GPU Nuclear

S D 3527-005 REV 6

ISSUE DATE September 1987

☒ ITS
☐ NSR
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DIVISION

SYSTEM DESCRIPTION

FOR

Submerged Demineralizer System

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Title	System Description for the Submerged Demineralizer System	No. 3527-005	Page 2 of

Rev.	SUMMARY OF CHANGE	Approval	Da
0	Initial issue per GPU Nuclear letter 4400-82-L-0017.		2/
1	Updated per GPU Nuclear letter 4410-83-L-0018.		4/
2	Updated per GPU Nuclear letter 4410-83-L-0154.		6/
3	Updated per GPU Nuclear letter 4410-84-L-0030. Incorporates changes made by ECMs S-1163 (Revision 0 through 3), 1100 Revision 0, 1140 Revision 0, 1237 Revision 0, 1058 Revision 2, 1151 Revision 0, 1161 Revision 0, 1157 Revision 0, 1159 Revision 0, and 1141 Revision 0.		7/
4	Annual Update. Incorporates changes by S-ECM [illegible] Revisions 0 and 1; ECAs 072, 042, 047, 041, and [illegible].		8/8
5	Annual Update. Incorporates changes made by S-ECM 1058 Revision 2; ECAs 041, 072, 087, and 312.		8/8
6	Annual Update. Incorporates updates to the valve and component lists; updates historical data, deletes the Early Defueling DWC Reactor Vessel Filtration System which is no longer applicable.		9/8

FORM 4000-ENG-7310.06-2 (11/83)

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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APPENDICES

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.

Decon amination 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

Burns & Roe Drawing 2027

Burns & Roe Drawing 2045

Burns & Roe Drawing E-032

Burns & Roe Dwg. 2007 Sht 2 of 2

Burns & Roe Dwg. 2012 Sht 2 of 2

Burns & Roe Dwg. 2014 Sht 2 of 3

Burns & Roe Dwg. 2026

Burns & Roe Dwg. M043

Burns & Roe Dwg. M323

Chem-Nuclear Dwg. 527-D-A-5001

Chem-Nuclear Dwg. 527-D-A-5002

Chem-Nuclear Dwg. 527-D-A-5004

Chem-Nuclear Dwg. 527-D-A-5006

Chem-Nuclear Dwg. 527-D-A-5009

Chem-Nuclear Dwg. 527-D-A-5011

Chem-Nuclear Dwg. 527-D-A-5013

Chem-Nuclear Dwg. 527-D-L-5026

Chem-Nuclear Dwg. 527-D-L-5027

Chem-Nuclear Dwg. 527-D-L-5031

Bechtel Dwg. 2-M74-SDS01

Bechtel Dwg. 2-M74-PW01

Bechtel Dwg. 2-M74Y-DWC03

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

1.2.7 DWCS TER and System Descriptions

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 DWC Fuel Transfer Canal/Spent Fuel Pool Cleanup System as described in Reference 1.2.7.

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 Capacity

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 Process Piping Design Requirements

1.6.2.1 Piping is designed to ANSI B31.1 in accordance with the requirements of Regulatory Guide 1.143. Welded construction has been utilized to the maximum extent possible with butt 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 <u>Monitor Tank Requirements</u>

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

2.0 Detailed Description of the System

2.1 Components

2.1.1 Submerged Demineralization System Pumps

2.1.1.1 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 parallel of ion exchangers and then to the fuel pool.

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

2.1.1.6 RCS 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 <u>FTC Drain/Processing Pump</u> (FCC-P-1)

See Appendix 18.

2.1.1.8 <u>FTC Shallow End Drainage Pump</u> (DWC-P-1)

<u>Note</u>: Uses old IIF Processing Pump.

See Appendix 19.

2.1.1.9 <u>DWC Fuel Transfer Canal/Spent Fuel Pool Cleanup System Pumps (DWC-P-3A & B and DWC-P-4A & B)</u>

<u>Early Defueling</u>

See Reference 1.2.7.

2.1.2 <u>Submerged Demineralization System Tanks</u>

2.1.2.1 <u>Off Gas Separator Tank (CN-T-VA02)</u>

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 Tank: 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 fliter, 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 <u>Submerged Demineralization System Post Filter</u>

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.

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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 Exchanger and Filter Vessel Lifting and Positioning Tools

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

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

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

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

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

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

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

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

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

c) The J-hooks are engaged and 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 allow the length of the tool to be altered necessary by adding or deleting pipe sections.

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

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

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

2.1.8.4 Moveable Spent Vessel Rack Lifting Device

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

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

2.1.8.5 Vessel Nozzle Plugging Tool

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

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

2.1.8.6 Pressure Instrument Diaphragm Removal Tool

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

2.1.8.7 Vent Hose Handling Tools

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

(a) 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. 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-FSL-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-i, 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 fr m 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 4221-ADM-3620.01 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 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.

5.1.2.4 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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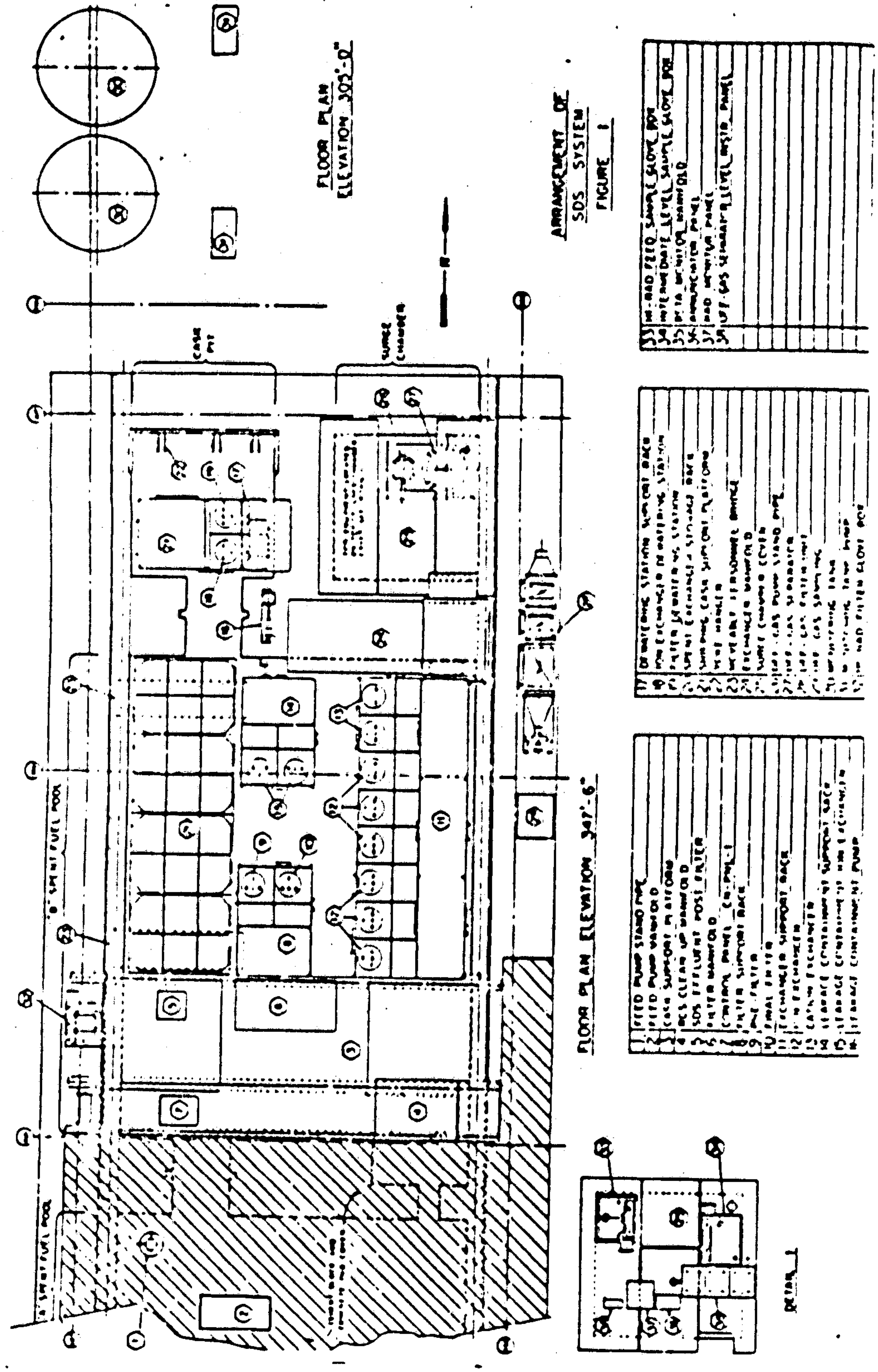
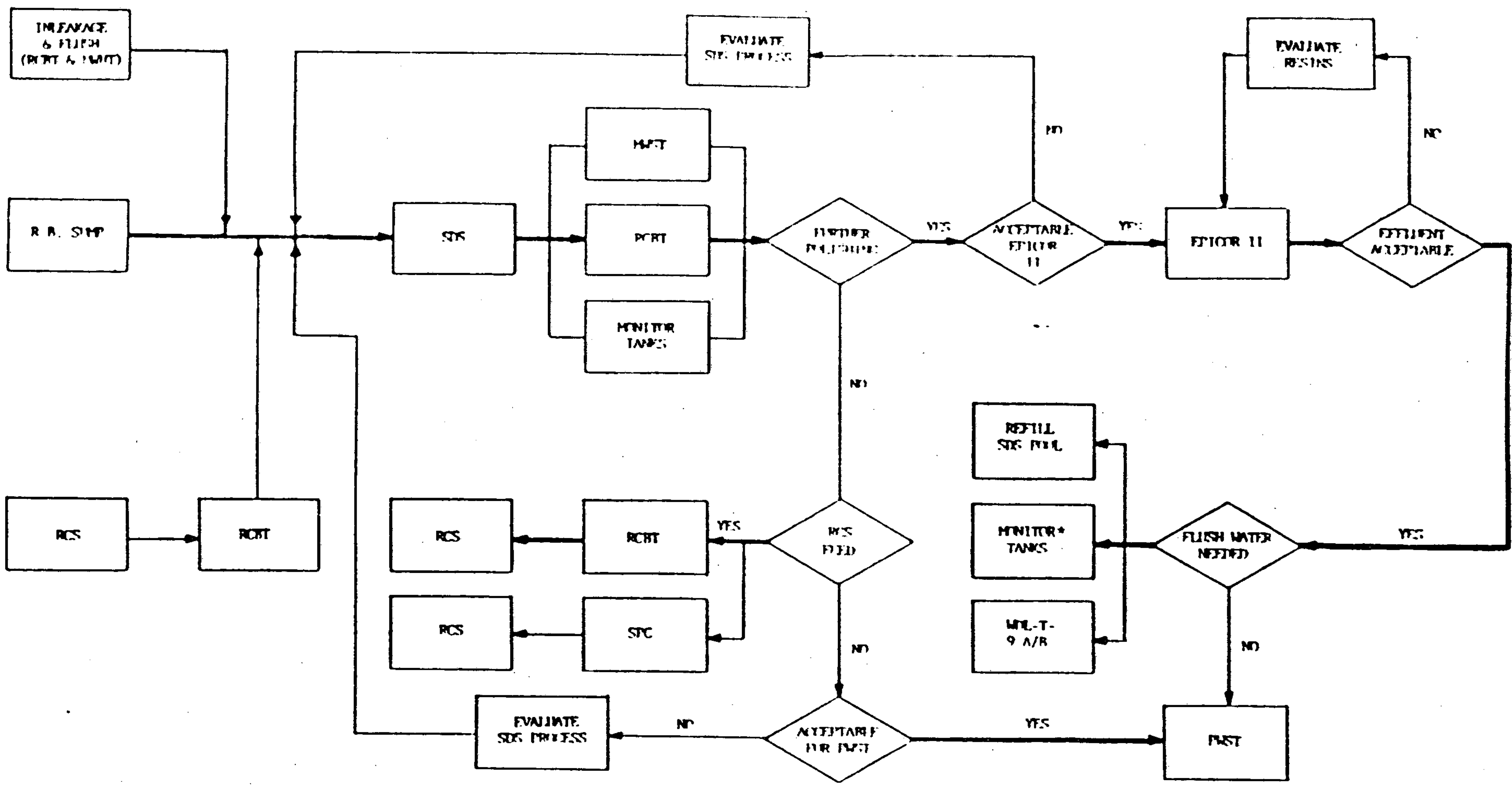
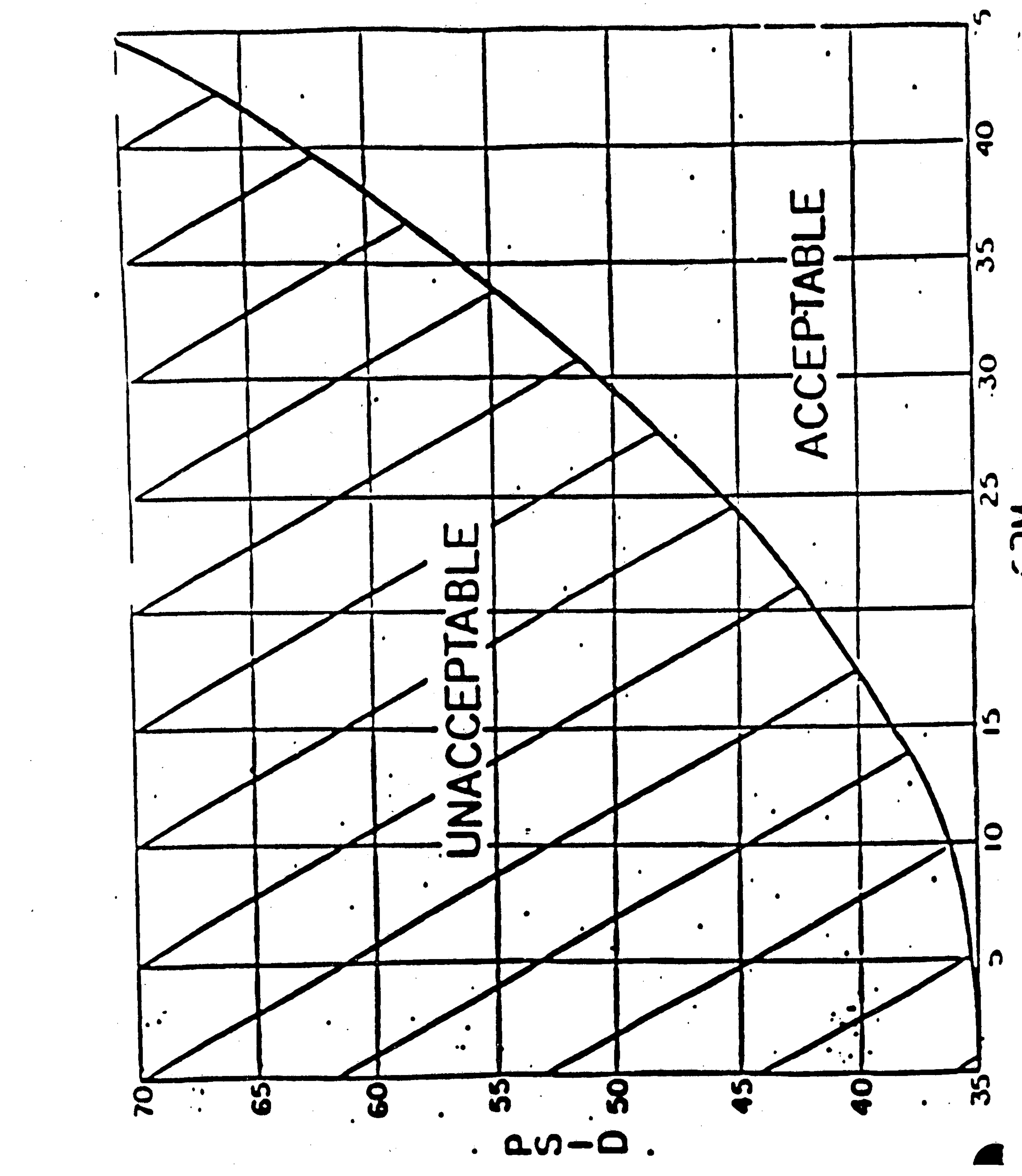

FLOOR PLAN
ELEVATION 305'-0"
ARRANGEMENT OF
SDS SYSTEM
FIGURE 1
FLOOR PLAN ELEVATION 347'-6"
DETAIL 1
CASK PIT
SURGE CHAMBER
"B" SPENT FUEL POOL
"A" SPENT FUEL POOL

PROCESSING LOGIC PLAN



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


UNACCEPTABLE
ACCEPTABLE
PS-D
70
65
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45
40
35
10
15
25
30
35
40

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	Strong Acid Cation Mixed Cation/ Anion, or IE-96/Linde A	2 Ci Cs+Sr or 20 Ci γ-emitter Na break	- Dewatered Burial * - Minimize Na Breakthrough - Operational Convenience - Liner handling limit (Bare Pick) - Shipping considerations	<2 Curies Cs+Sr <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

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	

Appendix No. 1

to

Submerged Demineralizer System

System Design Description

Title

S.D.S. Pumps/Blowers

Appendix 1

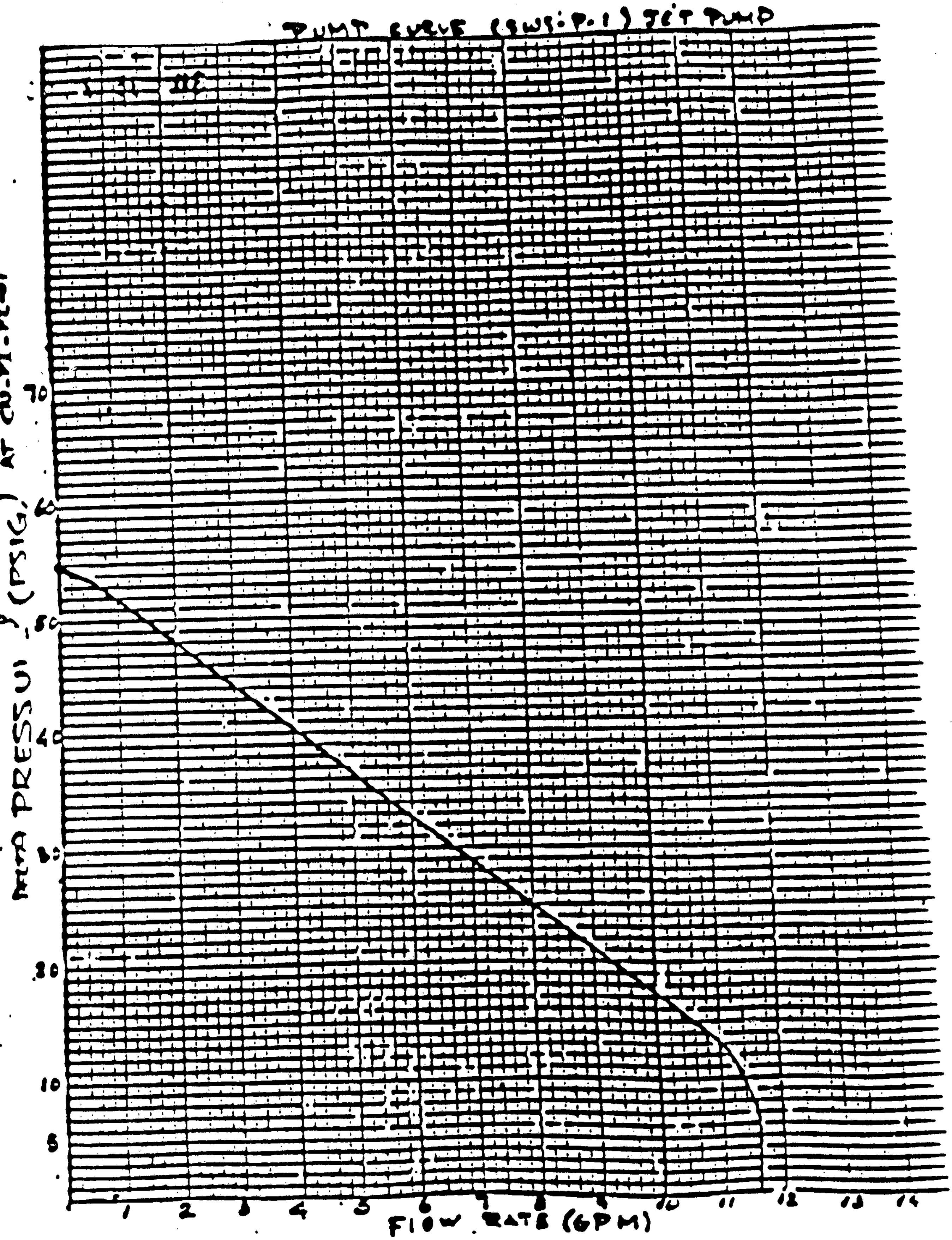
SDS PUMPS/BLOWERS

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
PRESSURE (PSIG) AT
70
60
50
40
30
20
10
5
1
2
3
4
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6
7
8
9
10
11
12
13
14
FLOW RATE (GPM)

0321y LC

Appendix 1

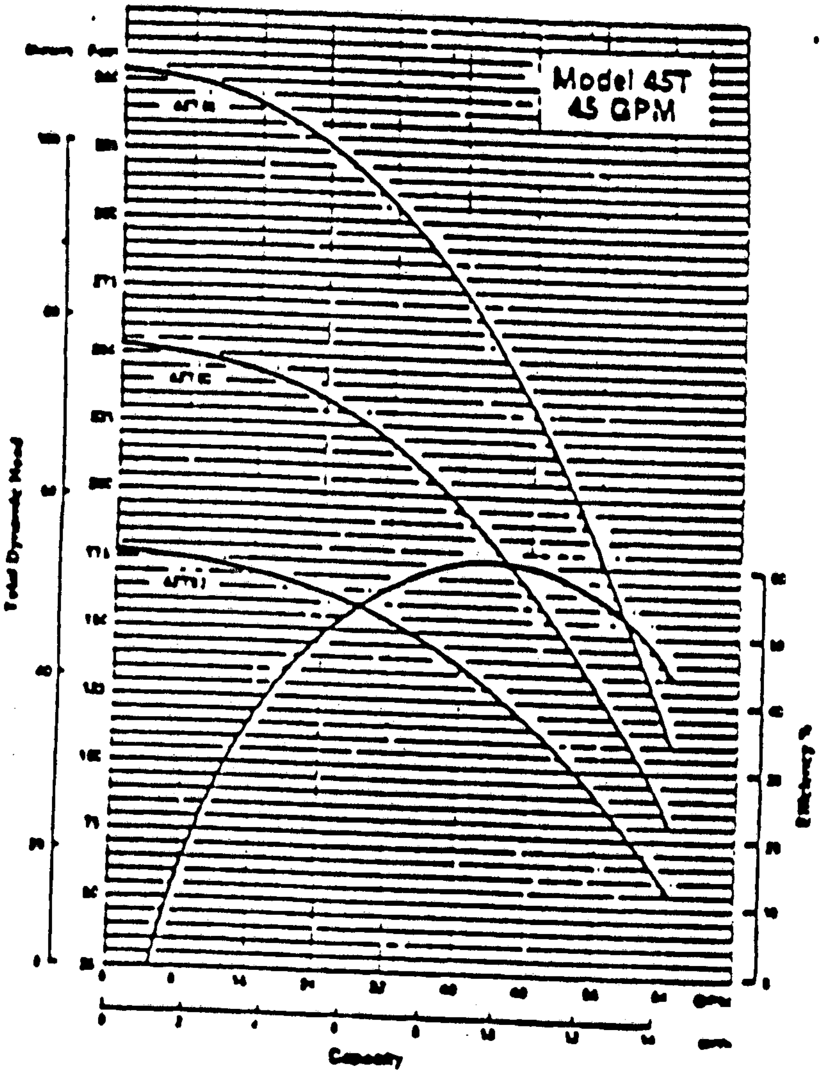
SDS PUMPS/BLOWERS

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

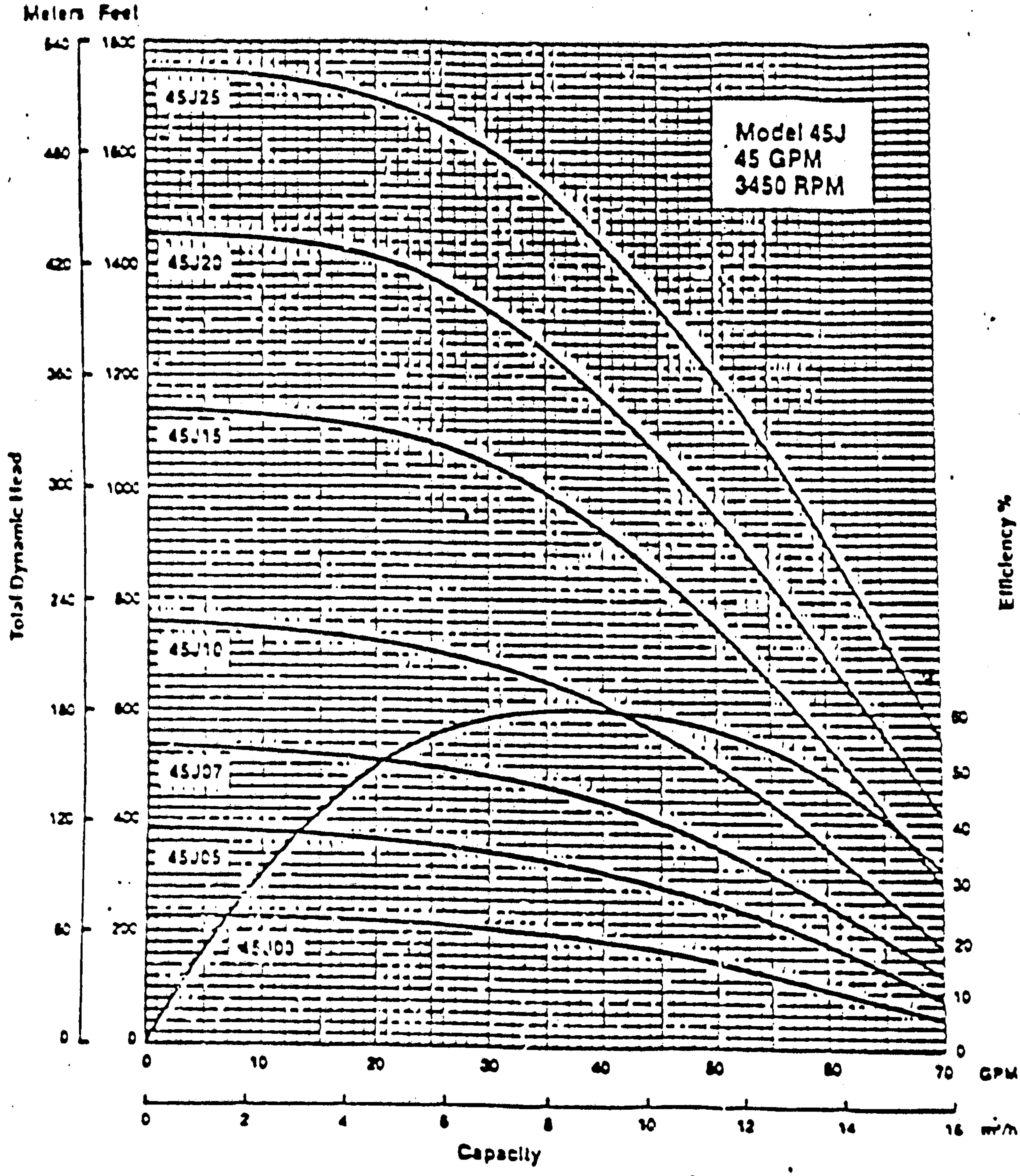
SDS PUMPS/BLOWERS

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 FCC-P-1 (Goulds 45J05)

Figure 1

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

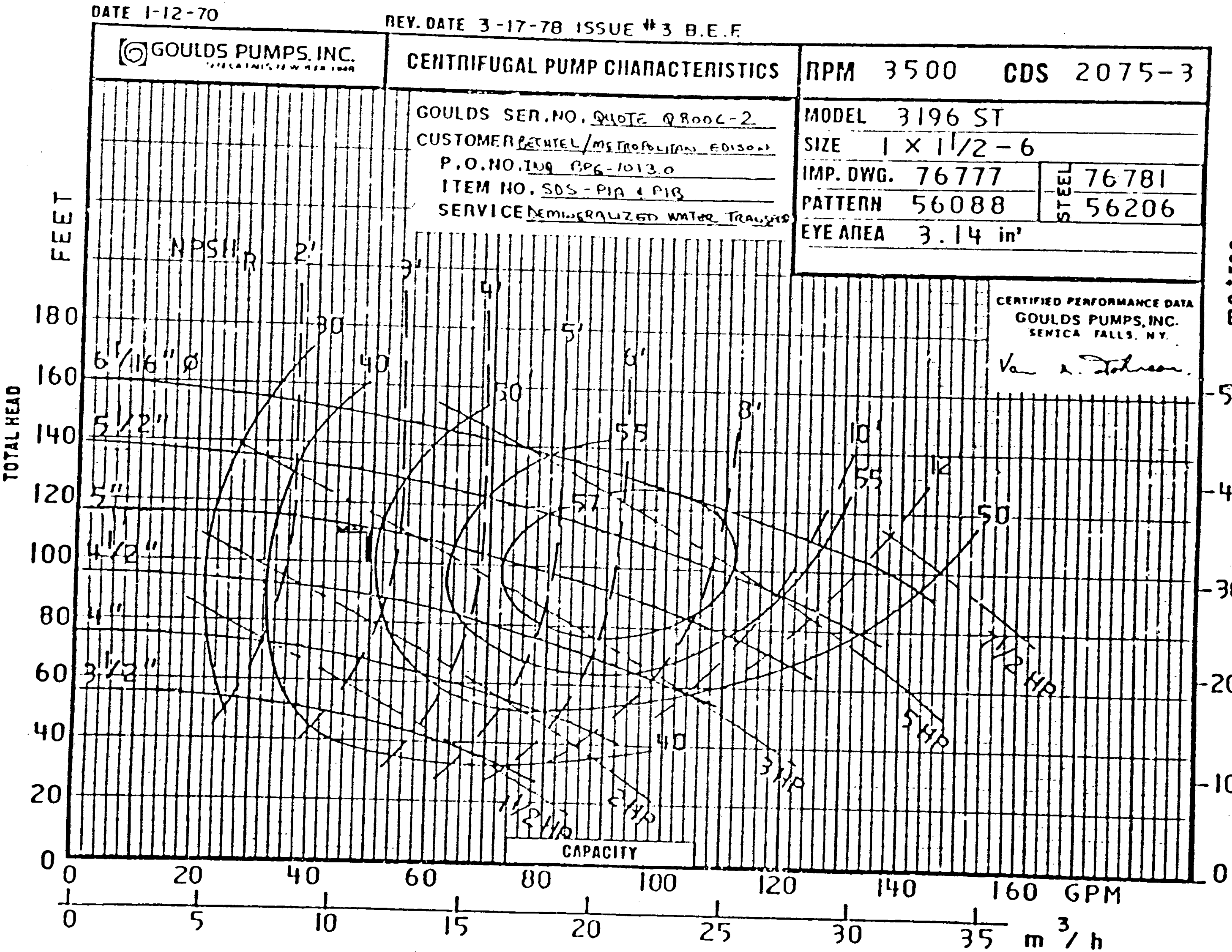
Manufacturer	Reliance
Type	P
Enclosure	ODP
Rated Horse Power	5 HP
Rated Speed	3500 RPM
Lubricant/Coolant	Oil/Air
Power Requirements	460 Volts, 3 Phase 60 Hz, 6.6 Amps
Power Source	SDS-STR-1 and SDS-STR-2

Reference

Drawing No.	2-M080A, Rev. 0

APPENDIX 1 SDS SDD

SDS-P-1A & SDS-P-1B



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SD 3527-005

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

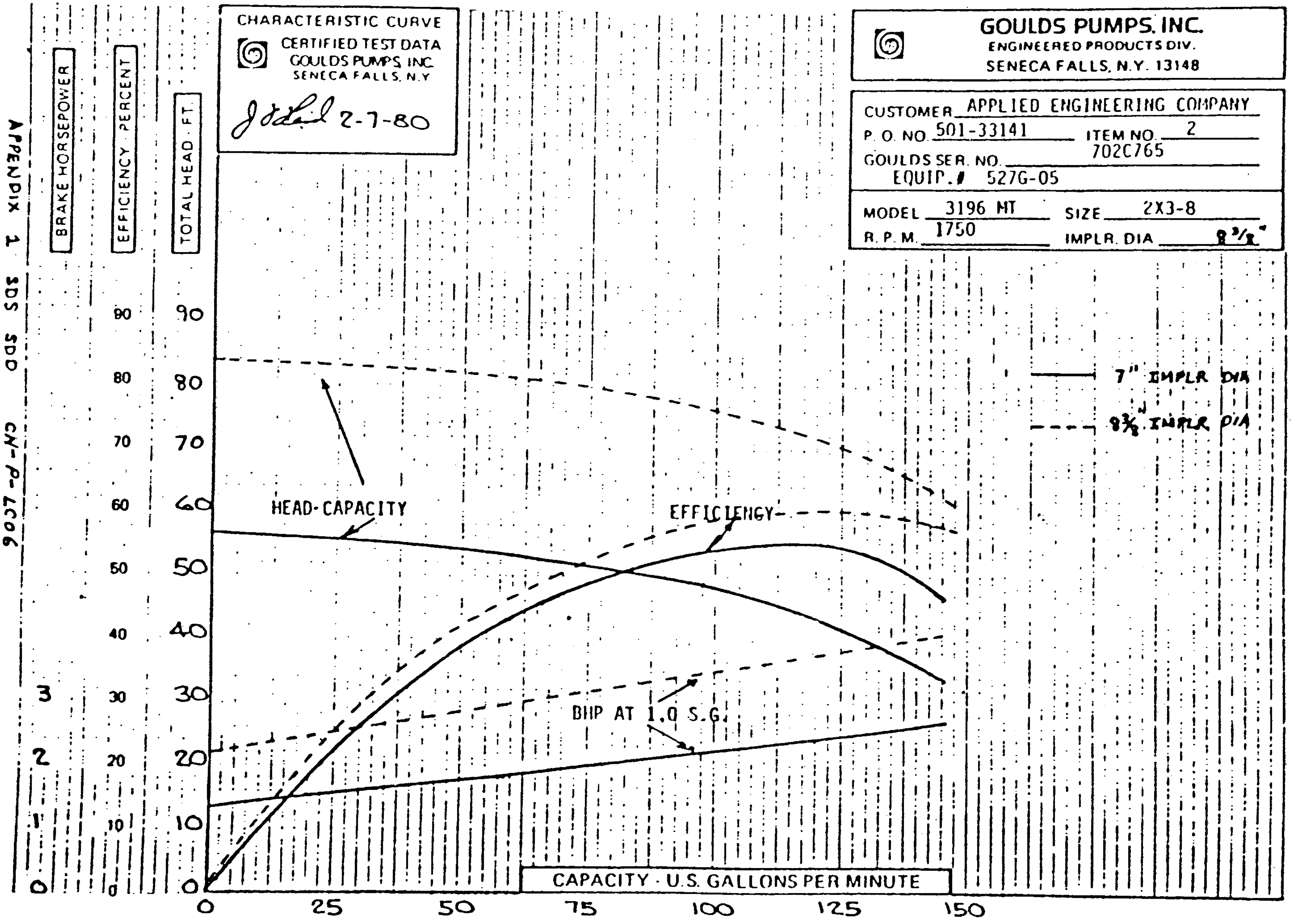
Manufacturer	Westinghouse
Type	Type S
Enclosure	TEFC
Rated Horse Power	3 HP
Rated Speed	1750 RPM
Lubricant/Coolant	Oil/Air
Power Requirements	460 Volts, 3 Phase 60 Hz, 4.8 Amps
Power Source	SDS-PDP 6A

Reference

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

APPENDIX 1 SDS SDD CN-P-LC06

A-26845



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SD 3527-005

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

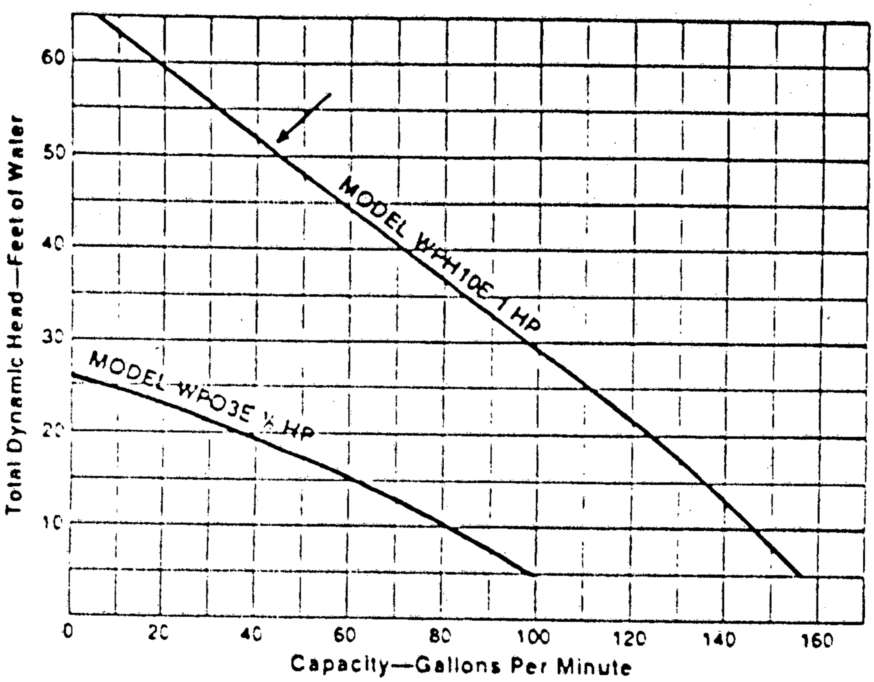
Drawing No.	DS-527-G-05, Rev. 2

SPECIFICATIONS

Order No.	HP	Volts	Phase	RPM	Solids	Max. Amps	WL
WPO311E	1/3	115	1	1750	¾"	9.4	56

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

PERFORMANCE RATING (GPM)

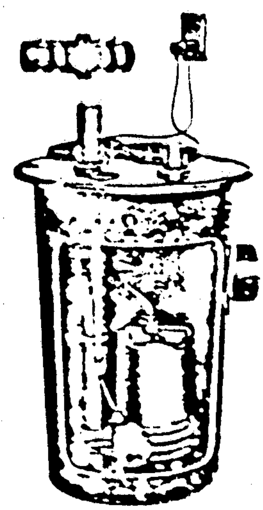


WP03 (⅓ HP)	TDH	GPM
Total Dynamic Head Feet to Water	5	100
	10	85
	15	62
	20	36
	25	3

WPH10 (1 HP)	TDH	GPM
Total Dynamic Head Feet to Water	10	147
	20	124
	30	98
	40	71
	50	45
	60	18

Model 3870 Packaged Effluent Ejector System

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



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

Package Includes:

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

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

GOULDS PUMPS, INC.
SENECA FALLS NEW YORK 13148

APPENDIX 1
SDS SDD
CN-P-VA04

Form No. A-478A-WS

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

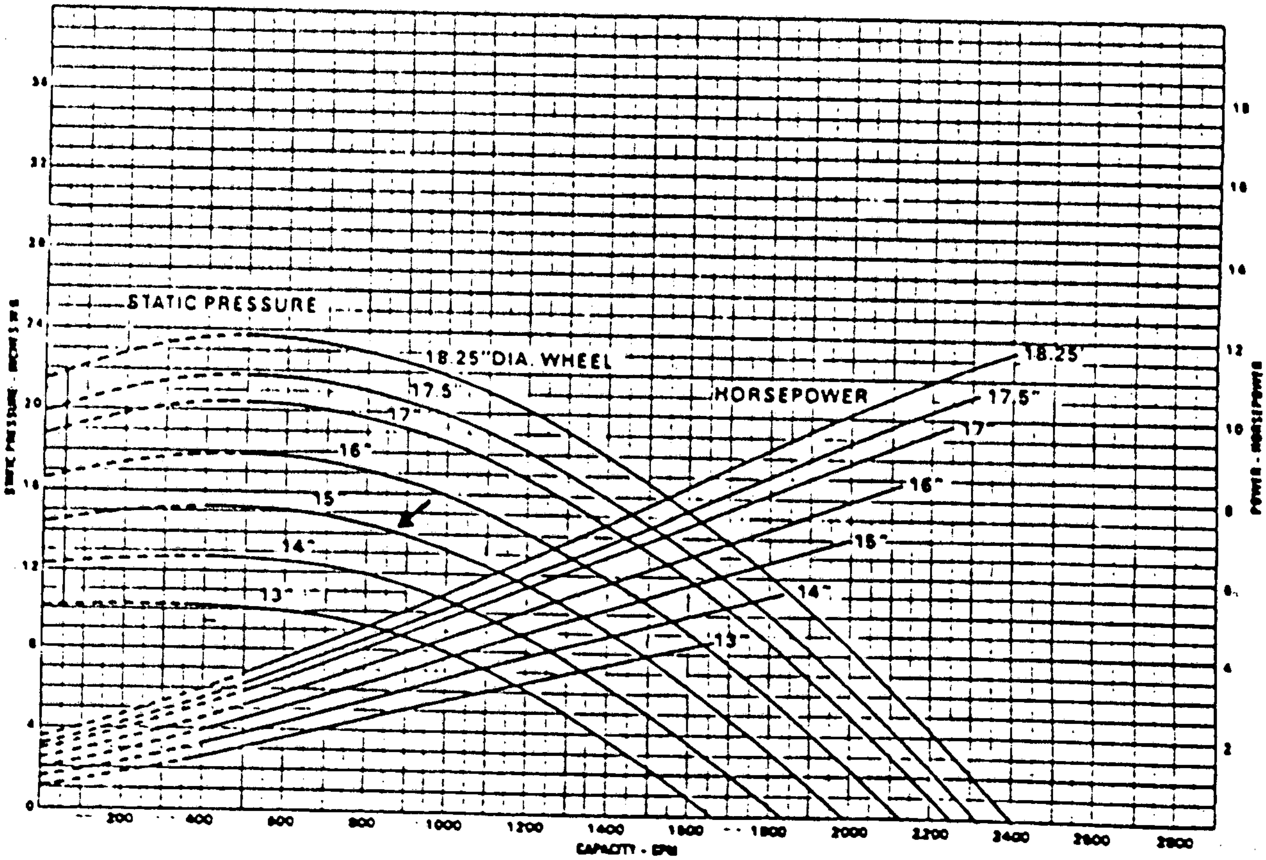
CAPACITIES and STATIC PRESSURES

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

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

Capacity	3500 R.P.M.							
	18.25" Wheel		17.0" Wheel		15.0" Wheel		13.0" Wheel	
C.F.M.	S.P.	B.H.P.	S.P.	B.H.P.	S.P.	B.H.P.	S.P.	B.H.P.
400	23.5	3.0	20.3	2.6	15.1	1.9	10.2	1.3
500	23.6	3.4	20.4	2.8	15.2	2.2	10.1	1.5
600	23.5	3.7	20.3	3.3	15.1	2.5	10.0	1.7
700	23.3	4.2	20.1	3.7	14.9	2.9	9.7	2.0
800	23.0	4.6	19.6	4.0	14.5	3.2	9.2	2.3
900	22.5	5.0	19.3	4.5	14.0	3.5	8.7	2.6
1000	22.0	5.5	18.6	4.9	13.3	3.8	8.0	2.8
1100	21.0	6.0	17.7	5.3	12.3	4.2	7.1	3.1
1300	19.0	6.9	15.8	6.1	10.4	4.9	5.0	3.5
1500	16.7	7.9	13.3	6.9	7.9	5.5	2.4	4.0

3500 R.P.M. PERFORMANCE CHART



APPENDIX 1 SDS SDD CN-E-VA05

Appendix 1

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

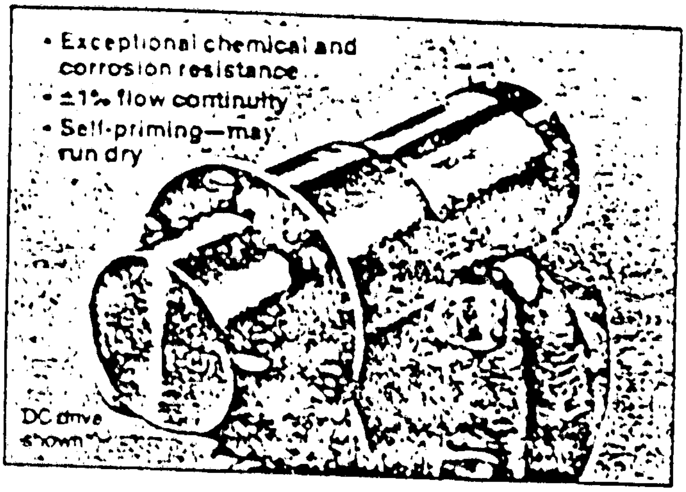
Reference

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

SD 3527-005

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



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

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

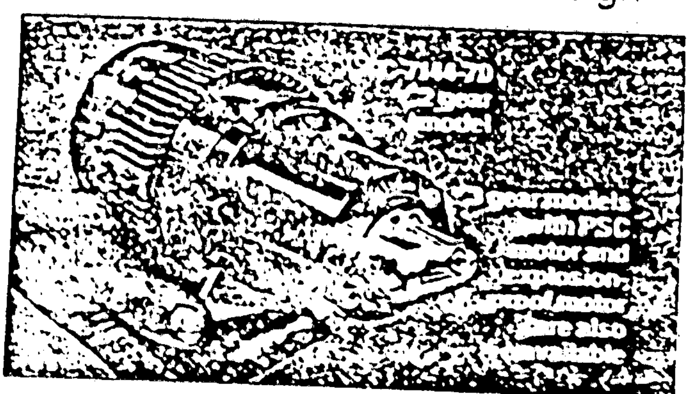
Pumps are compact and very lightweight—many models weigh less than 1½ lbs. Side ports are ⅛" (F)NPT. Each pump is fully factory tested prior to shipment and includes installation, operation, and maintenance instructions. (Service kits available.)

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

Catalog number	Power requirements	Motor type	Maximum motor rpm	Amps	Flow ml/min	Maximum pressure	Price	Service kits Cat. no.	Service kits Price
C-7144-50	115 VAC 60 Hz, 115 VDC	Variable speed universal AC/DC	5,600	1.1	0-600	100 psi	$322.00	C-7144-47	$37.50
C-7144-55	115/230 VAC 50/60 Hz	Explosion proof	3,150	2.3	265	175 psi	468.00	C-7144-47	37.50
C-7144-60	115/230 VAC 50/60 Hz	Induction TEFC	3,150	1.6	265	175 psi	282.00	C-7144-47	37.50
C-7144-65	—	Air motor	6,000	—	0-500	175 psi	328.00	C-7144-47	37.50
C-7144-40	0 to 24 VDC	Brush	10,000	0-0.5	0.25-8	40 psi	228.00	C-7144-42	37.50
C-7144-41	0 to 24 VDC	Brush	10,000	0-0.5	1.5-30	45 psi	228.00	C-7144-47	37.50
C-7144-42	0 to 24 VDC	Brush	10,000	0-0.5	50-600	60 psi	228.00	C-7144-47	37.50
C-7144-43	0 to 24 VDC	Brush	10,000	0-0.5	8.4-600	175 psi	250.00	C-7144-47	37.50

Magnetic drive 2 and 3 gear pumps...

with patented suction-shoe design

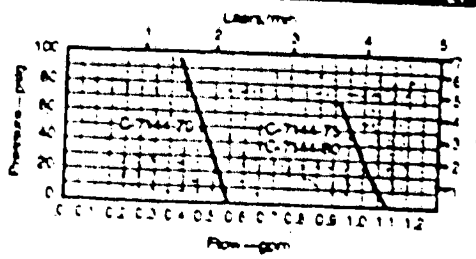


Uniquely designed suction shoe acts as a sealing member to separate the inlet side from the pressure side of the pump. The major design advantage is its size: the suction shoe is a fraction of the size of a conventional cavity plate housing. This makes the pump lighter and more compact, and—most importantly—permits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

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

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

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



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

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

Appendix 1 (Cont'd)

SDS PUMPS/BLOWERS

Pump Details

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

Motor Details

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

Reference

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

Appendix No. 2

to

Submerged Demineralizer System

System Design Description

Title

SDS Filter Vessels

APPENDIX NO. 2

PREFILTER/FINAL FILTER

Vessel Details

Identification (Prefilter)	F-10001 Series
(Final Filter)	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. 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/1B 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

Apppendix No. 7 (Cont'd)

SDS INSTRUMENT INDEX

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

Apppendix No. 7 (Cont'd)

SDS INSTRUMENT INDEX

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

Apppendix No. 7 (Cont'd)

SDS INSTRUMENT INDEX

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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SDS INSTRUMENT INDEX

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

Apppendix No. 7 (Cont'd)

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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

Apppendix No. 7 (Cont'd)

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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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SDS INSTRUMENT INDEX

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

SDS INSTRUMENT INDEX

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

Apppendix No. 7 (Cont'd)

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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