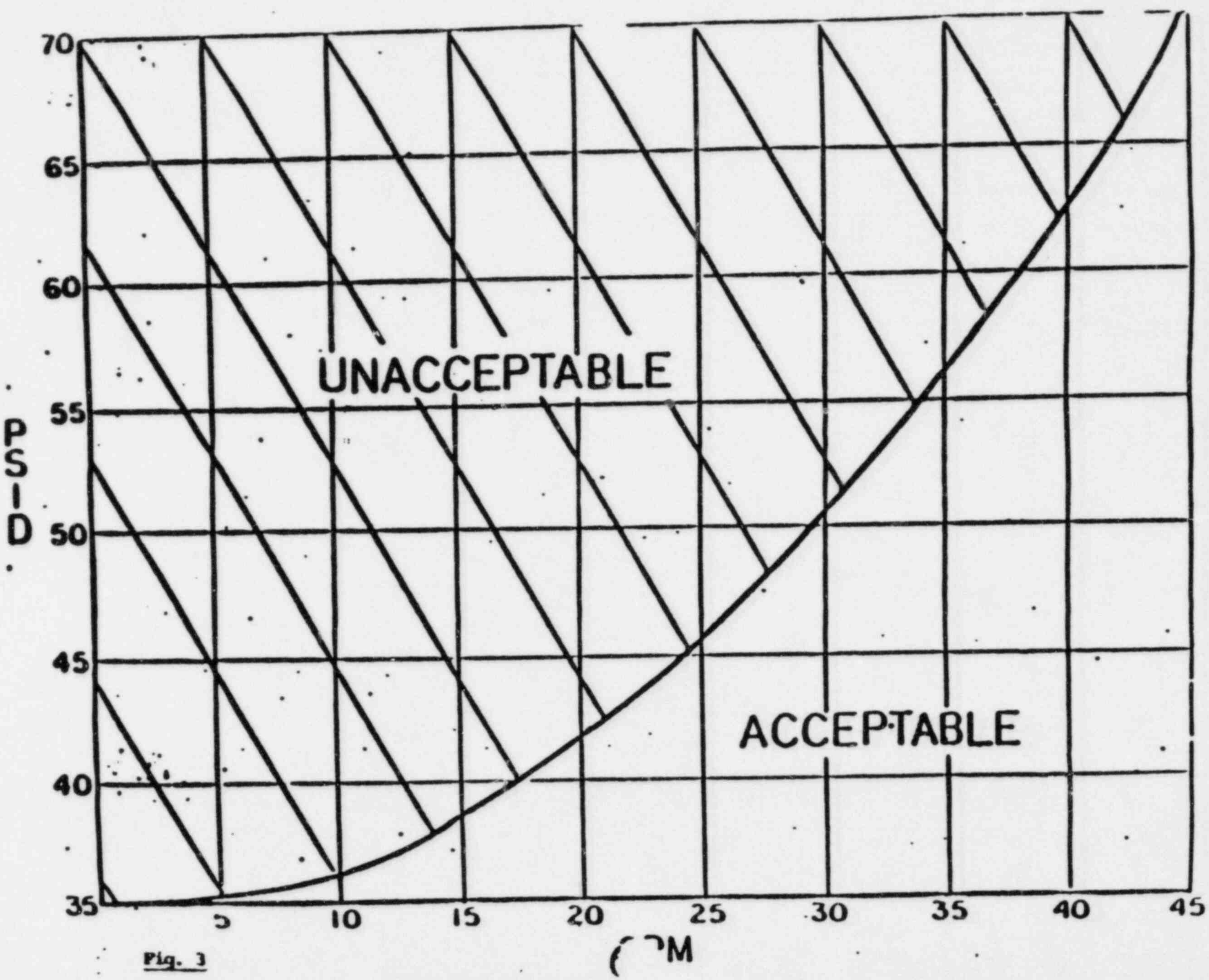


Fig. 3

SD 3527-005

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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-96/ Linde A	60,000 Ci(Cs)	- Zeolite Radiation Stability	60,000 Curies (Total Cs)	12-15
SDS	2	2 x 4	Same as SDS No. 1	IE-96/ 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-96/ 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-96/ Linde A	Same as SDS No. 1	- Same as SDS No. 1	N/A	1/train
EPICOR-II	5	6 x 6	Na Removal		2 Ci Cs+Sr	- Dewatered Burial *	<2 Curies Cs+Sr	
				Strong Acid Cation Mixed Cation/ Anion, or IE-96/Linde A	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	2 Ci Cs+Sr	- Dewatered Burial *	<2 Curies Cs+Sr	<5
EPICOR-II	7	4 x 4	Polishing Backup	Organic Cation/Anion	0.6 Ci Cs+Sr	- Dewatered Burial *	<0.6 Curies Cs+Sr	<5

* Assumes Licensing variance from 10 CFR 61 requirements

SD 3527-005

TABLE 2
SDS COMPONENT VENTS AND DRAINS

SDS COMPONENT	VENTS TO	DRAINS TO	
Ion Exchange Manifold	Offgas Filters	Offgas Separators	
Beta Monitoring Manifold	Offgas Filters	Offgas Separators	
RCS Cleanup Manifold	Offgas Filters	Offgas Separators	
High Rad Filter Sample Glovebox	Offgas Filters	Offgas Separators	
High Rad Feed Sample Glovebox	Offgas Filters	Offgas Separator	
Intermediate Level Sample Glovebox	Offgas Filters	Offgas Separator	
Ion Exchange Trains	Offgas Separator	Leakage Containment	
Final Filter	Offgas Filter	Leakage Containment	
Pre Filter	Offgas Filter	Leakage Containment	
SDS Post Filter Enclosure	Offgas Filters	Lined with Herculon NO DRAIN	
Vessel Storage Racks	Common Vent to Offgas Filters/ Hi Rad Filter Sample Glovebox; Line Drainable To Pool	Pool	
SDS Monitor Tanks	Existing F.H.B. Exhaust	Existing Bldg. Drain	
Offgas Separator	Offgas Filters	RCS manifold	
Offgas Filters	Building Stack	N/A	

SD 3527-005

Appendix No. 1

to

Submerged Demineralizer System

System Design Description

Title

S.D.S. Pumps/Blowers

Appendix 1

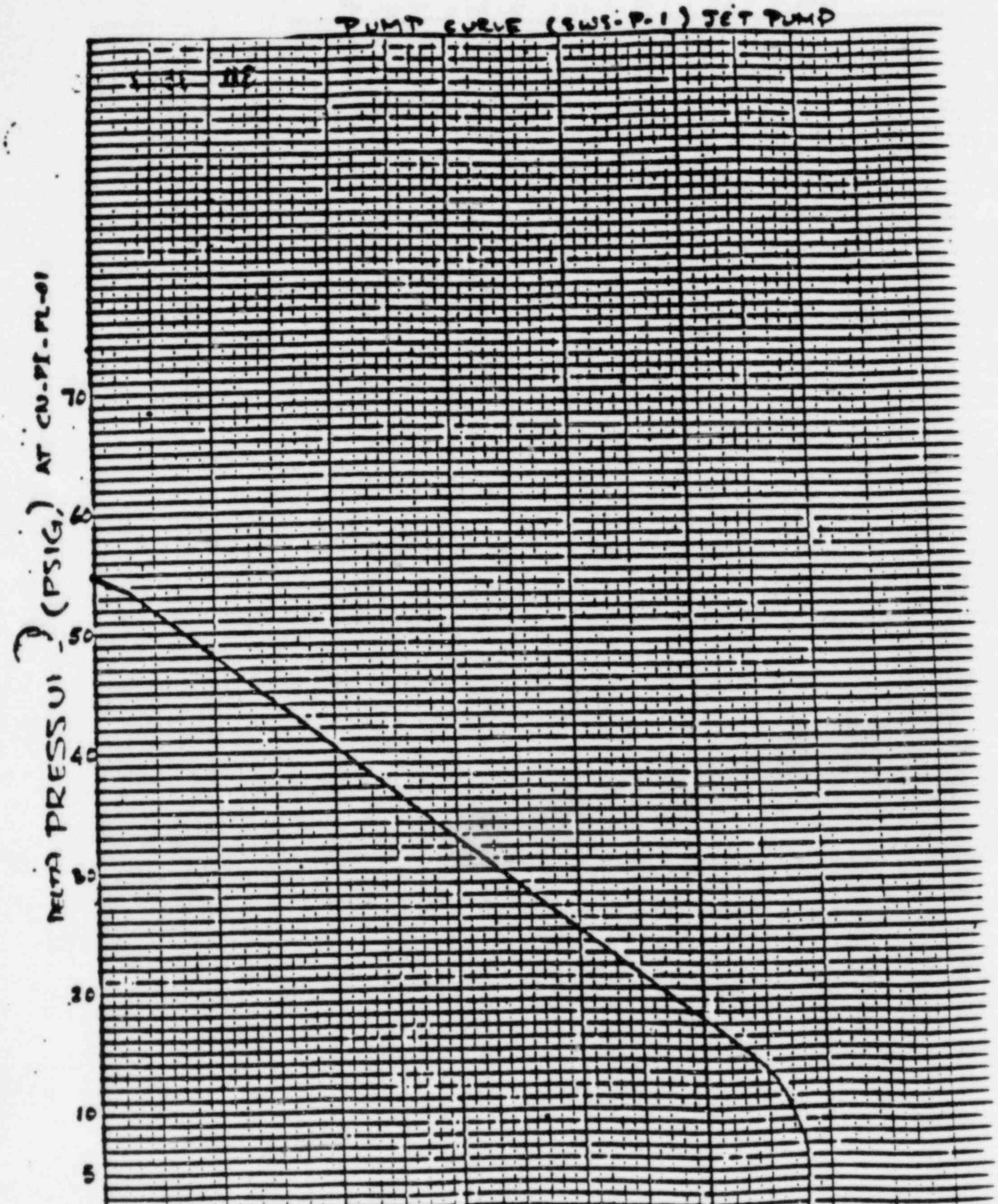
SDS PUMPS/BLOWERS

Pump Details

Identification	SWS-P-1
Noun Name	Reactor Building Basement Jet Pump
Manufacturer	Goulds Pumps Inc.
Model No.	GHISD
Type	Deep Well Jet Pump with Packer assembly
Standard Material Designation	Cast Iron
Rated Speed	3450 RPM
Rated Capacity	25 GPM
Rated Total Dynamic Head	113 ft.
Design Temperature	40°C
Lubricant	Water
Packer	Goulds - FP2-14
Well Head Adapter	Goulds - AWJ-2

Motor Details

Manufacturer	Wagner
Type	C
Rated Horse Power	1 1/2 HP
Rated Speed	3450 RPM
Lubricant/Coolant	Oil/Air
Power Requirements	115/230 Volts, Phase 60 Hz, 17.5/8.75 Amps
Power Source	PDP-2B


PUMP CURVE (SWS-P-1) JET PUMP
DELTA PRESSURE (PSIG) AT CU-PI-PL-01
70
60
50
40
30
20
10
5
1
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4
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13
14
FLOW RATE (GPM)

Appendix 1

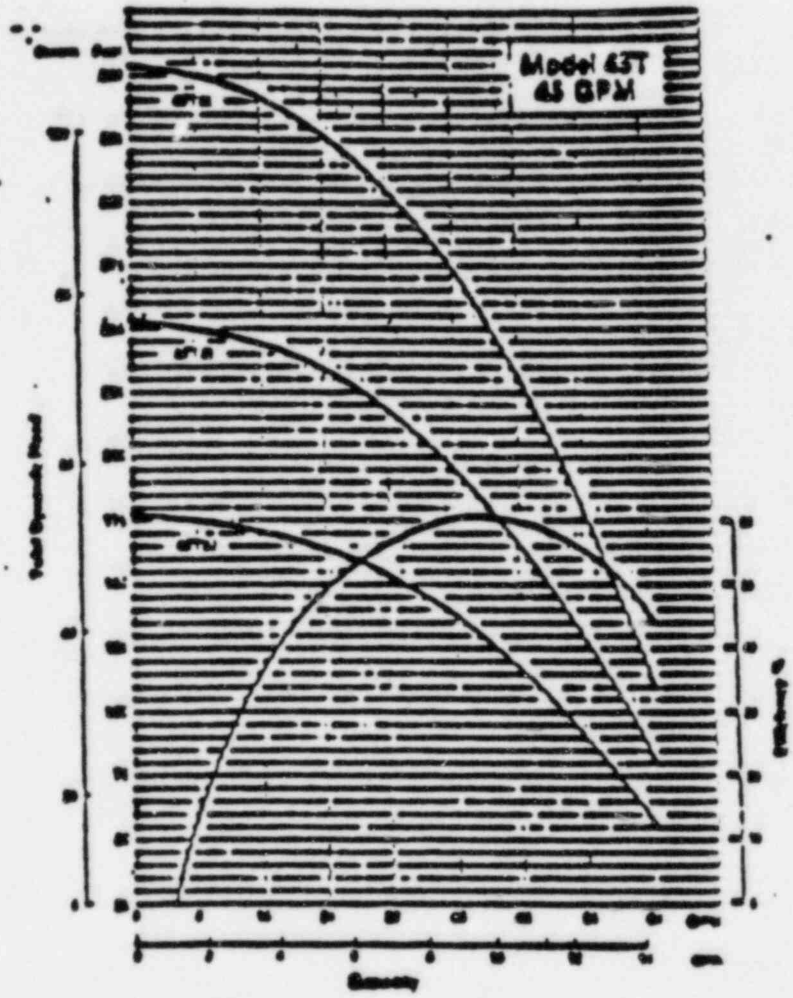
SDS PUMPS/BLOWERS

Pump Details

Identification	DWC-P-1
Noun Name	Fuel Transfer Canal Shallow End Drain Pump
Manufacturer	Goulds Pumps Inc.
Model No.	4ST05434
Type	Submersible
Standard Material Designation	Stainless Steel
Rated Speed	3500 RPM
Rated Capacity	15 GPM
Rated Total Dynamic Head	345 ft. • 15 gpm
Design Temperature	100°F (140°F max.)
Lubricant	Water

Motor Details

Manufacturer	Franklin Electric
Model	2341272003
Enclosure	Stainless Steel
Rated Horse Power	5 HP
Rated Speed	3450 RPM
Lubricant/Coolant	Water/Air
Power Requirements	460 Volts, 3 Phase 60 Hz, 8.7 Amps
Power Source	PDP-6A



Pump Curve For Fuel Transfer Canal
Shallow End Drain Pump (Goulds 4ST05434)

Appendix 1

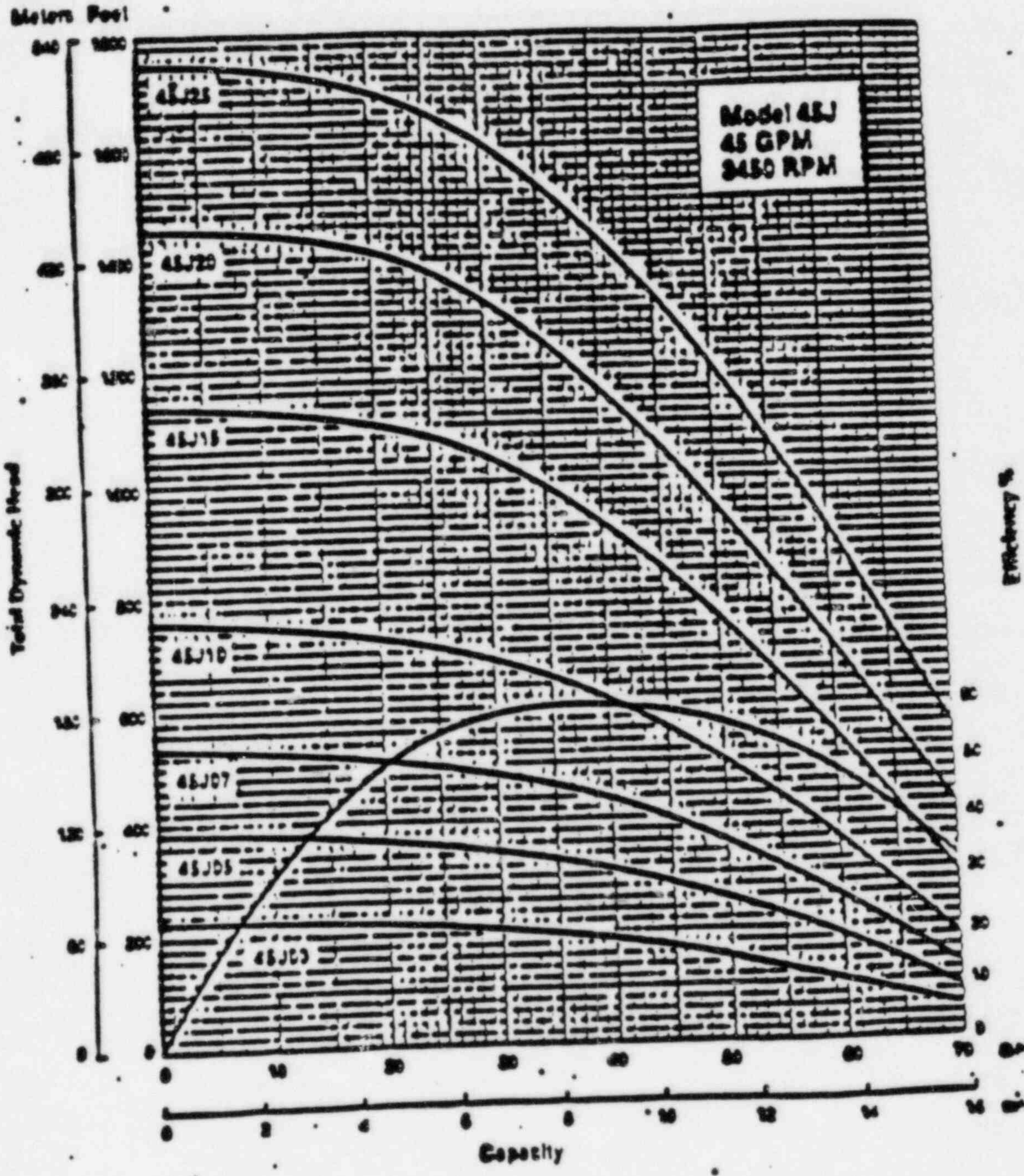
SDS PUMPS/BLOWERS

Pump Details

Identification	FCC-P-1
Noun Name	Fuel Transfer Canal Drain Pump
Manufacturer	Goulds Pumps Inc.
Model No.	45J05434
Type	Submersible
Standard Material Designation	Stainless Steel
Rated Speed	3500 RPM
Rated Capacity	45 GPM
Rated Total Dynamic Head	280 ft • 45 GPM
Design Temperature	100°F
Lubricant	Water

Motor Details

Manufacturer	Franklin Electric
Model	2341272003
Enclosure	Stainless Steel
Rated Horse Power	5 HP
Rated Speed	3450 RPM
Lubricant/Coolant	Water/air
Power Requirements	460 Volts, 3 Phase 60 Hz, 8.7 Amps
Power Source	PDP-6-A



Pump Curve for Fuel Transfer Canal Drain Pump TCC-P-1 (Goulds 45J05)

0321y LC

Appendix 1

SDS PUMPS/BLOWERS

Pump Details

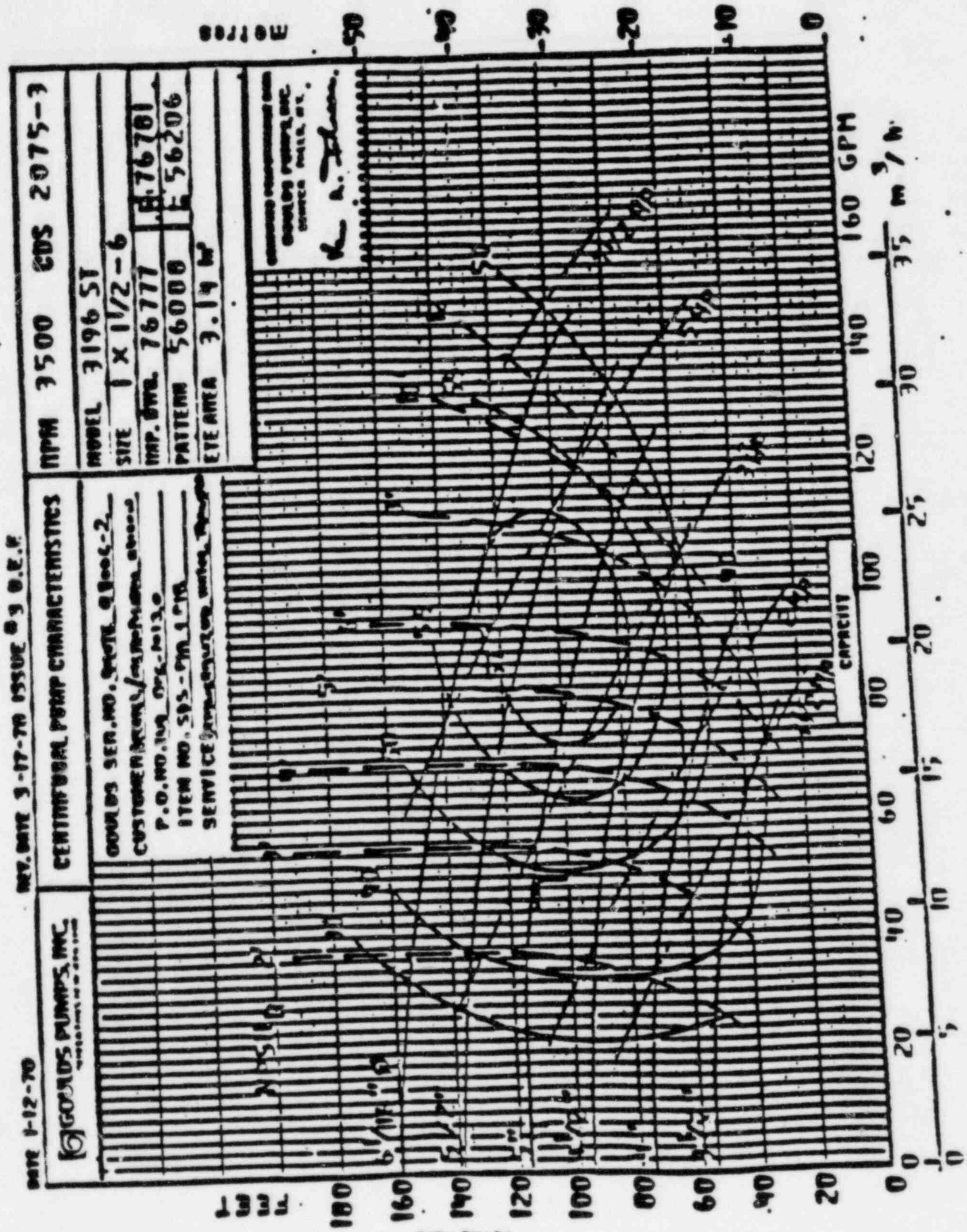
Identification	SDS-P-1A and SDS-P-1B
Noun Name	Monitor Tank Transfer Pumps
Manufacturer	Goulds Pumps Inc.
Model No.	3196 "ST"
Type	Double Mechanical Seal - Centrifugal
Standard Material Designation	Stainless Steel
Rated Speed	3500 RPM
Rated Capacity	50 GPM
Rated Static Pressure	111 Ft.
Design Temperature	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 & SDS SDD SDS-P-1A & SDS-P-1B

Appendix 1

SDS PUMPS/BLOWERS

Pump Details

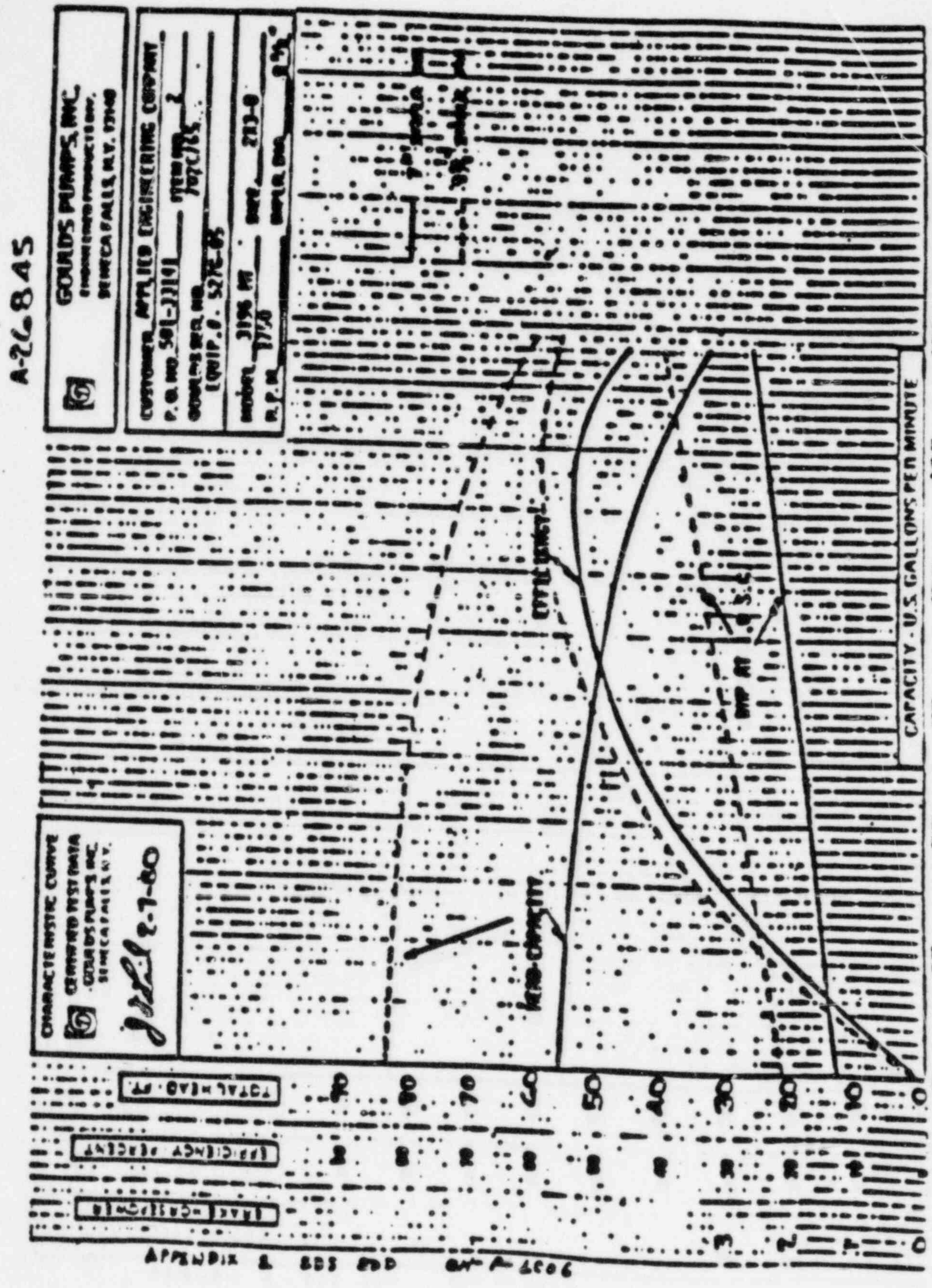
Identification	CN-P-LC06
Noun Name	Leakage Containment System Pump
Manufacturer	Goulds Pumps Inc.
Model No.	3196 MT-A-60
Type	Centrifugal
Standard Material Designation	316 S.S.
Rated Speed	1750 RPM
Rated Capacity	120 GPM
Rated Static Pressure	55 Ft.
Design Temperature	100°F
Lubricant	Water

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
GOULDS PUMPS, INC.
SENECA FALLS, N.Y.
CHARACTERISTIC CURVE
CERTIFIED TEST DATA
GOULDS PUMPS INC
SENECA FALLS, N.Y.
8-7-80
TOTAL HEAD - FT.
EFFICIENCY PERCENT
CAPACITY - U.S. GALLONS PER MINUTE
0
25
50
75
100
125
150
10
20
30
40
50
60
70
80
90

Appendix 1

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 Static Pressure	65 Ft.
Design Temperature	100°F
Lubricant	Water

Motor Details

Manufacturer	Franklin
Type	Submersible
Enclosure	Henmetically 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-PDP 6A

Reference

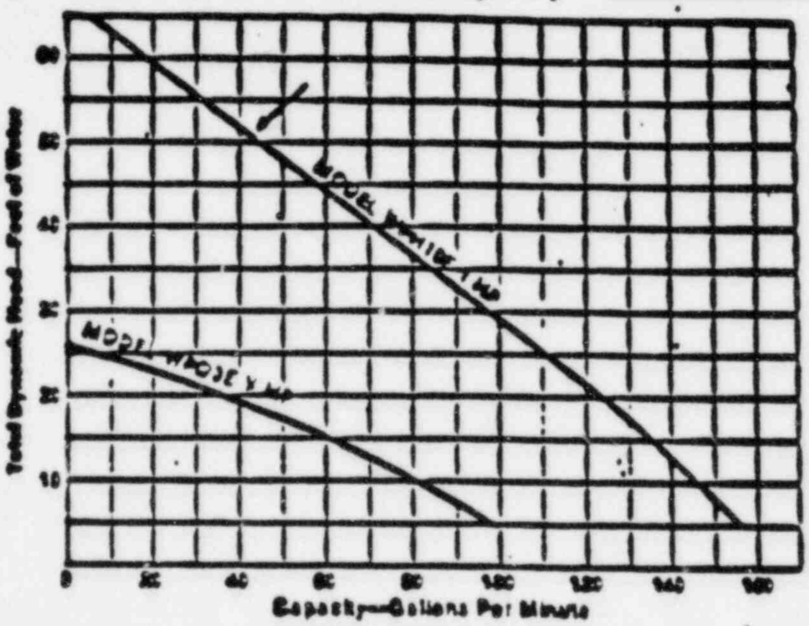
Drawing No.	DS-527-G-05, Rev. 2

SPECIFICATIONS

Order No.	HP	Volts	Phase	RPM	Solids	Max. Amps	Wt.
WPD311E	1/2	115	1	1750	2"	9.4	[illegible]

Order No.	HP	Volts	Phase	RPM	Solids	Max. Amps	Wt.
WPH1012E	1	230	1	3450	2"	11.0	70
[illegible]	1	208/230	3	3450	2"	7	70
[illegible]	1	460	3	3450	2"	3.5	70

PERFORMANCE RATING (GPM)



WPD3 (½ HP)	TDH	GPM
Total Dynamic Head Feet to Water	5	100
	10	[illegible]
	15	[illegible]
	20	35
	25	5

WPH10 (1 HP)	TDH	GPM
Total Dynamic Head Feet to Water	10	147
	20	134
	30	[illegible]
	40	71
	50	45
	60	[illegible]

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
2" Solids Handling Capability
2" NPT Discharge Connection

Package Includes:

- Submersible Sewage Pump (WPD311E) or (WPH1012E)
- Mercury Level Control Switch (ALS2-6 for ½ H.P. package) (ALS2-7 for 1 H.P. package)
- Magnetic Contactor (ALS3-1 with 1 H.P. units only).
- Polyethylene Basin (ALS1-1801P)
- Basin Cover (ALS8-1822S)
- Check Valve (ALS9-2)

Order No. SWPD311E 115 Volts, 85 Lbs.
Order No. SWPH1012E 230 Volts, 109 Lbs

GOULDS PUMPS, INC.
SENECA FALLS, NEW YORK 13148

APPENDIX E
SDS 800
OW-P-VA09

Form No. [illegible]

Appendix 1

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 Instruction Manual

"E" and "RE" BLOWERS and EXHAUSTERS

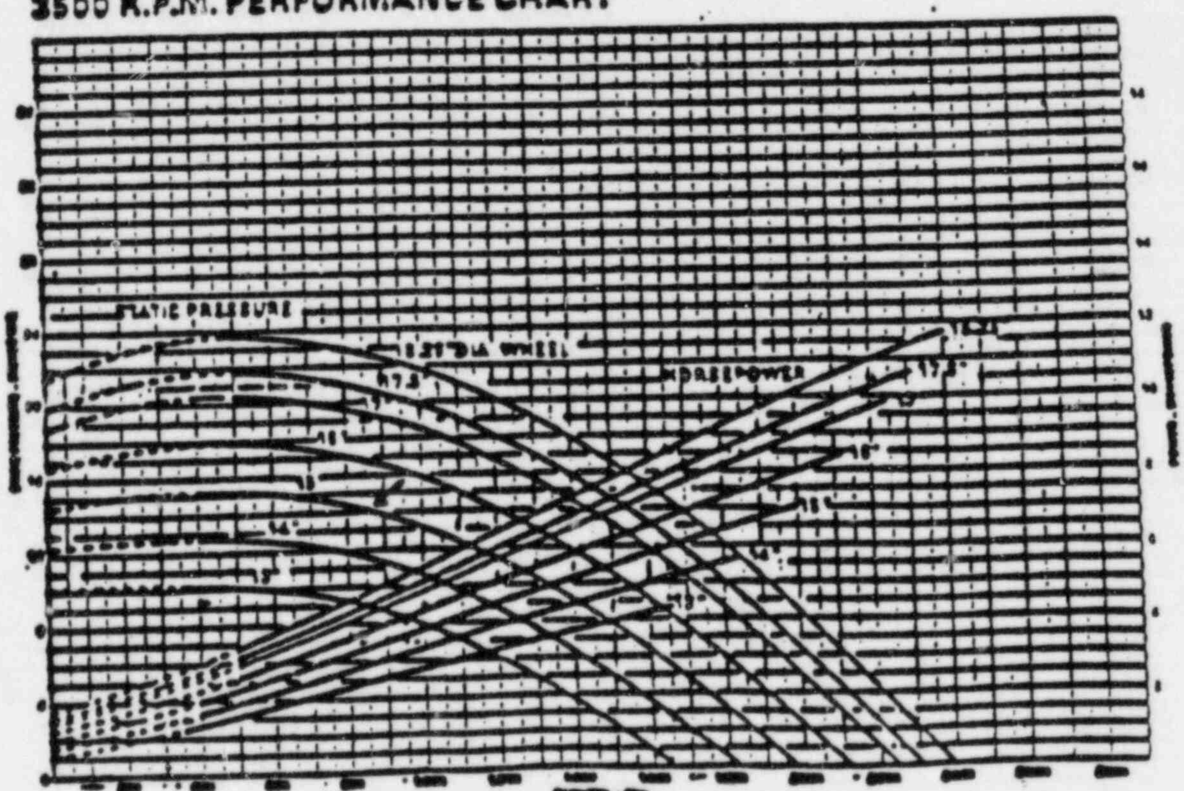
CAPACITIES and STATIC PRESSURES

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

Ratings are for standard air at [illegible] lbs per cubic foot density at [illegible] 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.

[illegible]	[illegible] Wheel		[illegible] Wheel		[illegible] Wheel		[illegible] Wheel	
C.F.M.	S.P.	B.H.P.	S.P.	B.H.P.	S.P.	B.H.P.	S.P.	B.H.P.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

3500 R.P.M. PERFORMANCE CHART



APPENDIX 1 SDS SDD GN-E-VA05

Appendix 1

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

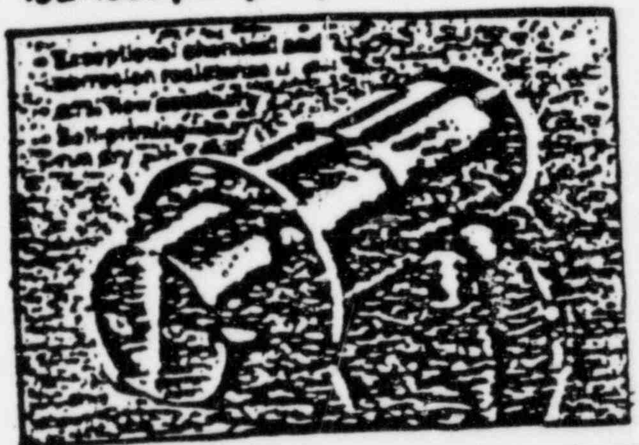
Motor Details

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



[illegible]

[illegible]

Magnetic drive 2 and 3 gear pumps...
with patented suction-shoe design

[illegible]

[illegible]

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. 2

to

Submerged Demineralizer System

System Design Description

Title

SDS Filter Vessels

APPENDIX NO. 2

PREFILTER/FINAL FILTER

Vessel Details

Identification (Prefilter) (Final Filter)	F-10001 Series F-20001 Series
Number Installed	Two (2)
Manufacturer	APCO
Installation	Vertical
Outside Diameter/Height, ft. in.	2 Ft. 1/2 In./4 Ft. 5 1/2 Inch
Shell Thickness	3/16 Inch
Shell Material	Stainless Steel (304)
Design Pressure/Temperature	150 PSIG/100°F
Volume	10 Cubic Feet
Prefilter Media	125 Micron Cuno or Layered Sand
Final Filter Media	10 Micron Cuno or Layered Sand

APPENDIX NO. 2

PREFILTER/FINAL FILTER

Vessel Details

Identification (Prefilter) (Final Filter)	D-00001 Series
Number Installed	Two (2)
Manufacturer	APCO
Installation	Vertical
Outside Diameter/Height, ft. in.	2 Ft. 1/2 In./4 Ft. 5 1/2 Inch
Shell Thickness	3/16 Inch
Shell Material	Stainless Steel (304)
Design Pressure/Temperature	350 PSIG/100°F
Volume	10 Cubic Feet
Prefilter Media	Layered Sand
Final Filter Media	Layered Sand

APPENDIX NO. 2

PREFILTER/FINAL FILTER

Vessel Details

Identification (Prefilter) (Final Filter)	D-2003X Series
Number Installed	Two (2)
Manufacturer	Buffalo
Installation	Vertical
Outside Diameter/Height, ft. in.	2 Ft. 1/2 In./4 Ft. 5 1/2 Inch
Shell Thickness	3/8 Inch
Shell Material	Stainless Steel (316L)
Design Pressure/Temperature	350 PSIG/100°F
Volume	10 Cubic Feet
Prefilter Media	Layered Sand
Final Filter Media	Layered Sand

APPENDIX NO. 2

PREFILTER/FINAL FILTER/"CATION" SAND FILTER

Vessel Details

Identification (Prefilter) (Final Filter)	U-00001 Series
Number Installed	Two (2)
Manufacturer	APCO/Buffalo
Installation	Vertical
Outside Diameter/Height, ft. in.	2 Ft. 1/2 In./4 Ft. 5 1/2 Inch
Shell Thickness	3/8 Inch
Shell Material	Stainless Steel (316L)
Design Pressure/Temperature	350 PSIG/100°F
Volume	10 Cubic Feet
Prefilter Media	Layered Sand
Final Filter Media	Layered Sand
"Cation" Sand Filter Media	Layered Sand

Appendix No. 3

to

Submerged Demineralizer System

System Design Description

Title

SDS Demineralizer Vessels

APPENDIX NO. 3

ZEOLITE DEMIN VESSELS

Vessel Details

Identification	D-10011 through D-10018 (Permutit) D-20021 through D-20042 (Buffalo Tank) U-00001 through U-00047 (Buffalo/APCO)
Number Installed	Six (6)
Manufacturer	Permutit/Buffalo Tank/APCO
Installation	Vertical
Outside Diameter/Height, ft. in.	2 Ft. 1/2 In./4 Ft. 5 1/2 Inch
Shell Thickness	3/8 Inch
Shell Material	Stainless Steel (316L)
Design Pressure/Temperature	350 PSIG/400°F
Volume	10 Cubic Feet

Appendix No. 3 (Cont'd)

LEAKAGE CONTAINMENT ION EXCHANGE VESSELS

Vessel Details

Identification	D-00001 through D-00010
Number Installed	Two (2)
Manufacturer	APCO
Installation	Vertical
Outside Diameter/Height, ft. in.	2 Ft. 1/2 In./4 Ft. 5 1/2 Inch
Shell Thickness	3/16 Inch
Shell Material	Stainless Steel (304)
Design Pressure/Temperature	150 PSIG/100°F
Volume	10 Cubic Feet

Appendix No. 4

to

Submerged Demineralizer System

System Design Description

Title

Waste Storage Tanks

(Deleted)

Appendix No. 5

to

Submerged Demineralizer System

System Design Description

Title

SDS Monitor Tanks

APPENDIX NO. 5

SDS MONITOR TANKS

Vessel Details

Identification	SDS-T-1A through SDS-T-1B
Manufacturer	Buffalo Tank
Number Installed	Two (2)
Design Capacity, Gallons	12,000 Gal. Each
Installation	Vertical
Outside Diameter/Height, ft. in.	8 Ft./32 Ft.
Shell Material	Stainless Steel (304)
Shell Thickness, In.	3/16 Inch
Design Temperature, °F	Amb.
Design Pressure, PSIG	Atmospheric
Corrosion Allowance, In.	None
Design Code	API-650, Appendix J
Code Stamp Required	API-650, Appendix J

Appendix No. 5 (Cont'd)

MONITOR TANK 1A/1B VOLUME VERSUS LEVEL

Level Indication	Tank Volume	Level Indication	Tank Volume	Level Indication	Tank Volume
0	156	135	4353	270	8550
1	187	136	4384	271	8581
2	218	137	4415	272	8612
3	249	138	4446	273	8643
4	280	139	4477	274	8674
5	311	140	4509	275	8705
6	342	141	4539	276	8736
7	373	142	4570	277	8767
8	404	143	4601	278	8799
9	435	144	4632	279	8830
10	466	145	4664	280	8861
11	498	146	4695	281	8892
12	529	147	4726	282	8923
13	560	148	4757	283	8954
14	591	149	4788	284	8985
15	622	150	4819	285	9016
16	653	151	4850	286	9047
17	684	152	4881	287	9078
18	715	153	4912	288	9109
19	746	154	4943	289	9141
20	777	155	4974	290	9172
21	808	156	5006	291	9203
22	840	157	5037	292	9234
23	871	158	5068	293	9265
24	902	159	5099	294	9296
25	933	160	5130	295	9327
26	964	161	5161	296	9358
27	995	162	5192	297	9389
28	1026	163	5223	298	9420
29	1057	164	5254	299	9451
30	1088	165	5285	300	9483
31	1119	166	5316	301	9514
32	1150	167	5348	302	9545
33	1181	168	5379	303	9576
34	1213	169	5410	304	9607
35	1244	170	5441	305	9638
36	1275	171	5472	306	9669
37	1306	172	5503	307	9700
38	1337	173	5534	308	9731
39	1368	174	5565	309	9762
40	1399	175	5596	310	9793
41	1430	176	5627	311	9824
42	1461	177	5658	312	9856
43	1492	178	5690	313	9887

Appendix No. 5 (Cont'd)

MONITOR TANK 1A/1B VOLUME VERSUS LEVEL (Cont'd)

Level Indication	Tank Volume	Level Indication	Tank Volume	Level Indication	Tank Volume
44	1523	179	5721	314	9918
45	1555	180	5752	315	9949
46	1586	181	5783	316	9980
47	1617	182	5814	317	10011
48	1648	183	5845	318	10042
49	1679	184	5876	319	10073
50	1710	185	5907	320	10104
51	1741	186	5938	321	10135
52	1772	187	5969	322	10166
53	1803	188	6000	323	10198
54	1834	189	6032	324	10229
55	1865	190	6063	325	10260
56	1897	191	6094	326	10291
57	1928	192	6125	327	10322
58	1959	193	6156	328	10353
59	1990	194	6187	329	10384
60	2020	195	6218	330	10415
61	2052	196	6249	331	10446
62	2083	197	6280	332	10477
63	2114	198	6311	333	10508
64	2145	199	6342	334	10539
65	2176	200	6374	335	10571
66	2207	201	6405	336	10602
67	2239	202	6436	337	10633
68	2270	203	6467	338	10664
69	2301	204	6498	339	10695
70	2332	205	6529	340	10726
71	2363	206	6560	341	10757
72	2394	207	6591	342	10788
73	2425	208	6622	343	10819
74	2456	209	6653	344	10850
75	2487	210	6684	345	10882
76	2518	211	6715	346	10913
77	2549	212	6747	347	10944
78	2581	213	6778	348	10975
79	2612	214	6809	349	11006
80	2643	215	6840	350	11037
81	2674	216	6871	351	11068
82	2705	217	6902	352	11099
83	2736	218	6933	353	11130
84	2767	219	6964	354	11161
85	2798	220	6995	355	11192
86	2829	221	7026	356	11224

Appendix No. 5 (Cont'd)

MONITOR TANK 1A/ 3 VOLUME VERSUS LEVEL (Cont'd)

Level Indication	Tank Volume	Level Indication	Tank Volume	Level Indication	Tank Volume
87	2860	222	7057	357	11255
88	2891	223	7089	358	11286
89	2923	224	7120	359	11317
90	2954	225	7151	360	11348
91	2985	226	7182	361	11380
92	3016	227	7213	362	11410
93	3047	228	7244	363	11441
94	3078	229	7275	364	11472
95	3109	230	7306	365	11503
96	3140	231	7337	366	11534
97	3172	232	7368	367	11566
98	3202	233	7389	368	11597
99	3283	234	7431	369	11628
100	3265	235	7462	370	11659
101	3296	236	7493	371	11690
102	3327	237	7524	372	11721
103	3358	238	7555	373	11752
104	3389	239	7586	374	11783
105	3420	240	7617	375	11814
106	3451	241	7648	376	11845
107	3482	242	7679	377	11876
108	3513	243	7710	378	11908
109	3544	244	7741	379	11939
110	3575	245	7773	380	11970
111	3606	246	7804	381	12001
112	3638	247	7835	382	12032
113	3669	248	7866	383	12063
114	3700	249	7897	384	12094
115	3731	250	7928	385	12125
116	3762	251	7959	386	12156
117	3792	252	7990	387	12188
118	3824	253	8021	388	12219
119	3855	254	8052	389	12250
120	3886	255	8083	390	12281
121	3917	256	8115	391	12312
122	3948	257	8146	392	12343
123	3980	258	8177	393	12374
124	4011	259	8208	394	12405
125	4042	260	8239	395	12436
126	4073	261	8270	396	12467
127	4104	262	8301	397	12498
128	4135	263	8332	398	12529
129	4166	264	8363	399	12561
130	4197	265	8394	400	12592

Appendix No. 5 (Cont'd)

MONITOR TANK 1A/1B VOLUME VERSUS LEVEL (Cont'd)

Level Indication	Tank Volume	Level Indication	Tank Volume	Level Indication	Tank Volume
131	4228	266	8425		
132	4259	267	8457		
133	4290	268	8488		
134	4322	269	8519		

Appendix No. 6

to

Submerged Demineralizer System

System Design Description

Title

SDS Off Gas Separator Tank

APPENDIX NO. 6

SDS OFF GAS SEPARATOR TANK

Vessel Details

Identification	CN-T-VA02
Manufacturer	APCO
No. Installed	One (1)
Design Capacity, Gallons	590 Gal. Each
Installation	Vertical
Outside Diameter/Height, ft. in.	36 In./10 Ft.
Shell Material	Stainless Steel (304)
Shell Thickness	3/16 Inch
Design Temperature, °F	100°F
Design Pressure, PSIG	16 PSIG
Corrosion Allowance, In.	None
Design Code	ASME Section VIII, Div. 1
Code Stamp Required	ASME Section VIII, Div. 1

Appendix No. 6 (Cont'd)

OFF GAS SEPARATOR TANK VOLUME VERSUS LEVEL

Level Indication (percent)	Tank Volume (gallons)	Level Indication (percent)	Tank Volume (gallons)	Level Indication (percent)	Tank Volume (gallons)
0	25.8	40	198.5	80	371.7
1	30.2	41	202.8	81	375.3
2	34.5	42	207.1	82	379.7
3	38.8	43	211.4	83	383.9
4	43.2	44	215.7	84	388.3
5	47.5	45	220.0	85	392.6
6	51.8	46	224.3	86	396.9
7	56.1	47	228.7	87	401.2
8	60.4	48	232.9	88	405.5
9	64.7	49	237.3	89	469.9
10	69.0	50	241.6	90	414.2
11	73.4	51	245.9	91	418.5
12	77.7	52	250.2	92	422.8
13	82.0	53	254.5	93	427.1
14	86.3	54	258.9	94	431.4
15	90.6	55	263.2	95	435.7
16	94.9	56	267.5	96	446.1
17	99.2	57	271.8	97	444.4
18	103.5	58	276.1	98	448.7
19	107.9	59	280.4	99	453.0
20	112.2	60	284.7	100	457.3
21	116.5	61	289.1		
22	120.8	62	293.4		
23	125.1	63	297.7		
24	129.4	64	302.0		
25	133.7	65	306.3		
26	138.1	66	310.6		
27	142.4	67	314.9		
28	146.7	68	319.3		
29	151.0	69	323.6		
30	155.3	70	327.9		
31	159.6	71	332.2		
32	163.9	72	337.5		
33	168.3	73	340.8		
34	172.6	74	345.1		
35	176.9	75	349.5		
36	181.2	76	353.8		
37	185.5	77	358.1		
38	189.8	78	362.4		
39	194.1	79	366.7		

NOTE: The above values represent tank volume versus level and do not include corrections for water in the standpipe. The standpipe has a linear relationship of 0.81 gallons per percent.

Appendix No. 7

to

Submerged Demineralizer System

System Design Description

Title

S.D.S. Instrument List

Appendix No. 7

SDS INSTRUMENT INDEX

FUNCTIONAL CODE UNDER
REMARKS: I-INDICATION
C-CONTROL
A-ALARM

TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
CN-PI-FL01	Filtration Manifold Influent Pressure Gage	Filter Manifold	Ashcroft	1279S	0-160 psi	N/A	I
CN-PI-FL02	Filter Influent Sample Pressure Gage	High Rad Filter Sample Glove Box	Ashcroft	1279S	0-160 psi	N/A	I
CN-PI-FL03	Prefilter Influent Pressure Gage	Filter Manifold	Ashcroft	1279S	0-160 psi	N/A	I
CN-PI-FL04	Prefilter Effluent Pressure Gage	Filter Manifold	Ashcroft	1279S	0-160 psi	N/A	I
CN-PI-FL05	Final Filter Effluent Pressure Gage	Filter Manifold	Ashcroft	1279S	0-160 psi	N/A	I
CN-PI-FL06	Filter Effluent Sample Pressure Gage	High Rad Filter Sample Glove Box	Ashcroft	1279S	0-160 psi	N/A	I
CN-PI-IX08	IX Manifold Influent Pressure Gage	IX Manifold	Ashcroft	1279S	0-160 psi	N/A	I
CN-PI-IX09	Train No. 1 IX "A" Effluent Pressure Gage	IX Manifold	Ashcroft	1279S	0-160 psi	N/A	I
CN-PI-IX10	Train No. 1 IX "B" Effluent Pressure Gage	IX Manifold	Ashcroft	1279S	0-160 psi	N/A	I

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TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
CN-PI-IX11	Train No. 1 IX "C" Effluent Pressure Gage	IX Manifold	Ashcroft	1279S	0-160 psi	N/A	I
CN-PI-IX12	Train No. 2 IX "A" Effluent Pressure Gage	IX Manifold	Ashcroft	1279S	0-160 psi	N/A	I
CN-PI-IX13	Train No. 2 IX "B" Effluent Pressure Gage	IX Manifold	Ashcroft	1279S	0-160 psi	N/A	I
CN-PI-IX14	Train No. 2 IX "C" Effluent Pressure Gage	IX Manifold	Ashcroft	1279S	0-160 psi	N/A	I
CN-PI-IX15	Cation Effluent Pressure Gage	IX Manifold	Ashcroft	1279S	0-160 psi	N/A	I
CN-PI-IX16	IX Manifold Flushline Pressure Gage	IX Manifold	Ashcroft	1279S	0-160 psi	N/A	I
CN-PI-LC17	Leakage Containment Pump Discharge Pressure Gage	Above Leakage Containment IX	Ashcroft	1279S	0-60 psi	N/A	I
CN-PSL-LC17	Leakage Containment Pump Discharge Pressure Switch Low	Discharge of Leakage Containment Pump	Static "O" Ring	Pressure Switch Type 4NN-K5	1-50 psig	30 psig	A
CN-PAL-LC17	Leakage Containment Pump Discharge Pressure Low Alarm	Annunciation Panel No. 1	Ronan	X2-1003	N/A	30 psig	A
CN-PI-LC18	Leakage Containment IX "A" Effluent Pressure Gage	Above Leakage Containment IX	Ashcroft	1279S	0-60 psi	N/A	I

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TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
CN-PI-LC19	Leakage Containment IX "B" Effluent Pressure Gage	Above Leakage Containment IX	Ashcroft	1279S	0-60 psi	N/A	I
CN-PI-LC20	Leakage Containment Pump Suction Pressure Gage	Above Leakage Containment IX	Ametek	132210	0-30" Hg	N/A	I
CN-PSHH-VA28	Off Gas Header Influent Pressure Gage, Switch, Hi, Switch Hi-Hi	Off Gas Ventilation Unit	Dwyer	3015	0-15" H_2O	5 and 7 H_2O	I,C,A
CN-PAH-VA28	Off Gas Header Influent Pressure High Alarm	Annunciator Panel No. 1	Ronan	X2-1003	N/A	5" H_2O	A
CN-PI-VA29	Off Gas Blower Suction Pressure Gage	Off Gas Ventilation Unit	Dwyer	2015	0-15" H_2O	N/A	I
CN-PI-VA30	Off Gas Blower Discharge Pressure Gage	Off Gas Ventilation Unit	Dwyer	2004	0-4" H_2O	N/A	I
CN-PI-SA33	Removable Sample Cylinder Pressure Gage	Intermediate Level Sample Glove Box	Ashcroft	1000 TA	0-160 psi	N/A	I
CN-PI-SA34	Cation IX Effluent Sample Cylinder Pressure Gage	Intermediate Level Sample Box	Ashcroft	1000 TA	0-160 psi	N/A	I
CN-PI-SA35	Train No. 2 IX "C" Sample Cylinder Pressure Gage	Intermediate Level Sample Box	Ashcroft	1000 TA	0-160 psi	N/A	I
CN-PI-SA36	Train No. 1 IX "A" Sample Cylinder Pressure Gage	Intermediate Level Sample Box	Ashcroft	1000 TA	0-160 psi	N/A	I

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TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
CN-PI-SA37	Train No. 1 IX "B" Sample Cylinder Pressure Gage	Intermediate Level Sample Box	Ashcroft	1000 TA	0-160 psi	N/A	I
CN-PI-SA38	Train No. 2 IX "A" Sample Cylinder Pressure Gage	Intermediate Level Sample Box	Ashcroft	1000 TA	0-160 psi	N/A	I
CN-PI-SA39	Train No. 2 IX "B" Sample Cylinder Pressure Gage	Intermediate Level Sample Box	Ashcroft	1000 TA	0-160 psi	N/A	I
CN-PI-SA40	Train No. 1 IX "C" Sample Cylinder Pressure Gage	Intermediate Level Sample Box	Ashcroft	1000 TA	0-160 psi	N/A	I
CN-PI-SA41	Cation IX Influent Sample Cylinder Pressure Gage	Intermediate Level Sample Box	Ashcroft	1000 TA	0-160 psi	N/A	I
CN-PI-SA42	High Rad Feed Sample Pressure Gage	High Rad Feed Sample Box	Ashcroft	1279S	0-160 psi	N/A	I
CN-PI-DW43	Dewatering Station Demin Water Pressure Gage	Dewatering Station	Ashcroft	1220	0-160 psi	N/A	I
CN-PI-DW44	Dewatering Station Air Supply Pressure Gage	Dewatering Station	Ashcroft	1220	0-160 psi	N/A	I
CN-PI-DW45	Dewatering Station Tool Venting Pressure Gage	Dewatering Station	Ashcroft	1220	0-160 psi	N/A	I
CN-PI-1V50	Off Gas Bypass Control Valve Air Supply Pressure	Off Gas Ventilation Unit	Ashcroft		0-100 psi	N/A	I
CN-PI-VA51	Spent Vessel Offgas Sampling Gauge No. 1	West side of Fuel Pool B on Hand Rails	Ashcroft	12795	0-60 psi	N/A	I

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TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
CN-PI-VA52	Spent Vessel Offgas Sampling Gauge No. 2	West side of Fuel Pool B on Hand Rails	Ashcroft	12795	0-60 psi	N/A	I
CN-PI-VA53	Vessel Vent Hose Pressure Gauge	Attached to vessel storage rack vent manifold	Ashcroft	12795	0-60 psi	N/A	I
CN-PI-VA54	Vessel Vent Hose Pressure Gauge	Attached to vessel storage rack vent manifold	Ashcroft	12795	0-60 psi	N/A	I
CN-PI-VA55	Vessel Vent Hose Pressure Gauge	Attached to vessel storage rack vent manifold	Ashcroft	12795	0-60 psi	N/A	I
CN-PI-VA56	Vessel Vent Hose Pressure Gauge	Attached to vessel storage rack vent manifold	Ashcroft	12795	0-60 psi	N/A	I
CN-PI-VA57	Vessel Vent Hose Pressure Gauge	Attached to vessel storage rack vent manifold	Ashcroft	12795	0-60 psi	N/A	I
CN-PI-VA58	Vessel Vent Hose Pressure Gauge	Attached to vessel storage rack vent manifold	Ashcroft	12795	0-60 psi	N/A	I
CN-PI-VA59	Vessel Vent Hose Pressure Gauge	Attached to vessel storage rack vent manifold	Ashcroft	12795	0-60 psi	N/A	I

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TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
CN-PI-VA60	Vessel Vent Hose Pressure Gauge	Attached to vessel storage rack vent manifold	Ashcroft	12795	4-20 MADC 0-60 psi	N/A	I
CN-PI-VA61	Vessel Vent Hose Pressure Gauge	Attached to vessel storage rack vent manifold	Ashcroft	12795	0-60 psi	N/A	I
CN-PI-VA62	Vessel Vent Hose Pressure Gauge	Attached to vessel storage rack vent manifold	Ashcroft	12795	0-60 psi	N/A	I
SDS-PI-6	Monitor Tank Transfer Pump 1B Discharge Pressure Gauge (Local)	Rack SDS-R2	Robert-shaw	S-775-DM-4 1/2	0-100 psig	N/A	I
SDS-PT-9	Monitor Tank Transfer Pump 1B Discharge Pressure Transmitter	Rack SDS-R2	Foxboro	E11GM-1SAB1	0-100 psig 4-20 MADC	N/A	I
SDS-PI-9	Monitor Tank Transfer Pump 1B Discharge Pressure	Panel SDS-LCP-1	Magnetics	1151-VB420	4-20 MADC 0-100 psig	N/A	I
SDS-PI-8	Monitor Tank Transfer Pump 1A Discharge Pressure Gauge (Local)	Rack-SDS-R1	Robert-shaw	S-775-DM-4 1/2	0-100 psig	N/A	I

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TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
SDS-PT-10	Monitor Tank Transfer Pump 1A Discharge Pressure Transmitter	Rack SDS-R1	Foxboro	E11GM-ISAB1	0-100 psig 4-20 MADC	N/A	I
SDS-PI-10	Monitor Tank Transfer Pump 1A Discharge Pressure (Panel)	Panel SDS-LCP-1	Sigma	1151VB420	4-20 MADC 0-100 psig	N/A	I
CN-FE-IX03	Train No. 1 Influent Flow Element	IX Manifold Influent Piping	Fischer Porter	10LV2201-AB3C	N/A	N/A	I
CN-FI/FQI-IX03	Train No. 1 Influent Flow Indicator/Totalizer	IX Manifold	Fischer Porter	50LV2114-A2B	0-20 gpm	N/A	I
CN-FE-IX04	Train No. 2 Influent Flow Element	IX Manifold Influent Piping	Fischer Porter	10LV2201-AB3C	N/A	N/A	I
CN-FI-FQI-IX04	Train No. 2 Influent Flow Indicator/Totalizer	IX Manifold	Fischer Porter	50LV2114-A2B	0-20 gpm	N/A	I
CN-FE-LC05	Prefilter Containment Flow Element	Prefilter Containment Effluent Piping	Fluid Flow Products	301	N/A	N/A	I
CN-FI-LC05	Prefilter Containment Flow Indicator	Containment Support Rack	Dwyer	1223-36	0-18" H_2O	N/A	I

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TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
CN-FE-LC06	Final Filter Containment Flow Element	Final Filter Containment Effluent Piping	Fluid Flow Products	301	N/A	N/A	I
CN-FI-LC06	Final Filter Containment Flow Indicator	Containment Support Rack	Dwyer	1223-36	0-18" H_2O	N/A	I
CN-FE-LC07	Train No. 1 IX "A" Containment Flow Element	Train No. 1 IX "A" Containment Effluent Piping	Fluid Flow Products	301	N/A	N/A	I
CN-FI-LC07	Train No. 1 IX "A" Containment Flow Indicator	Containment Support Rack	Dwyer	1223-36	0-18" H_2O	N/A	I
CN-FE-LC08	Train No. 1 IX "B" Containment Flow Element	Train No. 1 IX "B" Containment Effluent Piping	Fluid Flow Products	301	N/A	N/A	I
CN-FI-LC08	Train No. 1 IX "B" Containment Flow Indicator	Containment Support Rack	Dwyer	1223-36	0-18" H_2O	N/A	I
CN-FE-LC09	Train No. 1 IX "C" Containment Flow Element	Train No. 1 IX "C" Containment Effluent Piping	Fluid Flow Products	301	N/A	N/A	I
CN-FI-LC09	Train No. 1 IX "C" Containment Flow Indicator	Containment Support Rack	Dwyer	1223-36	0-18" H_2O	N/A	I
CN-FE-LC10	Train No. 2 IX "A" Containment Flow Element	Train No. 2 IX "A" Containment Effluent Piping	Fluid Flow Products	301	N/A	N/A	I

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TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
CN-FI-LC10	Train No. 2 IX "A" Containment Flow Indicator	Containment Support Rack	Dwyer	1223-36	0-18" H_2O	N/A	I
CN-FE-LC11	Train No. 2 IX "B" Containment Flow Element	Train No. 2 IX "B" Containment Effluent Piping	Fluid Flow Products	301	N/A	N/A	I
CN-FI-LC11	Train No. 2 IX "B" Containment Flow Indicator	Containment Support Rack	Dwyer	1223-36	0-18" H_2O	N/A	I
CN-FI-LC12	Train No. 2 IX "C" Containment Flow Element	Train No. 2 IX "C" Containment Effluent Piping	Fluid Flow Products	301	N/A	N/A	I
CN-FI-LC12	Train No. 2 IX "C" Containment Flow Element	Containment Support Rack	Dwyer	1223-36	0-18" H_2O	N/A	I
CN-FE-LC13	Cation IX "A" Containment Flow Element	Cation IX "A" Containment Effluent Piping	Fluid Flow Products	301	N/A	N/A	I
CN-FI-LC13	Cation IX "A" Containment Flow Element	Containment Support Rack	Dwyer	1223-36	0-18 H_2O	N/A	I
CN-FE-LC14	Cation IX "B" Containment Flow Element	Cation IX "B" Containment Effluent Piping	Fluid Flow Products	301	N/A	N/A	I
CN-FI-LC14	Cation IX "B" Containment Flow Indicator	Containment Support Rack	Dwyer	1223-36	0-18" H_2O	N/A	I
CN-FI-VA17	Off Gas Header Influent Flow Indicator	Off Gas Header	Dwyer	Mark II	0-7000FPM	N/A	I

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TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
CN-FSL-PM18	Beta Monitor Manifold Effluent Flow Switch	Beta Monitor Manifold	Fluid Components	12-64-4	N/A	Later	A
CN-FAL-PM18	Beta Monitor Manifold Effluent Low Flow Alarm	Annunciator Panel No. 1	Ronan	X2-1003	N/A	Later	A
CN-FI-SA19	Off Gas Sample Station Air Supply Flow Indicator	Off Gas Sample Station	Eberline	Ping 1A		N/A	I
CN-FI-SA20	Off Gas Sample Station Sample Flow Indicator	Off Gas Sample Station	Dwyer		0-100 lpm	N/A	I
CN-FI-DW21	Dewatering Station Air Purge Flow Indicator	Dewatering Station	SK Instruments	18123	5-25 cfm	N/A	I
CN-FQIC-DW22	Dewatering Station Demineralizer Water Flow Totalizer/Controller	Dewatering Station	Hershey Products Niagra	01B10	5-15 gpm	N/A	C,I
CN-FE-PF23	Post Filter Effluent Flow Element	Post Filter	Combus-tion Engineering	W3-0750-30		N/A	I
CN-FI/FQI-PF23	Post Filter Effluent Flow Indicator/Totalizer	Post Filter	Combus-tion Engineering	W 315	0-30 gpm	N/A	I
CN-FI-1V25	Instrument Air Flow Rate to Off Gas Level Bubbler	"B" Fuel Pool Surge Tank Skid	Dwyer		0-2 SCFH	N/A	I
CN-FI-1V26	Instrument Air Flow Rate to Off Gas Level Bubbler	"B" Fuel Pool Surge Tank Skid	Dwyer		0-2 SCFH	N/A	I

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TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
SDS-FM-13	SDS Monitor Tank Transfer Pumps Discharge Flow	Transfer Pumps Discharge	Brooks	9457 AB7C1A2A	18-132 gpm	N/A	I
CN-TI-VA03	Off Gas Heater Influent Temperature Indicator	Off Gas Header	Moeller	4900	25-125°F	N/A	I
CN-TE-VA04	Off Gas Heater Effluent Temperature Element	Off Gas Header	Moeller	4900	N/A	N/A	I,C,A
CN-TI-VA04	Off Gas Heater Influent Temperature Indicator	Off Gas Header	Chromalox	3803	0-400°F	N/A	I
CN-TSH-VA04	Off Gas Heater Effluent Temperature High Switch	Off Gas Header	Chromalox	3803	N/A	Variable	C
CN-DPSL/ DPI-VA01	Filter Manifold Containment DP Indicator/Switch	Filter Manifold	Dwyer	3001	0-1" H_2O	.25"	A,I
CN-DPAL-VA01	Filter Manifold Containment DP Low Alarm	Filter Manifold	Ronan	X15-1001S	N/A	.25"	A
CN-DPSL/DPI-VA02	Hi Rad Filter Sample Box DP Indicator/Switch	Hi Rad Filter Sample Box	Dwyer	3001	0-1" H_2O	.25"	A,I
CN-DPAL-VA02	Hi Rad Filter Sample Box DP Low Alarm	Hi Rad Filter Sample Box	Ronan	X15-1001S	N/A	.25"	A

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TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
CN-DPSL/ DPI-VA04	IX Manifold Containment DP Indicator/Switch	IX Manifold	Dwyer	3001	0-1" H_2O	.25"	A,I
CN-DPAL/ VA04	IX Manifold Containment DP Low Alarm	IX Manifold	Ronan	X15-1001S	N/A	.25"	A
CN-DPI-PF01	Post Filter DP Indication	Post Filter	Meriam Inst. Co.	1126	0-50PSID	N/A	I
CN-TAH-VA04	Off Gas Heater Effluent Temperature High Alarm	Annunciator Panel No. 1	Ronan	X2-1003	N/A	200°F	A
CN-TIC-VA05	Off Gas Heater Effluent Temperature Instrument Controller	Off Gas Header in Control Panel	Chromalox	3803	0-400°F	N/A	I,C,A Receive's input from CN-TE-VA04 (Under Remarks)
CN-TI-VA06	Charcoal Filter Temperature Indicator	Charcoal Filter	Moeller	4900	50-400°F	N/A	I
CN-TI-RC07	RCS Clean-up Manifold Influent Temperature	RCS Clean-up Manifold	Analogic	PI-2452	0-199.9°F	N/A	I

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TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
CN-TE-RC07	RCS Clean-up Manifold Influent Temperature Element	RCS Clean-up Manifold Influent Piping	Thermo Electri-cal	TSC-2-J-316-26-IL-3-1	N/A	N/A	I
CN-DPI-VA05	Off Gas Roughing Filter DP Indicator	Off Gas Header	Dwyer	2002	0-2" H_2O	N/A	I
CN-DPI-VA06	No. 1 Off Gas HEPA Filter DP Indicator	Off Gas Header	Dwyer	2004	0-4" H_2O	N/A	I
CN-DPI-VA07	Off Gas Charcoal Filter DP Indicator	Off Gas Header	Dwyer	2003	0-3" H_2O	N/A	I
CN-DPI-VA08	No. 2 Off Gas HEPA Filter DP Indicator	Off Gas Header	Dwyer	2004	0-4" H_2O	N/A	I
CN-DPSL/DPI-VA09	Intermediate Sample Box DP Indicator/Switch	Intermediate Sample Box Shell	Dwyer	30001	0-1" H_2O	N/A	I
CN-DPAL-VA09	Intermediate Sample Box DP Low Alarm	Annunciator Panel No. 1	Ronan	X2-1003	0.25" H_2O	N/A	A
CN-DPSL/DPI-VA10	Beta Monitor Containment DP Low Alarm	Beta Monitor Manifold	Dwyer	3001	0-1" H_2O	0.25" H_2O	A,I
CN-DPAL-VA10	Beta Monitor Containment DP Low Alarm	Annunciator Panel No. 1	Ronan	X2-1003	N/A	0.25" H_2O	A
CN-DPSL/DPI-VA11	High Rad Feed Sample Box DP Indicator/Switch	High Rad Feed Sample Box	Dwyer	3001	0-1" H_2O	0.25" H_2O	A,I
CN-DPAL-VA11	High Rad Feed Sample Box DP Low Alarm	Annunciator Panel No. 1	Ronan	X2-1003	N/A	0.25" H_2O	A

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TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
CN-DPSL/ DPI-VA12	RCS Manifold Containment DP Indicator/Switch	RCS Manifold Containment	Dwyer	3001	0-1" H_2O	0.25" H_2O	A,I
CN-DPAL-VA12	RCS Manifold Containment DP Low Alarm	Annunciator Panel No. 1	Ronan	X15-1001S	N/A	0.25" H_2O	A,I
CN-LT-VA03	Off Gas Separator Tank Level Transmitter	"B" Fuel Pool Surge Tank Skid	Goulds	PD3000-400-12-11	0-100" 4-20MADC		I,C,A
CN-LC-VA03	Off Gas Separator Tank Level Controller	"B" Fuel Pool Surge Tank Skid	Moore Ind.	DCA/4-20-MA/D XLX3/TX/117VAC			I,C
CN-LSH-VA03	Off Gas Separator Tank Level High Switch	"B" Fuel Pool Surge Tank Skid	Moore Ind.	DCA/4-20-MA/S-XI/I/117VAC		90 Percent	A
CN-LAH-VA03	Off Gas Separator Tank Level High Alarm	Annunciator Panel No. 1	Ronan	X2-1003		90 Percent	A
CN-LI-VA03	Off Gas Separator Tank Level Indicator	"B" Fuel Pool Surge Tank Skid	Moore Ind.		0-100 Percent		I
CN-LE-FL06	Filter Manifold Containment Sump Level Element	Filter Manifold	Warrick	3R1C2			C,A
CN-LS-FL06	Filter Manifold Containment Sump Level Switch	Filter Manifold	Warrick	2C1G12		2"	C,A
CN-LAH-FL06	Filter Manifold Containment Sump Level High Alarm	Filter Manifold	Ronan	X15-1001S		2"	A

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TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
CN-LE-SA07	High Rad Filter Sample Glove Box Sump Level Element	Inside Glove Box	Warrick	3R1C2			C,A
CN-LSH-SA07	High Rad Filter Sample Glove Box Sump Level Switch	On Glove Box	Warrick	2C1G12		2"	C,A
CN-LAH-SA07	High Rad Filter Sample Glove Box Sump Level Alarm	On Glove Box	Ronan	X15-1001S		2"	A
CN-LE-RC09	RCS Manifold Containment Sump Level Element	In RCS Manifold Containment	Warrick	3R1G2			
CN-LSH-RC09	RCS Manifold Containment Sump Level Switch	In RCS Manifold Containment	Warrick			2"	C,A
CN-LAH-RC09	RCS Manifold Containment Sump Level High Alarm	On RCS Manifold Containment	Ronan	X15-1001S		2"	A
SDS-LAHL-1	SDS Monitor Tank T-1A Level High/Low	Annunciator Panel No. 1	Ronan	X2-1003	N/A	18.56MA Hi 4.88MA Lo	A
SDS-LAH-1A	SDS Monitor Tank T-1A Level High	Control Room Panel SPC-PNL-3	Later	Later	N/A	N/A	A

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TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
SDS-LI-1	SDS Monitor Tank T-1A Level	Panel SDS-LCP-1	Sigma	1151VB420	4-20 MADC 0-400"	N/A	I
SDS-LI-1A	SDS Monitor Tank T-1A Level	Panel SDS-LCP-2	Sigma	1151VB420	4-20 MADC 0-400"	N/A	I
SDS-LSHL-1	SDS Monitor Tank T-1A Level High/Low	Panel SDS-LCP-1	Foxboro	63U-BT-OJER	4-20 MADC N/A	Hi 364"(I) Lo 16"(D)	A,C
SDS-LT-1	SDS Monitor Tank T-1B Level High/Low	Monitor Tank 1A	Foxboro	E13DM-ISAH1	0-400" 4-20 MADC	N/A	A,I,C
SDS-LAHL-3	SDS Monitor Tank T-1B Level High/Low	Annunciator Panel No. 1	Ronan	X2-1003	N/A	Hi 364" Lo 22"	A
SDS-LAH-3A	SDS Monitor Tank T-1B Level High	Control Room Panel SPC-PNL-3	Later	Later	N/A	N/A	A
SDS-LI-3	SDS Monitor Tank T-1B Level	Panel SDS-LCP-1	Sigma	1151VB420	4-20 MADC 0-400"	N/A	I
SDS-LI-3A	SDS Monitor Tank T-1B Level	Panel SDS-LCP-2	Sigma	1151VB420	4-20 MADC 0-400"	N/A	I
SDS-LSHL-3	SDS Monitor Tank T-1B Level High/Low	Panel SDS-LCP-1	Foxboro	63U-BT-OJER	4-20 MADC N/A	Hi 364"(I) Lo 16"(D)	A,C
SDS-LT-3	SDS Monitor Tank T-1B Level	Monitor Tank 1B	Foxboro	E13DM-ISAH1	0-400" 4-20 MADC	N/A	A,I,C

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Apppendix No. 7 (Cont'd)

SDS INSTRUMENT INDEX

TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
SDS-LE-11	SDS Monitor Tank T-1A Level	Monitor Tank 1A	Drexel-brook	Y700-2-57	N/A None	N/A	Discon-nected
SDS-LSLL-11							Deleted
SDS-LE-12	SDS Monitor Tank 1-B Level	Monitor Tank 1B	Drexel-brook	Y700-2-57	N/A None	N/A	Discon-nected
SDS-LSLL-12							Deleted
CN-RE-IX03	IX Manifold General Area Radiation Element	Top of RMP-1	Eberline	DAI-4	Later	N/A	A,I,C
CN-RIT/RSH/RSHH-IX03	IX Manifold General Area Radiation Indication/Switch	RMP-1 Panel EE-GRMP-1	Eberline	ECI-3	1-10,000 mR/hr	Later	A,I,C
CN-RAH/RAHH-IX03	IX Manifold General Area High and High-High Alarm (Local Light)	RMP-1 Panel EE-GRMP-1	Eberline	RMS11-Ru	Later	5mR/hr	A
CN-RE-IX04	IX Manifold Effluent in Line Radiation Element	Inside IX Manifold	TGM	N-210-BNC	Later	N/A	A,I,C
CN-RY-IX04	IX Manifold Effluent in Line Radiation Discriminator	RMP-1 Panel EE-GRMP-1	Aston	205	Later	N/A	A,I,C
CN-RIT-IX04	IX Manifold Effluent in Line Radiation Indicator/Transmitter	RMP-1 Panel EE-GRMP-1	Mech-tronics	1254	$10-10^6$ cps	N/A	A,I,C

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Apppendix No. 7 (Cont'd)

SDS INSTRUMENT INDEX

TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
CN-RSH-IX04	IX Manifold Effluent in Line Radiation High Switch	RMP-1 Panel EE-GRMP-1	Mech-tronics	1254	Later	6000 cps	A,C
CN-RE-LC05	Leakage Containment System Influent Radiation Element	Leakage Containment System Influent Piping	TGM	N-210-BNC	Later	N/A	A,I,C
CN-RY-LC05	Leakage Containment System Influent Radiation Discriminator	RMP-1 Panel EE-GRMP-1	Aston	205	Later	N/A	A,I,C
CN-RIT-LC05	Leakage Containment System Influent Radiation Indicator/Transmitter	RMP-1 Panel EE-GRMP-1	Mech-tronics	1254	$10\text{-}10^6$ cps	N/A	A,I,C
CN-RSH-LC05	Leakage Containment System Influent Radiation High Switch	RMP-1 Panel EE-GRMP-1	Mech-tronics	1254	Later	6000 cps	A,C
CN-RE-VA06	Off Gas Header Influent Radiation Element	Off Gas Header	Eberline	DAI-1	Later	N/A	A,I.
CN-RIT-VA06	Off Gas Header Influent Radiation Indicator/ Transmitter	RMP-1 Panel EE-GRMP-1	Eberline	ECI-1	.01-100Mr/hr	N/A	A,I
CN-RSH-VA06	Off Gas Header Influent Radiation High Switch	RMP-1 Panel EE-GRMP-1	Eberline	ECI-1	Later	1.5mR/hr	A
CN-RE-PM07	"A" Zeolite Beds Effluent Radiation Element		TGM	N-210-BNC	Later	N/A	A,I

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Apppendix No. 7 (Cont'd)

SDS INSTRUMENT INDEX

TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
CN-RY-PM07	"A" Zeolite Beds Effluent Radiation Discriminator	RMP-1 Panel EE-GRMP-1	Aston	205	Later	N/A	A,I
CN-RIT/RSH-PM07	"A" Zeolite Beds Effluent Radiation Indicator/ Transmitter/switch	RMP-1 Panel EE-GRMP-1	Mech-tronics	1254	$10\text{-}10^6$ cps	$9X10^5$ cps	A,I
CN-RE-PM08	"B" Zeolite Beds Effluent Radiation Element		TGM	N-210-BNC	Later	N/A	A,I
CN-RY-PM08	"B" Zeolite Beds Effluent Radiation Discrimination	RMP-1 Panel EE-GRMP-1	Aston	205	Later	N/A	A,I
CN-RIT/RSH-PM08	"B" Zeolite Beds Effluent Radiation Indicator/ Transmitter/switch	RMP-1 Panel EE-GRMP-1	Mech-tronics	1254	$10\text{-}10^6$ cps	$9X10^5$ cps	A,I
CN-RE-PM09	"C" Zeolite Beds Effluent Radiation Element		TGM	N-210-BNC	Later	N/A	A,I
CN-RY-PM09	"C" Zeolite Beds Effluent Radiation Discriminator	RMP-1 Panel EE-GRMP-1	Aston	205	Later	Later	A,I
CN-RIT/RSH-PM09	"C" Zeolite Beds Effluent Radiation Indicator/ Transmittal/switch	RMP-1 Panel EE-GRMP-1	Mech-tronics	1254	$10\text{-}10^6$ cps	$9X10^3$ cps	A,I
CN-RE-PM10	Cation Beds Influent Radiation Element		TGM	N-210-BNC	Later	Later	A,I
CN-RY-PM10	Cation Beds Influent Radiation Discriminator	RMP-1 Panel EE-GRMP-1	Aston	205	Later	Later	A,I

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Apppendix No. 7 (Cont'd)

SDS INSTRUMENT INDEX

TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
CN-RIT/RSH-PM10	Cation Beds Influent Radiation Indicator/ Transmitter/Switch	RMP-1 Panel EE-GRMP-1	Mech-tronics	1254	$10-10^6$ cps	$9X10^2$ cps	A,I
CN-RE-PM11	Cation Beds Effluent Radiation Element		TGM	N-210-BNC	Later	Later	A,I
CN-RY-PM11	Cation Beds Effluent Radiation Discriminator	RMP-1 Panel EE-GRMP-1	Aston	205	Later	Later	A,I
CN-RIT/RSH-PM11	Cation Beds Effluent Radiation Indicator/ Transmitter/switch	RMP-1 Panel EE-GRMP-1	Mech-tronics	1254	$10-10^6$ cps	$9X10^2$ cps	A,I
CN-RE-VA12	Off Gas Particulate Sample Radiation Element		Eberline	PING-1A	Later	Later	A,I
CN-RIT-VA12	Off Gas Particulate Sample Radiation Indicator/ Transmitter	Packaged Off Gas Sampler	Eberline	ECI-1	$10-10^6$cpm	Later	A,I
CN-RSH-VA12	High Off Gas Particulate Sample Radiation Switch	Packaged Off Gas Sampler	Eberline	PING-1A	Later	Later	A
CN-RAH-VA12	Off Gas Particulate Sampler Radiation Alarm High	Packaged Off Gas Sampler	Eberline	PING-1A	Later	Later	A
CN-RR-VA12	Off Gas Particulate Sampler Radiation Recorder	Packaged Off Gas Sampler	Eberline	PING-1A	4-20MADC $10-10^6$cpm	Later	I

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Apppendix No. 7 (Cont'd)

SDS INSTRUMENT INDEX

TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
CN-RE-VA13	Off Gas Charcoal Sampler Radiation Element	Packaged Off Gas Sampler	Eberline	PING-1A	Later	Later	A,I
CN-RIT-VA13	Off Gas Charcoal Sampler Radiation Indicator/ Transmitter	Packaged Off Gas Sampler	Eberline	PING-1A	$10\text{-}10^6$cpm	Later	A,I
CN-RSH-VA13	Off Gas Charcoal Sampler Radiation Switch High	Packaged Off Gas Sampler	Eberline	PING-1A	Later	Later	A
CN-RAH-VA13	Off Gas Charcoal Sampler Radiation Alarm High	Packaged Off Gas Sampler	Eberline	PING-1A	Later	Later	A
CN-RR-VA13	Off Gas Charcoal Sampler Radiation Recorder	Packaged Off Gas Sampler	Eberline	PING-1A	4-20MADC $10\text{-}10^6$cpm	Later	I
CN-RE-VA14	Off Gas Ion Chamber Sampler Radiation Element	Packaged Off Gas Sampler	Eberline	PING-1A	Later	Later	A,I
CN-RIT-VA14	Off Gas Ion Chamber Sampler Radiation Indicator/Transmitter	Packaged Off Gas Sampler	Eberline	PING-1A	$10\text{-}10^6$cpm	Later	A,I
CN-RSH-VA14	Off Gas Ion Chamber Sampler Radiation Switch High	Packaged Off Gas Sampler	Eberline	PING-1A	Later	Later	A
CN-RAH-VA14	Off Gas Ion Chamber Sampler Radiation Alarm	Packaged Off Gas Sampler	Eberline	PING-1A	Later	Later	A
CN-RR-VA14	Off Gas Ion Chamber Sampler Radiation Recorder	Packaged Off Gas Sampler	Eberline	PING-1A	$10\text{-}10^6$cpm	N/A	I

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0945x LC

Apppendix No. 7 (Cont'd)

SDS INSTRUMENT INDEX

TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
CN-RA-AS15	Common Alarm for RMP-1	Surge Tank Skid Adjacent to Annunciation Panel	Ronan	506W	Later	N/A	A
CN-RR-RR16	Radiation Recorder	RMP-1 Panel EE-GRMP-1	Wes-tronics	M11E	0-100 DC 0-100 DC	N/A	I
CN-RE-PF17	Post Filter Influent Radiation Element	Post Filter Influent Line	Eberline	RD-22		N/A	I
CN-RI-PF17	Post Filter Influent Radiation Indication	Post Filter Lid	Eberline	SAM-2	0 to $5X10^5$ cpm	N/A	I
CN-RE-PF18	Post Filter Effluent Radiation Element	Post Filter Effluent Line	Eberline	RD-22		N/A	I
CN-RI-PF18	Post Filter Effluent Radiation Indication	Post Filter Lid	Eberline	SAM-2	0 to $5X10^5$ cpm	N/A	I
FCC-HIS-1	Fuel Transfer Canal Drain Pump	CN-PNL-1	C-H	E30JF			
FCC-PI-2	Fuel Transfer Canal Fill Pump Air Supply	Local					
FCC-KL-3	New Fuel Storage Pit Drainage Pump Isolation Valve	CN-PNL-1	C-H	E30CM			

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Apppendix No. 7 (Cont'd)

SDS INSTRUMENT INDEX

TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
FCC-KS-3	New Fuel Storage Pit Drainage Pump Isolation Valve	FCC-V003					
FCC-PI-3	Fuel Transfer Canal Drain Line Pressure Gauge	Manifold (in containment)	Later	Later	0-200 psig 0-200 psig	N/A	I
FCC-PI-4	Fill Valve Mainfold Pressure	Local					
FCC-LSHL-5	New Fuel Storage Pit Level Switch	Local					
FCC-LI-102	Fuel Transfer Canal Level	SPC-PNL-3	Wes-tronics	7201	10-50 MADC 0-500" wc	N/A	I-(previously tagged RC-LI-102A)
FCC-LT-102	Fuel Transfer Canal Level	RC-LCP1	Foxboro	E13DM HKAH1	0-18psig 10-50MADC		
FCC-LIS-103	Fuel Transfer Canal Level	RC-LCP1	Barton	288A	0-18psig 0-500" wc	453" wc(I)	
FCC-FICV-104	Fuel Transfer Canal Bubbler Regulator	RC-LCP1	Moore	62VNA		2.5 CFH	
RC-LI-102	Reactor/IIF Level	SPC-PNL-3	Wes-tronics	7201	10-50 mAdc 0-100" wc	N/A	I

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SDS INSTRUMENT INDEX

TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
RC-LIC-102	IIF Level Control (proportional)	SPC-PNL-3	Foxboro	62H	10-50 mAdc 50-10 mAdc	66%	C-(previously tagged SPC-LIC-3A)
RC-LT-102	Reactor/IIF Level	RC-LCP-1	Foxboro	E13DM HKAMI	[illegible]-36 psig [illegible]0-50 mAdc	N/A	I/C
RC-LI-102A	Reactor/IIF Level	CN-PNL-1	GE	DWG# 157C4653TA	10-50 mAdc 0-100" wc	N/A	I
RC-LAH-103	IIF Level Hi	SPC-PNL-3			N/A	N/A	A
RC-LAL-103	IIF Level Lo	SPC-PNL-3			N/A	N/A	A
RC-LIS-103	Reactor/IIF Level	RC-LCP1	Barton	258	0-3.6 psig	Hi-78"WC(I) Lo-54"WC(D)	
RC-LAH-103A	IIF Level Hi	CN-PNL-1	Ronan	X2-1003	N/A	N/A	A
RC-LAL-103A	IIF Level Lo	CN-PNL-1	Ronan	X2-1003	N/A	N/A	A
RC-FICV-104	IIF Bubbler Regulator	Panel RC-LCP1	Moore	62VNA	N/A	2.5 CFH	C,I
RC-PAL-105	IIF Bubbler Air Supply Pressure	Control Room Panel SPC-PNL-3	Later	Later	N/A	N/A	A
RC-PSL-105	IIF Bubbler Air Supply Pressure	Panel RC-LCP1	Static-O-Ring	4N-K4	0-20 psig N/A	15 psig(D)	A
DWC-HIS-1266	IIF Fill Isolation Valve WDL-V40	CN-PNL-1	C-H	E30JM			

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Apppendix No. 7 (Cont'd)

SDS INSTRUMENT INDEX

TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
DWC-HIS-1266	IIF Fill Emergency Stop	Local	C-H	102SOT5			
DWC-HIS-1266-1	IIF Fill Low Trip Block	CN-PNL-1	C-H	E30DM			
DWC-HIS-1	New Fuel Storage Pit Drainage Pump DWC-P-1	CN-PNL-1	C-H	E30JF			
DWC-HS-1	New Fuel Storage Pit Drain Emergency Stop	Local	C-H	102SOT5			
DWC-HIS-1A	New Fuel Storage Pit Drain High Trip Block	CN-PNL-1	C-H	E30DM			

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Appendix No. 8

to

Submerged Demineralizer System

System Design Description

Typical Analysis of Water Processed

Appendix 8

Typical Analysis of Water Processed

Isotope	RCS 2/81	RCS 6/85	RCS 5/86	RB Sump 9/80	RB Sump Decon 7/83
H-3	0.066uCi/ml	0.07uCi/ml	0.085uCi/ml	0.97uCi/ml	0.12uCi/ml
Sr-89	0.25uCi/ml	not detectable	not detectable	0.18uCi/ml	not detectable
Sr-90	23uCi/ml	2.3uCi/ml	2.4uCi/ml	2.64uCi/ml	1.6uCi/ml
Sb-125	1.6×10^{-3}uCi/ml	0.055uCi/ml	0.013uCi/ml	9.1×10^{-3}uCi/ml	0.023uCi/ml
Cs-134	3.4uCi/ml	5.8×10^{-3}uCi/ml	0.01uCi/ml	27.7uCi/ml	0.14uCi/ml
Cs-137	25uCi/ml	0.14uCi/ml	0.35uCi/ml	172uCi/ml	2.1uCi/ml
pH	7.6	7.55	7.58	8.6	7
Boron	3800ppm	5230ppm	5460ppm	2000ppm	3193ppm
Na	1240ppm	1420ppm	1500ppm	1100ppm	240ppm
Volume (gallons)	88,000	---	35,000	625,000	20,000

Appendix No. 9

to

Submerged Demineralizer System

System Design Description

Title

S.D.S. Drawing List

Appendix No. 9
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
527D-A-5001	CNSI-TMI Supply Manifold Submerged Ion Exchangers P and ID
527D-A-5002	CNSI-TMI P and ID Contaminated Feed Water System
527D-A-5004	CNSI-TMI P and ID Off-Gas and Liquid Separation System
527D-A-5005	CNSI-TMI Ion Exchange Flow Sheet
527D-A-5006	CNSI-TMI 527-A-03/Intermediate Sampling System
527D-A-5007	General Layout Plan Ion-Exchange Equipment
527D-A-5009	CNSI-TMI 527A-02 P and ID Beta Monitoring Manifold
527D-A-5010	Ion Exchanger Support Assembly Drawing
527C-A-5011	CNSI-TMI Dewatering Station P and ID
527D-A-5013	P and ID RCS Clean-Up Manifold
527D-A-5014	Pool Floor Equipment Base Locations Installation Dimensions
527D-D-5002	Prefilter 125 Micron
527D-D-5003	Final Filter 10 Micron
527D-D-5004	Prefilter/Final Filter Details

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
527D-D-5007	Off-Gas Separator Item No. 527D-01
527D-D-5008	Off-Gas Pump Stand Pipe
527D-D-5009	Exchanger Skirt and Lifting Lugs
527D-D-5011	Prefilter With Agitator
527D-D-5012	Ion Exchanger, Final Filter and Prefilter Details
527D-D-5013	Ion Exchanger and Final Filter
527D-D-5014	Prefilter
527D-J-5001	Beta Monitoring Housing Details
527C-J-5002	Beta Monitor Mounting Detail for L527-65 RE527-13
527D-J-5003	Radiation Monitor Panel RMP-1 Arrangement
527D-J-5004	Radiation Monitors Holder and Weight Assy and Det for Ion Exchange Filters Radiation Monitors
527D-J-5005	Radiation Monitors Holders and Weight Assembly and Details for Ion Exchanger
527D-L-5001	Filter Manifold Piping Plan and Elevations
527D-L-5002	Ion-Exchanger Support Rack Piping
527D-L-5003	Ion-Exchanger Support Rack Piping
527D-L-5004	Filter and Leakage Containment Exchanger Rack Piping
527D-L-5005	Intermediate Level Sampling Glove Box Layout and Details 527A-03

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
527D-L-5008	Unit (I) Support Rack and Exchanger Piping Manifold Interconnecting Piping Plan and Section "A-A"
527D-L-5009	Unit (I) Support Rack and Exchanger Piping Manifold Interconnecting Piping Plan and Section "B-B"
527D-L-5010	Unit (I) Support Rack and Exchanger Piping Manifold Interconnecting Piping Plan and Section "C-C"
527D-L-5011	Piping Plan and Elevation Exchanger Manifold
527D-L-5012	Piping Sections Exchanger Manifold
527D-L-5014	Filter Manifold and Filter Rack Interconnect Piping
527D-L-5015	Filter Manifold and Filter Rack Interconnect Piping
527D-L-5016	Piping Arrangement Surge Chamber Area
527D-L-5017	Piping Section Surge Chamber Area
527D-L-5018	Piping Section Surge Chamber Area
527D-L-5021	Piping Arrangement - Plan Off-Gas System
527D-L-5022	Filter Manifold and Hi-Rad Filter Box (527-A-01) Interconnect Piping
527D-L-5023	Piping Arrangement - 527A-02 Beta Monitoring Manifold

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
527D-L-5026	Utility Piping Arrangement Plan - Unit II - "B" Fuel Pool
527D-L-5027	Utility Piping Arrangement Details - Unit II - "B" Fuel Pool
527D-L-5028	Piping Arrangement - Sections Off-Gas System
527D-L-5029	Piping Arrangement - Dewatering Station
527D-L-5030	Piping Arrangement RCS Clean-Up Manifold
527D-L-5031	Composite Piping Arrangement Ion Exchanger, Polish Manifold, Filter Manifold and RCS Clean-Up Manifold
527D-L-5032	Composite Piping Elevation Ion Exchanger, Polish Manifold, Filter Manifold and RCS Clean-Up Manifold
527D-L-5033	Composite Piping Arrangement Surge Chamber Area Plan Column AM to AP
527D-L-5034	Composite Piping Arrangement Surge Chamber Area Elevations
527D-M-5003	Filter Manifold Assembly Plan and Elevation
527D-M-5004	Filter Manifold Assembly Sections
527D-M-5005	Filter Manifold Assembly Details
527D-M-5006	Filter Manifold Assembly Details
527D-M-5007	CNSI-TMI Ion Exchanger Support Unit Ia
527D-M-5008	CNSI-TMI Ion Exchanger Support Units Ib, Id and Ie
527D-M-5009	CNSI-TMI Ion Exchanger Support Unit Ic

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
527D-M-5010	CNSI-TMI Ion Exchanger Support Unit II
527D-M-5011	CNSI-TMI Ion Exchanger Support Unit III
527D-M-5012	Ion Exchanger Support Details
527D-M-5013	Off-Gas Separator and Stand Pipe - Skid Detail
27D-M-5015	Cask Support Platform Plan, Section and Detail
527D-M-5016	Surge Chamber Cover Plan and Details
527D-M-5017	Exchanger Manifoid Plans and Sections
527D-M-5018	Exchanger Manifold Sections and Details
527D-M-5019	Cask Support Platform Filter Manifold Shielding Details
527D-M-5020	Ion Exchanger Lifting Yoke Guide Details
527D-M-5021	Spent Ion Exchanger Storage Rack
527D-M-5022	Beta Monitoring Manifold Plans and Sections
527D-M-5023	1-13C Shipping Cask Support Platform
527D-M-5024	Yoke Hanger Detail
527D-M-5025	Plans and Details Dewatering Station
527D-M-5026	Pipe Containment and Restraint Details
527D-M-5027	Moveable Spent Ion Exchanger Storage Rack
527D-M-5028	Spent Ion Exchanger Storage Rack - Unit 3
527D-M-5029	Spent Ion Exchanger Storage Rack - Unit 4a

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
527D-M-5030	RCS Clean-Up Manifold Assembly, Plan, Elevation and Details
527D-M-5031	RCS Clean-Up Manifold Assembly, Sections and Details
527D-M-5032	Spent Ion Exchanger Storage Rack - Unit 4b
527D-M-5033	Shielded Pipe Chase for RCS Clean-Up Manifold Arrangement Assembly and Details
527D-M-5034	Radiation Shielding Between RCS Clean-Up Manifold and Pipe Chase Assembly and Details
527D-M-5035	Personnel Crane Basket Assembly
527D-M-5036	Personnel Crane Basket Details
527D-M-5037	Storage Rack Lifting Device Plan, Sections and Details
527D-P-5002	CNSI-TMI Electrical Wiring Diagrams 460 Volt Motors, Etc.
527C-P-5003	CNSI-TMI Electrical Wiring Diagrams 120 Volt Sump Pumps
527D-P-5004	CNSI-TMI Electrical Plan Power and Lighting
527D-P-5005	CNSI-TMI Electrical Details and Bill of Materials
527D-P-5006	CNSI-TMI Electrical Sections
527D-P-5007	Loop Diagram FI/FQI - 527-07, -09, -10 LI-527-01
527D-P-5008	Electrical Connection Diagram Annunciator Panel No. 1 and Single Point Annunciators
527D-P-5009	Instrument and Electrical Plan and Details

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
527C-P-5010	Loop Diagram LC/LSH-527-03, LC-527-04, LSH-527-04, LC/LSH-527-43
527D-P-5011	Instrument and Electrical Sections
527D-P-5012	Loop Diagram Area and Off-Gas Gamma Monitors
527D-P-5013	Interconnection Wiring Diagram Radiation Recorder RJR-527-01
527D-P-5014	Loop Diagram Beta Monitoring System
527D-P-5016	Loop Diagram Underwater Radiation Monitoring System
527D-P-5017	Loop Diagram Pressure Instr., Temperature Instr., Demineralized Water Flow Control
527C-R-1003	Unit IIB Structural Bracing for Rigging
527C-R-1004	Unit IIA Structural Bracing for Rigging
527C-R-1005	Unit IIIA Structural Bracing for Rigging
527C-R-1006	Unit IIIB Structural Bracing for Rigging
527C-R-1007	Load Transfer Triangle and Spreader Bar Details
527D-R-1008	Unit IIIA Rigging Details
527D-R-1009	Unit IIIB Rigging Details
527C-R-1010	Arrangement for Mating Unit IIIB to IIIA
527D-R-1011	Unit IIA Rigging Details
527D-R-1012	Unit IIB Rigging Details

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
527C-R-1013	Arrangement for Mating Unit IIB to IIA
527D-R-1014	Unit ID/IE Rigging
527C-R-1015	Load Transfer Triangle and Adjustable Spreader Bar
527D-R-1016	Unit IC Rigging
527D-R-1017	Unit IB Rigging
527D-R-1018	Unit IA Rigging
527C-R-1019	Compression Rigging Lug Details
527D-R-1020	Alignment and Compression Rigging Assemblies for Unit IA, IB, IC, ID, IE
527D-R-1021	Filter Manifold Rigging
527D-R-1022	Shipping Cask Support Platform Rigging
527D-R-1024	Beta Manifold Rigging and Pad Eye Details
527D-R-1025	Ion Exchanger Manifold Rigging Details
527D-R-1026	Ion Exchanger Manifold Rigging Sections
527C-R-1027	Intermediate Glove Box Table 527A-03T Swivel Shackle Bolt Hole Location Details
527C-R-1028	Hi-Rad Filter Glove Box Support Table 527A-01T Rigging Support Details
527D-R-1029	Intermediate Level Glove Box Assembly Rigging
527D-R-1030	Hi-Rad Filter Sample Box and Support Rigging Details

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
527C-R-1031	Lightweight Padeye Test Rig Assembly (Torque)
527C-R-1032	Lightweight Padeye Test Rig Assembly (Hydraulic)
527D-R-1033	Off-Gas Air Filtration System Rigging
527C-R-1034	Hi-Rad Feed Glove Box Rigging Support Details
527D-R-1035	Hi-Rad Feed Sample Glove Box Assembly Rigging
527D-R-1036	Surge Chamber Cover Rigging for Covers 1A, 2A, 3A, 4A (typ)
527D-R-1037	Off-Gas Separator and Standpipe Rigging Phase II
527D-R-1038	Off-Gas Separator and Standpipe Rigging Phase I and III
527D-R-1041	Ion Exchanger Transport Cask 14-195-H Assembly Rigging
527D-R-1044	Dewatering Station Structural Bracing Required for Rigging
527D-R-1045	Dewatering Station Rigging Phase I and Phase II
527C-R-1046	Dewatering Station Rigging Phase III
527D-T-5001	Assembly and Details Remote Disconnect for Hansen Coupler
527D-T-5002	Intermediate Level Sampling Glove Box 527A-03
527D-T-5003	Intermediate Level Sampling Glove Box 527A-03
527C-T-5004	Intermediate Sampling Manifold Bottle Lifting Mechanism Details 527A-03
527D-T-5008	Hi-Rad Feed Sample Glove Box 527A-04

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
527D-T-5009	Lifting Yoke Assembly for Exchanger Tanks
527D-T-5010	Remote Disconnect Guide and Supports
527D-T-5011	Exchanger Yoke Details
527D-T-5012	Hi-Rad Filter Sample Glove Box 527A-01
527D-T-5014	Hi-Rad Feed Sample Glove Box Layout and Details 527A-04
527D-T-5015	Hi-Rad Filter Glove Box Layout and Details 527-01
527D-T-5016	Lifting Yoke Assembly for CNS-1600 Shipping Cask
527D-T-5017	Hi-Rad Filter Glove Box Piping and Sections 527A-01
527D-T-5018	Hi-Rad Feed Sample Glove Box Piping and Sections 527-04
527D-T-5019	Lifting Yoke Details
527D-T-5020	Support Table 527A-03T and 527A-04T for Intermediate Level Glove Box and Hi-Rad Feed Glove Box
527D-T-5022	Lifting Yoke Assembly for Unspent Exchanger Tanks
527D-T-5023	Exchanger Yoke Details for Unspent Exchanger Tanks
527D-T-5024	Support Table 527A-01T for Hi-Rad Filter Glove Box 527A-01
527D-T-5025	Cask and Exchanger Tank Alignment Fixture
527D-T-5026	Shielded Pipe Chase 527A-01C for Hi-Rad Filter Glove Box 527A-01 Arrangement, Assembly and Details

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
527D-T-5027	Assembly and Details Remote Disconnect for Hansen Coupler at Dewatering Station
527D-T-5028	Dewatering Station Remote Disconnect Guide and Supports
527D-T-5029	Valve Stem Extensions and Shielding, Assembly and Details for Glove Boxes and Manifolds
527D-T-5030	Valve Stem Extensions and Shielding, Assembly and Details for Manifolds
527D-T-5031	Hansen Coupler Remote Connector Assembly and Details for Prefilter Nozzle A
527D-T-5032	Manipulator and Recovery Tool
DD-527A-J-5001 Sht. 1 of 3	Installation Design Detail Material List
DD-527A-J-5001 Sht. 2 of 3	Installation Design Detail Material List
DD-527A-J-5001 Sht. 3 of 3	General Notes for Fabrication and Installation of Instruments and Supports
DD-527C-J-5002	Installation Design Detail Level Control Panel Off-Gas Separator
DD-527A-J-5004	Installation Design Detail Flow Indicator/Totalizer and Liquid Vortex Flow Element
DD-527A-J-5007	Installation Design Detail Flow Indicating U-Tube Manometer and Orifice
DD-527A-J-5008	Installation Design Detail Flow Indicating Manometers Orientation - Ion/Cation Exch. Sys.
DD-527A-J-5013	Installation Design Detail Pressure Differential Indicator/Switch

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
DD-527A-J-5016	Installation Design Detail Feed Temp. Indicator TI-527-07 and TI-527-41
DD-517C-J-5017	Installation Design Detail Mounting Support for Annunciator Panel No. 1 and Hi-Rad Alarm
DD-527A-J-5018	Installation Design Detail Electronic Level Switch LC and LSH-527-04
DD-527A-J-5019	Installation Design Detail Electronic Level Switch LC/LSH-527-03 and LC/LSH-527-43
DD-527A-J-5020	Installation Design Detail Hi Rad. Alarm RAH-527-11
DD-527A-J-5021	Installation Design Detail Hi Rad. Alarm RAH-527-01
DD-527A-J-5022	Installation Design Detail Underwater Gamma Radiation Monitors
DD-527D-J-5023	Installation Design Detail Sample System Piping Off-Gas Radiation Monitor
DD-527A-J-5024	Installation Design Detail Mounting Support for Relay Panel RP-1
DD-527A-J-5025	Installation Design Detail Support Stand for Filter Radiation Monitors

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
RW3501-012C-14	Filter Manifold and Filter Rack Interconnect Piping
RW3501-012C-14-01	Filter Manifold and Filter Rack Interconnect Piping - Piping Detail
RW3501-012C-14-02	Filter Manifold and Filter Rack Interconnect Piping - Piping Detail
RW3501-012C-14-03	Filter Manifold and Filter Rack Interconnect Piping - Piping Detail
RW3501-012C-14-04	Filter Manifold and Filter Rack Interconnect Piping - Piping Detail
RW3501-012C-14-05	Filter Manifold and Filter Rack Interconnect Piping - Piping Detail
RW3501-012C-14-06	Filter Manifold and Filter Rack Interconnect Piping - Piping Detail
RW3501-012C-14-07	Filter Manifold and Filter Rack Interconnect Piping - Piping Detail
RW3501-012C-15	Filter Manifold and Filter Rack Interconnect Piping

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
RW3501-012C-22	Filter Manifold and Hi-Rad Filter Box (527A-01) Interconnect Piping
RW3501-012A-08	Unit (1) Support Rack and Exchanger Piping Manifold Interconnecting Piping Plan and Section "A-A"
RW3501-012A-08-01	Unit (1) Support Rack and Exchanger Piping Manifold Interconnecting Piping - Piping Detail
RW3501-012A-08-02	Unit (1) Support Rack and Exchanger Piping Manifold Interconnecting Piping - Piping Detail
RW3501-012A-08-03	Unit (1) Support Rack and Exchanger Piping Manifold Interconnecting Piping - Piping Detail
RW3501-012A-08-04	Unit (1) Support Rack and Exchanger Piping Manifold Interconnecting Piping - Piping Detail
RW3501-012A-08-05	Unit (1) Support Rack and Exchanger Piping Manifold Interconnecting Piping - Piping Detail
RW3501-012A-08-06	Unit (1) Support Rack and Exchanger Piping Manifold Interconnecting Piping - Piping Detail
RW3501-012A-08-07	Unit (1) Support Rack and Exchanger Piping Manifold Interconnecting Piping - Piping Detail
RW3501-012A-08-08	Unit (1) Support Rack and Exchanger Piping Manifold Interconnecting Piping - Piping Detail
RW3501-012A-08-09	Unit (1) Support Rack and Exchanger Piping Manifold Interconnecting Piping - Piping Detail
RW3501-012A-08-10	Unit (1) Support Rack and Exchanger Piping Manifold Interconnecting Piping - Piping Detail
RW3501-012A-08-11	Unit (1) Support Rack and Exchanger Piping Manifold Interconnecting Piping - Piping Detail

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
RW3501-012A-08-12	Unit (1) Support Rack and Exchanger Piping Manifold Interconnecting Piping - Piping Detail
RW3501-012A-08-13	Unit (1) Support Rack and Exchanger Piping Manifold Interconnecting Piping - Piping Detail
RW3501-012A-08-14	Unit (1) Support Rack and Exchanger Piping Manifold Interconnecting Piping - Piping Detail
RW3501-012A-08-15	Unit (1) Support Rack and Exchanger Piping Manifold Interconnecting Piping - Piping Detail
RW3501-012A-08-16	Unit (1) Support Rack and Exchanger Piping Manifold Interconnecting Piping - Piping Detail
RW3501-012A-08-17	Unit (1) Support Rack and Exchanger Piping Manifold Interconnecting Piping - Piping Detail
RW3501-012A-08-18	Unit (1) Support Rack and Exchanger Piping Manifold Interconnecting Piping - Piping Detail
RW3501-012A-08-19	Unit (1) Support Rack and Exchanger Piping Manifold Interconnecting Piping - Piping Detail
RW3501-012A-09	Unit (1) Support Rack and Exchanger Piping Manifold Interconnecting Piping - Section "B-B"
RW3501-012A-10	Unit (1) Support Rack and Exchanger Piping Manifold Interconnecting Piping - Section "C-C"
RW3501-005-03	Intermediate Level Sample Layout and Details
RW3501-005-03-01	Air Filter Ass'y
RW3501-005-04	Intermediate Level Sampling Glove Box 527A-03 Details
RW3501-005-05	Intermediate Level Sample Layout and Details
RW3501-005-06	Tubing Loop Sheet

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
RW3501-005-07	Support Table 527A-03T for Intermediate Level Glove Box
RW3501-007-01	Hi-Rad Filter Glove Box Piping and Sections 527A-01
RW3501-007-02	Hi-Rad Filter Glove Box Layout and Details 527A-01
RW3501-007-03	Hi-Rad Filter (01) Glove Box Details
RW3501-007-04	Hi-Rad Filter Sample Glove Box 527A-01
RW3501-007-05	Hi-Rad Filter Sample Glove Box 527A-01
RW3501-007-06	Support Table for Hi-Rad Filter Glove Box
RW3501-007-07	Misc. Details for Support Table
RW3501-007-08	Misc. Details for Support Table and Piping Shield
RW3501-008-01	Hi-Rad Feed Sample Glove Box Piping and Sections 527A-04
RW3501-008-02	Hi-Rad Feed Sample Glove Box Layout and Details 527A-04
RW3501-008-03	Hi-Rad Feed Sample (-04) Glove Box Details
RW3501-008-04	Hi-Rad Feed Sample Glove Box 527A-04
RW3501-008-05	Hi-Rad Feed Sample Glove Box Details (04)
RW3501-008-06	Support Table 527A-04T for Hi-Rad Feed Glove Box
RW3501-009-01	Beta Monitor Mounting Detail for L527-65 RE527-13
RW3501-010-04 Sht. 1 of 2	Off-Gas Separator and Standpipe, Piping Rack

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
RW3501-010-04 Sht. 2 of 2	Off-Gas Separator and Standpipe, Piping Rack
RW3501-002-01	Filter Manifold Piping Plan and Elevations
RW3501-002-02	Filter Manifold Assembly Details
RW3501-002-03	Filter Manifold Assembly Plan and Elevation
RW3501-002-04	Filter Manifold Assembly Sections
RW3501-002-05	Filter Manifold Assembly Details
RW3501-002-06	Filter Manifold Assembly Details
RW3501-002-07	Filter Manifold Assembly Box and Details
RW3501-003-01	Exchanger Manifold
RW3501-003-02	Exchanger Manifold Sections and Misc. Details
RW3501-003-03	Exchanger Manifold Misc. Details
RW3501-003-04	Exchanger Manifold Containment Plates Details
RW3501-003-05	Coping Details for Exchanger Manifold
RW3501-003-06	Beta Monitor Housing Details Type B
RW3501-003-07	Exchanger Manifold Structure Assembly
RW3501-003-11	Piping Plan and Elevation Exchanger Manifold
RW3501-003-12	Piping Sections Exchanger Manifold
RW3501-004-01	Beta Monitoring Manifold
RW3501-004-02	Beta Monitoring Manifold Misc. Details
RW3501-004-03	Beta Monitor Housing Details Type "A"

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
RW3501-004A-23	Piping Arrangement - 527A-02 Beta Monitoring Manifold
RW3501-005-01	Intermediate Level Sample Glove Box
RW3501-005-02	Intermediate Level Sampling Glove Box 527A-03
RW3501-012E-16	Piping Arrangement Surge Chamber Area
RW3501-012E-16-01	Surge Chamber Area Piping Detail
RW3501-012E-16-02	Surge Chamber Area Piping Detail
RW3501-012E-16-03	Surge Chamber Area Piping Detail
RW3501-012E-16-04	Surge Chamber Area Piping Detail
RW3501-012E-16-05	Surge Chamber Area Piping Detail
RW3501-012E-16-06	Surge Chamber Area Piping Detail
RW3501-012E-16-07	Surge Chamber Area Piping Detail
RW3501-012E-16-08	Surge Chamber Area Piping Detail
RW3501-012E-16-09	Surge Chamber Area Piping Detail
RW3501-012E-16-10	Surge Chamber Area Piping Detail
RW3501-012E-16-11	Surge Chamber Area Piping Detail
RW3501-012E-16-12	Surge Chamber Area Piping Detail
RW3501-012E-16-13	Surge Chamber Area Piping Detail
RW3501-012E-16-14	Surge Chamber Area Piping Detail
RW3501-012E-16-15	Surge Chamber Area Piping Detail
RW3501-012E-16A	Off-Gas Separator and Standpipe Skid Piping Arrangement

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
RW3501-012E-17	Piping Sections Surge Chamber Area
RW3501-012E-18	Piping Sections Surge Chamber Area
RW3501-012F-ML-01 Sht. 1 of 2	Bill of Material
RW3501-012F-ML-01 Sht. 2 Of 2	Bill of Material
RW3501-012F-26	Utility Piping and Polish Manifold Piping Piece Mark Dwgs.
RW3501-012F-27	Utility Piping Arrangement Details Unit No. 2 - "B" Fuel Pool
RW3501-012L-31	Composite Piping Arrangement Ion Exchanger, Polish Manifold, Filter Manifold and RCS Clean-Up Manifold
RW3501-012L-32	Composite Piping Arrangement Ion Exchanger, Polish Manifold, Filter Manifold and RCS Clean-Up Manifold
RW3501-012L-33	Composite Piping Arrangement Surge Chamber Area Plan - Column AM to AP
RW3501-012L-34	Composite Piping Arrangement Surge Chamber Area Elevations
RW3501-012N-21-01	Off-Gas System Piping
RW3501-012N-21-02	Off-Gas System Beta Manifold Piping
RW3501-012N-21-03	Off-Gas System Hi-Rad Feed Sample Glove Box Piping Connection
RW3501-012N-21-04	Off-Gas System Piping from Hi Rad Filter Sample Glove Box
RW3501-012N-21-05	Off-Gas System Exchanger Manifold Exhaust Piping

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
RW3501-012N-21-06	Off-Gas System Piping
RW3501-012N-21-07	Off-Gas System Piping
RW3501-012N-21-08	Off-Gas System Piping
RW3501-012N-21-09	Off-Gas System Piping
RW3501-012N-21-10	Off-Gas System Piping
RW3501-012Q-1	Plate Layout for Pipe Supports 527-PS-1-49
RW3501-015-B1	RCS Clean-Up Manifold Pipe Bend
RW3501-015-01 Sht. 1 of 7	RCS Clean-Up Manifold Assembly
RW3501-015-01 Sht. 2 of 7	RCS Clean-Up Manifold Assembly
RW3501-015-01 Sht. 3 of 7	RCS Clean-Up Manifold Assembly
RW3501-015-01 Sht. 4 of 7	RCS Clean-Up Manifold Assembly
RW3501-015-01 Sht. 5 of 7	RCS Clean-Up Manifold Assembly
RW3501-015-01 Sht. 6 of 7	RCS Clean-Up Manifold Assembly
RW3501-015-01 Sht. 7 of 7	RCS Clean-Up Manifold Assembly
RW3501-015-02	RCS Clean-Up Manifold Brick Placement Layout
RW3501-015-30	Piping Arrangement RCS Clean-Up Manifold
RW3501-015-30-01	RCS Clean-Up Manifold Piping
RW3501-015-30-02	RCS Clean-Up Manifold Piping
RW3501-015-30-03	RCS Clean-Up Manifold Piping
RW3501-015-30-04	RCS Clean-Up Manifold Piping

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
RW3501-015-30-05	RCS Clean-Up Manifold Piping
RW3501-015-30-06	RCS Clean-Up Manifold Piping
RW3501-015-30-07	RCS Clean-Up Manifold Piping
RW3501-015-30-08	RCS Clean-Up Manifold Piping
RW3501-015-30-09	RCS Clean-Up Manifold Piping
RW3501-015-30-10	RCS Clean-Up Manifold Sump Pump Piping
RW3501-015-30-11	RCS Clean-Up Manifold Sump Pump Piping
RW3501-031-00-01	Ion Exchanger, Filter and Leakage Containment Exchanger Rack Piping
RW3501-031-00-02	Ion Exchanger, Filter and Leakage Containment Exchanger Rack Piping
RW3501-031-00-03	Ion Exchanger, Filter and Leakage Containment Exchanger Rack Piping
RW3501-031-02	Ion Exchanger Support Rack Piping Bundle Piping
RW3501-031-03	Ion Exchanger Support Rack Piping
RW3501-031-03-09	Ion Exchanger Support Rack Piping Details
RW3501-031-04	Filter and Leakage Containment Exchanger Rack Piping
RW3501-031-04-07	Leakage Containment Exchanger Rack Piping Details
RW3501-031-04-08	Leakage Containment Exchanger Rack Piping Details
RW3501-031-04-09	Leakage Containment Exchanger Rack Piping Details

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
RW3501-031-04-10	Leakage Containment Exchanger Rack Piping Details
RW3501-031-04-11	Leakage Containment Exchanger Rack Piping Details
RW3501-031-04-12	Leakage Containment Exchanger Rack Piping Details
RW3501-031-04A	Filter and Leakage Containment Exchanger Rack Piping
RW3501-031-07A Sht. 1 of 3	CNSI-TMI Ion Exchanger Support Unit 1A
RW3501-031-07A Sht. 2 of 3	CNSI-TMI Ion Exchanger Support Unit 1A
RW3501-031-07A Sht. 3 of 3	CNSI-TMI Ion Exchanger Support Unit 1A
RW3501-031-08B Sht. 1 of 2	CNSI-TMI Ion Exchanger Support Unit 1B
RW3501-031-08B Sht. 2 of 2	CNSI-TMI Ion Exchanger Support Unit 1B
RW3501-031-08D-01	CNSI-TMI Ion Exchanger Support Unit 1D
RW3501-031-08D-02	CNSI-TMI Ion Exchanger Support Unit 1D
RW3501-031-08E-01	CNSI-TMI Ion Exchanger Support Unit 1E
RW3501-031-08E-02	CNSI-TMI Ion Exchanger Support Unit 1E
RW3501-031-09 Sht. 1 of 7	CNSI-TMI Ion Exchanger Support Unit 1C
RW3501-031-09 Sht. 2 of 7	CNSI-TMI Ion Exchanger Support Unit 1C
RW3501-031-09 Sht. 3 of 7	CNSI-TMI Ion Exchanger Support Unit 1C
RW3501-031-09 Sht. 4 of 7	CNSI-TMI Ion Exchanger Support Unit 1C
RW3501-031-09 Sht. 5 of 7	CNSI-TMI Ion Exchanger Support Unit 1C

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
RW3501-031-09 Sht. 6 of 7	CNSI-TMI Ion Exchanger Support Unit 1C
RW3501-031-09 Sht. 7 of 7	CNSI-TMI Ion Exchanger Support Unit 1C
RW3501-031-10A Sht. 1 of 2	CNSI-TMI Ion Exchanger Support Unit IIA
RW3501-031-10A Sht. 2 of 2	CNSI-TMI Ion Exchanger Support Unit IIA
RW3501-031-10C Sht. 1 of 3	CNSI-TMI Ion Exchanger Support Unit IIB
RW3501-031-10C Sht. 2 of 3	CNSI-TMI Ion Exchanger Support Unit IIB
RW3501-031-10C Sht. 3 of 3	CNSI-TMI Ion Exchanger Support Unit IIB
RW3501-031-11A Sht. 1 of 2	CNSI-TMI Ion Exchanger Support Unit IIIA
RW3501-031-11A Sht. 2 of 2	CNSI-TMI Ion Exchanger Support Unit IIIA
PW3501-031-11B Sht. 1 of 3	CNSI-TMI Ion Exchanger Support Unit IIIB
RW3501-031-11B Sht. 2 of 3	CNSI-TMI Ion Exchanger Support Unit IIIB
RW3501-031-11B Sht. 3 of 3	CNSI-TMI Ion Exchanger Support Unit IIIB
RW3501-031-12	Ion Exchanger Support Details Moveable Personnel Bridge
RW3501-031-12A	Ion Exchanger Support Details Moveable Personnel Bridge II
RW3501-031-13	Ion Exchanger Support Details Cross Bracing
RW3501-031-14	Ion Exchanger Remote Valve Operators
RW3501-031-15 Sht. 1 Of 2	Ion Exchanger Piping Rack Details
RW3501-031-15 Sht. 2 of 2	Ion Exchanger Piping Rack Details
RW3501-031-16	Cask Support Connection Unit IIIA

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
RW3501-031-17	Pipe Containment Stand
RW3501-031-18	Load Transfer Triangle and Spreader Bar Details
RW3501-031-19	Unit IIA Structural Bracing for Rigging
RW3501-031-20	Unit IIB Structural Bracing for Rigging
RW3501-031-21	Unit IIIA Structural Bracing for Rigging
RW3501-031-22	Unit IIIB Structural Bracing for Rigging
RW3501-031-23	Pipe Chase for Unit I
RW3501-031-24	Restraints for Unit 1 and Unit 2
Rw3501-031-25	Strut Rod Orientation Assembly and Details
RW3501-031-28	Load Transfer Triangle and Adjustable Spreader Bar
RW3501-031-29	Compression Rigging Lug Details
RW3501-031-30	Unit 1A Rigging
RW3501-031-31	Unit 1C Rigging
RW3501-031-32	Remote Valve Operator (Diaphram Valve)
RW3501-032-01	Assembly and Details - Remote Disconnect for Hansen Coupler
RW3501-032-02	Remote Disconnect Guide and Supports
RW3501-032K-31 Sht. 1 of 2	Hansen Coupler Remote Connector Assembly and Details for Prefilter Nozzle "A"
RW3501-032K-31 Sht. 2 of 2	Hansen Coupler Remote Conn. Bill of Material for Prefilter Nozzle "A"

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
RW3501-033-01	Cask Support Platform Plan, Sections and Details
RW3501-033-06	Shielded Pipe Chase RCS Clean-Up Manifold Arrangement and Assembly
RW3501-033-07	Shielded Pipe Chase RCS Clean-Up Manifold
RW3501-033-08	Radiation Shielding Between RCS Clean-Up Manifold and Pipe Chase Assembly and Details
RW3501-033-09	Field Fabrication Details
RW3501-034-01 Sht. 1 of 3	Metal Forms for Surge Chamber Cover
RW3501-034-01 Sht. 2 of 3	Metal Forms for Surge Chamber Cover Details
RW3501-034-01 Sht. 3 of 3	Surge Chamber Cover Plan and Details - 1A
RW3501-034-02 Sht. 1 of 3	Metal Forms for Surge Chamber Cover
RW3501-034-02 Sht. 2 of 3	Metal Forms for Surge Chamber Cover Details
RW3501-034-02 Sht. 3 of 3	Surge Chamber Cover Plant and Details - 2A
RW3501-034-03 Sht. 1 of 3	Metal Forms for Surge Chamber Cover
RW3501-034-03 Sht. 2 of 3	Metal Forms for Surge Chamber Cover Details
RW3501-034-03 Sht. 3 of 3	Surge Chamber Cover Plan and Details - 3A
RW3501-034-04 Sht. 1 of 3	Metal Forms for Surge Chamber Cover
RW3501-034-04 Sht. 2 of 3	Metal Forms for Surge Chamber Cover Details
RW3501-034-04 Sht. 3 of 3	Surge Chamber Cover Plan and Details - 4A
RW3501-034-06	Surge Chamber Cover Brick
RW3501-035-01 Sht. 1 of 2	Spent Ion Exchanger Storage Rack Unit 1

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
RW3501-035-01 Sht. 2 of 2	Spent Ion Exchanger Storage Rack Unit 1
RW3501-035-02 Sht. 1 of 2	Moveable Spent Ion Exchanger Storage Rack
RW3501-035-02 Sht. 2 of 2	Moveable Spent Ion Exchanger Storage Rack
RW3501-035-03	Spent Ion Exchanger Storage Rack - Unit 3
RW3501-035-04a	Spent Ion Exchanger Storage Rack - Unit 4a
RW3501-035-04b	Spent Ion Exchanger Storage Rack - Unit 4b
RW3501-037-01 Sht. 1 of 2	Cask Support Platform
RW3501-037-01 Sht. 2 of 2	Cask Support Platform
RW3501-038-01	Assembly and Details - Remote Disconnect for Hansen Coupler at Dewatering Station
RW3501-038-01 Sht. 1 of 2	Plans and Details Dewatering Station
RW3501-038-01 Sht. 2 of 2	Plans and Details Dewatering Station
RW3501-038-02	Dewatering Station Remote Disconnect Guide and Support
RW3501-038-03	Dewatering Station and Ion Exchanger Station Lanyards
RW3501-038-04	Dewatering Station Structural Bracing Required for Rigging
RW3501-038-05	Lead Shielding for Dewatering Station Piping
RW3501-038B-29	Piping Arrangement Dewatering Station
RW3501-038B-29-A1	Dewatering Station Pipe Bending Details
RW3501-038B-29-A2	Dewatering System Pipe Bending Details

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
RW3501-038B-29-A3	Dewatering Station Pipe Bending Details
RW3501-038B-29-01	Dewatering Station Ion Exchanger Vessels - Air/N / Emergency Demineralized Water Supply
RW3501-038B-29-02	Dewatering Station Air/N_2/ Emergency Demineralized Water Inlet
RW3501-038B-29-03	Dewatering Station Filter Vessels Air/N_2/ Emergency Demineralized Water Supply
RW3501-038B-29-04	Dewatering Station Demineralized Water From Ion Exchanger Vessels to Off-Gas Separator
RW3501-038B-29-05	Dewatering Station Filter Vessel Outlet
RW3501-038B-29-06	Dewatering Station Demineralized Water Supply
RW3501-038B-29-07	Dewatering Station Remote Disconnect Tool Pipe Extensions
RW3501-038B-29-08	Dewatering Station Remote Disconnect Tool Pipe Extensions
RW3501-051-05 Sht. 1 of 3	Prefilter 125 Micron Assembly
RW3501-051-05 Sht. 2 of 3	Prefilter 124 Micron, Filter Cylinder Details
RW3501-051-05 Sht. 3 Of 3	Prefilter 125 Micron, Head Details
RW3501-051-06 Sht. 1 of 3	Final Filter, 10 Micron
RW3501-051-06 Sht. 2 of 3	Final Filter, 10 Micron, Misc. Details
RW3501-051-06 Sht. 3 of 3	Final Filter, Filter Subassembly and Misc. Details
RW3501-052-01 Sht. 1 of 3	Ion Exchanger Assembly w/o Agitator
RW3501-052-01 Sht. 2 of 3	Top Head Assembly and Details

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
RW3501-052-01 Sht. 3 of 3	Bottom Skirt and Assembly
RW3501-058-02	Shielding Cylinder for Feed Pump Removal and for Gas Pump Removal
RW3501-059-01	Personnel Crane Basket Assembly
RW3501-081-01	Valve Extension 1" Rising Stem Diaph. Valve
RW3501-081-02	Valve Stem Extensions 1/2", 3/4", 1" and 1 1/2" ITT Grinnel Ball Valves
RW3501-081-03	Valve Stem Extensions 1/4" Ball, 1/4" Needle and 3/8" Ball Whitey Series 43, 44 and IRS 4 Resp.
RW3501-081-04	Valve Stem Extension Pneumatic Operator
RW3501-081-05	Valve Stem Extensions 1" ITT Grinnell Ball Valves
RW3501-081-06	Valve Stem Extensions 1" Rising Stem Diaph. Valve
RW3501-082-02	Rack IIA Wiring Diagram
RW3501-082-02-02	Ion Exchanger Rack IIA Electrical (Instrumentation) Plan and Elevations
RW3501-082-03	Rack IA Wiring Diagram
RW3501-082-03-01	Rack IA Elementary
RW3501-082-03-02	Ion/Cation Exchanger Rack I Electrical (Instrumentation) Plan and Elevations
RW3501-082-04	Filter Manifold Wiring Diagram
RW3501-082-04-01	Filter Manifold Elementary

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
RW3501-082-04-02	Filter Manifold Electrical (Instrumentation) Plan and Elevations
RW3501-082-05	Exchanger Manifold Wiring Diagram
RW3501-082-05-01	Exchanger Manifold Elementary
RW3501-082-05-02	Exchanger Manifold Electrical (Instrumentation) Plan and Elevations
RW3501-082-07	Intermediate Level Sampling Glove Box
RW3501-082-07-02	Intermediate Level Sample Glove Box (Electrical Instrumentation) Plan and Elevations
RW3501-082-08	RCS Clean-Up Manifold Wiring Diagram
RW3501-082-08-01	RCS Clean-Up Manifold Elementary
RW3501-082-08-02	RCS Manifold Electrical (Instrumentation) Plan and Elevation
RW3501-082-09	Hi-Rad Filter Glove Box Wiring Diagram
RW3501-082-09-01	Hi-Rad Filter Glove Box Elementary
RW3501-082-09-02	Hi-Rad Filter Sample Glove Box Electrical (Instrumentation) Plan and Elevations
RW3501-082-10	Hi-Rad Feed Sample Glove Box Wiring Diagram
RW3501-082-10-02	Hi-Rad Feed Sample Glove Box Electrical (Instrumentation) Plan and Elevations

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
RW3501-082-11	Beta Monitor Manifold Wiring Diagram
RW3501-082-11-02	Beta Monitoring Manifold Electrical (Instrumentation) Plan and Elevations
RW3501-082-11-03	Beta Monitor Manifold Megohmmeter Readings
RW3501-082-12	Dewatering Station Wiring Diagram
RW3501-084-01 Sht. 1 of 2	Shielded Pipe Chase Assembly 527A-01-C
RW3501-084-01 Sht. 2 of 2	Shielded Pipe Chase Details
RW3501-IDX-01	Filter Manifold Index
RW3501-IDX-02	Filter Rack Piping Index
FSK-1743-3060	Off-Gas Air Filtration System Arrangement (MSA Drawing)
PI-35675	Mine Safety Appliance Contactor Panel (Chromalox Dwg.)
106-057080-999	Duct Heater (Chromalox Dwg.)
3475-E019	480V motor control center aux. one line diagram
3475-E031	480V unit sub sta. one line diag.
3475-E032	Misc. PWR PNL schedules for Submerged Demineralizer System
3475-E119	Fuel Handling Bldg. ele. 347'6" conduit plan for SDS (SH 1)
3475-E125	FHB ele. 347'6" conduit plan for SDS (SH 2)
3475-E796	Block diag. 480V USS 2-32
3475-E798	Ext. conn. for 480V USS 2-32

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
3475-E799	Int. and ext. conn. for MCC 2-32B (section 5 rear)
3475-E800	Int. conn. for USS 2-32 Unit 12
3475-E804	Block diag. misc. SDS
3475-E805	Block diag. misc. SDS
3475-E806	Block diag. misc. SDS
3475-E807	Block diag. misc. SDS
3475-E808	Block diag. misc. SDS
3475-E809	Inter. and ext. conn. for 2-32B (section 1 front)
3475-E810	Conn. diag. for ann. PNL No. 1
3475-E811	Conn. diag. Hi-Rad Filter Sample Glove Box 527-A-01
3475-E812	Conn. diag. Hi-Rad Filter Sample Glove Box 527-A-01
3475-E813	Conn. diag. Off-Gas Separator LVL inst. rack
3475-E814	Conn. diag. for Unit 3A of SDS
3475-E815	Conn. diag. for Unit IIA of SDS
3475-E816	Conn. diag. for Unit 1A of SDS
3475-E817	Conn. diag. for Filter Manifold of SDS

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
3475-E820	Conn. diag. for local starter CN 60 for leakage containment pump 527 GM-05
3475-E821	Conn. diag. for local starter CN 58 for Off-Gas Blower pump 527 GM-04
3475-E822	Conn. diag. for local starter CN 55 for Off-Gas Bottoms Pump 527 GM-02
3475-E823	Conn. diag. Hi-Rad Feed Sample Glove Box 527-A-04
3475-E824	Conn. diag. Ion Exchanger Manifold
3475-E825	Conn. diag. int. lvl. Sample Glove Box 527-A-03
3475-E826	Conn. diag. Beta Monitor Manifold 527-A-02
3475-E827	Conn. diag. "Off-Gas HDR" Term. Box CN 70 and PI/PSH/PSHH-527-18 and RE-527-18
3475-E828	Elem. diag. SDS 480V Feed Pump 527 GM-01
3475-E829	Elem. diag. SDS 480V Off-Gas Blower and Leak Cont. pump
3475-E830	Elem. diag. SDS Off-Gas Bottom pump 527 GM-02
3475-E831	Elem. diag. SDS 480V Off-Gas HTR 527-E-01
3475-E832	Conn. diag. HTR cont. PNL for Off-Gas HTR 527-E-01
3475-E833	Conn. diag. rad. mon. PNL RMP.1 (Sh. 1 of 3)
3475-E834	Conn. diag. rad. mon. PNL RMP.1 (Sh. 2 of 3)
3475-E835	Conn. diag. rad. mon. PNL RMP.1 (Sh. 3 of 3)
3475-E836	Conn. diag. for RCS Clean-Up Manifold

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
3475-E837	Block diag. misc. SDS
3475-E838	Conn. diag. dewatering station
3475-E839	Elem. diag. Rad. Monitor PNL RMP-1 control and alarm
3475-E840	Conn. diag. for RE-527-11, 12 and 13 and RAH-527-11
3475-E852	Elem. diag. R.B. Waste Pump WG-P-1
3475-E853	Elem. diag. sol. valve AV-01, AV-02 and SV-13
3475-E886	Block diag. SDS misc. Rad. Monitor
3475-E887	Conn. diag. Filter Containment Rad. det. inst. rack
3475-E892	Int. and ext. conn. for LCL cont. PNL WMG 149
3475-E893	Elem. diag. alarms - cont. PNL CN-PNL-1
3475-E894	Int. and ext. conn. for cont. PNL CN-PNL-1 (Sh. 1 of 2)
3475-E895	Int. and ext. conn. for cont. PNL CN-PNL-1 (Sh. 2 of 2)
3475-E903	Conn. diag. for hoist 527-T-04
3475-BM-E819	Bill of material for local starter CN 52
3475-BM-E820	Bill of material for local starter CN 60
3475-BM-E821	Bill of material for local starter CN 58

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
3475-BM-E822	Bill of material for local starter CN 55
2-M74-SDS01	Piping and Instrument Diagram, SDS Feed and Monitor Tank System
2-M74-DW01	Piping and Instrument Diagram, Demineralized Service Water
2-M74-PW01	Piping and Instrument Diagram, Processed Water Storage and Recycle System
2-POA-6201	General Arrangement, SDS Monitor Tanks, Fuel Handling Building, El. 305'0"
2-COC-6201	FHB, El. 305'0", SDS Equipment, Foundations and Misc. Support Steel
2-COR-6201	FHB, El. 305'0", SDS Equipment, Foundations Reinforcing Details
2-C21-008	Civil Structural Standards, Anchor Bolt Schedule and Details
2-C8R-6201	FHB, SDS Equipment Foundations Reinforcing Bar List
2-E21-005	One Line Diagram SDS Admin. Building
2-E38-DWC01	Connection Diagram, DWC-STR-1 & Terminal Box
2-E38-DWC02	Connection Diagram, DWC-HS-1266 & DWC-HS-1
2-E38-RC02	Connection Diagram, RC-LCP1
2-E38-SDS01	Connection Diagram, Local Control Panel SDS-LCP1
2-E38-SDS02	Connection Diagram, Local Control Panel SDS-LCP2
2-E38-SDS03	Connection Diagram, SDS Monitor Tank Transfer Pump Local Starters
2-E38-SDS04	Connection Diagram, SDS Misc. Devices
2-E38-SDS05	Connection Diagram, SDS Misc. Term Boxes
2-E76-DWC01	DWC Pump

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
2-E76-DWC02	Isolating Valve WDL-V40
2-E76-DWC03	IIF Level Alarms
2-E76-SDS01	Schematic Diagram, SDS Monitoring Tank Transfer Pump (P1A)
2-E76-SDS02	Schematic Diagram, SDS Monitoring Tank Transfer Pump (P1B)
2-E76-SDS03	Schematic Diagram, SDS Monitor Tank Inlet Valves
2-E76-SDS04	Schematic Diagram, SDS Misc. Instrumentation and Alarms
2-E76-SDS05	Schematic Diagram, SDS Misc. Instrumentation and Alarms
2-E80-SDS01	Bill of Materials, Local Control Panel, SDS-LCP-1
2-E80-SDS02	Bill of Materials, Local Control Panel, SDS-LCP-2
2-E81-DWC-01	DWC Pull Slips
2-E81-RC-02	RCS water level monitoring pull slips
2-E81-SDS01	SDS Pull Slips
2-J23-001	Instrument Piping Class Specification
2-J25-002	Installation Details
2-J25-003	Installation Details
2-J25-005	Installation Details
2-J25-007	Installation Details
2-J25-011, Sht. 1	Installation Details, Reactor/Refueling Canal Water Level Monitoring System
2-J25-013	Installation Details, IIF Water Level Monitoring System
2-J71-SDS01	Instrument Rack Layout, Instrument Rack SDS-R-1
2-J71-SDS02	Instrument Rack Layout, Instrument Rack SDS-R-2

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
2-J73-SDS01	Panel Drawing, SDS Feed and Monitor Tank, Panel SDS-LCP-1
2-J73-SDS02	Panel Drawing, SDS Feed and Monitor Tank, Panel SDS-LCP-2
2-J73-SDS-03	Panel Drawing, SDS Control Panel-CN-PNL-1
2-J74-SDS01	Instrument Installation Detail, SDS Monitor Tank Transfer Pump P-1A Discharge
2-J74-SDS02	Instrument Installation Detail, SDS Monitor Tank Transfer Pump P-1B Discharge
2-J74-SDS03	Instrument Installation Detail, SDS Monitor Tank T-1A
2-J74-SDS04	Instrument Installation Detail, SDS Monitor Tank T-1B
2-J75-RC02	Loop Diagram, RC System Water Level Montoring System
2-J75-SDS01	Loop Diagram, SDS Monitor Tank T-1A Level
2-J75-SDS02	Loop Diagram, SDS Monitor Tank T-1B Level
2-J75-SDS03	Loop Diagram, SDS Monitor Tank, P-1A Discharge
2-J75-SDS04	Loop Diagram, SDS Monitor Tank, P-1B Discharge
2-J75-SDS05	Loop Diagram, SDS Monitor Tank T-1A Low Level Trip
2-J75-SDS06	Loop Diagram, SDS Monitor Tank T-1B Low Level Trip
2-J77-SDS01	Logic Diagram, SDS Feed and Monitor Tank Transfer Pumps
2-J77-SDS02	Logic Diagram, SDS Feed and Monitor Tank Inlet Valves
2-J77-SDS03	Logic Diagram, SDS Feed and Monitor Tank Alarms
2-J78-SDS01	Level Setting Diagram, SDS Monitor Tank, T-1A
2-J78-SDS02	Level Setting Diagram, SDS Monitor Tank, T-1B

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
2-POH-001	HVAC, Partial Plans
2-P15-001	Wall and Floor Penetration Schedule
2-P15-002	Wall and Floor Penetration Schedule
2-P60-DW01	Piping Isometric, Demineralized Water System, FHB, Unit 1/Unit 2 Corridor
2-P60-SDS01	Piping Isometric, SDS, Aux and Fuel Handling Building
2-P60-SDS02	Piping Isometric, SDS, Aux and Fuel Handling Building
2-P60-SDS03	Piping Isometric, SDS, Aux and Fuel Handling Building
2-P64-DW01	Hanger Details, Demineralized Water System, FHB, Unit 1/Unit 2 Corridor
2-P64-SDS01	Hanger Details, SDS Feed and Monitor Tank System, Aux and Fuel Handling Bldg.
2-P64-SDS02	Hanger Details, SDS Feed and Monitor Tank System, Aux and Fuel Handling Bldg.
2-P64-SDS03	Hanger Details SDS Feed and Monitor Tank System, Aux and Fuel Handling Bldg.
2-E21-SDS01	SDS-One Line Diagram
2-M100A-00001-01	Two 12,000 Gallon, 96" O.D. x 32'0", Straight Shell Water Storage Tanks, Buffalo Tank
2-EOR-6201	Grounding and Raceway, Submerged Demineralizer System
JS082080	SDS Graphic Display
2D-950-29-001 Sht. 1 of 2	SDS Demineralizer Liner
2D-950-29-001 Sht. 2 of 2	SDS Demineralizer Liner
2D-950-29-002	SDS Spray Header Assembly
2E-950-02-001	SDS Plan View

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
2D-950-29-003 Sht. 1 of 3	SDS Prefilter 125 Micron Assembly
2D-950-29-003 Sht. 2 of 3	SDS Prefilter 125 Micron Head Details
2D-950-29-003 Sht. 3 of 3	SDS Prefilter 125 Micron Filter Cylinder Details
2D-950-29-004 Sht. 1 of 3	SDS Final Filter 10 Microns
2D-950-29-004 Sht. 2 of 3	SDS Final Filter 10 Microns Misc. Details
2D-950-29-004 Sht. 3 of 3	SDS Final Filter 10 Microns Filter Sub-Assembly and Misc. Details
2C-950-29-005 Sht. 1 of 2	SDS Plug
2C-950-29-005 Sht. 2 of 2	SDS Plug Tool
2C-950-29-006	SDS Vent Hose Retainer Clip
2B-950-29-007	SDS Hose Support
2D-950-29-008	SDS Ion Exchanger Off-Gas System Connection Options
2D-950-29-009 Sht. 1 of 2	SDS Exchanger Lifting Yoke Replacement Assembly
2D-950-29-009 Sht. 2 of 2	SDS Exchanger Lifting Yoke Details
2D-950-29-010 Sht. 1 of 2	SDS Unspent Exchanger Lifting Yoke Replacement Assembly
2D-950-29-010 Sht. 2 of 2	SDS Unspent Exchanger Lifting Yoke Details
2D-950-29-011 Sht. 1 of 2	Exchanger Retrieval Tool Assembly
2D-950-29-011 Sht. 2 of 2	Exchanger Retrieval Tool Details
2C-950-21-001	Sump Sucker P and ID Surface Water Suction Feed Tankage Fill System
2C-950-21-002	SDS P and ID Beta Monitoring Manifold
2R-950-21-001	P and ID Composite Submerged Demineralizer System

Appendix No. 9 (Cont'd)
S.D.S. DRAWING LIST

DRAWING NO.	TITLE
2-M75-DWC01	Schematic Diagram - IIF Processing System (1 of 2)
2-M75-DWC03	Schematic Diagram - Early Defueling DWC Reactor Filtration System
2-M75-DWC04	Schematic Diagram - Interim Fuel Transfer Canal Processing System
2-P70-DWC01	Piping Composite - Defueling Water Cleanup System - Reactor Building
2-J77-DWC01	Logic Diagram - IIF Fill Isolation Valve WDL-V40
2-J77-DWC02	Logic Diagram - IIF Processing Pump DWC-P-1
2-J77-DWC03	Logic Diagram - IIF Level Alarm
2-J77-DWC04	Logic Diagram - IIF Misc. Alarms
2-J78-DWC01	Level Setting Diagram, Internals Indexing Fixture
2-P70-FCC02	Reactor Building Sump and Fuel Transfer Canal Draining Network
2-J77-FCC01	Logic Diagram - Fuel Transfer Canal Surface Suction Pump (FCC-P-1)
2-COP-1306	Reactor Building IIF Platform Plans, Sections, Details
11127718C (B&W)	Wiring Diagram - Water Level Sensing System

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.)

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

SD 3527-005

*(Print No.)

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-21 through 23 Deleted				
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

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*(Print No.)

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

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*(Print No.)

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"	SDS to RCBT's	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-61	1"	Flush Connection Isolation	Ball	
CN-V-IX-62	1"	Flush Connection Isolation Check	Check	
CN-V-IX-63	2"	SDS to RCBT Shut Off	150# Ball Valve SW	
CN-V-IX-64	2"	SDS to RCBT Check	600# Check SW	
CN-V-IX-65	3/4"	SDS to RCBT Vent	Globe SW	
CN-V-IX-66	1"	SDS to RCBT Drain	Y-Globe SW	
CN-V-IX-67	1"	SDS to RCBT Drain	Y-Globe SW	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
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
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

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
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
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

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
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
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

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
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-5014
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	
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	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
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
CN-V-PM-178 (V-527-119)*	1/4"	Train #2 IX "C" Outlet Flow Diversion	3-Way Ball Valve Whitey SS-43XS4	527-L-5014
CN-V-PM-179 (V-527-120)*	1/4"	Cation Exchangers Influent Flow Diversion	3-Way Ball Valve Whitey SS-43XS4	527-L-5014
CN-V-PM-180 (V-527-121)*	1/4"	Cation Exchangers Effluent Flow Diversion	3-Way Ball Valve Whitey SS-43XS4	527-L-5014
CN-V-PM-181 (V-527-88)*	1/4"	Cation Exchangers Influent Sample Isolation	Ball Valve Whitey SS-43S4	527-L-5014
CN-V-PM-183 (V-527-96)*	1/4"	Train #1 - IX "A" EFF Sample Throttle	Needle Valve Whitey SS-1RS4	527-L-5014
CN-V-PM-184 (V-527-95)*	1/4"	Train #1 - IX "B" EFF Sample Throttle	Needle Valve Whitey SS-1RS4	527-L-5014
CN-V-PM-185 (V-527-93)*	1/4"	Train #1 - IX "C" EFF Sample Throttle	Needle Valve Whitey SS-1RS4	527-L-5014

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-PM-186 (V-527-94)*	1/4"	Train #2 - IX "A" EFF Sample Throttle	Needle Valve Whitey SS-1RS4	527-L-5014
CN-V-PM-187 (V-527-92)*	1/4"	Train #2 - IX "B" EFF Sample Throttle	Needle Valve Whitey SS-1RS4	527-L-5014
CN-V-PM-188 (V-527-91)*	1/4"	Train #2 - IX "C" EFF Sample Throttle	Needle Valve Whitey SS-1RS4	527-L-5014
CN-V-PM-189 (V-527-89)*	1/4"	Cation Exchangers Influent Sample Throttle	Needle Valve Whitey SS-1RS4	527-L-5014
CN-V-PM-190 (V-527-90)*	1/4"	Cation Exchangers Influent Sample Throttle	Needle Valve Whitey SS-1RS4	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
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	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
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-PM-229 (V-527-197)*	1/4"	Cation Exchangers Influent Beta Monitor Flush Line Check	Check Valve Nupro SS-4C-1	
CN-V-PM-230	1/4"	Cation Exchangers Effluent Beat Monitor Flush Line Check	Check Valve Nupro SS-4C-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-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
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

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
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
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

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
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
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	Deleted.			
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	Deleted.			
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

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
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	
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	Deleted.			
CN-V-VA-236	Deleted.			
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	1"	Offgas Bottoms Pump Discharge Check	Swing Check	
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	
CN-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	
CN-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	
CN-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	
CN-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	
CN-V-SA-259 (V-527-164)*	1/4"	Sample Flask Inlet Stop	Angle Pattern Ball Valve SS-43S4-A Whitey	527-L-5014	
CN-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
CN-V-SA-261 (V-527-172)*	1/4"	Sample Flask Outlet Stop	Angle Pattern Ball Valve SS-43S4-A Whitey	527-L-5014	
CN-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 Flash 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"
CN-V-SA-273 (V-527-175)*	1/4"	Sample Flask Outlet Stop	Angle Pattern Ball Valve SS-43S4-A Whitey	527-L-5014	Effluent
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"
CN-V-SA-277 (V-527-176)*	1/4"	Sample Flask Outlet Stop	Angle Pattern Ball Valve SS-43S4-A Whitey	527-L-5014	Effluent
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-4C-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 SS44F6	527-L-5014
CN-V-SA-307 (V-527-103)*	3/8"	Filter Effluent Sample Outlet Stop	Ball Valve Whitey SS44F6	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-44F6	
CN-V-SA-311 (V-527-109)*	3/8"	Hi Rad Feed Influent Sample Stop	Ball Valve Whitey SS-44F6	
CN-V-SA-312 (V-527-111)*	3/8"	Hi Rad Feed Sample Spigot	Ball Valve Whitey SS-44F6	
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 SS22RS4	
CN-V-DW-468	1/4"	Sample Bomb Bypass	S.S. Whitey Needle Valve SS22RS4	
CN-V-DW-469	1/4"	Outlet from Sample Bomb	S.S. Whitey Needle Valve SS22RS4	
CN-V-DW-470	1/4"	Sample System Isolation	S.S. Whitey Needle Valve SS22RS4	
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
CN-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
CN-V-RC-361 (V-527-251)*	1"	RCS Manifold Influent Check	150# Swing Check Valve BW 316 SS	
CN-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
CN-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
CN-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

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-RC-365 (V-527-253)*	1"	RCS Manifold Influent "Tie-In" Connection Check	150# Swing Check Valve SW 316 SS	
CN-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
CN-V-RC-367 (V-527-265)*	1"	RCS Return From Filter Manifold	300# Ball Valve SW 316 SS ITT Grinnell 1"-3023-1-1	
CN-V-RC-368 (V-527-250)*	1"	RCS Return From Filter Manifold	150# Swing Check Valve BW 316 SS	
CN-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
CN-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
CN-V-RC-371 (V-527-255)*	1"	RCS Manifold Effluent Check	150# Swing Check Valve BW 316 SS	
CN-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
CN-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-i-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	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
CN-V-PF-66	3/4"	Post Filter Vent First Isolation	150# Ball Valve SW 316 SS ITT Grinnell 3/4"-3015-1-8	
CN-V-PF-67	3/4"	Post Filter Vent Second Isolation	150# Ball Valve SW 316 SS ITT Grinnell 3/4"-3015-1-8	
CN-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	
CN-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	
CN-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	
CN-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	
CN-V-PF-72	1"	Post Filter Flush Isolation	Tufline Plug Valve 8972AL	
CN-V-PF-73	1/2"	Post Filter Effluent to Monitor Tanks Vacuum Breaker	1/2" MPT Vacuum Breaker McMaster Carr c/N 4817K4	
CN-V-PF-74	1/2"	Post Filter Atmospheric Vent	Ball Valve SS-8BK Whitey	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
SDS-V-002A	1 1/2"	Monitor Tank "A"	150# Ball Valve Isolation Valve	2-M74-SDS-01 SW 316 SS ITT Grinnell 1 1/2"-3015-1-1
SDS-V-002B	1 1/2"	Moni'or Tank "B"	150# Ball Valve Isolation Valve	2-M74-SDS-01 SW 316 SS ITT Grinnell 1 1/2"-3015-1-1
SDS-V-003	2"	Monitor Tanks Outlet Cross	150# Ball Valve Connect Valve	2-M74-SDS-01 SW 316 SS ITT Grinnell 2"-3015-1-1
SDS-V-004A	2"	Monitor Pump 1A Suction	150# Ball Valve	2-M74-SDS-01 SW 316 SS ITT Grinnell 2"-3015-1-1
SDS-V-004B	2"	Monitor Pump 1B Suction	150# Ball Valve	2-M74-SDS-01 SW 316 SS ITT Grinnell 2"-3015-1-1
SDS-V-005A	3/4"	Monitor Pump 1A Suction	150# Ball Valve Instrument Isolation	2-M74-SDS-01 SW 316 SS ITT Grinnell 3/4"-3015-1-1
SDS-V-005B	3/4"	Monitor Pump 1B Suction	150# Ball Valve Instrument Isolation	2-M74-SDS-01 SW 316 SS ITT Grinnell 3/4"-3015-1-1
SDS-V-006A	3/4"	Monitor Pump 1A Discharge	150# Ball Valve Instrument Isolation	2-M74-SDS-01 SW 316 SS ITT Grinnell 3/4"-3015-1-1

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
SDS-V-006B	3/4"	Monitor Pump 1B Discharge	150# Ball Valve Instrument Isolation	2-M74-SDS-01 SW 316 SS ITT Grinnell 3/4"-3015-1-1
SDS-V-007A	2"	Monitor Pump 1A Discharge	Check Valve Check Valve	2-M74-SDS-01 Ladish 5261-0607-20A
SDS-V-007B	2"	Monitor Pump 1B Discharge	Check Valve Check Valve	2-M74-SDS-01 Ladish 5261-0607-20A
SDS-V-008A	2"	Monitor Pump 1A Discharge	150# Ball Valve Valve	2-M74-SDS-01 SW 316 SS ITT Grinnell 2"-3015-1-1
SDS-V-008B	2"	Monitor Pump 1B Discharge	150# Ball Valve Valve	2-M74-SDS-01 SW 316 SS ITT Grinnell 2"-3015-1-1
SDS-V-009A	1"	Monitor Pump 1A Sample	150# Ball Valve Isolation Valve	2-M74-SDS-01 SW 316 SS ITT Grinnell 1"-3015-1-1
SDS-V-009B	1"	Monitor Pump 1B Sample	150# Ball Valve Isolation Valve	2-M74-SDS-01 SW 316 SS ITT Grinnell 1"-3015-1-1
SDS-V-010A	3/4"	Monitor Pump 1A Sample	Globe Valve Valve	2-M74-SDS-01 Ladish 7271-0714-07
SDS-V-010B	3/4"	Monitor Pump 1B Sample	Globe Valve Valve	2-M74-SDS-01 Ladish 7271-0714-07

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
SDS-V-011	1 1/2"	Monitor Tanks Discharge	150# Ball Valve Cross Connect	2-M74-SDS-01 SW 316 SS ITT Grinnell 1 1/2"-3015-1-1
SDS-V-012A	1 1/2"	Monitor Tank "A"	Check Valve Recirc. Check Valve	2-M74-SDS-01 Ladish 5201-0607-15A
SDS-V-012B	1 1/2"	Monitor Tank "B" Recirc.	Check Valve Check Valve	2-M74-SDS-01 Ladish 5201-0607-15A
SDS-V-013A	1 1/2"	Monitor Tank "A" Recirc.	150# Ball Valve	2-M74-SDS-01 SW 316 SS ITT Grinnell 1 1/2"-3015-1-1
SDS-V-013B	1 1/2"	Monitor Tank "B" Recirc.	150# Ball Valve	2-M74-SDS-01 SW 316 SS ITT Grinnell 1 1/2"-3015-1-1
SDS-V-014	2"	Monitor Pump Discharge to	150# Ball Valve Epicor	2-M74-SDS-01 SW 316 SS ITT Grinnell 2"-3015-1-1
SDS-V-018	2"	Monitor Pump Discharge to	150# Ball Valve PWST, Second Isolation Valve	2-M74-SDS-01 SW 316 SS ITT Grinnell 2"-3015-1-1
SDS-V-23A	3/4"	Monitor Tank "A", Level	150# Ball Valve Instrument Isolation	2-M74-SDS-01 SW 316 SS ITT Grinnell 3/4"-3015-1-1

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
SDS-V-23B	3/4"	Monitor Tank "B", Level	150# Ball Valve Instrument Isolation	2-M74-SDS-01 SW 316 SS ITT Grinnell 3/4"-3015-1-1
SDS-V-024A	1 1/2"	Monitor Tank "A" Drain	150# Ball Valve First Isolation Valve	2-M74-SDS-01 SW 316 SS ITT Grinnell 1 1/2"-3015-1-1
SDS-V-024B	1 1/2"	Monitor Tank "B" Drain	150# Ball Valve First Isolation Valve	2-M74-SDS-01 SW 316 SS ITT Grinnell 1 1/2"-3015-1-1
SDS-V-025A	1 1/2"	Monitor Tank "A" Inlet	150# Ball Valve	2-M74-SDS-01 SW 316 SS ITT Grinnell 1 1/2"-3015-1-1
SDS-V-025B	1 1/2"	Monitor Tank "B" Inlet	150# Ball Valve	2-M74-SDS-01 SW 316 SS ITT Grinnell 1 1/2"-3015-1-1
SDS-V-026A	2"	Monitor Tank "A" Inlet	150# Ball Valve	2-M74-SDS-01 SW 316 SS ITT Grinnell 2"-3015-1-1
SDS-V-026B	2"	Monitor Tank "B" Outlet	150# Ball Valve	2-M74-SDS-01 SW 316 SS ITT Grinnell 2"-3015-1-1
SDS-V-028	2"	Monitor Pump Discharge	Check Valve to Epicor Check Valve	2-M74-SDS-01 Ladish 5261-0607-20A

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
SDS-V-031	2"	Monitor Pump Discharge	Check Valve to PWST Check Valve	2-M74-SDS-01 Ladish 5261-0607-20A
SDS-V-032	2"	Monitor Tank Demin. Water	150# Ball Valve Isolation	2-M74-SDS-01 SW 316 SS ITT Grinnell 2"-3015-1-1
SDS-V-033	2"	Monitor Tank Demin. Water	Check Valve Supply Check Valve	2-M74-SDS-01 Ladish 5261-0607-20A
SDS-V-034A	1 1/2"	Monitor Tank "A" Drain	150# Ball Valve Second Isolation Valve	2-M74-SDS-01 SW 316 SS ITT Grinnell 1 1/2"-3015-1-1
SDS-V-034B	1 1/2"	Monitor Tank "B" Drain	150# Ball Valve Second Isolation Valve	2-M74-SDS-01 SW 316 SS ITT Grinnell 1 1/2"-3015-1-1
SDS-V-036	3/4"	Monitor Pump Discharge	150# Globe Valve Header Vent	2-M74-SDS-01 Ladish 7271
SDS-V-037	3/4"	Monitor Pump Discharge	150# Globe Valve Header Vent	2-M74-SDS-01 Ladish 7271
SDS-V-038	1"	Monitor Pump Discharge	150# Globe Valve Header Drain	2-M74-SDS-01 Ladish 7271
SDS-V-039	2"	Monitor Pump Discharge	150# Ball Valve to FWST First Isolation	2-M74-SDS-01 SW 316 SS ITT Grinnell 2"-3015-1-1
SDS-V-050	2"	Monitor Pump Discharge	150# Check Valve to RCS manifold Check Valve	2-M74-SDS-01 SW 316 SS Alloyco Fig. 370

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
SDS-V-051	1"	Monitor Pump Discharge to	150# Ball Valve RCS manifold First Isolation Valve	2-M74-SDS-01 SW 316 SS ITT Grinnell 1"-3015-1-'
SDS-V-052	1"	Monitor Pump Discharge to	150# Ball Valve RCS manifold Second Isolation Valve	2-M74-SDS-01 SW 316 SS ITT Grinnell 1"-3015-1-1
SDS-V-053	1"	Monitor Tank Discharge	Check Valve to RCS Manifold Check Valve	2-M74-SDS-01
SDS-V-054	1 1/2"	Monitor Tank System	150# Ball Valve Drainline Isolation	2-M74-SDS-01 SW 316 SS ITT Grinnell 1 1/2"-3015-1-8
SDS-V-055A	3/4"	Monitor Tank 1A Sample	300# Ball Valve Flush Valve	2-M74-SDS-01 SW 316 SS ITT Grinnell 3/4"-3013-1-8
SDS-V-055B	3/4"	Monitor Tank Pump 1B	300# Ball Valve Sample Flush Valve	2-M74-SDS-01 SW 316 SS ITT Grinnell 3/4"-3013-1-8
SDS-V-056	2"	Monitor Tank Pump	Ball Valve Discharge to PWST	2-M74-SDS-01 ITT Grinnell Isolation
SDS-V-057	2"	Monitor Tank Pump Discharge	Ball Valve Discharge to Epicor II	2-M74-SDS-01 ITT Grinnell Isolation
SDS-V-058	3/4"	Monitor Tank Pump Discharge Header Vent Second Isolation		PO No. 190124

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
SDS-V-059	1"	Monitor Tank Pump Discharge Header Drain Second Isolation		PO No. 190126
SDS-S-1A	2"	Strainer, Monitor Tank Pump	Wye Type Strainer SDS-P-1A Suction	2-M74-SDS-01 316 SS Mueller Steam Specialty Co.
SDS-S-1B	2"	Strainer, Monitor Tank Pump	Wye Type Strainer SDS-P-1B Suction	2-M74-SDS-01 316 SS Mueller Steam Specialty Co.
SWS-V-1	1 1/2"	Penetration ISSI, 1st out-board Containment Isolation	WATTS 150# Ball SA 8501 LL S.W.	ASTM A182, GRF316, 316SS
SWS-V-2	1 1/2"	Penetration ISSI, 2nd out-board Containment Isolation	WATTS 150# Ball SA 8501 LL S.W.	ASTM A182, GRF316, 316SS
SWS-V-4	1"	Flush Connection Inlet Isolation	WATTS 150# Ball SA 8501 LL S.W.	ASTM A182, GRF316, 316SS
SWS-V-5	1"	Flush Connection Inlet Check	Crane 150# Swingcheck #61-600 S.W.	ASTM A182, GRF316, 316SS
SWS-V-6	3/4"	1st Low Drain Isolation	WATTS 150# Ball SA 8501 LL S.W.	ASTM A182, GRF316, 316SS
SWS-V-7	3/4"	2nd Low Point Drain Isolation	WATTS 150# Ball SA 8501 LL S.W.	ASTM A182, GRF316, 316SS
FCC-V001	1 1/2"	Canal Drain Manifold Isolation (RB Sump)	150-300# Ball SW ITT-Grinnell 3015-1-1	
FCC-V002	1 1/2"	Canal Drain Manifold Isolation (Canal Drain)	150-300# Ball SW ITT-Grinnell 3015-1-1	
FCC-V003	1 1/2"	Canal Drain Manifold Isolation (New Fuel Pit)	Ball SW ITT-Grinnell 3015-1-4	

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VALVE NO.	SIZE	DESCRIPTION	TYPE, MANUFACTURER & MODEL NUMBER	MATERIAL SPECIFICATION
FCC-V004*	4"	FCC-P-2 Bypass	150-300# Ball BW ITT-Grinnell 3113-1-1	TP 316L
FCC-V005	3"	FCC-P-2 Suction	150-300# Ball BW ITT-Grinnell 3113-1-1	TP 316L
FCC-V006	3"	FCC-P-2 Discharge	150-300# Ball BW ITT-Grinnell 3113-1-1	TP 316L
FCC-V007	3/4"	FCC-P-2 Air Supply	600# Pressure Regulator NPT Masonelian Mod 17-22	
FCC-V-008	3/4"	FCC-PI-2 Root Isolation	800# Globe SW Vogt SW-12501	
FCC-V009	3/4"	FCC-PI-3 Root Isolation	800# Globe SW Vogt SW-12501	
FCC-V010	3/4"	FCC-PI-4 Root Isolation	800# Globe SW Vogt SW-12501	ASTM A182, GR F316
FCC-V011	3"	Canal Fill Manifold Isolation	150# Ball BW ITT-Grinnell 3113-1.1	TP 316L
FCC-V012	2"	Canal Fill Manifold Isolation	150# Ball BW ITT-Grinnell 3113-1-1	TP 316L
FCC-V013	4"	Canal Fill Manifold Isolation	150# Ball BW ITT-Grinnell 3113-1-1	TP 316L
FCC-V014	Deleted			
FCC-V015	1 1/2"	Canal Drain Manifold Inlet Check (Canal Drain)	800# Check SW Newco 38SFBM4	
FCC-V016	1 1/2"	Canal Drain Manifold Inlet Check (New Fuel Pit)	800# Check SW Newco 38SF8M4	

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Submerged Demineralizer System

System Design Description

Title

S.D.S. Procedure List

APPENDIX 11

SDS OPERATING PROCEDURE LIST

Procedure Number	Title
4215-OPS-3527.01	SDS Operational Guidelines
4215-OPS-3527.02	SDS Operational Guidelines for RCBT & IIF Processing
4215-OPS-3527.03	Submerged Ion Exchangers System Operation
4215-OPS-3527.04	RCBT Processing through SDS
4215-OPS-3527.20	IIF Processing through SDS
4215-OPS-3527.05	Leakage Containment System
4215-OPS-3527.06	SDS Vent and Drain Subsystem
4215-OPS-3527.07	SDS Monitor Tanks
4215-OPS-3527.08	Filter Vessel Replacement Procedure
4215-OPS-3527.09	Cation Ion Vessel Replacement Procedure
4215-OPS-3527.10	SDS Zeolite Exchanger Vessel Replacement Procedure
4215-OPS-3527.11	Leakage Containment Vessel Replacement Procedure
4215-OPS-3527.12	SDS Electrical Procedure
4215-OPS-3527.13	Loading SDS Vessel into 1-13C-II Shipping Cask
4215-OPS-3527.14	SDS Shipping Cask Inerting
4215-OPS-3527.15	Spent Vessel Dewatering Station Operation
4212-OPS-3527.01	SDS Leakage Containment Ion Exchanger Sampling Procedure
4212-OPS-3527.02	SDS Prefilter and Final Filter Sampling Procedure
4212-OPS-3527.03	SDS Feed Sampling Procedure
4212-OPS-3527.04	SDS Influent/Effluent Resin Liner Sampling Procedure
4212-OPS-3527.05	SDS Monitor Tank Sampling

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SDS OPERATING PROCEDURE LIST

Procedure Number	Title
4215-OPS-3527.16	10 Cuft Vessel Loading Procedure
4215-OPS-3527.17	MWHT Processing through SDS
4215-OPS-3527.18	SDS Post Filter Changeout
4215-OPS-3527.19	Operational Maintenance for the SDS Vacuum System
4215-OPS-3527.21	SDS Vessel Gas Sample & Vent Header Flushing
4215-OPS-3527.22	DWCS Processing through SDS
4215-OPS-3527.23	Filter Media Mixing Procedure
4215-OPS-3527.24	Fuel Transfer Canal Drain Pump Operations
4215-OPS-3527.25	Removal of SDS Leakage Containment or Sand Filter Vessels from Pool Storage and Transfer to FHB
4215-OPS-3527.47	Neutralizer Tanks Processing through SDS
4210-OPS-3232.01	Sampling of Spent SDS Liners Using the SDS Vacuum System
4210-OPS-3232.02	Staging of Reactor Bldg. Sump Water for Future Processing
4210-OPS-3527.05	SDS Spent Vessel Tool & Dewatering Station Operations
4215-OPS-3525.04	Reactor Vessel Filtration System/SDS Operation
4215-OPS-3232.25	New Fuel Pit Transfer to RCBT's

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SDS EMERGENCY PROCEDURE LIST

Procedure Number	Title
4210-EAP-3527.01	SDS General Emergency
4210-EAP-3527.02	Leakage in the SDS Feed Filtration System
4210-EAP-3527.03	Leakage in the SDS Submerged Ion Exchangers System
4210-EAP-3527.04	Loss of Vent and Drain Subsystem
4210-EAP-3527.05	SDS Cask Accident

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SDS RESPONSE PROCEDURE LIST

Procedure Number	Title
4210-RAP-3527.02	Local Annunciators - SDS Alarm Responses
4210-RAP-3527.01	SDS Panel 1 Alarm Responses
4210-RAP-3527.03	SDS Panel 2 Alarm Responses
4210-RAP-3527.04	SDS vs Alarm Responses
4210-RAP-3527.05	CN-PNL-1 Alarm Responses
4210-RAP-3527.06	SDS Offgas Sampler Panel 1

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to

Submerged Demineralizer System

System Design Description

Title

RB Basement Jet Pump System

System Design Description

SYSTEM DESIGN DESCRIPTION

OF THE

REACTOR BUILDING BASEMENT JET PUMP SYSTEM

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1.0 DESIGN DESCRIPTION

1.1 Summary

This system is designed to draw water from the basement of the Containment Building and deliver it to the RCS clean-up manifold of the Submerged Demineralizer System (SDS). Within the SDS the water will normally be routed via the prefilter and final filter to the ion exchangers. Alternately the water can be filtered and stored in the MWHT or RCBT's.

1.2 References

1.2.1 S-ECM-1141; Pipe from penetration 1551 to the RCS manifold.

1.2.2 Burns and Roe Calculation WG-61-02; WG-61 1-1/2" Line Rupture in F.H. Building (SWS-P-1)

1.2.3 ECM-1039; Jet Pump Installation in the Reactor Building.

1.3 Detailed System Description

1.3.1 The jet pump is a commercially available Goulds pump rated at 1 1/2 HP. It is placed on the 305' elevation of the Reactor Building in the vicinity of the incore instrumenation cable chase penetration. A suction packer assembly is lowered inside a 4" PVC pipe into the incore instrumentation trench, and suction is taken at that point. A 1" I.D. rubber hose with leak tight "quick disconnect" fittings is coupled to the pump discharge at one end and to containment penetration 626 at the other. From just inside the containment penetration to the tie-in with the SDS piping, the system is hard piped with 1-1/2" Schedule 40 stainless steel pipe. This pipe is not shielded in the Annulus between the Reactor Building and the Fuel Handling Building. Within the Fuel Handling Building the pipe is shielded with a minimum of 1 inch of lead. These shielding requirements reduce area dose rates to $<$ 1 mrem/hr. System piping design conforms to Regulatory Guide 1.143 and as such all piping outside the Containment is per ANSI B31.1, non-seismic with commercial grade QA. Within the containment there are no valves or other devices to prevent flow in either direction. Double isolation is provided just outside the Reactor Building in the Fuel Handling Building. A 1" Diameter line located near the top of the system piping and just inside the Fuel Handling Building serves as a vacuum breaker and flush connection. Flush water will be plant demineralized water or processed water. This is a plant operations option. Flush water will be supplied via rubber hose to the flush connection. Electricity to the pump is fed through a 4 conductor no. 9 power cord which parallels the pump discharge hose up through the Containment and Fuel Handling Building penetrations. Inside the Fuel Handling Building the power cord is routed to a motor control center located on the east wall at the operating floor elevation.

1.3.2 Jet Pump (SWS-P-1)

Type:	Goulds Cat.# GH 15D
Motor:	1 1/2 hp.
Discharge pressure	30-50 psi
Packer system:	Goulds Cat.# FP2-14
Wellhead Adapter:	Goulds Cat.# AWJ2

1.3.3 System Capacity

System operation is 5 gpm by throttling back on the pump discharge flow. As the Δp across the filters increases due to solids deposition, the system pressure must be increased by opening the throttle valve.

1.3.4 Discharge Hose

154 feet long, 1" I.D. Water Hose; 300 psi design working pressure, Buna - N tube with polyester reinforcement, neoprene cover; Design life: approx. 1 yr. in contact with sump water. Fittings: 1" Diameter Hansen type 8-ST quick disconnects; straight thru design.

1.3.5 Piping

1-1/2" sched. 40 Austenitic Stainless Steel
Design Code: B31.1 (non-seismic)
Design Pressure: 150 psig.
Design Temperature: Ambient

1.4 System Performance Characteristics

The RB basement pump was chosen based on the need for taking suction at the 282' elevation of the Reactor Building and pumping through the prefilter and final filter to the SDS ion exchange train directly.

1.5 System Arrangement

The pump and motor are located on elevation 305', with a well head adapter and packer assembly lowered to the basement floor, discharge hose and power cable is routed across the 305' elevation floor to column R-9, up through the 347' elevation seismic gap (west of the incore instrumentation termination plate), and then northeastward to meet the hard piping and electrical connection extending into the containment through penetration R-626. The hose is anchored at the 347' elevation seismic gap, column R-9 above the 305' elevation floor, and the curbing on the north side of the open stairwell on the 305' elevation. The hard piping is routed through containment penetration R-626 and Fuel Handling Building penetration 1551, north along the west wall of the Fuel Handling Building to the west side of the RCS manifold.

1.6 Instrumentation and Control

The pump control will be via on/off buttons with indicator lights showing power to the panel and pump. Controls and indication will be located on panel CN-PNL-1. The switch/power supply may be temporarily rerouted to the Temporary RV Filtration System. An off button is also available on the starter box located on the east wall of the 347' elevation of the Fuel Handling Building. Though the system is designed to be started and run in the valves wide open mode, system flow may be decreased by throttling any of the process line valves.

1.7 System Interfaces

The R.B. basement Pump discharges through flexible hoses and the FCC drain manifold to hard pipe in containment Penetration R-626 and Fuel Handling Building Penetration No. 1551. Inside the Fuel Handling building the fluid from the R.B. basement Pump interfaces with 1-1/2" schedule 40 stainless steel piping on the RCS manifold, were it is reduced to 1" and connected via a 1" flange.

The R.B. basement Pump interfaces electrically with 480V, 3ϕ, 60 Hz cycle power from circuit 7 of the 480V distribution panel PDP-2B located on the 328' Elevation of the Auxiliary Building. The 480 Volts is stepped down through a 15KVA transformer to 240V 3ϕ 60Hz, to a motor starter box on the east wall of 347'6" elevation of the Fuel Handling Building.

Pump control is from SDS panel CN-PNL-1, located on the west end of the Cask Support Platform at the South end of B Fuel Pool.

2.0 SYSTEM LIMITATIONS

2.1 If the pump is to be shut down for an extended period (i.e. longer than approximately 3 hours) the discharge hose must be vented. This will keep the high vacuum which will form as water attempts to flow back to the RB Sump from unduly stressing the hose.

2.2 If debris clogs the pump suction screen, cavitation induced damage to the pump could occur. Therefore, if flow to the tanks is un-accountably low, or if pressure delivered to the SDS is lower than anticipated, the pump should be stopped and the line back-flushed to clear the pump inlet.

3.0 OPERATION

System operation shall be per operating procedure 4215-OPS-3527.03.

4.0 CASUALTY EVENTS AND RECOVERY PROCEDURES

4.1 Casualty Events

The only significant casualty event possible in this system is a breech of pressure boundary experienced during pumping of Reactor Building sump water to the SDS RCS manifold. The result of this scenario would be a release of containment sump water to either the Reactor Building elevations 305' or 347' or to the 347' elevation of the Fuel Handling Building.

4.2 Design Features to Mitigate Effects of Casualty Events

During the transfer of Reactor Building sump water to the RCS manifold the operator controlling the on/off switch for SWS-P-1 will monitor the pump discharge pressure CN-PI-FL-01 (ref. 2.3) located on the SDS prefilter inlet. It can then be concluded that a hose or pipe leak will result in a loss of pressure as indicated on CN-PI-FL-01 and will be secured immediately by de-energizing SWS-P-1. However, an undetected leak located in the Reactor Building will result in increased surface contamination in the area of the leak but no off-site exposure. The resulting exposure to on-site personnel is minimized by back flushing of all process lines after pumping. Standing water will be redirected to the containment sump via the floor drains.

Unchecked leakage of containment sump water on to the Fuel Handling Building 347' elevation floor will be directed to the Auxiliary Building waste collection system via the floor drains. A process pipe leak in the Fuel Handling Building (resulting from a 5 minute undetected guillotined rupture of a 1-1/2" transfer pipe resulting in a 371 gallon spill, ref. 1.2.4) results in a worst case off-site exposure of approximately 2200 times smaller magnitude than that resulting from the rupture of a Waste Gas Decay Tank as analyzed in the TMI-2 FSAR. (See also SDS Technical Evaluation Report Section 7.2)

5.0 SURVEILLANCE

Pump Surveillance will be by occasional non-routine visual observation on containment entries subsequent to entry no. 9. (April 30, 1981).

Portions of the R.B. basement Pumps' discharge hose and power (electrical) cable may be observed from closed circuit TV cameras located inside the Reactor Building, dependent on present locations of cameras.

6.0 ACCEPTANCE TESTING

The R.B. basement Pump will be given a functional test once installed to prove that operation is consistent with experienced SDS processing flow rates.

Appendix No. 13

to

Submerged Demineralizer System

System Design Description

Title

Process Program Limiting Parameters

APPENDIX No. 13

PROCESS CONTROL PROGRAM LIMITING PARAMETERS

COMPONENT	PARAMETER	LIMIT	BASIS
Prefilter	Differential Pressure	See attached graph	Mechanical Performance
Final Filter	Differential Pressure	See attached graph	Mechanical Performance
Ion Exchangers	Flow Rate	10 gpm/train	Residence Time
Ion Exchangers	Curie Loading	60,000 Ci (Cs) 2,000 Ci (Sr)	Admin. Limit based on DOE Task Force
"Cation" Sand Filter	Differential Pressure	See attached graph	Mechanical Performance
Manifold Containments	Differential Pressure	.25 inches water gauge	Provide sufficient flow to off-gas system
RCBT	Volume	72,000 gallons	Admin. Limit based on 90 percent capacity
Feed Stream	Temperature	140°F (max.)	Protect resin
Leakage Containment	Flow Rate	50gpm/total flow	mechanical performance
SDS Effluent - to Epicor II	Activity Level	<2 Ci total (Cs and Sr)	Assures Less Than 1 uCi/cc of Primary Long-Lived Isotopes to Permit dewatered burial (assumes licensing variance).

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PROCESS CONTROL PROGRAM LIMITING PARAMETERS

COMPONENT	PARAMETER	LIMIT	BASIS
		<13.6Ci Total (Sr-90)	Assures Deposits of less than 13.6 Ci Sr-90 to Ensure 6X6 will not be Type "B" Shipment (Stabilization required).
		<20Ci Total (γ-emitter)	Assures Deposits of Less Than 20 Ci gamma emitters to Permit bare handling of 6X6 at Less Than 20 R/hr (Stabilization required).
SDS Effluent-Recycle	Activity Level	$>2.00X10^{-1}$ uci/ml	Minimize curve Loading in Epicor II
PWST	Ai/MPCi	$\leq 6.4X10^{6}$	In accordant with PEIS, as long as Radiation Levels are acceptable
Off Gas Prefilter	Differential Pressure	0.5 inches water	Mechanical Performance
Off Gas HEPA and Charcoal Filters	Differential Pressure	2.0 inches water	Mechanical Performance
Off Gas Prefilter, HEPA and Charcoal Filters	Radiation Level	100 mR/hr at Contact with Filter Housing (Shielded or Unshielded)	Admin. Limit based on Minimizing Exposure

SD 3527-005

APPENDIX No. 13

PROCESS CONTROL PROGRAM LIMITING PARAMETERS

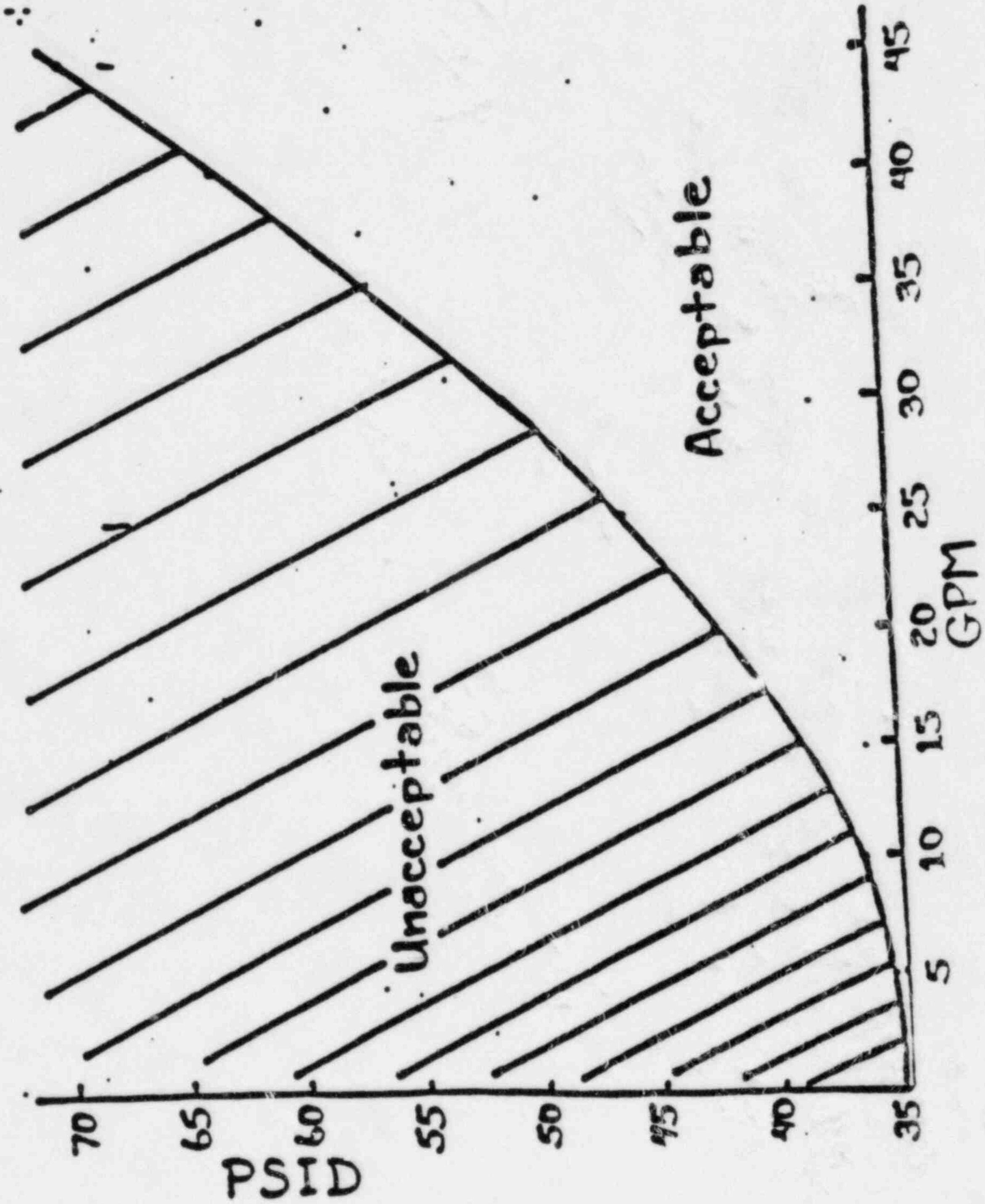
COMPONENT	PARAMETER	LIMIT	BASIS
Leakage Containment Ion Exchanger	Curie Loading	0.18 Ci	1 μCi/gm, curies with half lifes of 5 years to permit dewatered shallow land burial
Fuel Pool Quality	Ph	8.5 to 10.0	Corrosion
	Boron Conc.	6000 ppmB, max	Criticality
	Na Grade	Reactor coolant Grade Na OH	Minimize Cl^-
	Cl^-	5.0 ppm, max.	Corrosion
	F^-	5.0 ppm, max	Corrosion
	Suspended Solids	1.0 ppm, max	Pool clarity
	Turbidity	1.0 NTU, max	Pool clarity
	Gross B,δ	5×10^{-4} μci/ml max. excluding H_3	Allow use of processed water and small leaks from SDS operation, and minimize pool water recontamination and surface dose Rates

SD 3527-005

0950x LC

Attachment

Allowable ΔP across single sand Filter



Appendix No. 14

to

Submerged Demineralizer System

System Design Description

Title

Monitor Tank

System Design Description

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1.0 DESIGN DESCRIPTION

1.1 Summary

The submerged demineralizer system monitor tank system is a temporary system capable of collecting and monitoring processed water from the submerged demineralizer system (SDS) and transferring it to either the processed water storage and recycle system (PW), the Epicor II System, the RCS manifold or the SDS flush header. The submerged demineralizer system processes, by filtration and demineralization, highly contaminated waste water from the containment sump, various liquid radwaste storage tanks, and the reactor coolant system.

The SDS monitor tank system components include the SDS monitor tanks, SDS monitor tank transfer pumps, and associated instrumentation, piping, and valves.

1.2 References

1.2.1 Piping and Instrument Diagram (P and ID), SDS Feed and Monitor Tank System, Drawing 2-M74-SDS01.

1.2.2 General Arrangement, SDS Monitor Tanks, Fuel Handling Building, El. 305'-0", Drawing 2-POA-6201.

1.2.3 Burns and Roe Floor and Equipment Drains, Auxiliary and Fuel Handling Building, Plan at Elevation 305'-0", Drawing 2249.

1.2.4 Burns and Roe Flow Diagram, Heating and Ventilation, Fuel Handling Building, Drawing 2343.

1.2.5 Piping Line Index, Standard 15737-2-P-002.

1.2.6 (2) 12,000 Gallon, 96" O.D. x 32'-0" Straight Shell Water Storage Tanks, Buffalo Tank, Drawing 2-M100A-00001-01 (Buffalo Tank Drawing L-4274).

1.2.7 SDS One Line Diagram, Drawing 2-E21-005.

1.2.8 Instrument Index, Document 15737-2-J16-001.

1.2.9 Schematic Diagram, SDS Miscellaneous Instrumentation and Alarms, Drawing 2-E76-SDS04.

1.2.10 Loop Diagram, SDS Monitor Tank T-1A Level, Drawing 2-J75-SDS01.

1.2.11 Loop Diagram, SDS Monitor Tank T-1B Level, Drawing 2-J75-SDS02.

1.2.12 Loop Diagram, SDS Transfer Pump P-1A Discharge, Drawing 2-J75-SDS03.

1.2.13 Loop Diagram, SDS Transfer Pump P-1B Discharge, Drawing 2-J75-SDS04.

1.2.14 Instrument Rack Layout, Drawing 2-J71-SDS 01.

1.2.15 Instrument Rack Layout, Drawing 2-J71-SDS 02.

1.2.16 Logic Diagram, SDS Feed and Monitor Tank Transfer Pumps, Drawing 2-J77-SDS01.

1.2.17 Logic Diagram, SDS Feed and Monitor Tank Inlet Valves, Drawing 2-J77-SDS02.

1.2.18 Logic Diagram, SDS Feed and Monitor Tank Alarms, Drawing 2-J77-SDS03.

1.2.19 P and ID, Demineralized Service Water, Drawing 2-M74-DW01.

1.2.20 P and ID, Processed Water Storage and Recycle System, Drawing 2-M74-PW01.

1.2.21 HVAC, Partial Plans, Drawing 2-POH-001.

1.2.22 Level Setting Diagram, SDS Monitor Tank T-1A, Drawing 2-J78-SDS01.

1.2.23 Level Setting Diagram, SDS Monitor Tank T-1B, Drawing 2-J78-SDS02.

1.2.24 Master Valve Log (Burns and Roe).

1.2.25 Outline Drawing, SDS Monitor Tank Transfer Pumps, Drawing 2-M080A-00001-01 (Goulds serial no. 706C332.2-3).

1.2.26 Instruction Manual, SDS Monitor Tank Transfer Pumps, Drawing 2-M080A-00004-01 (Goulds pumps model no. 3196).

1.2.27 Performance Curve, SDS Monitor Tank Transfer Pumps, Drawing 2-M080A-00004-01 (Goulds pump model no. 3196).

1.2.28 Burns & Roe Recovery Flow Diagram, Auxiliary Building Emergency Liquid Cleanup System, Drawing M006.

1.2.29 Piping Line Specification, Standard 15737-2-P-001.

1.3 Detailed System Description

1.3.1 Process System Flowpaths (See Reference 1.2.1)

The SDS monitor tanks, SDS-T-1A and SDS-T-1B, collect processed water from the SDS "cation" sand filters. The effluent is routed to the tanks via separate 1 1/2-inch influent lines, allowing the capability for selection of either tank for filling operations. Each influent line contains a motor operated isolation valve. These valves, SDS-V002A and SDS-V002B, automatically isolate their respective tank when the level transmitter for the associated tank senses a high liquid level. Hand switches associated with these valves are provided for remote manual operation.

Manually operated valves, SDS-V025A and SDS-V025B, provide redundant isolation when used in conjunction with the above noted valves, SDS-V002A and SDS-V002B.

Monitor tank overflow and drain line piping is routed to an existing floor drain at el. 305'-0" of the fuel handling building (Ref. 1.2.3). The floor drain is routed to the auxiliary building sump via the existing auxiliary building drainage system. Vents from the monitor tanks are routed to the interior of a fuel handling building H and V system exhaust duct in the model room (Ref. 1.2.4 and 1.2.21).

Monitor tank transfer pumps, SDS-P-1A and SDS-P-1B, take suction directly from the monitor tanks. Transfer pump suction piping is 2-inch diameter and allows selection of either tank as the source of water. Isolation valves SDS-V026A, SDS-V026B, and SDS-V003 are provided on the crossover line of the pump suction piping to permit the correct monitor tank/transfer pump alignment to be selected. The crossover line is also equipped with a demineralized service water system tie-in (Ref. 1.2.19) to provide the capability for flushing system piping. Each transfer pump suction line is equipped with a wye-type strainer, SDS-S-1A and SDS-S-1B (for system start-up only), and a pressure test connection.

Transfer pump discharge piping is 2 inches in diameter and allows selection of either pump for water delivery functions. Discharge piping is equipped with a local pressure gauge and a pressure transmitter for remote indication. From the pumps, a 2-inch main discharge header is routed through the fuel handling building and auxiliary building, into the Unit 1/Unit 2 corridor and to the processed water storage and recycle system interface valve, PW-V039. The main discharge line also contains a flow totalizer, a 2" spare capped connection, a return line to the RCS manifold in the Fuel Handling Building, and a bypass line to the EPICOR II system in the Auxiliary Building just prior to the Unit 1/Unit 2 corridor.

A 1 1/2-inch recirculation line is routed from each pump discharge to the monitor tanks. Correct valve lineup will allow selection of either pump to recirculate to either tank. Sample lines are routed from each recirculation line to a sample sink adjacent to the pumps. From the sample sink, the effluent is directed to an existing floor drain at el. 305'-0" of the fuel handling building. Sample flush lines which direct flow directly to the existing floor drain are also installed to allow flushing of the sample lines prior to taking a sample.

1.3.2 Major System Components

1.3.2.1 Monitor Tanks (See Table 1)

Two 12,000-gallon monitor tanks (SDS-T-1A and SDS-T-1B) are located at el. 305'-0" of the fuel handling building in an area known as the "model room." The tanks are non-Seismic Category I. A structural restraint system is provided to prevent their collapse in order to protect the structural integrity of the fuel handling building during a seismic event. The structural restraint system consists of steel framework for bracing the upper portion of the tanks, along with anchor bolts and hold-down lugs for supporting the base. Mixing of the liquid within the tanks is accomplished by pump recirculation. A mixing eductor system capable of recirculating the equivalent of three tank volumes in approximately 3 hours is used in each tank to provide representative sampling capability. The eductor system consists of a single 1 1/2-inch Schutte and Koerting Co. Type 268 eductor and associated piping and supports.

1.3.2.2 Monitor Tank Transfer Pumps (See Table 2)

Monitor Tank transfer pumps, SDS-P-1A and SDS-P-1B, located at el. 305'-0" of the fuel handling building, are single-stage horizontal centrifugal types with mechanical seals and plugged casing drains. Pump casings are manufactured of ASTM A 296, Grade CF8M, stainless steel.

Motors for the pumps are supplied with electrical service from the 480-volt power distribution panel PDP-6A (circuits 8 and 10).

1.3.3 Process System Design

The system design temperature range is 40-120 F. The maximum operating pressures of the system piping and valves are provided in References 1.2.5.

Piping is fabricated and installed in accordance with ANSI B31.1, Power Piping Code. System piping and valves are manufactured of stainless steel.

1.4 System Performance Characteristics

The flow rate of the influent to the monitor tanks from SDS ranges from 5 to 15 gpm. This influent flow rate is determined by the number of SDS zeolite trains (one/two) in service.

During recirculation the transfer pump recirculation rate to the tanks is about 60 gpm.

The effluent transfer rate from the monitor tank is controlled by the pump discharge throttle valve and also depends on the discharge path. In the case of the processed water storage tanks the maximum flow rate (unthrottled) is between 80 to 90 gpm. When the effluent is transferred to the Epicor II system for further processing the flow rate is limited to a nominal valve of 10 gpm.

The normal operating pressure range (unthrottled) at the discharge of the transfer pumps is appproximately 40 to 60 psig. Discharge pressure varies in this range with the water level in the monitor tanks and the discharge path being employed.

1.5 System Arrangement (See Reference 1.2.2)

The monitor tanks and monitor tank transfer pumps are located in the northwest corner of the fuel handling building, at el. 305'-0" (as shown on Reference 1.2.2) in an area known as the "model room."

Tanks are mounted vertically, and are located 11 feet apart between centers. A 20-inch manway on the side of each tank provides personnel access for surveillance, inspection, and maintenance purposes.

Space is provided around the tanks and pumps for future shielding if required. Curbing is also provided around the tanks and pumps to retain spills.

Controls for the monitor tank transfer pumps are provided at local control panel SDS-LCP-1 (described in Section 1.6.1), and at local starters SDS-STR-1 and SDS-STR-2 (described in Section 1.6.15). Controls for the monitor tank inlet motor operated isolation valves, SDS-V002A and SDS-V002B, are provided at local control panel SDS-LCP-1.

1.6 Instrumentation and Control

1.6.1 Local Control Panel

The primary control for the system is accomplished from local panel SDS-LCP-1, located at el. 347'-6" of the fuel handling building. Devices mounted on this panel include the following:

a. Indicators for the liquid level in the monitor tanks and the discharge pressure of the transfer pumps.

b. Hand switches and indicator lights for the motor operated isolation valves.

c. Hand switches and indicator lights for the monitor tank transfer pumps.

d. Monitor tank/transfer pump selector switch.

Local control panel SDS-LCP-2, located at el. 305'-0" of the fuel handling building, is equipped with level indicators for the monitor tanks.

1.6.2 Annunciators

Alarms for high/low tank level are included on the SDS annunciator panel, located at el. 347'-6" of the fuel handling building. An additional high level alarm is provided for each tank on panel SPC-PNL-3, located in the main control room.

1.6.3 Level Transmitters

Differential pressure transmitters (SDS-LT-1 and SDS-LT-3) are provided to measure the liquid level in the monitor tanks. Their output is transmitted to the level indicators described in Section 1.6.4 and the level switches described in Section 1.6.5. Their output signal is 4-20 mA dc for a range of 0-400 inches H_2O.

1.6.4 Level Indicators

Monitor tank level indicators, SDS-LI-1 and SDS-LI-3, are provided on local control panel SDS-LCP-1. Monitor tank level indicators, SDS-LI-1A and SDS-LI-3A, are provided on local control panel SDS-LCP-2. The input signal from each level indicator is 4-20 mA dc and their scale is 0-400 inches H_2O.

1.6.5 High/Low Level Switches

A dual-setpoint electronic bistable switch is provided in each monitor tank level transmitter loop. The instrument tag numbers are SDS-LSHL-1 and SDS-LSHL-3. The high setpoint (high level) will trip the associated monitor tank inlet motor operated valve (SDS-V002A or SDS-V002B) and actuate alarms on the main control room on panel SPC-3, and on the CN annunciator panel described in 1.6.2. The low setpoint (low level) will trip or lock out the aligned transfer pump and activate an alarm on the CN annunciator panel. (This window is common for both the high and low level alarms.) The bistables are located in local control panel SDS-LCP-1.

1.6.6 Position Indicators

Position indicator lights, SDS-KL-1 and SDS-KL-3, are provided for the monitor tank inlet motor operated isolation valves (SDS-V002A and SDS-V002B) on control panel SDS-LCP-1.

1.6.7 Hand Switches

Hand switches, SDS-KHS-1 and SDS-KHS-3, and SDS-KHS-5 and SDS-KHS-7 are provided, respectively, for the following components on local control panel SDS-LCP-1:

a. Monitor tank inlet motor operated isolation valves.

b. Monitor tank transfer pumps.

In addition to the hand switches indicated above, selector switch SDS-KHS-11, located on control panel SDS-LCP-1, is provided to choose the correct monitor tank/transfer pump alignment.

Local hand switches (SDS-KHS-5A and SDS-KHS-7A) are provided for the transfer pumps on their respective local starters described in Section 1.6.15.

1.6.8 Pressure Test Connections

The suction line of each transfer pump is equipped with a pressure test connection to verify pump performance.

1.6.9 Pressure Transmitters

Pressure transmitters (SDS-PT-9 and SDS-PT-10) are provided on the discharge of the transfer pumps to sense pump discharge pressure. Their output is transmitted to the pressure indicators described in section 1.6.11. Their output signal is 4-20 mA dc for a range of 0-100 psig.

1.6.10 Pressure Indicators

Transfer pump pressure indicators, SDS-PI-9 and SDS-PI-10, are provided on local control panel SDS-LCP-1, described in section 1.6.1. Their input signal is 4-20 mA dc and their scale is 0-100 psig.

1.6.11 Pressure Gauges

The discharge lines of the transfer pumps are equipped with pressure gauges SDS-PI-6 and SDS-PI-8. Their range is 0-100 psig.

1.6.12 Flow Totalizer

The common transfer pump discharge header is equipped with a flow totalizer, SDS-FM-13, to measure the quantity of liquid discharged from the system. Since the totalizer can be reset to zero, a batch may be discharged and the quantity recorded by the operator. The totalizer can then be rezeroed for an ensuing water transfer operation.

1.6.13 Instrument Racks

Instrument racks are provided for transfer pump discharge pressure instrumentation. The instrumentation for transfer pump SDS-P-1A is located on rack SDS-R-1 and the instrumentation for transfer pump SDS-P-1B is located on rack SDS-R-2. The instrument racks are located at el. 305'-0" of the fuel handling building.

1.6.14 Local Starters

Local starters, SDS-STR-1 and SDS-STR-2, are provided to control the monitor tank transfer pumps. They are located at el. 305'-0" of the fuel handling building.

1.7 System Interfaces

The submerged demineralizer system feed and monitor tank system interfaces with the following systems:

a. Submerged demineralizer system

b. Processed water storage and recycle system

c. Epicor II System (Auxiliary Building emergency liquid cleanup system)

d. Demineralized service water system

e. Fuel handling building HVAC system

f. Auxiliary and fuel handling building floor drainage system

The system is designed to provide a temporary recovery system capable of collecting and monitoring processed water from SDS. Sample points located downstream of the monitor tank transfer pumps provide the capability for monitoring the liquid effluent. If it is determined that the effluent is not suitable for discharge to the processed water storage tanks, additional cleanup may be achieved by recycling the effluent through the SDS for further processing or transferring the effluent to EPICOR II for polishing. A flowpath exists for discharging the effluent from EPICOR II to the processed water storage tanks.

The demineralized service water system tie-in provides the capability for flushing system piping.

Monitor tank vents are routed to the interior (no physical connection) of a fuel handling building H and V system exhaust duct to ensure that the tritium concentration in the model room is ALARA.

The monitor tank overflow and drain lines, and the sample sink drain line are routed to an existing floor drain in the fuel handling building.

2.0 SYSTEM LIMITATIONS, SETPOINTS, AND PRECAUTIONS

The monitor tanks are provided with level transmitters (described in Section 1.6.3) to sense either a high or low liquid level. If a high liquid level condition exists, the monitor tank inlet motor operated valve will close and alarms will annunciate on the main control room panel, SPC-3, and on the CN annunciator panel described in Section 1.6.2. If a low liquid level condition exists, the aligned transfer pump will trip and an alarm will annunciate on the CN annunciator panel.

The high level setpoint and the low level setpoint are 364 inches and 16 inches, respectively, from the bottom of the tank.

System operators should be aware of the liquid level in the tanks by observing the level indicators located on the control panels described in Section 1.6.1. Tank level indications are based on a zero reference at the actual tank low point.

Operators should also be aware of the monitor tank/transfer pump alignment during pumping operations and the position of motor operated isolation valves (SDS-V002A and SDS-V002B) located on the 347' elevation of the Fuel Handling building in the vicinity of the "B" Spent Fuel Pool on the influent lines to the tanks.

Operation of the monitor tank transfer pumps shall be in accordance with Reference 1.2.26. To avoid excessive water velocities, transfer pumps shall not be operated simultaneously unless at least one pump is operating in the recirculation mode.

3.0 OPERATIONS

3.1 Initial Fill

Prior to filling the preselected tank, the tank vent and drain system must be operable and the proper valve lineup selected.

Prior to initial transfer pump operation, the high point vents must be opened to enable air trapped in the system piping to escape.

To avoid contamination or fouling of the flow totalizer, SDS-FM-13, system piping must be thoroughly flushed prior to initial totalizer installation.

3.2 Startup

When the monitor tank filling process has been secured, the proper valve lineup (See Ref. 1.2.1 for correct valve lineups during various modes of operation) must then be selected on the suction and discharge sides of the pumps. This includes the recirculation line associated with the pump selected.

Administrative controls must be used to verify the correct valve lineup prior to pumping operations and to ensure that valves are not inadvertently closed during water delivery operations.

Basket screens from each transfer pump suction line strainer (SDS-S-1A or SDS-S-1B) should be removed after initial system cleaning (flushing).

3.3 Normal Operation

3.3.1 Batch Mode

In this operational mode, one of the two monitor tanks are filled with SDS processed water in batch sizes of approximately 12,000 gallons. The selected monitor tank rate of filling is determined by the number of SDS Zeolite Trains (one or two) in service and will range from 5 to 10 gpm.

After one monitor tank has received a batch, it is isolated and the contents recirculated, the associated sample line purged, and the effluent sampled.

Based on the results of the sample, the tank contents are either transferred to a processed water storage tank for storage and reuse, the RCS manifold for recycling through the SDS, or to the Epicor II System for further polishing.

While one tank is being recirculated, sampled, and transferred, the second tank is available to receive effluent from the SDS.

3.3.2 Continuous Feed Mode

The continuous feed mode employes the monitor tanks as surge tanks between the SDS and Epicor II systems. In this mode processed water flows into the monitor tanks from the SDS and is pumped to the Epicor II System for further processing. This is done in a fashion that maintains flow rate in and out of the tanks identical.

3.3.3 Bypass Mode

In the Bypass Mode, effluent from the SDS is sent to either the Reactor Coolant Bleed Tanks or Miscellaneous Waste Storage Tank thus bypassing the monitor tanks from the processing stream. The monitor tanks are then employed as a source of flush water to support SDS Operations.

3.4 Shutdown

Flow to a monitor tank may be discontinued by shutting the associated manually operated valve, SDS-V025A or SDS-V025B, or the associated motor operated valve, SDS-V002A or SDS-V002B. The SDS feed pump in operation must also be shut down or its flow directed to either the reactor coolant bleed tanks or Miscellaneous Waste Storage Tank.

3.5 Draining

The monitor tanks are equipped with an externally sloped bottom (1/4 inch per foot) to provide the capability to drain the full contents of each tank to the existing drainage system.

Transfer pumps are equipped with plugged casing drains.

The 2-inch process line to the processed water storage tanks contains a low point drain.

3.6 Refilling

Prior to refilling the preselected tank, the tank vent and drain system must be operable and the proper valve lineup selected.

3.7 Infrequent Operations

Redundant transfer pumps are provided. Therefore, with one pump out of service, the other transfer pump may be used for pumping operations. This operation requires that the monitor tank/transfer pump selector switch, SDS-KHS-11, be placed in the proper position and the isolation valves located on the transfer pump suction piping be properly aligned.

3.8 Transient Operations

If a loss of power transient were to occur, motor operated isolation valves SDS-V002A and SDS-V002B would fail as-is. Therefore, if a loss of power transient were to occur while a monitor tank is being filled, the motor operated isolation valve (SDS-V002A or SDS-V002B) associated with the tank being filled, would fail in the open position. This would increase the possibility of overflowing the tank being filled. However, loss of system power would cause pressure in the line from the post filter to the monitor tanks to go negative and open the automatic syphon breaker. This will limit additional monitor tank filling to the contents of the fill line.

During a loss of power transient, operator action should involve manual isolation of the monitor tanks. A loss of power transient would also interrupt monitor tank transfer pump operation.

4.0 CASUALTY EVENTS AND RECOVERY PROCEDURES

4.1 Casualty Events

Possible system casualty events include the following:

a. System leakage

b. High radiation level

4.2 Design Feature to Mitigate Effects of Casualty Events

Liquid retention curbing is provided around the tanks and pumps to retain spills caused by a localized system leakage.

The system is designed with the capability to recycle batches to the SDS system (RCS manifold) if necessary to maintain the radiation zone limits set for the model room.

4.3 Recovery Procedures

Recovery from a system leakage casualty event would involve isolation of the leak and collection of the spill. Recovery from a high radiation casualty event would entail transferring the effluent to the RCS manifold for reprocessing.

5.0 MAINTENANCE

5.1 Maintenance Approach

The submerged demineralizer system feed and monitor tank system is a temporary recovery system and, therefore, no major maintenance program is required.

Redundant transfer pumps, and a demineralized service water system tie-in for flushing system piping, are provided to facilitate maintenance.

5.2 Corrective Maintenance

If repair welding is done to any part or component of the system it will be done in accordance with the procedures used for initial construction. The specific part or component shall be isolated, drained, repaired, and hydrotested for the required amount of time and pressure. After hydrotest procedures have been completed, the part or component shall receive final flushing with demineralized water.

Transfer pump corrective maintenance shall be in accordance with Reference 1.2.26.

5.3 Preventive Maintenance

Transfer pump preventive maintenance shall be in accordance with Reference 1.2.26.

5.4 Inservice Inspection

The system has no formal inservice inspection program.

Manways are provided on each monitor tank to provide the capability for personnel access.

6.0 ACCEPTANCE TESTING

Monitor tanks are shop hydrostatically tested in accordance with the requirements of Reference 1.2.6.

System piping and valves are field hydrostatically tested in accordance with the requirements of Reference 1.2.5.

Acceptance testing shall be in accordance with GPUNC procedures.

APPENDIX A

TABLE 1

SDS MONITOR TANKS

Tank Details

Identification	SDS-T-1A through SDS-T-1B
Manufacturer	Buffalo Tank
Number Installed	Two (2)
Capacit,' - Gallons	12,000 Gal. Each
Installation	Vertical
Outside Diameter/Height, ft. in.	8 Ft./32 Ft.
Shell Material	Stainless Steel (304 L), SA-240
Shell Thickness, In.	3/16 Inch
Design Temperature, °F	40-120°F
Design Pressure, PSIG	Atmospheric
Corrosion Allowance, In.	None
Design Code	API-650, Appendix J
Code Stamp Required	API-650, Appendix J

APPENDIX A

TABLE 2

SDS MONITOR TANK TRANSFER PUMPS

Pump Details

Identification	SDS-P-1A and SDS-P-1B
Noun Name	Monitor Tank Transfer Pumps
Manufacturer	Goulds Pumps Inc.
Model No.	3196 ST AA
Type	Single Stage Horizontal Centrifugal
Standard Material Designation	Stainless Steel
Rated Speed	3500 RPM
Rated Capacity	50 GPM
Rated Total Dynamic Head	111 Ft.
Shutoff Head	116 Ft.
Design Temperature	500°F
Shaft Seal	Mechanical - Single unbalanced type
Lubricant	Oil

Motor Details

Manufacturer	Reliance
Type	P (Induction)
Enclosure	ODP

APPENDIX A

TABLE 2

SDS MONITOR TANK TRANSFER PUMPS

(Cont'd)

Rated Horse Power	5 HP
Rated Speed	3495 RPM
Insulation class	B
Lubricant/Coolant	Grease/Air
Service	Continuous duty
Power Requirements	460 Volts, 3 Phase 60 Hz, 6.6 Amps
Power Source	SDS-STR-1 and SDS-STR-2

Appendix No. 15

to

Submerged Demineralizer System

System Design Description

Title

SDS Off Gas Filters

APPENDIX NO. 15

ROUGHING FILTER

Filter Details

Type	Dustfoe G-Series
Number Installed	One (1)
Manufacturer	MSA
Installation	Horizontal
Dimensions	24 In. High/24 In. Wide/11 1/2 In. Deep
Resistance (clean)	0.30" W.G. Max at 1000 CFM Capacity
Efficiency (clean)	60-65 percent NBS
Frame	16 Ga. C.S. Cad Plated
Filter Media	Glass Fibers
Separator	Aluminum .0015 THK
Gasket	Sponge Neoprene
Design Code	UL 900 Class 1 Approved and Labeled

APPENDIX NO. 15

HEPA FILTERS

Filter Details

Type	HEPA
Number Installed	Two (2)
Manufacturer	MSA
Installation	Horizontal
Dimensions	24 In. High/24 In.Wide/11 1/2 In. Deep
Resistance (clean)	1.00" W.G. Max at 1000 CFM Capacity
Efficiency (clean)	$\geq$99.97 percent (DOP) at 0.3 micron
Frame	14 Ga. C.S. Cad Plated
Filter Media	Glass Fibers
Separator	Aluminum .0015 THK
Gasket	Sponge Neoprene
Design Code	UL 586 Approved and Labeled

APPENDIX NO. 15

CHARCOAL ABSORBER

Filter Details

Type	Sure-Sorber
Number Installed	One (1)
Manufacturer	MSA
Installation	Horizontal
Dimensions	24 In. High/24 In. Wide/11 1/2 In. Deep
Resistance (clean)	1.00" W.G. Max at 1000 CFM Capacity
Efficiency (clean)	≥99.97 percent (Freon II)
Frame	Stainless Steel, Type 304
Filter Media	Charcoal
Separator	None
Gasket	Sponge Neoprene
Design Code	AACC Standard CS-8

Appendix No. 16

to

Submerged Demineralizer System

System Design Description

Title

Liner Recombiner and

Vacuum Outgassing System

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. The system may also be used to aid in taking gas samples from defueling canisters.

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. In addition, a tie-in to the vacuum system has been provided to allow gas samples of defueling canisters to be drawn.

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 CFM 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 cyclinder. 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.

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.

1.5.1.4 Canister Dewatering System (DS)

The vacuum system has a tie-in to the DS providing a means to take gas samples from the defueling canisters.

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 <u>Piping Design Requirements</u>

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 <u>Filter Requirements</u>

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 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.

2.1.5 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.

2.1.6 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.

2.1.7 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 or defueling canisters 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. "Coid" 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	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

Motor Details

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
VALVES

GPU #	SERVICE	LOCATION	SUPPLIER	MODEL	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 411	Liner Inlet To Vacuum System Isolation	Vacuum System Tool	Worcester Valve	11/2 5966T R13 1000		1 1/2" Ball Valve SS
CN-V-VS 412	Atmospheric Isolation	Same	Same	Same		Same
CN-V-VS 413	Vacuum System Tool Isolation	Same	Same	Same		Same
CN-V-VS 414 A&B	Liner Vent Hose To Vacuum System Isolation	Dewatering Station	Nupro	SS-8-BW-TW		1 1/2" Globe Valve SS
CN-V-VS 415	Knockout Drum Inlet	Vacuum System Skid	Jamesbury	21-3600-MT		1 1/2" Ball Valve SS
CN-V-VS H14C	Canister Vent Hose to Vacuum System Isolation	Vacuum System Skid	----	----		----
CN-V-VS 416	Suction Filter Inlet	Same	Same	Same		Same
CN-V-VS 417	Main Vacuum Pump Inlet	Same	Same	Same		1" Ball Valve SS
CN-V-VS 418	Main Vacuum Pump Outlet Check Valve	Same	Nupro	SS-16C-4-1/3		1" Check Valve SS
CN-V-VS 419	After Filter Inlet	Same	Jamesbury	21-3600-MT		1" Ball Valve SS

SD 3527-005

SDS VACUUM SYSTEM
VALVES

GPU #	SERVICE	LOCATION	SUPPLIER	MODEL	SET POINT	REMARKS
CN-V-VS 420	After Filter Outlet	Same	Same	Same		Same
CN-V-VS 421	Vacuum System Exhaust Pressure Regulator	Same	Fairchild	10113 BP		3/8" Regulating Valve
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

SDS VACUUM SYSTEM
VALVES

GPU #	SERVICE	LOCATION	SUPPLIER	MODEL	SET POINT	REMARKS
CN-V-VS 442	Instrument Air Pressure Relief	Same	Crosby	JRU-C	20 psig	Pressure Relief Valve
CN-V-VS 443	Instrument Air Inlet To Main Pump Gas Ballast	Vacuum System Skid	Part of CN-FI-VS-01	N/A		Needle Valve
CN-V-VS 444	Instrument Air Inlet To Vacuum System Backfill	Same	Part of CN-FI-VS-02	N/A		Same
CN-V-VS 445	Instrument Air Inlet To Main Pump Gas Ballast	Same	Nupro	SS-8C-1/3		1/2" Check Valve SS
CN-V-VS 446	Instrument Air Inlet To Vacuum System Backfill	Same	Same	Same		Same
CN-V-VS 447	Instrument Air Inlet To After Filter	Same	Same	SS-8-BK		1/2" Globe Valve SS
CN-V-VS 448	Instrument Air Inlet Knockout Drum	Same	Same	Same		Same
CN-V-VS 449	Instrument Air Inlet To Sample System	Same	Same	Same		Same
CN-V-VS 450	Inert Gas Pressure Relief	Inert Gas Manifold	Crosby	JRU-C	30 psig	Pressure Relief Valve
CN-V-VS 451	Inert Gas Inlet To Knockout Drum	Vaccum System Skid	Nupro	SS-8-BK		1/2" Globe Valve
CN-V-VS 452	Inert Gas Inlet To Vacuum System Tool	Same	Same	Same		Same
CN-V-VS 453	Inert Gas Inlet To Sample System	Same	Same	Same		Same

SDS VACUUM SYSTEM
VALVES

GPU #	SERVICE	LOCATION	SUPPLIER	MODEL	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-DKM4-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

GPU #	SERVICE	LOCATION	SUPPLIER	MODEL	SCALE	SET POINT	REMARKS
CN-FI-VS 01	Instrument Air Inlet To Main Vacuum Pump Gas Ballast Flow	Vacuum System Skid	AMETEK	20-7050	0-100%	2 SCFM	Flow Indicator
CN-FI-VS 02	Instrument Air Inlet To System Backfill Flow	Same	Fisher & Porter	10A1251-M-X	0-100%	4 SCFM	Same
CN-LS-VS 01	Knockout Drum Low Level Switch	Same	De-Laval	Kit 24577	N/A	N/A	Indicator Light on Panel
CN-LS-VS 02	Knockout Drum High Level Switch	Same	Same	Same	N/A	N/A	Main Vacuum Pump Cutoff
CN-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
CN-PI-VS 05A&B	Liner Vent Hose To Vacuum System Inlet	Dewatering Station	Same	Same	Same	Same	Pressure Gauge
CN-PI-VS 05C	Canister Vent Hose to Vacuum System Inlet	Dewatering Station	Same	Same	Same	Same	Pressure Gauge
CN-PI-VS 05C	Canister Vent Hose to Vacuum System Inlet	Dewatering Station	----	----	----	----	Same
CN-PI-VS 06	After Filter Effluent Pressure	Vacuum System Skid	Same	J-4840	0-15 psig	Same	Pressure Gauge

Appendix No. 17

to

Submerged Demineralizer System

System Design Description

Title

Internals Indexing Fixture Processing System

Deleted

Appendix No. 18

to

Submerged Demineralizer System

System Design Description

Title

Fuel Transfer Canal Draining System

SYSTEM DESIGN DESCRIPTION

OF THE

FUEL TRANSFER CANAL DRAINING SYSTEM

TABLE OF CONTENTS

6.0 Acceptance Testing

Figure 1 Pump Curve for Fuel Transfer Canal Drain Pump

1.0 DESIGN DESCRIPTION

1.1 Summary

The fuel transfer canal draining network (FCC), is a temporary modification in the reactor building designed to pump water from the canal and deliver the water to the reactor coolant bleed hold-up tanks (RCBT)'s via the SDS, or through SDS and back to the Fuel Transfer Canal or SFP "A" via DWCS piping.

1.2 References

1.2.1 S-ECM 1110, Installation of Fuel Transfer Canal Drain Equipment

1.2.2 Bechtel Drawing 2-P70-FCC02, Piping Composite of the Fuel Transfer Canal Draining Network

1.2.3 Bechtel Drawings 2-M75-DWC01 and 2-M75-DWC02, Schematic Diagrams of the Internals Indexing Fixture Processing System

1.2.4 Bechtel Drawing 2-P70-DWC01, Piping Composite of the Defueling Water Clean-up System, Phase I

1.2.5 Bechtel Drawing 2-J77-FCC01, Logic Diagram of the Fuel Transfer Canal Drain Pump (FCC-P-1)

1.2.6 S-ECM-1095; Fuel Transfer Canal Drain Pump (Electrical)

1.2.7 American National Standards Institute (ANSI) B31.1, Power Piping

1.2.8 System Operating Description of the Internals Indexing Fixture Processing System

1.2.9 ECA-3870-84-0102, FTC Shallow End Drainage Modifications

1.2.10 Bechtel Drawing 2-MTS-DWC04, Interim Fuel Transfer Canal Processing System

1.2.11 ECA-3525-84-0041, Definition of the DWCS

1.2.12 ECA-3525-84-0042, SDS Tie-in to DWCS

1.2.13 ECA-3525-84-0047, SDS Reroute

1.3 Detailed System Description

1.3.1 System Flowpaths (See Reference 1.2.2 and 1.2.3)

The fuel transfer canal drain pump, FCC-P-1, is used to pump shield water from the canal and deliver the water to the RCBT's. The pump is a commercially available submersible well pump located in the 6-inch canal drain line. Rubber hose is used to transfer water from the pump to the canal drain piping manifold. The manifold ties the FCC canal drain system line, the reactor building basement jet pump system and the FTC Shallow End Drainage System into a common discharge pathway. The common discharge line is routed to reactor building penetration R-626, through the annulus, fuel handling building penetration 1551, and the submerged demineralizer system (SDS) to either the RCBT's or to the Fuel Transfer Canal (FTC) or to the spent fuel pool "A" (SFP "A") as appropriate.

The fuel transfer canal drain and the FTC Shallow End Drainage System branch lines of the canal drain manifold contain double isolation, which includes a check valve in each line. During operation of canal drain pump FCC-P-1, the Shallow End Drainage Pump and the RB basement jet pump system branch lines of the manifold are valved out. Additional isolation is achieved by disconnecting hoses from the canal drain manifold.

1.3.2 System Components

1.3.2.1 Pump

Equipment No. FCC-P-1

Type: Vertical, 5 stage, high capacity submersible pump; Goulds model 45J05434

Motor: Continuous duty - 460V, 3>, 60Hz, 5hp

Head/Capacity: Per Figure 1

1.3.2.2 Hose

1-inch ID: Goodall Rubber Co. Saxon Hose, Spec, L-84 with a design working pressure of 300 psig.

1 1/2-inch ID: Goodall Rubber Co. Impact Water hose, Spec. N-320 with a design working pressure of 250 psig.

1.3.2.3 Piping Manifold

Applicable Code: Power Piping, ANSI B31.1

Piping: Austentitic stainless steel, schedule 80S

Valves: Austentitic stainless steel

Check - Class 600

Manual ball - Class 150

Air operated ball - Class 150 with air actuator and 3-way universal solenoid valve. Valve fails closed on loss of air or deenergization of solenoid.

1.3.2.4 Hose Couplers

1-inch diameter: Hansen series ST quick disconnects - stainless stell, straight through design with sleeve locking devices.

1 1/2 inch diameter: Hansen series HK quick disconnects - stainless steel, two-way shut-off with sleeve locking devices.

1.4 System Performance Characteristics

The goal of the system design was to provide a controlled means of draining the fuel transfer canal with the design flow/pressure being compatible with SDS. The time required to drain the canal was not a design consideration since failure to drain the canal is not a safety concern. The canal drain pump, FCC-P-1, was selected based on trying to obtain a maximum flowrate of 15 gpm through the SDS.

When returning flow back to the FTC or SFP "A', the flowrate will be that achievable by FCC-P-1. In this configuration, the system provides a means for interim processing of the FTC/SFP "A" until the DWCS becomes fully operational.

1.5 System Physcial Arrangement (See Reference 1.2.2)

Submersible pump FCC-P-1 is installed in a 4-inch pipe sleeve. A 2-inch suction line for the pump will be routed to an existing 4-inch drain. This arrangement allows the FTC to be drained to floor elevation 308'-0", when necessary.

From the outlet of pump FCC-P-1, hose is routed to the canal drain manifold at El. 347'6" of the reactor building. The manifold is secured to a free standing support. Hose is routed from the manifold to the inboard piping of reactor building penetration R-626. After the SDS Postfilter/Cation Sandfilter, piping is provided to the RCBT and SFP "A", and piping and hose are provided to the FTC via RB penetration R-539.

1.6 Instrumentation and Control

Pump FCC-P-1 control is via hand indicating switch FCC-HIS-1, which is located on SDS control panel CN-PNL-1 at El. 347'-6" of the fuel handling building. The switch starts and stops the pump and shows, via a light, that power is being delivered to the pump. The starter, FCC-STR-1, for the pump is mounted adjacent to panel CN-PNL-1.

Pressure gauge FCC-PI-3 is provided on the canal drain manifold to sense the line pressure downstream of the manifold isolation valves.

For operation of valve FCC-V003, refer to the system operating description of the FTC Shallow End Drainage System.

1.7 System Interfaces

1.7.1 The fuel transfer canal drain portion of the FCC system interfaces with the following water transfer systems:

a. Reactor building basement jet pump system

b. Fuel Transfer Canal Shallow End Drainage System.

c. SDS

Reactor building basement jet pump system pump SWS-P-1, draws water from the reactor building basement and delivers the water to SDS via the canal drain manifold, as noted in Section 1.3.1.

The fuel transfer canal shallow end drainage system is a system designed to drain the new fuel storage pit. The system drains the new fuel storage pit and delivers the water to an RCBT via SDS. Only one of these systems can be installed at a time as they use the same pump (DWC-P-1). Valve FCC-V003 is interlocked with pump

DWC-P-1 to close the valve when pump operation is shutdown.

1.7.2 Power for pump FCC-P-1 is supplied from circuit 12 of distribution panel PDP-6A.

2.0 SYSTEM LIMITATIONS AND PRECAUTIONS

2.1 The RB basement jet pump system, DWCS-RV Filtration System, and the FTC Shallow End Drainage System must not operate concurrently with the fuel transfer canal drain system. Only one branch connection on the canal drain manifold shall be open at any time. Pump/manifold valve line-ups are to be verified prior to any change in pumping operations.

2.2 Isolation valve FCC-V002 must be in the closed position when canal drain pump FCC-P-1 is not in operation to prevent possible siphoning.

2.3 Hose and fittings must be inspected for their condition prior to operation of the FCC canal drain network or periodically as determined by Radiochemical Engineering.

2.4 Whenever pump SWS-P-1 or pump DWC-P-1 has been used, flushing of the common discharge line must be verified prior to operation of fuel transfer canal drain pump FCC-P-1, if it is determined that the shield water in the canal does not require processing by SDS.

2.5 Normally, visual observation by camera can be used to check the water level in the fuel transfer canal. The level must be monitored to ensure pump FCC-P-1 does not operate with no water supply.

3.0 OPERATIONS

3.1 Normal operation

For head lift operations, reactor coolant grade (borated) water may have to be provided in the fuel transfer canal for shielding purposes only. The function of the canal drain portion of the FCC system is to provide a controlled means of draining this shield water from the canal.

Prior to operation of canal drain pump FCC-P-1, the following procedural steps must be verified:

1. Hoses are connected to their proper piping manifold branch connection (to be QC witnessed during installation) and all hoses are in good condition with couplings being secured.

2. Valves are aligned correctly; SWS system, DWC-RV Filtration System, and the FTC Shallow End Drainage System lines must be isolated at the fuel transfer canal drain manifold.

3. The SWS system has been flushed if required per Section 2.4.

The fuel transfer canal draining operation is started and stopped using on/off hand switch FCC-HIS-1 for canal drain pump FCC-P-1, and manually opening or closing valve FCC-V002. During initial pump operation, valve FCC-V002 shall be adjusted such that pressure gauge FCC-PI-3 reads less than or equal to 150 psig.

4.0 CASUALTY EVENTS AND RECOVERY PROCEDURES

4.1 Casualty Events

4.1.1 A breech of the system pressure boundary while delivering shield water from the fuel transfer canal could result in additional contamination of reactor building surfaces.

4.1.2 Introduction of reactor building sump water into the fuel transfer canal would contaminate the canal and could result in a potential criticality problem.

4.1.3 Failure of both pipe plugs in the canal 6-inch drain line would result in inadvertent draining of the fuel transfer canal, and could lead to an unplanned criticality.

4.2 Design Feature to Mitigate Effects of Casualty Events

4.2.1 A hose or pipe break will result in loss of line pressure. Pressure and flow indication are provided at various locations on the pump discharge flowpath. The piping and hoses are hydrostatically tested to 1.5 times their maximum operating pressure per ANSI B31.1. To ensure pressure boundary integrity, hoses are to be inspected prior to operation of the FCC canal drain network.

4.2.2 The fuel transfer canal and the FTC Shallow End Drainage System branch connections of the canal drain manifold contain double isolation, which includes a check valve in each line. This is to prevent reactor building sump and flush water from being delivered into the canal. In addition, the coupling connections on the canal drain and FTC Shallow End Drainage branch lines of the manifold are 1 1/2-inches and incorporate a two-way shut-off feature. All other manifold coupling connections, including the reactor building basement jet pump system connection, are 1-inch diameter. This prevents connecting a 1 1/2-inch pump discharge hose to the 1-inch RB basement jet pump system connection which does not include a check valve. QC is to verify that each hose is connected to the proper manifold branch connection prior to system turnover.

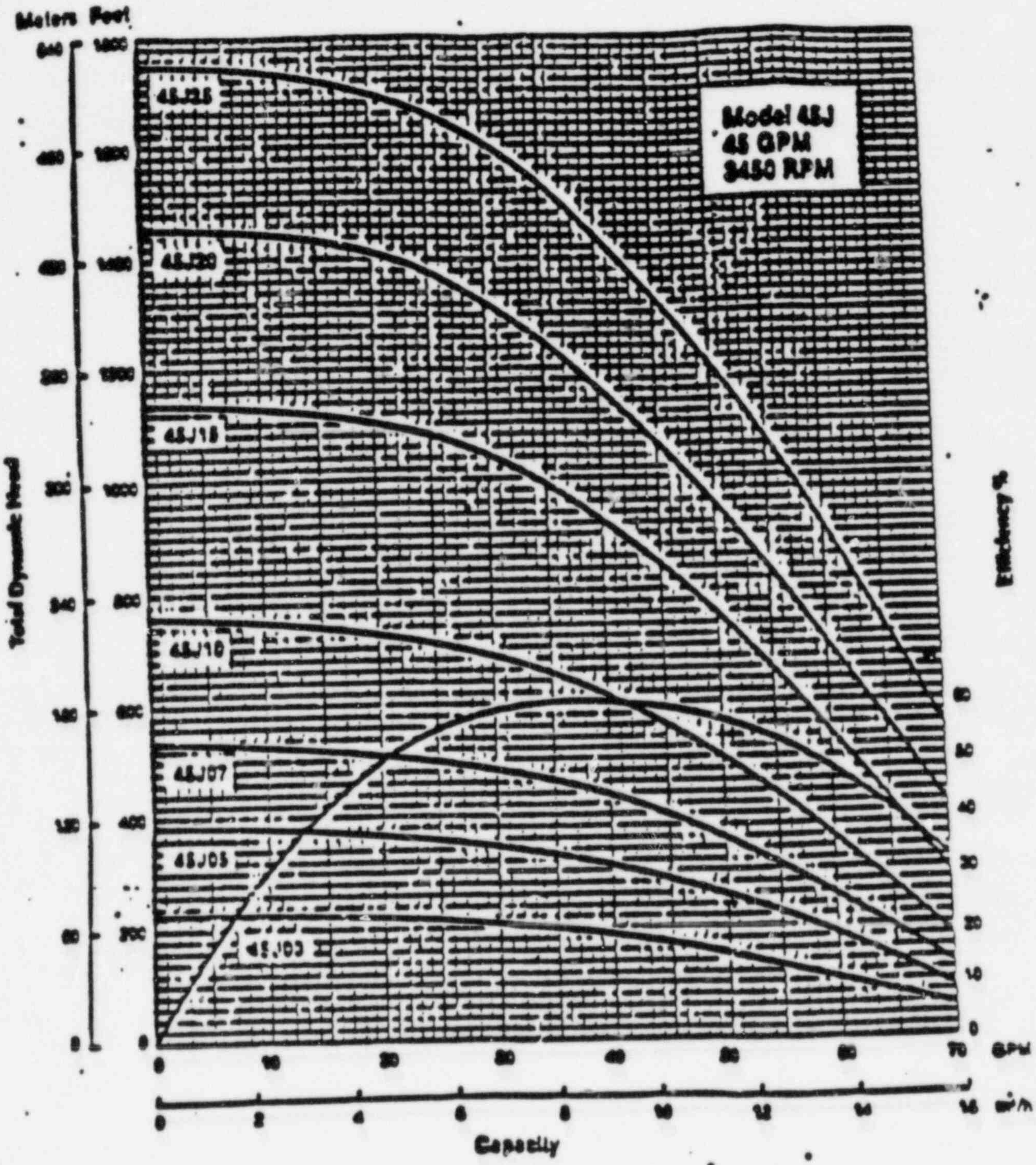
4.2.3 Two pipe plugs are installed in series in the fuel tranfer canal 6-inch drain line. The plugs are shoptested, and leak tested after installation to 1.5 times their maximum operting pressure with QC witnessing the field test. Installation of the pipe plugs is witnessed by QC to verify that two pipe plugs are installed. Since redundant plugs are installed, failure of one of the plugs does not allow the canal to drain.

5.0 SURVEILLANCE

Monitoring of the water level in the fuel transfer canal during operation of canal drain pump FCC-P-1 as well as inspection of the hose condition will be required by procedure.

6.0 ACCEPTANCE TESTING

Piping/hose assemblies and the pipe plugs are leak tested to 1.5 times their maximum operating pressure. Leak testing of the pipe plugs is QC witnessed.



Pump Curve for Fuel Transfer Canal Drain Pump FCC-P-1 (Goulds 45J03)
Figure 1

Appendix No. 19

To

Submerged Demineralizer System

System Design Description

Title

Fuel Transfer Canal Shallow End Drainage

System Operating Description

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1.0 DESIGN DESCRIPTION

1.1 Summary

The fuel transfer canal shallow end draining system is a temporary modification in the reactor building designed to pump water from the shallow end of the canal and deliver the water to the reactor coolant bleed hold-up tank (RCBT)'s.

1.2 References

1.2.1 ECA - 3870-84-0102 FTC Shallow End Draining Modifications.

1.2.2 Bechtel Drawing 2-P70-FCC02, Piping Composite of the Fuel Transfer Canal Draining Network.

1.2.3 ECA - 3258-84-0072 IIF Processing Level Control (Bubbler) and Pump Removal.

1.2.4 Bechtel Standard 15737-2-P-002, Piping Line Index.

1.2.5 Bechtel Standard 15737-2-P-001, Piping Line Specifications.

1.2.6 American National Standards Institute (ANSI) B31.1, Power Piping.

1.2.7 Bechtel Doc. 15737-2-J16-001, Instrument Index.

1.2.8 Bechtel Drawing 2-E76-DWC01, Schematic Diagram for the FTC Shallow End Drainage Pump.

1.2.9 Bechtel Drawing 2-J77-DWC02, Logic Diagram for the FTC Shallow End Drainage Pump.

1.2.10 Bechtel Drawing 2-J73-SDS03, Panel Layout for CN-PNL-1.

1.2.11 Bechtel Drawing 2-J78-FCC02, Level Setting Diagram for New Fuel Pit.

1.3 Detailed System Description

1.3.1 System Flowpaths (See Reference 1.2.2)

The fuel transfer canal shallow end drain pump, DWC-P-1, is used to pump water from the canal and deliver it to the RCBT's. The pump is a commercially available submersible well pump. The pump is housed in a 6-inch well which is set into the new fuel pit. Rubber hose is sued to transfer water from the pump to the canal drain piping manifold. The manifold ties the shallow end drainage system line, the reactor building surface water suction (SWS) system, the DWC-RV Filtration system and the fuel transfer canal drain (FCC) system into a common discharge pathway. The common discharge line is routed to reactor building penetration R-626, through the annulus, fuel handling building penetration 1551, and the submerged demineralizer system (SDS) pre and final filters to the RCBT's, etc.

The fuel transfer canal shallow end drainage system branch line of the canal drain manifold contains double isolation, which includes a check valve. During operation of canal drain pump DWC-P-1, the FCC system, DWC-RV Filtration system, and the SWS system branch lines of the manifold are valved out and disconnected from the manifold.

1.3.2 System Components

1.3.2.1 Pump

Equipment No. DWC-P-1

Type: Vertical, 14 stage, high capacity submersible pump; Goulds model 45T05434

Motor: Continuous duty - 460V, 3ϕ, 50Hz, 5hp

Head/Capacity: Per Figure 1

1.3.2.2 Hose

1 1/2-Inch ID: Goodall Rubber Co. Impact Water hose, Spec. N-320 with a design working pressure of 250 psig.

1.3.2.3 Piping & Piping Manifold (Refer to piping class NCD of Reference 1.2.6)

Applicable Code: Power Piping, ANSI B31.1

Piping: Austenitic stainless steel, schedule 80S

Valves: Austenitic stainless steel

Check - Class 600

Manual ball - Class 150

Air operated ball - Class 150 with air actuator and 3-way universal solenoid valve. Valve fails closed on loss of air or deenergization of solenoid.

1.3.2.4 Hose Couplings

1 1/2-inch diameter: Hansen series HK quick disconnects - stainless steel, two-way shut-off with sleeve locking devices.

1.4 System Performance Characteristics

The system is designed to provide a flow path for draining the shallow end of the Fuel Transfer Canal. This end of the canal is not expected to be filled, and as such, the system will operate only as required during accumulation of water from leakage from DWC pumps P-2A or 2B, or if the shallow end of the canal should need to be filled and then drained.

1.5 System Physical Arrangement (See Reference 1.2.2)

Submersible pump DWC-P-1 is housed in a 6-inch well which is located in the new fuel pit in the shallow end of the FTC.

From the outlet of pump DWC-P-1, hose is routed to the canal drain manifold at El. 348'-3" of the reactor building. The manifold is secured to a free standing support. Hose is directed from the manifold to the inboard piping of reactor building penetration R-626.

1.6 Instrumentation and Control

Pump DWC-P-1 is controlled via indicating hand switch, DWC-HIS-1, which is located on SDS control panel CN-PNL-1 at El. 347'-6" of the fuel handling building. The switch starts and stops the pump and contains indicating lights for pump status. The starter, DWC-STR-1, for the pump is mounted adjacent to panel CN-PNL-1.

A local emergency stop switch, DWC-HS-1, is located in the Reactor Building near the pump on El. 347'-6". This local switch overrides the indicating switch, and the pump can be started again only after the local switch has been reset.

Pressure gauge FCC-PI-3 is provided on the canal drain manifold to sense the line pressure downstream of the manifold isolation valves.

Air-operated valve FCC-V003 is interlocked with the pump such that the valve must be opened before the pump will start.

A high level alarm is provided at control panel CN-PNL-1 to inform the operator to begin draining the pit. A low level alarm is also provided at CN-PNL-1 to inform the operator to stop the pump. The low level alarm will not alarm when the pump is off.

1.7 System Interfaces

1.7.1 The fuel transfer canal shallow end drainage system interfaces with the following water transfer systems:

a. Reactor building surface water suction (SWS) system

b. Fuel Transfer Canal draining (FCC) system

c. DWC-RV Filtration (DWCS) system

Reactor building SWS system pump SWS-P-1, draws water from the reactor building basement and delivers the water to SDS via the canal drain manifold, as noted in Section 1.3.1.

Fuel transfer canal drain pump, FCC-P-1, is used to pump shield water from the canal and deliver it to the RCBT's via the canal drain manifold.

The DWC-RV Filtration pumps, DWC-P-2A/B, pump water from the RV through SDS to a RCBT while concurrently making up from another RCBT.

1.7.2 Power for pump DWC-P-1 is supplied from circuit 11 of distr'bution panel PDP-6A.

2.0 SYSTEM LIMITATIONS AND PRECAUTIONS

2.1 The SWS system, DWC-RV Filtration sytem, and the FCC system must not operate concurrently with the fuel transfer canal shallow end drainage system. Only one branch connection on the canal drain manifold shall be open at any time. Pump/manifold valve line-ups and hose connections/disconnections are to be verified prior to any change in pumping operations.

2.2 Hose end fittings must be inspected for their condition prior to operation of the canal shallow end drainage network.

2.3 The system can drain down the New Fuel Pit only until suction is broken. This will occur when the water level drops below the exposed lower end of the well.

2.4 Drainage can only begin when the water level rises above the suction of the pump.

3.0 OPERATION

3.1 Normal Operation

During defueling operations, the shallow end of the FTC may require drainage as a result of leakage, spills, or deliberate flooding of the canal. This system provides the means to accomplish this drainage.

Prior to operation of canal shallow end drainage pump DWC-P-1, the following procedural steps must be verified:

1. Hoses are connected to their proper piping manifold branch connection (to be QC witnessed during installation) and all hoses are in good condition with couplings being secured.

2. Valves are aligned correctly; SWS system, DWC-RV Filtration system, and the FCC system lines must be isolated at the fuel transfer canal drain manifold and hoses disconnected.

The fuel transfer canal shallow end drainage operation is started and stopped by opening or closing valve FCC-V003 and using on/off hand switch DWC-HIS-1. This, in turn, automatically stats or stops pump DWC-P-1.

4.0 CASUALTY EVENTS AND RECOVERY PROCEDURES

4.1 Casualty Events

4.1.1 A breech of the system pressure boundary while removing water from the shallow end of the fuel transfer canal could result in additional contamination of reactor building services.

4.1.2 Introduction of this water into the fuel transfer canal could contaminate the canal.

4.2 Design Features to Mitigate Effects of Casualty Events

4.2.1 A hose or pipe break will result in loss of line pressure. Pressure and flow indication are provided at various locations on the pump discharge flowpath. The piping and hoses are hydrostatically tested to 1.5 times their maximum operating pressure per ANSI B31.1. To ensure pressure boundary integrity, hoses are to be inspected prior to operation of the canal shallow end drainage network.

4.2.2 The fuel transfer canal and the shallow end drainage system branch connections of the canal drain manifold contain double isolation, which includes a check valve in each line. This is to prevent reactor building sump and flush water from being delivered into the canal. In addition, the coupling connections on the canal drain and shallow end drain lines of the manifold are 1 1/2-inches and incorporate a two-way shut-off feature. All other manifold coupling connections, including the reactor building SWS system connection, are 1-inch diameter. This prevents connecting a 1 1/2-inch pump discharge hose to the 1-inch SWS system connection which does not include a check valve. QC is to verify that each hose is connected to the proper manifold branch connection prior to system turnover.

5.0 SURVEILLANCE

Hose condition inspection will be required by procedure.

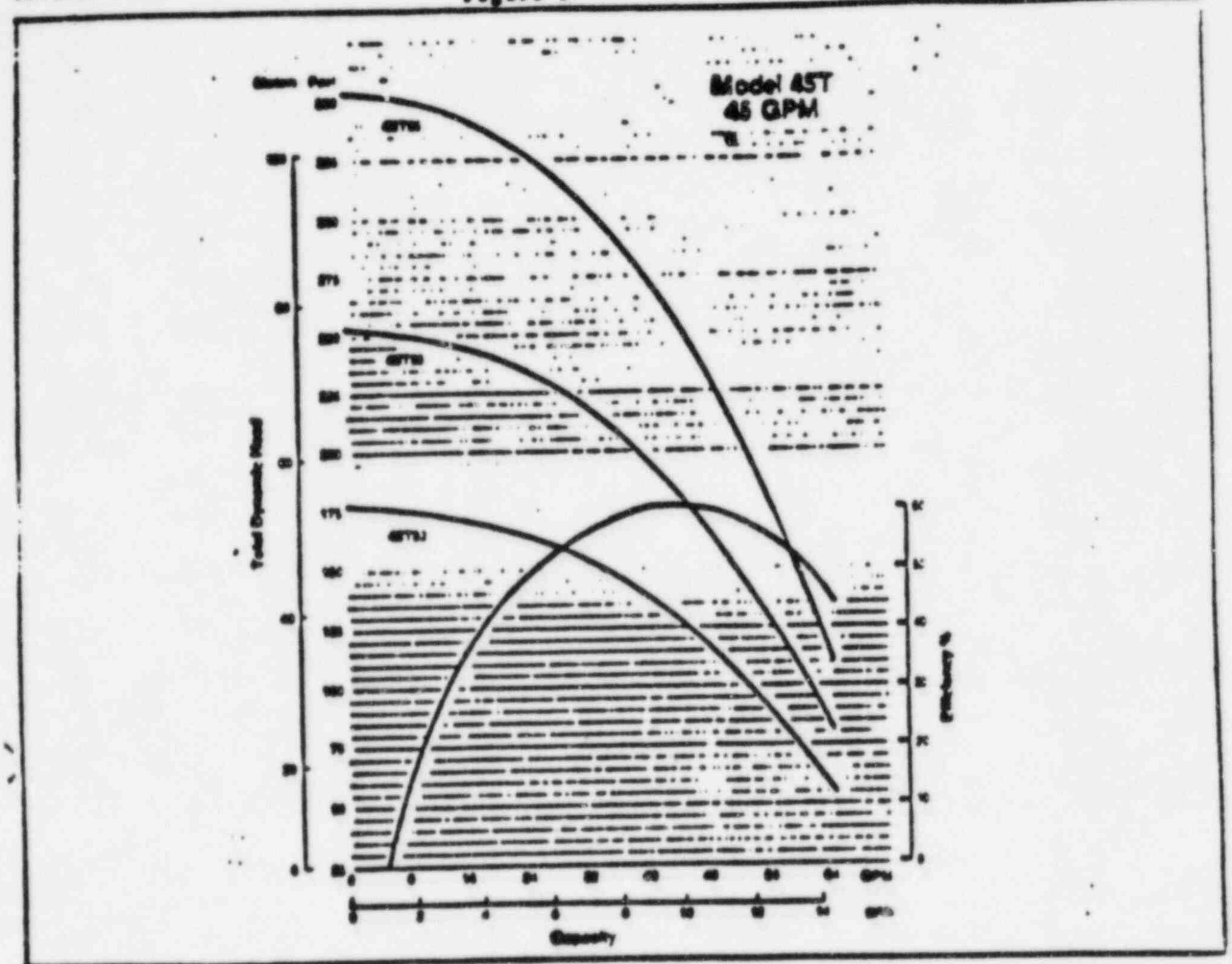
6.0 ACCEPTANCE TESTING

Per reference 1.2.2 and 1.2.5, piping/hose assemblies are leak tested to 1.5 times their maximum operating pressure.

Pump Curve for Fuel Transfer Canal Shallow End Drainage Pump

Model 45T

Figure 1



PERFORMANCE RATINGS — 45T Selection Charts — 45 GPM B.E.P.[1]

Horsepower	2				3					5				
Model No.	45T02				45T03					45T05				
Stages	7				10					14				
Tank Pressures	0	20	40	Max. Shut-off (lbs.)	0	20	40	60	Max. Shut-off (lbs.)	0	20	40	60	Max. Shut-off (lbs.)
Depth to Water in Feet[2]: 50	65	55	38	55	65	62	53	42	87	65	65	61	56	131
75	60	47	28	44	65	58	48	35	76	65	64	58	52	120
100	53	37		33	62	53	42	22	66	65	61	55	47	109
125	45	20		22	57	48	33		55	63	58	51	43	96
150	35			12	52	41	20		44	60	54	47	37	86
175					46	32			33	57	50	42	30	77
200					39	17			23	54	46	36	20	66
225										48	39	27		54
250										45	35	18		45
275										39	25			32
300										34	15			23

Ratings in this chart shown in Gallons per Minute.

[1] Best Efficiency Point
[2] Friction losses in discharge pipe and fitting are not included in these tables

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Appendix No. 20

To

Submerged Demineralizer System

System Design Description

Title

Early Defueling DWC Reactor Vessel Filtration System

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3.2 Startup

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3.4 Shutdown

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4.1 Loss of Power

4.2 Loss of Instrumentation/Instrument Air

4.3 Filter Media Rupture

4.4 Line and Hose Break

5.0 System Maintenance

6.0 Testing

6.1 Hydrostatic Testing

6.2 Leak Testing

6.3 Instrument Testing

7.0 Human Factors

1.0 DESIGN DESCRIPTION

1.1 Summary

The Early Defueling DWC Reactor Vessel Filtration system is a temporary liquid processing system which is designed to process water contained in the reactor vessel. The system is comprised of the filtration portion of the Reactor Vessel Cleanup System, the Submerged Demineralizer System (SDS), Reactor Coolant Bleed Tanks (RCBT) and the return pathway from the RCBTs to the reactor vessel used for the IIF Processing System. The system's major functions are:

a) to filter the water contained in the reactor vessel to remove suspended solids above a nominal .5 micron rating. This is done to maintain the clarity of the water to a 1 NTU rating.

b) to remove soluble fission products from the reactor vessel by demineralization of the water by batch processing through SDS to the RCBTs to reduce the dose rate contribution of the water. Also, Sb-125 concentration can be controlled by batch processing of reactor vessel water from the RCBTs through the EPICOR system.

The system is designed for operation sometime after plenum removal to supplant the IIF processing system and to precede the complete installation of the DWC System as described in References 9 and 10.

1.2 References

1. Planning Study, Defueling Water Cleanup System Doc. No. TPO/TMI-046

2. Technical Plan, Defueling Water Cleanup System Doc. No. TPO/TMI-047

3. Bechtel Drawing 2-POA-6401, General Arrangement Fuel Handling Building Plan El. 347'-6"

4. Bechtel Drawing 2-POA-1303, General Arrangement Plenum Removal Reactor Building

5. DCN No. 2026-30-2, Flow Diagram Spent Fuel Cooling and Decay Heat Removal

6. Burns & Roe Drawing No. 2026, Flow Diagram Spent Fuel Cooling and Decay Heat Removal

7. GPU Drawing No. 2R-950-21-001 P&ID Composite Submerged Demineralizer System

8. Division System Description for Reactor Vessel Cleanup System, Doc. No. 15737-2-M72-DWC01

9. Division System Description for Spent Fuel Pool/Fuel Transfer Canal Cleanup System, Doc. No. 15737-2-M72-DWC02

10. Instrument Index, Doc. No. 15737-2-J16-001

11. Design Engineering Valve List, Doc. No. 2-P16-001

12. Standard for Piping Line Specifications for GPU Nuclear Corp. TMI-Unit 2 Standard 15737-2-P-001

13. TMI-2 Recovery Mechanical Equipment List Bechtel North American Power Corp. Job 15737

14. ECA No. 3852-84-0040, Instrument Air Modifications for the DWCS

15. ECA No. 3525-84-0041, Definition of the Defueling Water Cleanup System

16. ECA No. 3245-84-0034, Defueling Water Cleanup System Penetration Modifications

17. ECA No. 3527-84-0042, SDS Tie-in to DWCS

18. Bechtel Area Piping Drawings

    a. 2-P70-DWC02 - Instrument Air Manifolds & Hose Routings for DWCS - Reactor & FHB

b. 2-P70-DWC03 - DWCS Hose Network Reactor Bldg. Plan El. 347'-6"

c. 2-P70-DWC04 - DWCS Hose Network Fuel Handling Bldg. Plan El. 347'-6"

d. 2-P70-DWC05 - DWC System Hose Network Sections and Details

e. 2-P70-DWC06 - DWCS - Process Hose Schedule - Reactor & FHB

19. TER-15737-2-G03-106, TMI-2 Division Technical Evaluation Report for Defueling Water Cleanup System

20. TER-15737-2-G03-114, TMI-2 Division Technical Evaluation Report for Defueling Canisters

21. Division I, System Design Description, Defueling Water Cleanup System Doc. No. 2-R72-DWC01

22. Bechtel Drawing 2-M74-DWC01, Defueling Water Cleanup (DWC) Reactor Vessel Cleanup System

23. Bechtel Drawing 2-M74-DWC02, Defueling Water Cleanup (DWC) Fuel Transfer Canal/Spent Fuel Pool Cleanup System

24. Bechtel Drawing 2-M74-DWC03, Defueling Water Cleanup (DWC) Auxiliary Systems

25. Bechtel Drawing 2-M75-DWC03, Early Defueling DWC Reactor Vessel Filtration System

26. Bechtel Drawing 2-M75-DWC04, Interim Fuel Transfer Canal Processing System

27. S-ECM 1151; Defueling Water Clean-up Phase I (Reactor Building)

28. Bechtel Drawings 2-M75-DWC01 and 2-M75-DWC02, Schematic Diagrams of the Internals Indexing Fixture Processing System

29. Burns and Roe System Description No. BR00174-00001-01, The Make-up and Purification System Description

30. Burns and Roe System Description No. BR0021X-00001-01, Radwaste-Disposal, Reactor Coolant Liquid System Description

31. Bechtel Drawing 2-P70-DWC01, Piping Composite Defueling Water Clean-up System Reactor Building

32. Bechtel Drawing 2-J77-DWC01, Logic Diagram IIF Fill Isolation Valve WDL-V40

33. Bechtel Drawing 2-J77-DWC02, Logic Diagram IIF Processing Pump DWC-P-1

34. Bechtel Drawing 2-J77-DWC03, IIF Level Alarms

35. Bechtel Piping Isometrics

a. 2-P60-DWC01-DWCS - Pumps P-2A&B, P-3A&B, P-4A&B, and Miscellaneous Details

b. 2-P60-DWC02-DWCS - Reactor Vessel Filter Trains A & B - Inlet Manifold Piping

c. 2-P60-DWC03-DWCS - Reactor Vessel Filter Trains A & B - Outlet Manifold Piping

d. 2-P60-DWC05-DWCS - Reactor Vessel Filter Train Sample Lines

e. 2-P60-DWC06-DWCS - Discharge Piping from Sample Boxes No. 1 & No. 2 to Penetration R-537

f. 2-P60-DWC12-DWCS - Borated Water Flush Piping from SPC-T-4

g. 2-P60-DWC17-DWC - Miscellaneous Piping Details

h. 2-P60-DWC18-DWCS - Miscellaneous Piping Details

h. 2-P60-DWC19-DWCS - Sample Panel No. 1, FHB

1.3 Detailed System Description

1.3.1 Description

The early defueling DWC reactor vessel filtration system is a liquid processing system which will process water from the reactor vessel. The system is shown schematically on Dwg. 2-M75-DWC03, and its associated Dwg. 2-M75-DWC04. (Note, some valves identified herein have been given an instrument designator as well as a valve number. When this occurs, the instrument designator is shown in parentheses after the valve number.)

The system has two submersible type pumps (deep well pumps), P-2A and 2B, which are housed in wells and located in the fuel storage pit in the shallow end of the fuel transfer canal in the Reactor Building. Each pump has a 220 gpm capacity and will process 200 gpm from reactor vessel and recirculate 20 gpm. The suction from the reactor vessel is through the Westinghouse work platform via hoses which connect the nozzles provided on the work platform to the wells.

The system has four particulate filters, F-1, 2, 3 and 4, each capable of filtering a flow of 100 gpm. The filters are composed to sintered metal filter media which is contained in modified fuel canisters. These filters are capable of removing debris, mainly fuel fines (UO_2) and core debris (ZrO_2), down to a 0.5 micron rating. Since the canisters contain fuel fines, they are designed to prevent a criticality condition from existing when they have been loaded. Also, the filters are submersed in the transfer canal to provide the appropriate radiation shielding.

The two pumps and four filters are arranged so that one pump discharges to two filters. Therefore, the filtration portion of the system is divided into two trains, each train contains one pump which feeds two filter canisters. This allows the system to filter 200 or 400 gpm from the Reactor Vessel. Normally, the system will process 400 gpm of Reactor Vessel water. The two pump arrangement allows for greater flexibility in system operations and provides redundancy to allow system operation during maintenance.

A filter is used continuously until the differential pressure reaches a predetermined setpoint. At this point the system s shutdown and then, after a waiting period (approximately 5 min.), it is restarted. The differential pressure is noted and if it returns to a low value, the system will be run again to the pressure setpoint. This process is repeated until the differential pressure at restart reaches a value near the shutdown setpoint. When this occurs within one hour, the train is shutdown and the filters are replaced.

Loaded canisters are expected to generate small quantities of oxygen and hydrogen gas due to radiolysis of water. pressure relief valves R-4, R-5. R-6, and R-7 are provided on the filter canister outlet lines upstream of their isolation valves. Their purpose is to prevent overpressuring the filter canisters when isolated due to the small quantities of H_2 and O_2 produced (approximately 0.029 ft^3/day.)

Once the water has been filtered, all, or a portion of, the flow can be returned to the Reactor Vessel. The amount of water returned is controlled by remotely adjusted valves V015A & B (HV30A&B). Each of these lines will connect, via flexible hoses, to the separate inlet nozzles on the work platform. A sparger has been placed on each return line to maintain a positive pressure in the attached hoses.

To remove soluble fission products, a maximum of 15 gpm of filtrate, not returned to the reactor vessel, can be batch processed through SDS and then routed to a RCBT while concurrently returning an equal amount of reactor coolant grade water to the RV from another RCBT. A 1 1/2 inch hose, equipped with "quick disconnect" two way shutoff fittings, connects the Early Defueling DWC RV Filtration System to the SDS via the fuel transfer canal drain manifold.

The manifold serves as a tie-in point for 3 other systems; the surface suction system (sump-sucker), the fuel transfer canal drain system, and the shallow end drainage system. Double isolation of the shallow end drainage system from the other two is provided by air operated ball valve FCC-V003 and check valve FCC-V016 in addition to manual valves located on each of the other branches of the manifold. The Early Defueling DWC RV Filtration System will use the same connections to the manifold as otherwise used by the fuel transfer canal drain system.

From the manifold, the system uses an existing flow path through Reactor Building penetration R-626 and fuel handling building penetration 1551 to SDS and then to RCBT. The SDS pre and final filters may be bypassed when processing using the Early Defueling DWC Reactor Vessel Filtration system.

Filling the RV/IIF is accomplished by transferring reactor coolant grade water from another RCBT to the RV/IIF via a waste transfer pump and an existing flow path through the WDL and MU systems to a cold leg of the reactor coolant system.

The roles of the RCBTs can be interchanged provided valves are properly realigned and the tank used to fill the IIF contains reactor coolant grade water.

Flow from the IIF may be manually throttled at valves CN-V-FL-1 or CN-V-FL-3 in SDS if desired. Flow to the IIF is controlled automatically or manually by valve MU-V9 based on RV/IIF water level. Shutoff of the IIF supply (via WDL-V40) is achieved automatically in the event of unacceptable water levels in the IIF and may also be manually accomplished at several locations.

Sample points are provided upstream and downstream of each filter train. These samples are routed to sample box 1, a glove box located in the FHB. The glove box has a self contained blower and HEPA filter which discharge to the FHB ventilation system. Samples can also be obtained from several points within the SDS.

This system provides the operator with the capability to periodically monitor the effectiveness of the system. Also, the turbidity of the effluent from the filters is constantly monitored by nephelometers and displays at the local control panel.

Several inlets have been provided on the system through which borated water can be gravity fed from the standby reactor pressure control system storage tank to backflush the system. The system will be backflushed as necessary when radiation levels in the piping are determined to be excessive prior to maintenance.

1.3.2 System Components

P-2 A/B Reactor Vessel Cleanup Pumps

Type: Vertical Submersible Deep Well Pump

Model: Goulds VIS 9AHC/2

Material: Stainless Steel Bowl and shaft with a bronze impeller

Motor: Franklin Electric 25 hp, 460 Volt, 3 phase

Rating: 264 FT TDH at 220 gpm

Minimum Flow: 20 gpm

F-1/2/3/4 Reactor Vessel Filters

Type: Pleated Sintered metal media

Model: Pall Trinity special product contained in a critically safe canister

Rating: 0.5 micron Nominal Removal Rating

Flow: 100 gpm

F-5 Filter Canister Post Filter

Type: Disposable Cartridge

Model: Filterite No. 921273 Type 18M503C-304-2-FADB-C150

Rating: 0.45 micron nominal removal rating

Flow: 20 to 60 gpm

PSV R-4, R-5, R-6, & R-7 Relief Valves

Model: Anderson Greenwood No. 83MS46-4L

Orifice Area: 0.049 in^2

Set Pressure: 130 psig

Sample Box 1

Type: Glove Box

Mrgr: Labconco

Model: Mo. 50002, Radioisotope Glove Box

Material: Fiberglass-reinforced polyester

Built-in Blower: 115 volt, 1/15 HP, variable speed

Filters: Inlet Prefilter, outlet HEPA filter

Dimensions: 50" x 30" x 37"

For instrumentation, valves, piping, and additional equipment details, see References 10, 11, 12, 13, 29 and 30.

1.4 System Performance Characteristics

The system is designed to function in any of the modes of operation shown in Table 1 below.

Table 1

Early Defueling DWC RV Filtration System Operational Configurations

FILTER FLOW (GPM) Return to Reactor Vessel		SDS FLOW (GPM) With Equivalent Return to Reactor Vessel
400	200	0
385	185	15

(Numbers in brackets indicate flow if only one train is in operation.)

The operational mode is determined by the solids loading in the reactor vessel. Normally, 400 gpm from the reactor vessel is filtered and 7 to 15 gpm of the filtrate is demineralized.

As the filters load up, the pressure differential across the filter train increases. As the differential pressure increases, the flow rate is maintained constant by manually adjusting remote valves V015A and V015B (HV-30A and 30B).

1.5 System Arrangement

Well pumps P-2A and 2B are located in the fuel storage pit of the Unit 2 Reactor Building. These pumps are housed in wells which are located in this pit. The wells are connected by hose to the Westinghouse work platform. The pump discharge is routed to the filter canisters via a skid mounted manifold which is located above the water level of the canal. The filter isolation valves are also located on the skid. The filter canisters are in racks which are submersed in the fuel transfer canal. The manifold is connected to the inlet and outlet of the filters via coded, armored hose. The inlet and outlet connections are coded to prevent misconnection of the hoses. The outlets from the filters return to the DWC manifold from where the water is routed back to the reactor vessel or to the SDS via the fuel transfer canal manifold. The fuel transfer canal drain manifold is located near the DWC manifold skid.

Sample box 1 is at the southeast end of the spent fuel pool A.

The system uses the following existing penetrations which have been modified for their temporary function.

Penetration No.	System	Modified Function
R-542	Decay Heat	Backflush
R-537	R.B. Emergency Spray and Core Flooding	Sampling Return
R-545B & C	Spares	Sampling
R-554D	Instrument Air to LOCA Dampers	Instrument Air Supply

For further location and arrangement information, see References 3, 4, and 35.

1.6 Instrumentation and Control

1.6.1 Controls

The majority of system control is handled remotely from a control panel which is located in the Fuel Handling Building. This is due to the fact that much of the system is located in the Reactor Building which has limited access. The reactor vessel cleanup pumps do have local hand switches to shut the pumps down.

Filtered water flow back to the reactor vessel is monitored by the operator and adjusted by remotely controlled valves V015A and V015B (HV30A&B).

On/off controls for the waste transfer pumps are located on radwaste panel 301B, and in the control room on control panel 9.

Valve WDL-40 has existing open/close controls located on radwaste panel 301B and in the control room on control panel 9. Additional open/close controls are located on SDS control panel CN-PNL-1. WDL-V40 terminates flow in the event of high or low water level in the IIF. A block switch is located on CN-PNL-1 which can be used to block the low level trip to permit filling the IIF to the desired level.

Water level is automatically maintained at a prescribed level (approximately 327'-6") in the IIF by valve MU-V9. Section 2.2 documents the actual set points. The control signal to valve MU-V9 is provided by the reactor water level monitoring system (bubbler) through proportional controller RC-LIC-102 which is located on control room panel SPC-PNL-3.

For further information on the instrumentation, refer to the Instrument Index (Ref. 10).

1.6.2 Power

The pump motors are supplied with 480V power through a motor control center which is energized by an existing unit substation located in the Auxiliary Building. 120 VAC power will be supplied from the control panel or local sources.

1.6.3 Monitoring

Monitoring equipment is provided to evaluate the performance of the system and to aid in proper operation of the system.

The discharge pressure of the submersible well pumps is monitored (PI-4A & 4B) to determine if the pump is operating correctly and also to provide another indication that the pump is operating.

In order to determine the degree of filter loading, the primary filter canisters and the secondary post filter are equipped with remote indication if differential pressure across the filters (DPI-5A, DPI-5B, and DPI-33). The differential pressure across the canisters will be used to determine when the filters are loaded to capacity.

The process fluid conditions are monitored to determine the effectiveness of the system. The turbidity level in the fluid is monitored (AI 43A & 43B) prior to its return to the source. Also, the capability to obtain grab samples of process fluid has been provided for at several locations in the system.

1.6.4 Trips and Interlocks

The reactor vessel cleanup well pumps, P-2A/B, are provided with low level setpoint trips to ensure that the pumps do not operate under potential cavitation conditions. A low level in the IIF will also trip pumps P-2A and P-2B.

The reactor vessel cleanup well pumps, P-2A/B are equipped with interlocks to prevent them from being started during a low level condition.

Valve WDL-V40 will be tripped closed on high level in the RV/IIF. The prevents over filling of the RV/IIF.

For trip setpoints, see Section 2.2.

1.7 System Interfaces

Those systems interfacing with the Early Defueling DWC RV Filtration System are as follows:

a) Standby Reactor Pressure Control System (existing)

Use: Provide a source of borated water for backflushing

Tie-in: A single connection from SPC-T-4 downstream of SPC-V1 to several points in system

b) Submerged Demineralizer System

Use: Remove soluble fission products and provide a path to the reactor coolant bleed tanks

Tie-in: Via fuel transfer canal drain manifold

c) Instrument Air System

Use: Provide source of instrument air to equipment in the Reactor Building

Tie-in: From existing Instrument Air supply to LOCA dampers

d) Interim Fuel Transfer Canal System

Use: Employ common pathway to SDS

Tie-in: Fuel transfer canal drain manifold

e) Surface Suction System (sump-sucker)

Use: Employ common pathway to SDS

Tie-in: Fuel transfer canal drain manifold

f) Shallow End Drainage System

Use: Employ common pathway to SDS

Tie-in: Fuel transfer canal drain manifold

g) FHB Ventilation System

Use: Receive sample box 1 ventilation

Tie-in: 4 inch diameter hose station at southeast end of FHB

1.8 Quality Assurance

The Early Defueling DWC RV Filtration system is classified according to the safety functions of its parts. There are two classifications in this system:

a. The filter canisters are classified as nuclear safety related and are designed to prevent a condition that could result in a return to nuclear criticality of the fuel retained in the filters.

b. The remaining portions of the system are subject to the BNAPC non-safety-related quality assurance program.

The TMI-2 Recovery QA Plan will be applicable for work performed on site.

2.0 SYSTEM LIMITATIONS, SETPOINTS AND PRECAUTIONS

2.1 Limitations

The system is flow limited to 200 gpm through each filter train, 400 gpm total, and 15 gpm through SDS.

The main filter canisters are limited to 45 psi pressure differential. At this point, an alarm on the local control panel will inform the operator to stop and restart the system or change out the filter.

The post filter is limited to 10 psi pressure differential. At this point, the filter is considered fully loaded and is changed out.

Influent to the IIF must be reactor coolant grade water.

Neither the surface suction system, the fuel transfer canal drain system, nor the shallow end drainage system may operate while the Early Defueling DWC RV filtration system is routing to SDS.

SDS must be configured for processing of reactor coolant.

Before initial system commissioning, and whenever the surface suction system (sump-sucker) has been used between early defueling DWC RV filtration processing cycles, flushing of the surface suction system must be verified.

2.2 Setpoints

DPSH 5 A/B trips the alarm at 45 psid across the filter canisters.

DPSH 33 trips the alarm at 10 psid across the filter canister post filter.

RC WC 102 trips MU-V-9 closed on high level.

RC-LIS 103 trips valve WDL-V40 and alarms at a high IIF level of 327'-9" and trips pumps and alarms at a low IIF level of 327'-3".

LIS 2A/B trip pumps 2 A/B at a decreasing level of 1'0" above the suction of the pump.

For additional setpoint information, refer to Ref. 10.

2.3 Precautions

Due to the number of quick disconnect couplings, extra care should be taken to ensure that the couplings are properly connected and that they are connected in the proper locations. This precaution will help prevent a loss of reactor vessel inventory.

The portion of the startup procedures concerning the well pumps should be strictly adhered to to prevent the rapid filling of an empty manifold. This situation could cause a harmful pressure wave to develop which has the potential to damage the filter media. Also, during initial startup, a siphon must be established in the suction of the well pumps. This will be done by filing the hose as much as possible and by slowly starting the system.

The filter canisters operate by a surface filtration method, and their efficiency increases as a cake is built up on the surface of the media. Therefore, the build up of this cake is an important part of the filtration process. To prevent the migration of fines to the post filter, routing to SDS should not be started until a cake has begun to be formed on the media. This can be verified by observing the turbidity of the filter effluent. When the filter train is started up, there will be an initial turbidity spike caused by smaller particles passing through the media. As the cake is build, these particles are stopped and the turbidity decreases. Once the turbidity reaches a level of 10 NTU or less, a portion of the flow may be routed to SDS. To prevent the breakdown of the cake, the system should not be started or stopped unnecessarily.

Due to the radioactivity in the water, the system should be carefully drained and flushed prior to any maintenance work.

Double isolation has been provide for in the system design to separate borated and nonborated water supplies.

3.0 OPERATIONS

3.1 Initial Fill

The system is filled initially by borated water from the standby reactor coolant pressure system through the backflushing system provided (see Section 3.7). The filters are filled to the inlet and outlet manifolds. The suction hose from the IIF to well pumps 2A/B should be filled a much as possible.

3.2 Startup

Prior to startup, valve alignment must be checked to verify that the process water for each filter train is take from and returned to the reactor vessel. The well pumps P-2A/B are isolated by the remote manual isolation valves V004A/B (HV27A/B). The path to SDS is isolated by remote isolation valves V018A/B. The return lines to the reactor vessel are isolated by the remote control valves V015A/B (HV 30 A/B). For initial startup, valves V016 A/B should be closed. The well pumps are started and placed on minimum recirculation flow. The pump isolation valve V004A or B (HV27A or B) for one filter train is slowly opened to allow any trapped air to escape through the automatic vent valves. Once the isolation valve is fully opened, the return valve V015 A/B (HV30A/B) is opened approximately 35%. During initial startup, the globe valve V016 A/B is opened slowly until 200 gpm through the train is obtained. Following initial startup, valves V016A/B (HV 30A/B) will remain in these positions, and startup will be initiated by slowly opening valve V004A/B (HV27A/B) with valve V015A/B (HV 30A/B) approximately 35% open. Flow is then adjusted to 200 gpm by adjusting valve V015A/B (HV 30A/B). The other train then is brought to the desired flow by following the same procedure.

SDS must be configured for reactor coolant processing, the automatic trip switches must be in the not-blocked position, the surface suction system must be flushed, and both the Surface Suction system and the Shallow End Drainage system must be isolated at the Fuel Transfer Canal Drain Manifold. The supply water to the IIF must be sampled to verify that it is within specification for reactor coolant grade water.

SDS processing is begun by starting waste transfer pump WDL-P-5B and opening valve WDL-V40. The pump will remain in minimum recirculation until flow to the IIF is required and MU-V-9 is opened. Then either V018A or V018B is opened, initiating flow through SDS to a RCBT. Valve MU-V9 automatically opens to maintain level in the IIF.

3.3 Normal Operation

Normal operation of the system is in one of the modes shown in Table 1 of Section 1.4. The mode of operation chosen is based on the particulate and radioactivity concentrations in the Reactor Vessel.

3.4 Shutdown

The steps to bring the system to a shutdown condition are basically the reverse of the startup procedure. Either (depending on system operation) of the isolation valves from the filtration trains to the SDS is closed. Then the return line from the RCBT's is isolated by closing WDL-V40 and MU-V9. The filtration trains are shut down one at a time by closing the flow return control valve and then shutting down the pumps and closing the pump isolation valves.

3.5 Draining

There is a low point drain which can drain both filtration train manifolds to the fuel transfer canal.

3.6 Refilling

The fully drained system can be refilled in the same manner that the system was initially filled. A partially drained system can be refilled by using either the backflush system (see Section 3.7) or the well pumps (see Section 3.2).

3.7 Infrequent Operations

Flushing of the system may be performed when the internal contamination level gets high or prior to internal maintenance work. The system is shutdown (see Section 3.4) prior to flushing.

One flushing option allows a gravity flush from SPC-T-4. Borated water is stored in the charging water storage tank, SPC-T-4, located at the 347 ft. elevation in the Fuel Handling Building. This tank is connected to the Early Defueling DWC RV Filtration System. Either filter train may be flushed without stopping flow through the other.

Flushing may be accomplished by opening one of the inlet valves from the flushing system (depending on which portion of the system is to be flushed) and then opening the drain valve to the fuel transfer canal. After sufficient time has been allowed to flush the system, the drain valve is closed and then the inlet valve is closed. The system is then restarted following the procedures in Section 3.2.

System inventory can be decreased or increased as needed by mismatching flow routed to/from the RCBT's. This may be done by changing the set point on RC-LIC-102. Also, the water can be routed to the RCBT as required for processing through EPICOR to remove Sb-125.

4.0 CASUALTY EVENTS AND RECOVERY PROCEDURES

4.1 Loss of Power

A loss of power to the entire system would simply shut the system down. A loss of power to the well pumps would shutdown the filtration portion of the system which would in turn cause level control RC-LIC-102 to close MU-V9 terminating flow from the RCBT.

Loss of power to individual components would place the component in its safe mode. An air operated valve, for example, would fail to a position that ensures no damage to other components.

Loss of power to the control panel would cause the loss of all information and fail all control and solenoid operated valves. The system would be shutdown until power is restored.

4.2 Loss of Instrumentation/Instrument Air

Loss of instrumentation would hamper operations but no adverse conditions would result and the system could be safely shut down until the problem is resolved.

Loss of a single instrument channel will result in the loss of indication for that channel and, for those channels that have control features, a flow mismatch. This flow mismatch will result in an automatic shutdown of the affected portion of the system (low level in RV trips DWC-P02A & B).

Loss of the internals indexing fixture (IIF) level indication system (bubbler) will result in an erroneous level indication which will be noted when compared with a redundant level indication system. Since this system has no control features, no adverse system conditions will result.

Loss of instrument air will take the individual components to their fail safe position. Flow mismatches induced by loss of air will result in automatic trips. Loss of air to the IIF level monitoring system will initiate a low air supply pressure alarm.

4.3 Filter Media Rupture

A failure of the filter media in the canister could potentially release fuel fines to the SDS portion of the system. A post filter is located downstream of both filter trains in the line to the SDS. This filter will trap any fuel fines which would be transported past the filter canisters in the event of filter failure. The post filter is designed to be critically safe and is sized so that a small accumulation of debris will increase the differential pressure to the alarm setpoint. Also, the nephelometers in the return line would alert the operator to a possible media rupture since the turbidity would increase rapidly.

The recovery procedure is to isolate the filter trains the find the ruptured filter by observing the differential pressure versus flow for each individual canister. Lower differential pressure for a given flow will indicate that this filter is ruptured. That canister or canisters and the post filter cartridge would be replaced and the system restarted.

4.4 Line and Hose Break

The consequences of any line and hose break is a loss of reactor vessel inventory. The system has been designed to mitigate the consequences of such an incident to the extent possible.

To help prevent a hose rupture, all process hoses are armored. In case of a hose rupture or line rupture, downstream of the reactor vessel pumps, P-2A & 2B, the system is equipped to trip these pumps on the IIF low level and alarm to the control panel. This event could deliver approximately 500 to 100 gallons of reactor vessel water to the area of the break. The potential areas affected would be the Reactor Building and the Fuel Handling Building, each of which has sumps or drains to the Aux. Bldg. sumps to contain the spill.

If a suction hose to the well pumps or a return hose to the reactor vessel should rupture, a siphoning of reactor vessel water would take place. The two 4 inch suction connections provided in the Westinghouse work platform are provided with two 3/4 inch holes drilled 18 inches below the water level which will act as a siphon breaker. The three 2 inch return lines are equipped with spargers, which are simply holes drilled into the pipes. The first holes are drilled 18 inches below the water level which will act as a siphon breaker. The sample return line is terminated 18 inches below the water level. Therefor, a maximum of approximately 3000 gallons of reactor vessel water would spill into the fuel transfer canal following a hose rupture. Approximately half of this water would be contained in the New Fuel Pit.

The recovery from these events would be accomplished by isolating the ruptured section and replacing the ruptured hose/pipe.

5.0 SYSTEM MAINTENANCE

The maintenance procedures are the recommended practices and intervals as described by the equipment vendors.

6.0 TESTING

6.1 Hydrostatic Testing

Piping and hose will be hydrostatically pressure tested. Testing of hose will be done after couplings have been attached. Pipe will be tested outside the buildings.

6.2 Leak Testing

All accessible connections will be initial service leak tested after the piping is assembled.

6.3 Instrument Testing

All instruments will be calibrated by vendors. Complete electric/pneumatic loop verification will be done during start-up.

7.0 HUMAN FACTORS

Filter canister hoses are coded for quick identification of inlet versus outlet.

Extensive use of hoses is made, especially in the Reactor Building, allowing quick installation and use of existing radiation shielding. Hoses which are expected to be frequently disconnected are equipped with quick disconnect couplings for ease of removal and replacement.

The following human factors guidelines have been incorporated into the design of the DWCS control panel:

- The panel includes all controls and displays required for normal operation

- Displays provide immediate feedback that the system has responded appropriately to an operator's action

- Controls and displays are laid-out for a left to right flow path

- Mimic lines are used to clarify flow paths

- Control devices are mounted 3 to 6 feet above the floor

- Each control device has a name plate

- Light bulbs are replaceable from the front of the panel

- Recorders are grouped on the right side of the panel away from the flow path

- Adjustments to recorders and controllers can be performed from the front of the panel