GPU Nuclear
P.O. Box 480
Middletown, Pennsylvania 17057
717-944-7621
Writer's Direct Dial Number:

February 5, 1982
4400-82-L-0017

TMI Program Office
Attn: Dr. B. J. Snyder, Program Director
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Sir:

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

My letter, 4400-82-L-0009, dated January 20, 1982, provided a partial submittal of updated Recovery System Descriptions (SD's) and Technical Evaluation Reports (TER's) and committed to provide additional SD's and TER's as they became available. In accordance with this commitment, attached are updated System Descriptions for the Mini Decay Heat Removal (MDHR) System and the Auxiliary Building Emergency Liquid Clean-up System (EPICOR-II). The remaining SD's and TER's identified in 4400-82-L-0009 will be provided as they become available.

Sincerely,

J. J. Barton
Acting Director, TMI-2

JJB:JJB:ch

Attachment

cc: L. H. Barrett, Deputy Program Director

A001 Add: B. J. Snyder
S/1

Recovery Program

System Description

Auxiliary Building Emergency

Liquid Clean-up System (EPICOR II)

APPENDIX

TITLE	TABLE
EPICOR II Pumps	1
Transfer Pump	2
Prefilter	3
Demineralizers	4
Miscellaneous Waste Hold-up Tank	5
Clean Water Receiving Tank	6
Off-Spec Water Receiving/Batch Tank	7
Sump Pump, Chemical Cleaning Building	8
Monorail Hoist System	9
CCB Ventilation System Nameplate Data	10
Air Compressors	11
Instrumentation and Controls	12
Radwaste Processing System (EPICOR II)	13
Radwaste Processing system (EPICOR II)	14

1.0 INTRODUCTION

1.1 System Functions

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

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

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

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

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

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

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

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

1.2 Summary Description of the System

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

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

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

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

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

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

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

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

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

The system interfaces with the TMI Unit 2 Radwaste Disposal Miscellaneous Liquids System, Demineralized Water System, the Submerged Demineralizer System, the Processed Water Storage Tank, the 80P Electrical System, Service Air System, the Unit 1 Liquid Waste Disposal System, Fire Protection System, the Fuel Pool Waste Storage System, and the Unit 2 Radwaste Disposal Reactor Coolant Liquid System.

NOTE: Although there is an interface with the Unit 1 Liquid Waste Disposal System, the Unit 1 System will not be used. In this respect Unit 11 will function independently. Valve ALC-V169 shall remain closed (unless transferring CC-T-1 or -2 to the "B" Spent Fuel Pool) and a spectacle flange is installed down stream of valves ALC-V169, ALC-V122 & ALC-V123.

1.3 System Design Requirements

1.3.1 Process System Design Requirements

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

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

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

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

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

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

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

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

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

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

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

1.3.1.10 The building sump shall be a covered sump.

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

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

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

NOTE: The Plant Service Air System is the preferred air supply.

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

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

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

1.3.1.17 Three resin traps are installed downstream of the demineralizers.

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

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

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

1.3.2 Material Handling Design Requirements

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

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

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

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

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

1.3.3 Air Handling Design Requirements

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

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

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

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

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

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

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

2.0 DETAILED DESCRIPTION OF THE SYSTEM

2.1 Components

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

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

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

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

2.1.2 Transfer Pump ALC-P-5

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

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

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

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

The pump may also be used for recirculating and sampling the contents of the Clean Water Receiving Tank and the Off Spec Water Receiving Batch Tank. The sample connection terminates at the Sample System sink. The pump is provided with a discharge pressure gage, and a flow element on the discharge line to Units No. 1, No. 2, the Spent Fuel Pool, the PWST's and the truck fill station. Remote indication of flow (ALC-F1-2) and a flow totalizer (ALC-FQ-2) are located on Panel ALC-PNL-1.

2.1.3 Prefilter (ALC-F-1)

The prefilter (Table 3) is the first stage of the Auxiliary Building Emergency Liquid Clean-up system. The filter is used to remove sodium and other non-radioactive chemicals. If the system is being used as a polishing system for the SUS effluent, the prefilter may be replaced with a demineralizer liner, if it has been determined that it is not required.

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

A 1/4" air connection is provided at the top of the liner to allow removal of the plug from the top of the false bottom after final dewatering. The false bottom is filled

with vermiculite to absorb water that may tend to accumulate to meet shallow land burial requirements. A manway approximately 24" in diameter is installed on top of the tank. On the manway cover is a four inch inspection port used for resin sampling once the container is spent.

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

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

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

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

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

To avoid breakthrough of sodium to the second liner, the batch size through the prefilter is limited.

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

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

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

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

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

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

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

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

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

a. Auxiliary Building Sump Tank

b. Neutralizer Tanks

c. Contaminated Drain Tanks

d. Reactor Building Sump

e. Deborating demineralizer back wash outlet

f. Fuel Storage Pool Submersible Pump Discharge

g. Unit No. 1 Miscellaneous Waste System

h. Demineralized Water System

i. Submergeo Demineralizer System (SDS)

j. Cond. Polisher Sump

k. Water Treatment Sump

l. Reactor Coolant Bleed Tanks

m. Concentrated Waste Storage Tank

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

A temporary tee connection is installed in place of the suction line strainer, WDL-U2028, on the Miscellaneous Waste Tank Pump WDL-P-6B suction line. Connected to this tee is a 2" line which supplies the liquid from the Miscellaneous Waste Holoup Tank to the suction side of EPICOR II Pump ALC-P-1. A 4" guard pipe with a combination of lead and concrete shielding encloses the suction piping run from the Auxiliary Building corridor to the Chemical Cleaning Building penetration. The guard pipe is open to the atmosphere of the Chemical Cleaning Building, which is under a slight negative pressure.

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

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

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

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

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

be stored in the Off-Spec Water Receiving Batch Tank, if desired. The Off-Spec Water Receiving Batch Tank should be flushed clean with demineralized water before it is used for clean water storage.

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

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

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

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

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

2.1.8 Chemical Cleaning Building Sump

The Chemical Cleaning Building sump is a stainless steel lined pit with a capacity of (4000) gallons located in the

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

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

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

2.1.9 20 Ton Monorail Hoist System

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

In order to minimize the radiation exposure to personnel during demineralizer and prefilter removal, the hoist is operated remotely using a remote pendant operating station in the Tv Monitor & Control Building. Remote operation is

aided through the use of a closed circuit TV system with six cameras. The pendant has six pushbuttons for trolley and hoist operation - one START, one STOP, two for north/south movement of the single speed trolley, and two for the hoist Quad-Speed Control System which are, a 4-step button for creep low, medium and high speed RAISE, and a 4-step button for creep low, medium and high speed LOWER.

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

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

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

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

2.1.11 Crud Filter - ALC-F-5

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

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

2.1.12 Ventilation Heating Unit & Moisture Separator

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

2.1.13 Ventilation Filter Unit

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

2.1.14 Ventilation Fan Assembly

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

2.1.15 Ventilation Radiation Monitor

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

2.1.16 Ventilation Weatherproof Enclosures

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

2.1.17 Chemical Cleaning Building Radiation Monitors

Four area radiation monitors (ALC-RM-8 thru 11) and an air sampler (ALC-RM-12) are provided in the Chemical Cleaning

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

2.1.18 Closed Circuit TV System

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

Camera No. 1 mounted on the monorail support structure outside the Chemical Cleaning Building to allow viewing of the prefilter or demineralizer while being loaded into the transfer cask. Camera No. 2 is mounted directly on the 20 Ton Hoist and provides a direct view of the monorail. Target markings which can be viewed with this camera are provided on the monorail to aid in the positioning of the Hoist. Cameras No. 4 and No. 5 provide a view of the top area ALC-F-1 and ALC-K-1 to aid in remote handling of these casks and to provide a surveillance capability for these casks during operation of the system. Camera No. 7 has a PAN-TILT control and is mounted on the west wall between ALC-K-1 and ALC-K-2 to provide remote monitoring of potential leak areas.

2.1.19 Major System Valves

Inlet Isolation Valve to EPICOR II System - ALC-V043

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

Service Air Regulator - ALC-V109

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

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

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

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

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

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

2.1.20 Sample System

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

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

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

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

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

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

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

2.1.21 Aux. Building Cleanup System Air Compressors

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

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

2.2 Instruments, Controls, Alarms, and Protective Devices

2.2.1 Cleanup System

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

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

The EPICOR II pumps are controlled through an automatic control unit which provides AUTO/MANUAL on-off switches and indicating lights for the pumps, prefilter and demineralizer high level alarms, and an ON/OFF switch for the unit.

Control power is provided for the EPICOR II solenoid operated air supply valves through these units. The speed of the pumps is controlled by throttling motor operated valves ALC-V260, 261, 262 and 263. A turbine flowmeter (ALC-Fl-1) is provided to monitor process flowrates.

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

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

2.2.2 Ventilation System

2.2.2.1 Heating Unit & Moisture Separator

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

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

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

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

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

2.2.2.2 Filter Unit

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

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

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

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

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

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

2.2.2.3 Fan Assembly

The fan assembly, as previously noted, is interlocked with the 60 Kw heater. A control interlock is provided through the fan and heater circuitry such that the heater may not be energized unless the fan is running. A flow indicating

switch (FIS-17) on the discharge of the fan provides a safety interlock: if the filtration unit is operating and the discharge flow of the fan falls below 4,000 cfm, the heater and fan motor will trip. FIS-17 is also tied into the common, remote panel mounted "Trouble" alarm. The fan is started and stopped from MCC2-33A.

2.2.2.4 Radiation Monitor (Controls)

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

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

3.0 PRINCIPLE MODES OF OPERATION

3.1 Startup

3.1.1 Ventilation System

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

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

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

3.1.2 Cleanup System

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

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

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

3.1.3 SDS Polishing Startup

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

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

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

3.2 Normal Operation

3.2.1 Ventilation System

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

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

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

3.2.2 Cleanup System

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

Upon completion of processing one batch, Transfer Pump ALC-P-5 is started to recirculate at least three tank volumes of water through tne Clean Water Receiving Tank after which a sample is drawn for analysis by the TMI water cnemistry laooratory. Water acceptable for discharge will

be pumped to the TMI Unit 2 Liquid Waste Disposal System for further sampling and monitored discharge, or to a truck via the truck fill station hose connection or to the Processed Water Storage Tanks. Out of Spec water will be pumped to the Off-Spec Water Receiving Batch Tank for reprocessing. (See para. 2.1.6 and 2.1.7)

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

3.3 Shutdown

3.3.1 Ventilation System

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

3.3.2 Cleanup System

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

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

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

3.4 Special or Infrequent Operation

3.4.1 Filter Changeout

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

3.5 Emergency

3.5.1 Loss of Chemical Building Ventilation System

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

3.5.2 Loss of Electrical Power

On loss of electrical power to the Chemical Cleaning Building MCC 2-33A, EPICOR II Pumps ALC-P-1, 2, 3 & 4 will automatically stop as the solenoid valves on the air supply lines fail closed on loss of power. Valves ALC-V043 and V086 fail "As Is". Valve ALC-V255 fails closed. Valve ALC-V242 fails closed on loss of power to stop flow from tank CC-T-1. If flow through the system is from the Misc. Waste Holdup Tank, WDL-T-2, operator action is required to close valve WDL-V2628. Power will be lost to Ventilation System 60Kw heaters, exhaust fan and radiation monitor. The ventilation unit inlet and outlet dampers should be closed. This same procedure should be followed in the event that only the exhaust fan is lost.

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

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

3.5.3 Loss of System Air

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

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

3.5.4 Fire

3.5.4.1 Ventilation System

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

3.5.4.2 Cleanup System

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

4.0 HAZARDS AND PRECAUTIONS

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

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

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

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

TABLE 1

EPCIOR II PUMPS

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

TABLE 2

TRANSFER PUMP

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

TABLE 3

FILTERS

PREFILTER

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

Resin Filters (Traps)

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

TABLE 3 (Cont'd)

CRUD FILTERS

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

TABLE 4

DEMINERALIZERS

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

TABLE 5

MISCELLANEOUS WASTE HOLD-UP TANK

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

TABLE 6

* CLEAN WATER RECEIVING TANK

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

* Rinse Holo Tank for U.T.S.G. Chem. Clean Sys.

TABLE 7

* OFF-SPEC WATER RECEIVING/BATCH TANK

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

* Chemical Cleaning Solution Tank for 0.1 S.G. Chem. Clean Sys.

TABLE 8

SUMP PUMP
CHEMICAL CLEANING BUILDING

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

TABLE 9

MONORAIL HOIST SYSTEM

Number Installed:	1
Manufacturer:	Harnischfeger, Inc., P&H
Model:	#36CS25E
Capacity:	20 ton
Total Lift:	25'-6"
Speed:	
Hoist:	20 FPM maximum (90% load) 10 FPM medium 5 FPM low 1 FPM creep
Trolley:	50 FPM
Control:	
Hoist:	Quad - Speed
Trolley:	Single Speed
Power Supply:	460 V AC, 3 Phase, 60 Hz MCC 2-33A
Control Voltage:	110 V AC
Control Station:	
Local and Remote six pushbutton pendant control; deadman type element control	
Reeving:	Four part single reeved

TABLE 10

CHEMICAL CLEANING BUILDING VENTILATION SYSTEM NAMEPLATE DATA

MSA Filter Unit

Identification No. ALC-E-H1

60KW Chromolax Heater Unit

480v, 3 Phase, 60 Hz

Cat. Number SCCP-080-3480

Type J 0-800 °F Temperature Controller

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

Internal Industrial Fan

Identification No. ALC-E-1

8000 CFM Fan Unit

30 HP

460 volts AC, 3 Phase, 60 Hz

ID Number P28G353G-G7-XD

Victoreen 640-3 Off Line Effluent Monitor

3 Channel Readout - gaseous, particulate, both

110 volts, AC, 1 Phase, 60 Hz

Self contained sample/return pump (4 cfm)

TABLE 11

AIR COMPRESSORS

Identification	ALC-P-7	ALC-P-8
Number Installed	1	1
Vendor	Le Roi (Dresser Industries Inc.)	
Type	Single Stage Rotary Screw	
Model No.	30SS	25SS
Capacity (CFM @ PSIG)	115 @ 100 110 @ 125 (Max.)	98 @ 100 95 @ 125 (Max.)
Rated Motor, HP, RPM	30, 1755	25, 1760
Power Source	460V, 3 Phase, 60 Hz MCC 2-33A	460V, 3 Phase, 60 Hz Power Panel HDP-M2

TABLE 12

INSTRUMENTATION AND CONTROL

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

TABLE 12

INSTRUMENTATION AND CONTROL

TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
ALC-FE-1	CC-T-2 inlet flow turbine flow meter	Piping	Hoffer	HO 3/4 2529-B-F1	2.5-29 GPM	N/A	
ALC-FQI-1	CC-T-2 inlet flow totalizer/indicator	ALC-PNL-1	Hoffer	266DFRTA	0-99,999,999 GAL 0-999KGPM	N/A	
ALC-FE-2	CC-T-2 discharge flow orifice plate	Piping	Foxboro	OP-FTT	0-100 GPM 0-250" WC.	N/A	
ALC-FT-2	CC-T-2 discharge flow transmitter	ALC-RCK-1	Foxboro	NE 13DM-II H2-A-E	0-100" WC. 4-20 MADC	N/A	
ALC-FY-3	CC-T-2 discharge flow square root converter	ALC-PNL-1	Foxboro	66AT-OJ	4 to 20 MADC	N/A	
ALC-FQ-2	CC-T-2 discharge flow integrator	ALC-PNL-1	Fisher & Porter	52-ET	4-20 MADC $0-10^7$ TPH	N/A	
ALC-FI-2	CC-T-2 discharge flow indicator	ALC-PNL-1	Fisher & Porter	51-1371	4-20 MADC 0-100 GPM	N/A	
ALC-FY-4	CC-T-2 discharge flow power supply	ALC-PNL-1	Foxboro	610-AT-OJ	120V 60 Hz 4-20 MADC		
ALC-LI-1	CC-T-1 tank level indicator	ALC-PNL-1	Foxboro	257P-1C	4-20 MADC 0-38 ft		
ALC-LT-1	CC-T-1 tank level transmitter	Local	Foxboro	NE13DM-II H_2-A-E 24"-480"	4-20MADC 0-340" H_2O	N/A	

TABLE 12

INSTRUMENTATION AND CONTROL

TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
ALC-LY-1	CC-T-1 tank level transm. PWR supply	ALC-PNL-1	Foxboro	610AT-3A	120V 60 Hz 4-20 MADC	N/A	
ALC-LI-2	CC-T-2 tank level indicator	ALC-PNL-1	Foxboro	257P-1C	4-20MADC 0-35 ft		
ALC-LT-2	CC-T-2 tank level transmitter	Local	Foxboro	NE13DM-II M2-A-3 8"-428"	0-414" H_2O 4-20 MADC	N/A	
ALC-LY-2	CC-T-2 tank level transm. PWR supply	ALC-PNL-1	Foxboro	610AT-0J	120V 60 Hz 4-20 MADC	N/A	
ALC-LS-1	Chem. Clean. Bldg. sump level switch	Local	Warrick	2C1F0	0-35 ft.	36 1/4 in. Below mtg. 48 1/4 in. face. 90 3/8 in.	
ALC-LAH-1	Chem. Clean. Bldg. sump Hi alarm	ALC-PNL-1	ROCHESTER			36 1/4 in. Below mtg. face.	
ALC-PI-1	ALC-P-5 discharge pressure gage	ALC-RCL-1	Arthur Moore	U.S. Gage 1981	0-160PSIG	N/A	Purchased with diaphragm seal & capillary.
ALC-PI-2	Service air pressure gage	ALC-RCL-1	Arthur Moore	U.S. Gage 1981	0-160PSIG	N/A	
ALC-FI-3	ALC-P-5 seal water flow indicator	Local	Fisher & Porter	10A1152M/5 1-1400KA & 50 MT4000	0-14.9 GPM 0-100%	N/A	
ALC-PI-3	Demin. water header pressure gage	ALC-RCL-1	Arthur Moore	U.S. Gage 1981	0-160 PSIG	N/A	

TABLE 12

INSTRUMENTATION AND CONTROL

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

TABLE 12

INSTRUMENTATION AND CONTROL

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

TABLE 12

INSTRUMENTATION AND CONTROL

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

TABLE 12

INSTRUMENTATION AND CONTROL

TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
ALC-TAH-15A	Charcoal Temp. Alarm	Filter Unit					
ALC-TAH-15B	Charcoal Temp. Alarm	ALC-PNL-1					
ALC-TS-15-2	Charcoal Filter Temp	Filter Unit	MSA			325°F	
ALC-TAHH-15	ALC-E-FA Charcoal Adsorber Temp.	Filter Unit					
ALC-DPI-16	HEPA Filter DP Indicator	Filter Unit	MSA		0-6" WG.		
ALC-DPS-16	HEPA Filter DP Switch	Filter Unit	MSA		1.5-5" WG.	3" WG.	
ALC-FE-17	Exhaust Flow Element	Duct	Dietrich	ANR-76	0-0.3" WG. (0-8000 scfm)		
ALC-FIS-17	Exhaust Flow Indicator and Switch	Local	DWYER		0-0.5" WG. 0-0.5" WG.	0.1" WG.	
ALC-RE-18	Exhaust Radiation Detector	Duct	NMC	SC-2X2			
ALC-RI-18	Exhaust Radiation Indicator	Control Building	NMC	AM-221F/CR M-5AAF	$10-10^6$ cpm	200,000 cpm Particulate 40,000 cpm Iodine 100,000 cpm Gas	
ALC-RR-18	Exhaust Radiation Recorder	Control Building	victoreen				
ALC-UA-19	Air Filtration Unit Trouble	ALC-PNL-1	Rochester	(Later)			
ALC-XYS-20	Air Filtration Unit Fan Control	MCC	GE	CR-2940			

TABLE 12

INSTRUMENTATION AND CONTROL

TAG NO.	SERVICE	LOCATION	SUPPLIER	MODEL NO.	INPUT/SPAN OUTPUT/SCALE	SET POINT	REMARKS
ALC-LS-21	Loop Seal Level High	Local	B/W	2-RH		2-1/2"	
ALC-UA-22	Cap-Gun Rad. Trouble	ALC-PNL-1	Rochester				From RH-1-12
ALC-FG-23	Aux. Blds. Liquid Clean Up Sampling System Flow	Piping				N/A	
ALC-HS-24	Tank CC-T-182 Selector Switch Level Interlock	ALC-PNL-1	GE	CR2940 W/UB 200A Contact			
N/A	ALC-F-1 Level controller	Field	CAP-GUN	(Later)	(Later)	High-5" from top of tank Low-12" from top of tank	Controls air supply to ALC-P-1
N/A	ALC-K-1 Level controller	Field	CAP-GUN		(Later)	"	Controls air supply to ALC-P-2
N/A	ALC-K-2 Level controller	Field	CAP-GUN		(Later)	"	Controls air supply to ALC-P-3
N/A	ALC-F-1 Hi Hi Level Alarm	Cap-Gun Control Unit	CAP-GUN			3" from top of tank	
N/A	ALC-K-1 Hi Hi Level Alarm	Cap-Gun Control Unit	CAP-GUN			3" from top of tank	
N/A	ALC-K-2 Hi Hi Level Alarm	Cap-Gun Control Unit	CAP-GUN			3" from top of tank	

TABLE 13

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

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

(b) Process water at 10 GPM.

(c) Minimize personnel exposure.

(d) Process water at the lowest possible cost.

SPECIFIC OBJECTIVES:

Container	Vessel Size	Primary Purpose	Composition	Process Vessel Contact Radiation Level Changeout Criteria	Gallons Processed to Reach Changeout Criteria	Total Number of Containers Required(5)	Projected Shipping Category
#1 Prefilter/ Demin.	6'D x 6'H	1. Na Removal 2. Other Cation Removal 3. Anion Removal	Mixed Cation Resin on top/ Anion on bottom	1,000 R/Hr. (1)	25,000	32	Large Quantity (6)
#2 First Demin.	6'D x 6'H	Cation Polishing Anion Polishing	Mixed Cation Resin Anion Resin	400 R/Hr. (2)	100,000	8	Large Quantity (6)
#3 Second Demin.	4'D x 4'H	Water Polishing Guard Bed	Mixed Resin	20 R/Hr. (3)	100,000	6	LSA
#4 Strainer	2'H x 1 1/2'W x 1 1/2'L	Catch Resin Fines	Strainer	2-3 R/Hr. (4)	150,000	-	LSA
#5 Post Filter	2' x 1 1/2' x 1 1/2'	Colloids Removal	1 Micron Cartridge	2-3 R/Hr.	1:0,000	2	LSA

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

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

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

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

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

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

TABLE 14

EPICOR II
RADWASTE PROCESSING SYSTEM
(SDS POLISHING MODE)

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

(b) Process water at 10 GPM.

(c) Minimize personnel exposure.

(d) Process water at the lowest possible cost.

SPECIFIC OBJECTIVES:

Container	Vessel Size	Primary Purpose	Composition	Process Vessel Contact Radiation Level Changeout Criteria(1)	Gallons Processed to Reach Changeout Criteria	Total Number of Containers Required	Projected Shipping Category
#1 Prefilter/	6'D x 6'H	Na Removal Other Cation Removal Anion Removal	Cation (top)/ Anion (bottom)	N/A	25,000	1	N/A
#2 First Demin.	6'D x 6'H	Anion Removal Cation Removal	Mixed Resin	< 1 R/Hr	110,000	30	Large Quantity
#3 Second Demin.	4'D x 4'H	Polishing Guard Bed	Mixed Resin	< 1 R/Hr	110,000	6	LSA
#4 Strainer	2'H x 1 1/2'W x 1 1/2'L	Catch Resin Fines	Strainer	< 1 R/Hr	150,000	-	LSA
#5 Post Filter	2' x 1 1/2' x 1 1/2'	Colloids Removal	1 Micron Cartridge	< 1 R/Hr	150,000	2	LSA

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

THREE MILE ISLAND NUCLEAR STATION UNIT 2

RECOVERY PROGRAM

SYSTEM DESCRIPTION

MINI DECAY HEAT REMOVAL SYSTEM

Revision 0

TABLE OF CONTENTS

FOR

MINI DECAY HEAT REMOVAL SYSTEM

Section		Page
1.0	INTRODUCTION	1
1.1	System Functions	1
1.2	Summary Description of the System	2
1.3	System Design Requirements	4
2.0	DETAILED DESCRIPTION OF SYSTEM	5
2.1	Components	5
2.2	Instruments, Controls, Alarms and Protective Devices	12
3.0	PRINCIPAL MODES OF OPERATION	15
3.1	Startup	15
3.2	Normal Operation	16
3.3	Shutdown	17
3.4	Special or Infrequent Operation	18
3.5	Emergency	21
4.0	HAZARDS AND PRECAUTIONS	22

APPENDIX

Title	Table No.	Page
Mini Decay Heat Removal Pumps	1	23
M.D.H.R. Heat Exchangers	2	25
M.D.H.R. Debris Filter	3	27
MDHR Air Filtration Fans	4	28
MDHR Exhaust H.E.P.A. and Prefilter Assembly	5	29
Instrumentation, Control & Alarms	6	31
TMI-2 Expected Decay Heat Load Vs. Time	Figure No. 1	
Typical MDHR Pump Characteristic Curve (MDH-P-1A, MDH-P-1B)	Figure No. 2	

1.0 INTRODUCTION

1.1 System Functions

The functions of the Mini Decay Heat Removal System (MDHR) are as follows:

a. Remove heat from the reactor coolant system by forced circulation through the core.

b. Provide a method of removing heat from the reactor coolant system during reactor vessel head removal and vessel defueling.

c. Provide piping connections for future cleanup of the reactor coolant system.

d. Provide a means of sampling the reactor coolant system utilizing the Mini Decay Heat Removal System.

e. Provide a means of controlling ambient temperature and airborne radiation levels in the pump and heat exchanger enclosures.

f. Provide a means of backup pressure control for the Reactor Coolant System.

The Mini Decay Heat Removal System has an interface with the following systems:

a. Alternate Decay Heat Removal System, ADH, (Westinghouse DWG. WTMI-1019-2).

b. Temporary Nuclear Sampling System, SNS, (Burns & Roe DWG. M044 & M045).

c. "Temporary" Nuclear Services Closed Cooling Water System, TNSCCW, (Burns & Roe DWG. M041).

d. Decay Heat Removal System, DH, (Burns & Roe DWG. 2026).

e. Heating and Ventilation Fuel Handling Building (Burns & Roe DWG. 2343).

f. H&V Mini Decay Heat Removal System Fuel Handling Building (Burns & Roe DWG. M227).

1.2 Summary Description of the System (Refer to Burns & Roe DWGS. M043 Rev. 9, M041 Rev. 6 and M227 Rev. 0)

When it is desirable to switch from the "loss to ambient" mode of cooling the Reactor Coolant System to forced circulation for decay heat removal, the Mini Decay Heat Removal System may be put into service. The Mini Decay Heat Removal System takes suction from the "B" loop reactor outlet (hotleg) via a connection to the Alternate Decay Heat Removal System (ADH) which connects to the original plant Decay Heat System (DH). After passing through one of the MDHR system's parallel heat exchangers and one of the MDHR pumps, the coolant is returned to the reactor through the "B" Core Flooding injection nozzle via a connection to the ADH and DH systems.

Within the Mini Decay Heat Removal System, the reactor coolant first passes through a filter to remove debris potentially accumulated in the Decay Heat Drop Leg. The filter may then be bypassed and can be removed in its lead shielded portable cask or replaced by a back-up filter.

The flow proceeds to the selected heat exchanger (MDH-HX-1A or MDH-HX-1B) where the heat is transferred to the shell side cooled by the "Temporary" Nuclear Services Closed Cooling System (TNS). (The TNS System is supplied by the existing plant Nuclear Service Closed Cooling System via a tie into the "A" Spent Fuel Cooler supply and return lines.)

The discharge from the MDHR heat exchangers combines into a common line and is routed to the selected Mini Decay Heat Removal Pump suction (MDH-P-1A or MDH-P-1B). The suction line contains the Temporary Nuclear Sampling System return sample connection. The MDH pumps discharge thru individual check valves and discharge isolation valves before combining into a common header containing a manually operated throttle valve to regulate flow to the reactor coolant system. This discharge header is provided with a full flow recirculation line and throttling valve running back to the heat exchanger suction to facilitate system testing, startup, and meet the minimum flow requirements during system operation.

Double valved tie-in connections are installed upstream and downstream of the system's outlet isolation valve (MDH-V15) to provide the capability to connect to a future system for RC water clean-up.

Prior to the coolant being returned to the ADH/DH system the flow rate can be measured and an RC water sample can be taken by the Temporary Nuclear Sampling System. Remotely operated valves are provided for flushing, venting and draining of the system to reduce area radiation levels for equipment maintenance.

Since two parallel pumps and heat exchangers have been installed in the system for redundancy, either pump can be operated with either heat exchanger. However, pump MDH-P-1B is to be preferentially used as the primary MDHR pump because of its superior access for maintainability. A "cross connect" line located downstream of the "A" heat exchanger but upstream of the "B" heat exchanger allows a series flow arrangement if additional heat removal capacity be required.

Redundant motor operated isolation valves are installed at the Mini Decay Heat Removal System tie-in points to the Alternate Decay Heat Removal System piping. These remote operated isolation valves function to separate the MDHR system from the safety grade Decay Heat Removal System and establish the interface with the RC system pressure boundary. The first MDHR system outlet isolation valve is provided with jog control capability and will be the normal method of flow control.

Radiation shielding of the MDHR system piping, pumps and heat exchangers has been provided by either utilizing existing shield walls or the construction of additional walls to minimize the exposure to operating personnel. The MDHR heat exchangers are located in the southern most portion of the 280'-6" elevation of the Fuel Handling building and are separated from the MDHR pumps on the north side by an existing 2' thick shield wall. A curb is provided around the perimeter of the MDHR heat exchangers to contain any flange leakage and direct it to a floor drain. The MDHR pumps are shielded on their north side and between the A & B pumps by 2' thick 7'-4" high seismically constructed concrete block walls. The pump cubicle is surrounded by 16" thick, 7'-4" high seismic block walls on the east and west sides. An entrance doorway exists on the east wall of the pump enclosure and a sheetmetal roof completes the cubicle to form a controlled HVAC environment. The supply and return sample lines from the MDHR pump's discharge and suction connection points to the Temporary Nuclear Sampling System on the 305'-0" elevation of the Fuel Handling Bldg. have continuous shielding installed. This shielding is either in the form of 2" lead brick, 1" lead sheet or 8" solid concrete block to prevent an excessive increase in area radiation levels during the sampling evolution.

Additionally these supply and return sample lines have demineralized water flush connections at the SNS system sample sink to backflush both lines to the MDHR system connection points if the area radiation levels should become excessive as a result of repeated sampling.

As mentioned above the MDHR pumps are enclosed in a shielded and environmentally controlled cubicle to prevent the spread of airborne contamination should a leak develop at the pump's seals or piping

flanges. The cubicles are ventilated by redundant HEPA fan/filtration units with a capacity of 2200 cfm each and are located on the 280'-6" elevation of the F.H. Building between the Decay Heat Service Coolers. The fan(s) (MDH-E-1A and MDH-E-1B) discharge to the general area after an air flow sample passes through the Particulate, Iodine and noble gas monitor (PING).

1.3 System Design Requirements

1.3.1 Overall System Performance Requirements

The Mini Decay Heat Removal System is designed to remove 2.25×10^6 BTU/hr from the Reactor Coolant System using one pump and one heat exchanger. This is sufficient to remove the decay heat generated on August 1, 1979 or any lower heat load thereafter and transfer it to the ultimate heat sink (i.e. river water) via the Nuclear Services Closed Cooling Water and Nuclear Services River Water Systems. This heat removal rate is satisfied by a MDHR system flow rate of 120 gpm @ 175°F with a T.N.S. system flow of 200 gpm and maximum TNS system temperature of 100°F. The MDHR system design temperature is 200°F and design pressure is 235 psig.

1.3.2 Applicable Design Codes and Standards for Piping and Components.

Description	Manufacturing Code	Installation Code
Connection to the decay heat system downstream of DH-V3 up to and including the first isolation valve.	ASME- Section III Class 2	ANSI B31.7 Class 2
Connection to the decay heat system downstream of DH-V3 from the first isolation valve up to and including the second isolation valve.	ASME- Section III Class 3	ANSI B31.7 Class 2
Connection to the decay heat system upstream of DH-V48 up to and including the second isolation valve.	ASME- Section III Class 2	ANSI B31.7 Class 2
N.S.C.C.W. System Connections: piping up to isolation valve.	ANSI B31.1*	ANSI B31.1*

Isolation valves	ASME- Section III	ANSI B31.1*
Balance of Piping 2" Piping	ANSI B31.1	ANSI B31.1
W/O. B.E. Seismic 4" Piping	ANSI B31.1	ANSI B31.1
Heat Exchangers	ASME-Section III Class 3	----------
Pumps	ASME-Section III Class 3	----------
Filter	ASME-Section VIII	

*Seismically supported for Category I loadings.

The portion of the system that are ANSI B31.7 Class 2 are seismic Category I. The remaining portions of the system that convey reactor coolant are designed to Operating Basis Earthquake (OBE) loads. The balance of the system is designed non-seismic except the NSCC tie-in lines up to the isolation valves which shall be Category I seismically supported.

All system process piping and tubing lines are constructed of stainless steel and the cooling water lines are fabricated using carbon steel.

2.0 DETAILED DESCRIPTION OF SYSTEM

2.1 Components

2.1.1 Mini-Decay Heat Removal Pumps, MDH-P-1A & MDH-P-1B

The Mini Decay Heat Removal Pumps (Table 1 and Figure 2) are single-stage centrifugal pumps rated at 120 gpm each with a developed head of 195 ft. The pumps are provided with mechanical shaft seals to minimize system leakage of radioactive water. Seal injection is provided from the pump discharge thru a cyclone separator. The separator drain is

routed back to the pump's suction. The mechanical shaft seals are provided with a demineralized water flush capability between the cyclone separator outlet and the seal inlet. This demineralized water connection will permit flushing of the durametallic seal faces just prior to securing the operating pump. The pre-shutdown flushing functions to remove the borated water from the closed loop seal injection system and thus prevents boron from crystalizing on the seal faces. The crystalized boron on the mechanical sealing components could result in seal face damage and subsequent leakage of radioactive water when the pump is restarted. The demineralized water seal supply comes from a local station quick disconnect via a removable hose. This supplies an isolation valve, flow meter and check valve (located outside the shielded MDHR pump cubical) before it ties into the outlet of the cyclone separator.

A failed seal's leakage is directed to the pump's base plate where it is drained to the floor drain system. This floor drain system is part of the plant's Radwaste Disposal Miscellaneous Liquids system. Consequently all floor drains in the MDHR area empty into the Auxiliary Building sump from which it is pumped into the Miscellaneous Waste Holdup Tank. From this tank, the liquids can be directed to almost any other part of the plant's radwaste liquid system. Existing traps in the floor drains prevent gases from leaking out of the drain lines and into areas which are not ventilated by the MDHR Pump Cubicle Ventilation sytem. Airborne radiation monitors will detect gross leakage indicating a seal failure.

The pump's are supplied with a constant level oiler in the bearing frame. Each MDHR pump casing drain plug has been provided with a 1/2" SS pipe nipple and screwed cap. This will permit "bagged" draining of the pump casing following system flush and pump isolation for subsequent maintenance.

The pumps have minimum flow protection thru a common recirculation line back to the heat exchangers suction (i.e. Recirculation line Throttle Valve, MDH-V20, is always cracked open). The MDHR pumps are located on the 280'6" level of the Fuel Handling Building to assure adequate NPSH during operation of the system when the reactor vessel head is removed.

The MDHR pumps are interlocked with the existing plant Decay Heat Removal Pumps, DH-P-1A and DH-P-1B, such that the MDH pumps will trip off if either DH pump starts. This prevents the possibility of overpressurizing the MDHR system if a decay heat pump is started when a Mini Decay Heat Removal Pump is in operation.

The power supply to the pump motors, which are non Class 1E, is supplied by redundant Class 1E Motor Control Centers and will be manually loaded on the Class 1E diesels in the event of a loss of off site power. The 15 hp pump motors are not Class 1E qualified. MDH-P-1A and MDH-P-1B are powered from MCC-2-11EA compt. 3AR and MCC-2-21EA compt. 3AR respectively. Control (start/stop/spring return to normal) and indication for the pumps are on the local panel (MDH-PNL-1) in the 280'6" el. of the F.H. Bldg. and the remote panel (MDH-PNL-2) in the Unit II control room.

2.1.2 Heat Exchangers, MDH-HX-1A and MDH-HX-1B

The Mini Decay Heat Removal System Heat Exchangers (Table 2) transfer the primary coolant heat to the Temporary Nuclear Services Closed Cooling Water System circulating through the shell side. The Nuclear Services River Water System, in turn, removes the heat from the Nuclear Service Closed Cooling Water heat exchangers and transfers it to the Mechanical Draft Cooling Towers.

The MDHR heat exchangers are of the "U" tube design with Temporary Nuclear Service Closed Cooling Water on the shell side and the reactor coolant on the tube side. The heat exchanger is designed in accordance with the ASME Code, Section III, Class 3, 1971 Ed. The tubes have been seal welded into the tube sheet. The heat exchangers are located on the 280'6" elevation of the Fuel Handling Building. The Temporary Nuclear Services Closed Cooling Water inlet isolation valve to the coolers is interlocked to close on a flow imbalance on the shell side of the cooler which would be indicative of a tube rupture or piping leak in the TNS system non-safety piping.

Relief valves are provided to prevent thermal over pressurization of either the shell or tube side when the MDHR heat exchangers are isolated.

2.1.3 MDHR Inlet Debris Filter, MDH-F-1

The Inlet Debris Filter (Table 3) has been designed to handle the debris that may be in the DH drop line when the system is started. It is a specially designed filter which fits into a lead shielded portable cask. The filter is considered a "one-shot" filter because the elements are not replaceable (however, the filter/cask unit is replaceable). The unit is constructed of Type 304 stainless steel with an all welded design having 3" inlet/outlet flanges and 1/2" vent/drain connectors. Additionally the inlet and outlet pipe stubs on the filter unit are provided with 1/2" tubing,

valve and quick disconnect. These are located external to the cask and permit draining the inlet/outlet connections below the flange connections prior to filter removal or replacement. It is a pressure vessel designed in accordance with the ASME BPVC Sect. VIII Div. 1 requirements. The unit is located in the F.H. Bldg. on the 280'6" elevation within the shield cask. This cask has an exterior shell consisting of a pipe spool 28" O.D. with top and bottom plates all constructed of carbon steel. Four casters welded to the bottom plate provide mobility for filter change out and will facilitate easy removal from its installed location. Internal lead shielding of the cask consists of 2" top and bottom with 3" on the vertical cylinder portion. After the "one-shot" usage of the filter it will be isolated, by-passed, and properly disposed of. If additional filtration is required, the depleted filter will be replaced with a duplicate unit.

2.1.4 MDHR Air Filtration Fans (MDH-E1A & MDH-E1B) and Pre-Filter/H.E.P.A. Filter Enclosures (MDH-F-1A/2A & MDH-F-1B/2B)

These redundant MDHR air filtration units (see Table 4 for fans and Table 5 for filters) function to exhaust air from the cubicals, filter the air, and transfers the air to the general area. This maintains acceptable temperatures in the cubicles, limits the buildup of contamination in the cubicles to permit maintenance, and minimizes the spreading of contamination. The existing F.H. Building air supply duct discharges 2900 cfm to the MDHR heat exchanger room where 900 cfm is drawn from the room into the Reactor Building Chase and 2000 is directed to the MDHR Pump Cubicle. The operating MDHR fan will exhaust 2200 cfm from the pump cubicle. Two thousand cfm is transferred from the heat exchange room and 200 cfm infiltrates from the general area for the total of 2200 cfm. This flow passes thru a common inlet balancing damper (D-109) and the motor operated damper upstream the operating filtration unit. The air then flows through the filtration unit. Each filtration unit contains two filter housings in parallel, each containing a pre-filter and HEPA filter. The flow proceeds thru the fan and out the motor operated discharge damper where it combines into a common discharge from the idle fan/filtration unit. The air is then exhausted to the general area at elevation 280'-6" after the flow is measured/alarmed and an airborne radiation sample is continuously monitored.

Each filtration unit is furnished with a differential pressure indication switch with a high d/p alarm. The fans (MDH-E-1A/1B) are controlled from local control switches on MDH-PNL-1 and are interlocked to open their respective motor operated supply and discharge dampers when the unit is started. Power for the fans is supplied by MCC - 2-11EA compt. 2ARR for MDH-E-1A and MCC - 2-21EA compt. 2ARR for MDH-E-1B.

2.1.5 Major System Valves

Mini Decay Heat Removal Suction Header Isolation Valves, MDH-V1 and MDH-V2

Two 600 psig (ANSI Rating), 2 inch stainless steel, electric motor operated globe valves in series are provided in the inlet suction header to the MDHR system. These valves provide redundant isolation capability from the tie-in to the ADHR system and DH system. Both valves are closed except when the Mini-Decay Heat Removal System is in operation. The electrical power to the valve motors is supplied from the redundant Class IE buses. MDH-V1 receives its power from MCC-2-11EA compt. 2BF and is controlled from panel 8A in the control room (formerly used to control DC-V114). MDH-V2 receives its power from MCC-2-21EA compt. 8BR and is controlled from panel 15 in the control room (formerly used to control WDL-V271).

Mini Decay Heat Removal Discharge Header Isolation Valves, MDH-V18 and MDH-V19

Two 1500 psig (AN I Rating), 2 inch stainless steel, electric motor operated globe valves in series are provided in the discharge header of the MDHR system tie-in to the ADHR system. These valves provide redundant isolation capability from the DH system and primary system boundaries. Both valves are closed except when the Mini-Decay Heat Removal system is required to operate. The existing plant Class IE buses provided redundant power to the valve's motor operators. MDH-V19 receives its power from MCC-2-11EA compt. 3DF and is controlled from panel 15 in the control room (formerly used to control WDL-V1126). MDH-V18 receives its power from MCC-2 -21EA compt. 7BF and is controlled from panel 8A in the control room (formerly used to control DC-V115). MDH-V18 has the capability of jog control if it is deemed necessary to throttle MDHR system outlet flow from the control room.

Nuclear Services Closed Cooling Water Supply Isolation Valve to Temporary NSCCW, TNS-V1007

One 350 psig, 300°F, 4 inch, stainless steel, electric motor operated gate valve is installed in the NSCCW supply line upstream of the Mini Decay Heat Removal Heat Exchangers (Retagged from BS-V4A which was spared). This valve provides the system boundary change from Seismic I, SC piping to Seismic II, conventional piping. The valve motor operator has been provided with a Class 1E power supply from MCC-2-21EA, compt. 6BF and is manually controlled from panel 8A in the Control Room (formerly used to control DC-V103). Additionally the valve is interlocked to close and isolate the NSCCW supply to the MDHR heat exchangers if the outlet flow exceeds the inlet flow to the heat exchangers or visa versa. The purpose of this is to prevent the spread of contamination to the NSCCW system in the event of a tube rupture in the MDHR heat exchangers or isolate the coolers if a piping leak occurs in the TNS system (i.e. isolates the safety portion of the NSCC from the non-safety TNS piping). The valve's nuclear classification is N-3, quality level Q-3, Seismic I, and Cleanliness class D.

MDHR System Remote Flushing, Draining and Vent Valves:

MDH-V21, MDH-V22, MDH-V29, MDH-V30, MDH-V32, MDH-V34, MDH-V35, and MDH-V36. The primary side of the MDH system has been designed with the capability for remote isolation, draining, flushing and venting to minimize radiation exposure to maintenance personnel. Eight 235 psig, 200°F, 2 inch, stainless steel, air operated Tufline plug valves, which fail close on loss of air or electric power, have been incorporated into the system to accomplish this. All the valves have their key lock control switches and indication on the local control panel, MDH-PNL-1, located on the 280'6" elevation of the Fuel Handling Building. The valves are classified conventional, quality level Q-3, Seismic I, and cleanliness class C. Valves MDH-V21 and MDH-V34 are the demineralized water flush supply valves for system flushing and debris filter flushing respectively. Check valves are located downstream of the above valves immediately adjacent to the MDHR system to prevent contamination of the D.W. system. Additionally, quick disconnects upstream of the remote flush valve are only installed when required for flushing.

Valves MDH-V30 and MDH-V35 located upstream of the debris filter (MDH-F-1) and valves MDH-V36 and MDH-V29 located downstream of the filters provide the capability to isolate the filter from the system and flush the connections to the floor drains before removal.

MDHR system remote venting is facilitated by opening MDH-V32 remotely during system draining. The Air & Gas Vent, MDH-U-1, located downstream of MDH-V32 prevents overflowing the MDHR system. Valve MDH-V32 will be opened when the system is to be refilled to ensure a solid system.

The solenoids for the above eight valves and MDH-V28 receive their power from Misc. Power Panel MPF-1 supplied from MCC 2-32A, compt. 9 ARF thru a 30 KVA transformer.

Debris Filter Bypass Valve, MDH-V28

A remote operated 235 psig, 200°F, 2 inch, stainless steel, air operated Tufline plug valve, which fails open on loss of air or electric power, is provided as a bypass around the inlet debris filter (MDH-F-1). The valve has its keylock control switch and indicating lights on the local control panel, MDH-PNL-1, and is opened when flow thru the Inlet Debris Filter is no longer required. MDH-V28 is a conventional valve, quality level Q-3, Seismic I, and cleanliness class C.

Relief Valves

Relief valves are installed where necessary to protect the system's heat exchangers and piping from overpressurization. The shell side of the MDHR Heat Exchangers, MDH-HX-1A and MDH-HX-1B, have Crosby 3/4" x 1" relief valves installed (TNS-V1002 and TNS-V1008). These relief valves have setpoints of 150 psig at 200°F with a capacity rating of 12 gpm. The tube side of MDH-HX-1A and 1B, have Vapor Corp. 3/4" x 1" relief valves installed (MDH-V4A and MDH-V4B). These reliefs have setpoints of 235 psig with a capacity rating of 53.5 gpm.

The MDH pumps, MDH-P-1A and 1B, each have Vapor Corp. 3/4" x 1" relief valves (MDH-V8A and MDH-V8B) installed on the pump's discharge. The reliefs have a setpoint of 235 psig with a discharge capacity of 53.5 gpm.

Manual Operated Valves With Extension Handwheels

The MDHR Heat Exchangers shell side (TNS) cooling water supply and return line isolation valves (4" gates) are provided with extension handwheels that penetrate an existing 2' thick shield wall on the H.X. North side. MDH-HX-1A and 1B have their inlet valve handwheels (TNS-V1004 & TNS-V1006) located in the vicinity of the shielded debris filter (MDH-F-1). The outlet valve handwheels (TNS-V1001 and TNS-V1003) are located within the MDHR

pumps cubicle enclosure and the manipulation will require the operating pump to be shutdown and the primary side lines flushed before the valves can be operated.

The primary side of the MDHR Heat Exchangers is provided with 2" diaphragm valves operated with remote handwheels on the inlet, outlet and cross connect valves. Inlet valves MDH-V-3A and 3B and outlet valves MDH-V-6A and 6B have their extension handwheels located in the pump cubicle. MDHR crossconnect valve, MDH-V5, also has it's remote handwheel located in the pump cubicle. Operation of these valves MDH-V3A/3B, MDH-V5, and MDH-V6A/6B will require the system to be shutdown and the primary lines flushed to reduce radiation levels before entrance to the MDHR pump cubicle.

MDHR Pump Suction and Discharge 2" diaphragm valves, MDH-V7A/B and MDH-V12A/B respectively, have their remote handwheels located on the 2' thick north shield wall of the pump cubicle for pump isolation should a flange or seal leak occur. The MDHR system's minimum recirculation throttling valve, MDH-V20, and outlet isolation valve, MDH-V15, are 2" globe type with their extension handwheels located on the north shield wall of the pump cubicle.

The manual remote valve associated with the MDHR system remote draining is MDH-V33, which functions to drain the entire system. This 1" plug valve has its extension handwheel located on the pump cubicle's 2' thick north shield wall at the eastern corner.

2.2 Instrumentation, Controls, Alarms and Protective Devices

As indicated on Table 6, the Mini Decay Heat Removal System is largely controlled from the local (MDH-PNL-1) and remote (MDH-PNL-2) panels located on the 280'6" el. of the F.H. Bldg. and the Control Room respectively. System isolation capability of both the primary coolant side and NSCCW side have their controls on C.R. panels 8A and 15. These isolation valves (MDH-V1, MDH-V2, MDH-V18, MDH-V19 and TNS-V1007) are powered from Class 1E Motor Control Centers using existing starter circuits spared as a result of system inoperability. The valves previously powered by the MCC starters will not be required to operate until their respective systems are repaired during the recovery operation (i.e. WDL-V0271, WDL-V1126, DC-V103, DC-V114, DC-V115).

Controls for valves used during remote flushing, venting and draining operations are located on the local control panel, MDH-PNL-1, in the F.H. Bldg. 280'6" elevation.

Multi-function process monitors on the local and remote panels are used to display pressure, temperature and flowrate.

MDH-P-1A/B have on/off/spring return to normal switches on the local and remote panels. Suction and discharge pressure indications for each pump are available on the local instrument rack and on the process monitors. The pumps are interlocked with the main decay heat pumps to trip if DH-P-1A or B is inadvertently started.

The heat exchanger's primary side instrumentation consists of inlet and outlet temperatures and is displayed at the process monitors. High individual heat exchanger outlet temperature is also alarmed in each process monitor. Local inlet pressure to each heat exchanger is available on the local instrument rack.

Primary side system flow rate readout is available on both process monitors with low flow being alarmed.

The heat exchanger's secondary side instrumentation consists of inlet and outlet flow indication on the local and remote panels. The flow differences are used to signal the automatic closing of TNS-V1007 (i.e. outlet flow greater than inlet flow or visa versa) and alarm the condition on the local and remote panels.

Three area gamma radiation monitors are provided on the 280'6" elevation of the Fuel Handling Building. They are located in the vicinity of MDH-P-1A, MDH-P-1B, and the MDH heat exchangers. Each one has indication adjacent to the local panel and on the remote panel with a common alarm annunciator on each panel.

The controls and indication associated with the MDHR air filtration system are located at the equipment or on the local control panel, MDH-PNL-1. MDH-E-1A/1B have on/off control switches on the local panel with interlocks to their respective suction and discharge motor operated dampers to open them when the fan is running. The prefilter and HEPA filter assemblies are provided with local differential pressure indication, a local high alarm and a common high d/p alarm on the remote panel. Exhaust air flow from the fans is indicated/alarmed locally with a low flow alarm on the remote panel. Additionally an airborne radiation monitor samples the air after the filters to alarm an abnormal condition locally and remotely. Valving is provided to allow an air sample to be taken before the filters.

A closed circuit TV system is provided to aid in system surveillance during operation such as monitoring the system for fluid leakage; pump seal failure; relief valve lifting or system flushing and draining to floor drains. The system consists of two TV cameras strategically located in the MDHR pump enclosure and heat exchanger room. The TV monitors and necessary controls are mounted on separate racks in the Cable Room at the 305'0" elevation of the control

building. Camera MDH-TVC-1 is mounted on the south wall of the MDHR pump enclosure, opposite the centerline of the shield wall dividing the pumps and is approximately 4 feet off the floor. It is provided with a PAN-Tilt mechanism to allow remote movement of the camera to permit scanning both pump's areas. Additionally the camera is fitted with a 30-150 mm zoom lens with remote focusing to facilitate detailed inspection of the pump components and piping. The camera is normally left pointed away from any direct line view of a radiation source. This will lengthen the life of the lense.

Camera MDH-TVC-2 is mounted on an I-beam near column AF & A67, approximately 7 feet above the floor facing east towards the MDHR heat exchangers to view relief valve sight glasses/valve positions. It is provided with the same remote control features as MDH-TVC-1. Each pump cubicle is provided with 4-100 watt incandescent lamps and the heat exchange rooms existing plant lighting has been augmented by three additional flo rescent fixtures having 3-40 watt lamps to insure adequate lighting for the TV cameras. All lighting fixtures in these areas were lamped or relamped with the longest life bulbs/tubes available to lengthen or eliminate relamping requirements since these areas will be inaccessible during normal operation.

The Mini-Decay Heat Removal Pumps, MDH-P-1A & 1B, are provided with a "Vibralarm" vibration monitoring system to continuously monitor the pump's bearing housings for impending fail re so that corrective action can be taken. Each pump has two single axis accelerometer sensors attached to the bearing housing to sense vibration in the vertical radial and horizontal radial direction (see Table 6 for details). The acceleration levels measured by the sensors are transmitted to the locally mounted Vibralarm Monitors near MDH-PNL-1 and are converted to velocity levels in inches/sec. One monitor for each pump indicates "alarm" and "shutdown" levels for each sensor via white and red indicator lights on the face of the panel. Also an amber indicating light is provided on the face of the panel to alarm: sensor, cable or input electronics fail re. Internal to each monitor panel are the calibration controls and a velocity level indicating meter which can be selected to read channel 1 or 2 (i.e. vertical or horizontal sensor). These local monitors are tied to the control room panel, MDH-PNL-2, via a common trouble alarm which will annunciate if any of the local alarms actuate.

The Mini-Decay Heat Removal Filter (MDH-F-1) is provided with differential pressure indication and high d/p alarm on the local panel (MDH-PNL-1) while the control room panel (MDH-PNL-2) is provided with a high d/p alarm only. This instrumentation will provide guidance as to when to bypass the filter or replace it.

3.0 PRINCIPAL MODES OF OPERATION

3.1 Startup

When it is desirable to switch cooling modes of the R.C.S from any given mode to forced circulation using the Mini Decay Heat Removal System, the following will be performed. One of the MDHR pump enclosure fan/filter units will be started to exhaust the air around the pumps thru HEPA filters. The operation of the fan/filter unit is required to minimize the potential spread of airborne contamination into the balance of the F.H. Building should a leak develop in the MDH system. The Fuel Handling Building H&V system should be operating prior to starting the system.

The MDHR system primary side will be filled and vented with borated water at a 3500 ppm Boron concentration. Nuclear Services Closed Cooling Water flow is established on the secondary side of the MDHR heat exchanger selected for service via the Temporary Nuclear Services Closed Cooling Water Subsystem tie-in to the "A" Spent Fuel Cooler (i.e. SP-C-1A is no longer operable). The "B" heat exchanger will normally be selected as the lead cooler with MDH-HX-1A isolated on the shell and tube sided by closed outlet valves. A minimum flowrate of 50 gpm will be set by throttling NS-V31A. The flowrate is not to exceed 245 gpm to prevent starving other components in the NSCCW system.

A valve line-up of the MDHR primary side will have the inlet and outlet remote isolation valves (MDH-V1, 2, 18, & 19) closed. The flow path will be arranged for flow thru the debris filter (MDH-F-1) with the bypass valve closed (MDH-V28). Heat Exchanger "A" will be isolated by its closed outlet valve (MDH-V6A) and the HX cross connect valve (MDH-V5) is closed to direct flow to the perferred "B" side heat exchanger. Similarily the "A" side MDHR pump is isolated by closed suction and discharge valves (MDH-V7A & 12A) to allow the "B" side MDHR pump to operate as the lead pump. The MDHR pumps minimum recirculation valve (MDH-V20) will be opened 1 full turn to allow a 10-15 gpm flow at shutoff head of the MDHR pump.

The Decay Heat Removal System will be aligned to interface with the MDHR system by verifying open DH-V2 and then opening DH-V1 (or DH-V171), DH-V3 and DH-V48. The MDHR system suction isolation valves (MDH-V1 & 2) are opened to pressurize the system to Reactor Coolant System pressure which will result in a static pressure at the "B" pump's suction of approximately 100 $\pm$ 10 psig as indicated by MDH-PI-28-2 or -3. If this static pressure exceeds 115 psi the MDHR system will be manually isolated by closing MDH-V1 & 2 and the RCS pressure decreased by increasing the letdown or RCS leakage.

The preferred MDHR pump (MDH-P-1B) will be started from the local (MDH-PNL-1) or remote (MDH-PNL-2) control panel and initial data will be taken to confirm proper operation while it is in the recirculation

mode via MDH-V20. MDHR system outlet isolation valve MDH-V19, will be opened and MDH-V18 jogged open gradually till 100 gpm is indicated on the system outlet flow meter (MDH-FIAL - 1-2 or 1-1).

During system startup the radiation levels on contact with the MDHR filter shield cask will be measured immediately and regularly thereafter to determine contact radiation levels. From then on contact readings will be taken periodically to identify trends in the buildup of contact radiation levels. The criteria for changeout of the MDHR filter cask assembly is based on an administrative radiological limit of 1 rem/hr. on contact with the cask and/or a differential pressure across the filter in excess of 65 psig above the clean filter d/p. Refer to section 3.4.2 for details on debris filter replacement.

3.2 Normal Operation

The MDHR system presents a forced flow option for core cooling. If the system is put into operation it may remain in service until complete defueling of the reactor core has taken place. Normal system fluid parameters may be monitored along with the area radiation levels in the 280'6" elevation of the F.H. Bldg. As decay heat generation rate is reduced with time, reactor coolant system temperature will slowly trend toward the TNSCCW temperature. Heat removal rate can be reduced to control the RCS cool down rate by throttling the TNSCCW flow with the "A" Spent Fuel Cooler outlet valve, NS-V31A. The primary coolant outlet temperature to the MDHR heat exchanger shall be maintained above 100°F. The Standby Reactor Coolant Pressure Control System (SPC) will be controlling the MDHR system pressure. If it becomes necessary to shift operating pumps, the standby pump will be placed in service prior to securing the operating pump. The operating pump's mechanical seal must be flushed with demineralized water prior to securing it per the method of section 3.4.5. MDH-P-1B is considered to be the normal operating pump because of its superior access for maintenance. Pump MDH-P-1A will be used only as a temporary backup while maintenance is performed on the 1B pump. Heat Exchanger swapping will require shutting down the system, and flushing to reduce radiation levels to gain access to the H.X. isolation valves.

During the normal system operation, reactor coolant is taken from the "B" side 36" reactor outlet line through a 12" line with two high pressure electric motor operated valves in series, DH-V1 and DH-V2. The flow exits the Reactor Building through penetration R-525 and immediately passes through an electric motor operated valve, DH-V3. The 8" Westinghouse Alternate Decay Heat Removal System tie-in is located directly downstream of DH-V3. This tie-in is isolated by two Westinghouse electric motor operated valves ADH-V01 and ADH-V02 before the line terminates in the valve pit outside the west wall of the Unit 2 Fuel Handling Building. A 2" line connects to the 8"

Westinghouse ADH system line downstream of DH-V3 to serve as the suction line for the MDHR system. Two electric motor operated isolation valves in series (MDH-V1 and MDH-V2) are installed in the 2" line upstream of the demineralized water flush connection and inlet debris filter (MDH-F-1) with bypass valve (MDH-V28). The line then connects to the suction header of the parallel MDH heat exchangers which are provided with inlet and outlet diaphragm valves with extension handwheels. A 2" heat exchanger cross connection line exists downstream of MDH-HX-1A but upstream of MDH-HX-1B to allow them to be operated in series. The 2" discharge lines from the HX outlets combine into a common header and are routed to the parallel MDHR pumps. Upstream of the pumps the sample return line ties in from the Temporary Nuclear Sampling System.

Each MDH pump is provided with suction and discharge manual diaphragm valves with remote handwheels and a discharge check valve to prevent reverse flow in the nonoperating pump. The pumps discharge into either a full flow recirculation line or the system's outlet isolation valve, MDH-V15, before proceeding to the system's electric motor operated outlet isolation valves, MDH-V18 and MDH-V19. MDH-V18 has been provided with jog control capability from the control room and will be the normal method of throttling MDHR system outlet flow. (Note: MDH-V15 and MDH-V20 have handwheel extensions for remote adjustment of flow.) Upstream of MDH-V18 & MDH-V19 are located the system's remote drain valves, sampling system supply line, and system flow element. Upstream and downstream of the system outlet isolation (MDH-V15) are located tie-in connections with double isolation valves for a future demineralization system. The 2" system discharge line connects to the 6" B return loop of the Westinghouse ADHR. The 6" line is isolated on the deadend side by ADH-V07B and ADH-V06B and connects into the 10" Decay Heat line upstream of DH-V-4B. Downstream of DH-V-4B the line penetrates the Reactor Building where it joins with the B side 14" Core Flooding line to the Reactor Vessel, completing the flow path.

3.3 Shutdown

The MDHR system is removed from service by closing the NSCCW supply to SF-C-1A via NS-V30A and closing the operating MDHR H.X. outlet valve (TNS-V1006 for B or TNS-V1004 for A). Primary side outlet valves MDH-V18 and MDH-V19 are closed from the control room. The operating MDHR pump (usually MDH-P-1B) will be tripped after the mechanical seals are flushed with demineralizer water per section 3.4.5. Inlet and Outlet isolation valves for the pump will be closed (MDH-V7B/12B or MDH-V7A/12A) along with the primary side inlet valves MDH-V1 and V2. The "A" Spent Fuel Cooler outlet valve (NS-V31A) is closed. If shutdown has occurred for maintenance purposes then refer to section 3.4.1 on Remote Flushing, Draining & Venting.

3.4 Special or Infrequent Operation

3.4.1 Flushing, Draining & Venting the System Remotely to Reduce Radiation Levels for Maintenance

Should it be required, for any reason, to enter the MDHR heat exchange room and/or pump cubicle it may be necessary to shut down the system and drain/flush it to reduce the area radiation levels to an acceptable level. This evolution will consist of shutting down the MD+R System as described in Section 3.3. The system's following in-line process valves will be verified open or opened: inlet/outlet/bypass valves for MDH-F-1 (i.e. MDH-V30/-35/--36/-29/-28 from MDH-PNL-1), suction/discharge valves for MDH-P-1A/B (i.e. MDH-V7A/-7B/-12A/-12B from extension handwheels on pump cubicle's north shield wall), and MDHR system recirculation/discharge valves (i.e. MDH-V20/-15 from extension handwheels on pump cubicle's north shield wall). It is not feasible to open the primary side flow paths for both heat exchangers because of ALARA considerations (i.e. HX inlet/outlet/bypass valve extension handwheels are located in the MDHR pump cubicle).

The system is vented by opening vent valve MDH-V32 from local panel MDH-PNL-1. System drain valve MDH-V33 is opened only enough to prevent overflowing the floor drain using its manual remote handwheel. Filter inlet/outlet drains MDH-V47/48 are also partially opened. When draining is completed as determined by the TV monitor observing the MDH-P-1B pump cubical's northeast corner, where the floor drain is located, the above three drain valves are closed. If the area radiation levels in the MDHR pump cubicles decrease sufficiently, the H.X. isolation/bypass valves (MDH-V3A/6A/5) should be opened prior to securing draining.

The system is refilled with demineralized water by installing the demineralized water quick disconnect hose at DW-V238 and opening DW-V238. The demineralized water supply valve, MDH-V21, is opened from panel MDH-PNL-1 and filling proceeds until air ceases flowing from the Air & Gas Vent (MDH-U-1) downstream of MDH-V32. MDH-V32 & MDH-V28 are closed from panel MDH-PNL-1 and the system flushing valve, MDH-V22, is opened from panel MDH-PNL-1. Demineralized Water flushing of the system will commence and run for 5 minutes and be monitored by observing the drain in the southwest area of the heat exchanger room with the T.V. monitor. The inlet/outlet valves for MDH-F-1 (MDH-V30/29) are closed and the bypass valve opened (MDH-V28) to allow a

new flush path for 5 minutes. Flushing will be secured by closing MDH-V21, V22 and DW-V238 (disconnecting supply hose). The system vent isolation valve (MDH-V32) and drain valve (MDH-V33) are reopened to allow complete draindown.

The system will be restored to startup status after maintenance by performing the MDHR primary side valve line-up the refilling with 3500 ppm borated water using a portable mix and fill apparatus.

3.4.2 Debris Filter Replacement

After initial operation of the MDHR system with the inlet debris filter, MDH-F-1, in service it may become necessary to install the backup filter due to a high pressure drop and/or contact radiation levels on cask exceeding 1 rem/hr. Installation and operation with the backup filter which results in very little increase in d/p will indicate that debris from the Decay Heat Drop Line has been removed prior to bypassing the filter.

For MDH-F-1 replacement the MDHR system must be shutdown as detailed in Section 3.3. The filter's inlet and outlet isolation valves (MDH-V35 and MDH-V36) are closed from panel MDH-PNL-1. MDH-DPS-35 root valves (MDH-V43 & -V44) are closed and vent valves (MDH-V45 & 46) are opened locally. Hoses will be connected to the quick disconnect fittings located downstream of MDH-V47 & MDH-V48 and connected to a container with an absolute filter vent. The inlet/outlet filter drains (MDH-V47/48) are opened to allow the liquid between the filter isolation valves to drain down to below the flange disconnect elevation. When the filter inlet and outlet lines have stopped draining, valves MDH-V45, -V46, -V47 and -V48 are closed and drain hoses removed.

The filter's inlet and outlet flanges can rapidly be disconnected, since the flange nuts are tack welded to the underside of the disconnect flanges. All flanges will be bagged to contain any dripping of radioactive liquid and the filter cask housing pulled out of its installed location. The flanges on the spent filter should be blind-flanged and suitable gaskets installed/torqued before any extensive movement of the filter cask. A new filter cask housing will be reinstalled and the flange connections leak tested prior to putting the MDHR system back in service.

3.4.3 Reactor Coolant System Water

Planning for RCS Cleanup recognizes the MDHR Pipe Stubs as potential intercept points for interfacing with the RCS. Use of the stubs will be evaluated along with other potential RCS Cleanup options.

3.4.4 MDHR Pump/Piping Enclosure HVAC HEPA Filter Replacement

HEPA filter replacement will be required when a high differential pressure is indicated across the prefilter/HEPA filter or the outlet airborne radiation monitor idicates the filters are not performing effectively. The standby fan/fitration unit (MDH-E-1A or MDH-E-1B) will be started from panel MDH-PNL-1 and the operating unit stopped. Remove and replace both sets of prefilters and HEPA filters from the secured unit. The filtration unit can serve as a backup unit after DOP testing is performed and completed.

3.4.5 MDHR Pump Mechanical Seal Flushing

When an operating MDHR pump must be secured it is imperative the seals be flushed with demineralized water before it is isolated. This operation will consist of connecting the demineralized water quick disconnect downstream of DW-V238 and opening the valve. The operating pump [MDH-P1B (A)] should be tripped and its suction and discharge isolation valves [MDH-V7B (A) and MDH-V12B(A)] verified open. Also verify MDH-V20 is in "Minimum Recirc" position and close the system isolation valves (MDH-V1, 2, 18 and 19). The system drain valve (MDH-V33) should be cracked open till suction pressure at the tripped pump decreases to less than 40 psig, then close MDH-V33. The demineralized water supply valve [MDH-V41B (A)] is opened for the MDHR pump which has been tripped. Restart the tripped pump [MDH-P1B (A)] and throttle open MDH-V33 until a flow of demineralized water of 1.5 to 2.5 gpm is seen on flow meter MDH-FI-7(6). After running the pump for 10 minutes, trip the pump and close MDH-V33. The demineralized water will have flushed out the borated water from the pump's seal block and the closed loop cyclone separator back to the process piping. Close D.W. supply valve MDH-V41B(A) when flow is no longer seen on MDH-FI-7(6). Close the tripped pump's suction/discharge isolation valves [MDH-V7B(A)/MDH-V12B(A)].

3.5 Emergency

3.5.1 Loss of Off-Site Power

In the event of loss of off-site power, the MDHR pump in operation will stop and the four system isolation valves will remain in their last position, but not energized. The air operated plug valves associated with the system's remote flushing, draining and venting (MDH-V34, MDH-V21, MDH-V30, MDH-V35, MDH-V36, MDH-V29, MDH-V32, MDH-V22) will fail closed on both loss of electrical power and air, which will stop the operation in progress. The filter bypass valve (MDH-V28) fails open on loss of electrical power/air to ensure a flow path is maintained through the MDHR system. The MDHR HVAC Filter Unit in operation will also stop. Instrumentation indication will be lost. Once the site Class 1E diesel generator sets are in operation the above loads will be sequenced on the 1E diesel generators manually to restore system operation and isolation capability.

3.5.2 Inadvertent Starting of Existing Plant Decay Heat Removal Pumps, DH-P-1A/or 1B

If either of the existing plant decay heat pumps, DH-P-1A or 1B, are inadvertently started, the operating MDHR pump will automatically trip to prevent overpressurizing the MDHR system. The DH pump should be secured and the desired MDHR pump restarted to restore system operation.

3.5.3 Loss of MDHR Pump(s) Cubicle Ventilation

If the operating HEPA fan/filter unit trips or becomes fouled the potential exists to spread airborne contamination into portions of the Fuel Handling Building not occupied by the MDHR system. The backup HEPA fan/filter unit should be immediately started to ventilate the MDHR Pump/Piping Enclosure so a negative pressure is maintained and any particulate airborne contamination is filtered.

3.5.4 Mini Decay Heat Removal Tube Failure

If a primary side tube failure occurs on the operating MDH heat exchanger, MDH-HX-1A or 1B, the inlet TNSCCW supply valve (TNS-V1007) will close due to the flow inbalance on the shell side. If operation must continue the affected cooler should be isolated and the backup cooler put into service. This will require system shutdown so the system can be flushed to reduce radiation levels and gain access to the heat exchanger isolation valves.

3.5.5 Gross System Leakage

In the event of gross system leakage, the system can be isolated from the RCS by shutting the remote operated isolation valves (MDH-V1, MDH-V2, MDH-V18, and MDH-V19).

4.0 HAZARDS AND PRECAUTIONS

4.1 Do not operate the Mini Decay Heat Removal pumps with the minimum recirculation valve, MDH-V20, closed. If the discharge path is blocked, shutoff head operation of the pump(s) should not exceed one minute.

4.2 Do not operate the pumps with the suction valves(s) throttled or closed.

4.3 Since the system is handling radioactive contaminated fluids and potential airborne contamination due to leakage, all appropriate health physics safety precautions must be observed during operation and maintenance.

4.4 Remote flushing capability exists for the system's primary side piping to provide a means for reducing the radiation levels in the piping. Flushing shall be performed before maintenance is begun.

4.5 Unless required for operation, a standby component (i.e. pump/heat exchanger/instrumentation) should be isolated by their outlet and/or inlet isolation valves or root valves to eliminate potential leakage paths and/or crud traps.

4.6 The Fuel Handling Building Heating and Ventilation System should be operated in conjunction with the MDHR exhaust system when the MDHR System is operating.

4.7 Pump MDH-P-1B should always be considered the "PRIMARY" pump because of the ease of maintainability versus MDH-P-1A.

TABLE 1

MINI DECAY HEAT REMOVAL PUMPS

Identification	MDH-P-1A, MDH-P-1B
Number Installed	Two
Manufacturer	Goulds Pumps, Inc.
Model No.	3196 ST (1 x 1-1/2-8)
Type	Single-Stage, Horizontal Shaft, Centrifigal
Rated Speed, rpm	3500
Rated Capacity, gpm	120
Developed Head, ft.	195
Design Pressure, Casing, psig	240
Design Temperature, °F	200
Lubricant/Coolant	Oil/Air
Min. Flow Requirements	10 gpm for 15 minutes max.
Motor Details	
Manufacturer	Westinghouse
Type	Squirrel Cage
Enclosure	Open Drip Proof
Rated Horepower, HP	15
Speed, rpm	3500
Lubricant/Coolant	Grease/Air
Power Requirements	460V, 3 Phase, 60 H_z, 18.5 amps (full load)
Power Source	MDH-P-1A, MCC-2-11EA compt. 3AR MDH-P-1B, MCC-2-21EA compt. 3AR

TABLE 1 (Con't.)

MINI DECAY HEAT REMOVAL PUMPS

Classification	
Code	ASME-Section III Class 3
Quality Control	3
Seismic	I
Cleanliness	B

TABLE 2

MINI DECAY HEAT REMOVAL COOLERS

Identification	MDH-HX-1A, MDH-HX-1B
Number Required	Two
Vendor	Babcock & Wilcox
Manufacturer	Atlas Industrial Mfg. Co.
Cleanliness Factor	0.85
Heat Transfer, BTU/hr	2.25×10^6 @ primary temp. = 175°F @ 120 gpm secondary temp. = 100°F @ 200 gpm
Tube Side:	
Fluid	Reactor Coolant
Fluid Flow, lbs/hr	60,000
Design Pressure	235 psig
Design Temperature, °F	200
Material	304 Stainless Steel
Pressure Drop, psig	1.3
Shell Side:	
Fluid	Nuclear Services Closed Cooling Water System
Fluid Flow, lbs/hr	100,000
Design Press. psig	175 psig
Design Temp. °F	200
Material	Carbon Steel
Pressure Drop, psig	8.3

TABLE 2 (Con't.)

MINI DECAY HEAT REMOVAL COOLERS

Classification	Shell	Tube
Code	ASME Section III, Class 3, 1971 Ed. with Addenda Thru 1971	
Quality Control	4	3
Seismic	I	I
Cleanliness	C	B

TABLE 3

MINI DECAY HEAT INLET DEBRIS FILTER

Filter Details	
Identification	MDH-F-1
Number Installed	1 & 3 Replacement Assemblies
Manufacturer	Fabricated on site
Type	Cartridge
Casing Material	304 Stainless Steel
Casing Dimensions	12-3/4" O.D. x 26-1/4" high
Size (Micron Removal Rate)	225
Operating Conditions	1[illegible] gpm @ 100 psig/155°F
Design Conditions	235 psig @ 200°F
Hydrostatic Test	353 psig @ 70°F
Code	ASME BPVC Section VIII Div. 1
Seismic	Class 2 - DBE

TABLE 4

MINI DECAY HEAT REMOVAL SYSTEM
AIR FILTRATION FANS

Fan Details	
Identification	MDH-E-1A & MDH-E-1B
Number Installed	2
Manufacturer	New York Blower
Model No.	Size #12 S.W.S.I.
Type	Centrifugal - upblast
Rated Capacity, CFM	2200
Static Press in H_2O	6.5
Rated Speed, RPM	4200
Fan Motor Details	
Manufacturer	
Type	Squirrel Cage Induction Motor
Enclosure	Open
Rated HP	5
Rated Speed, RPM	
Lubricant-Coolant	Oil/Air
Power Requirements	460 V/3 Phase/60 Hz
Power Source	MDH-E-1A - MCC-2-11EA compt. 2ARR MDH-E-1B - MCC-2-21EA compt. 2ARR
Classification	
Code	C
Quality	4
Seismic	II
Cleanliness	0

TABLE 5

MDHR EXHAUST H.E.P.A. & PREFILTER FILTER ASSEMBLY

H.E.P.A. Filter Details	
Identification	MDH-F-2A/MDH-F-2B
No. of Cells Installed/Train	2
Manufacturer	Mine Safety Appliance Company
Type	HEPA
Size	24" x 24" x 12"
Capacity, CFM	1100 CFM per filter/2200 CFM per train
Pressure Drop, Clean, in W.G.	1.1
Efficiency, %	99.97%/0.3 micron
Housing	2, Ultra-Lok Series "U", Bag-In, Bag-Out Filter Retaining System
Pressure Drop, Dirty, In W.G.	3.0
Prefilter Details	
Identification	MDH-F-1A/MDH-F-1B
No. of Cells Installed/Train	2
Manufacturer	Mine Safety Appliances Compan
Type	Air-O-J
Size	24" x 24" x 2"
Capacity, CFM	1100 per filter/2200 per trai
Pressure Drop; Clean, in W.G.	0.15
Efficiency, %	30%/ASHRAE Std #52
Pressure Drop, Dirty, in W.G.	0.25

TABLE 5 (Con't.)

MDHR EXHAUST H.E.P.A. & PREFILTER FILTER ASSEMBLY

Classification	
Code	C
Quality	3
Seismic	II
Cleanliness	D

TABLE 6

Instrumentation Controls and Alarms

Identification	Description	Function	Location	Type	Input Range	Output Range	Setpoint
TNS-FE-1	Flow Element	Temporary NSCCW Inlet Flow to Heat Exchangers MDH-HX-1A/1B	Piping	Orifice Plate	0-400 gpm	0-400" W.C.	N/A
TNS-FT-1	D/P Transmitter	Temporary NSCCW Inlet Flow to Heat Exchangers MDH-HX-1A/1B	Local MTG	Fox Bor E130M	0-400" W.C.	10-15 MADC	N/A
TNS-FDSH-1	Flow Diff. Alarm	T.N.S.C.C.W Flow imbalance between inlet and outlet flow to MDH-HX-1A/1B	PNL. 1	Fox Bor 63U-ET-CHAR	10-15 MADC	N/A	7.0 gpm
TNS-FDAH-1	Annunciator Light	T.N.S.C.C.W Flow imbalance between inlet and outlet flow to MDH-HX-1A/1B	PNL. 1	G.E. CR 2940	N/A	N/A	7.0gpm
TNS-FI-1A	Flow Indicator	T.N.S.C.C.W Inlet flow to MDH-HX-1A/1B	PNL. 1	Vertical Millimeter West VX252	10-50 MADC	0-400 gpm	N/A
TNS-FI-1B	Flow Indicator	T.N.S.C.C.W Inlet flow to MDH-HX-1A/1B	PNL. 2	Vertical Millimeter West VX252	10-50 MADC	0-400 gpm	N/A
TNS-HS-1	Push Button	T.N.S.C.C.W. Flow Inbalance - Alarm Acknowledge	PNL. 1	G. E. CR2940 WA202B	N/A	N/A	N/A
TNS-FE-2	Flow Element	Temporary NSCCW Outlet Flow from Heat Exchangers MDH-HX-1A/1B	Piping	Orifice Plate	0-400 gpm	0-400" W.C.	N/A
TNS-FT-2	D/P Transmitter	Temporary NSCCW Outlet Flow from Heat Exchangers MDH-HX-1A/1B	Local MTG	Fox Bor E130M	0-400" W.C.	10-15 MADC	N/A

TABLE 6

Instrumentation Controls and Alarms

Identification	Description	Function	Location	Type	Input Range	Output Range	Setpoint
TNS-FDSH-2	Flow Diff. Alarm	Temporary NSCCW Flow Inblance between Inlet and Outlet flow to MDH-HX-1A/1B	PNL. 1	Fox Bor 63U-ET-CHAR	10-15 MADC	N/A	7.0 gpm
TNS-FDAH-2	Annunciator Light	Temporary NSCCW Flow Inbalance between Inlet and Outlet flow to MDH-HX-1A/1B	PNL. 2	G.E. CR 2940	N/A	N/A	7.0 gpm
TNS-FI-2A	Flow Indicator	T.N.S.C.C.W Outlet flow from MDH-HX-1A/1B	PNL. 1	Vertical Millimeter West VX252	10-50 MADC	0-400 gpm	N/A
TNS-FI-2B	Flow Indicator	T.N.S.C.C.W Outlet flow from MDH-HX-1A/1B	PNL. 2	Vertical Millimeter West VX252	10-50 MADC	0-400 gpm	N/A
TNS-HS-2	Pushbutton	T.N.S.C.C.W. Flow Inbalance Alarm Acknowledge	PNL. 2	G.E.P.B. CR2940 WA2028	N/A	N/A	N/A
TNS-FHS-7	Hand Switch W/Ind. Lights	Operates Temporary NSCCW Valve TNS-V-1007 Flow to HT Exch. MDH-HX-1A/1B	PNL. 8A	P.B. W/R & G. Lights	N/A	N/A	N/A
MDH-RE-1	Area Rad. Monit.	MDH-P-1A Area Radiation	Local	Gamma Ion Chamber	$0-1\times10^{7}$ MR/HR		N/A
MDH-RM1-1A	Indication/Alarm	MDH-P-1A Area Radiation	Adjacent to PNL. 1	Alarm Ratemeter Victoreen 848-5		$0.1-1\times10^{7}$ MR/HR	2.5 R/HR

TABLE 6

Instrumentation Controls and Alarms

Identification	Description	Function	Location	Type	Input Range	Output Range	Setpoint
MOH-RAI-1B	Indication/Alarm	MOH-P-1A Area Radiation	PNL. 2	Alarm Ratemeter Victoreen 848-5		0.1-x10^7 MR/HR	2.5 R/HR
MOH-RE-2	Area Rad. Monit.	MOH-P-1B Area Radiation	Local	Gamma Ion Chamber	0-1x10^7 MR/HR		N/A
MOH-RAI-2A	Indication/Alarm	MOH-P-1B Area Radiation	Adjacent to PNL. 1	Alarm Ratemeter Victoreen 848-5		0.1-1x10^7 MR/HR	2.5 R/HR
MOH-RAI-2B	Indication/Alarm	MOH-P-1B Area Radiation	PNL. 2	Alarm Ratemeter Victoreen 848-5		0.1-x10^7 MR/HR	2.5 R/HR
MOH-RE-3	Area Rad. Monit.	HT. EXCH. COMPT. AREA Radiation	Local	Gamma Ion Chamber	0-1x10^7 MR/HR		N/A
MOH-RAI-3A	Indication/Alarm	HT. EXCH. COMPT. AREA Radiation	Adjacent to PNL. 1	Alarm Ratemeter Victoreen 848-5		0.1-1x10^7 MR/HR	1.0 R/HR
MOH-RAI-3B	Indication/Alarm	HT. EXCH. COMPT. AREA Radiation	PNL. 2	Alarm Ratemeter		0.1-1x10^7 MR/HR	1.0 R/HR
MOH-RAH-4	Alarm LT./Horn	Common Alarm for MOH-RE-1/2/3	PNL. 1	Light	N/A	N/A	2.5 or 1.0 R/HR.
MOH-RAH-5	Alarm LT./Horn	Common Alarm for MOH-RE-1/2/3	PNL. 2	Light	N/A	N/A	2.5 or 1.0 R/HR.

TABLE 6

Instrumentation Controls and Alarms

Identification	Description	Function	Location	Type	Input Range	Output Range	Setpoint
MDH-HS-4	Pushbutton	Common Alarm for MDH-RE-1/2/3 Acknowledge Button	PNL. 1	P.B.	N/A	N/A	N/A
MDH-HS-5	Pushbutton	Common Alarm for MDH-RE-1/2/3 Acknowledge Button	PNL. 2	P.B.	N/A	N/A	N/A
MDH-FE-1	Flow Element	Mini Decay Heat System Flow	Piping	Orifice Plate	0-200 gpm	0-750" W.C.	N/A
MDH-FT-1	D/P Transmitter	Mini Decay Heat System Flow	Local Rack	Bailey BQ75221	0-750" W.C.	4-20 MADC	N/A
MDH-FIAL-1-1	Indication/Alarm	Mini Decay Heat System Flow & Low Flow Alarm	PNL. 1	Process Monitor	4-20 MADC	0-200 gpm	60 gpm
MDH-FIAL-1-2	Indication/Alarm	Mini Decay Heat System Flow & Low Flow Alarm	PNL. 2	Process Monitor	4-20 MADC	0-200 gpm	60 gpm
MDH-FI-2	Sight Flow Indicator	Indicate Relief Valve MDH-V4A has lifted	Piping	Flapper Type Ametek #20-6120	N/A	N/A	N/A
MDH-FI-3	Sight Flow Indicator	Indicate Relief Valve MDH-V4B has lifted	Piping	Flapper Type Ametek #20-6120	N/A	N/A	N/A
MDH-FI-4	Sight Flow Indicator	Indicate Relief Valve MDH-V8A has lifted	Piping	Flapper Type Ametek #20-6120	N/A	N/A	N/A
MDH-FI-5	Sight Flow Indicator	Indicate Relief Valve MDH-V8B has lifted	Piping	Flapper Type Ametek #20-6120	N/A	N/A	N/A

TABLE 6

Instrumentation Controls and Alarms

Identification	Description	Function	Location	Type	Input Range	Output Range	Setpoint
MDH-FHS-1	Hand Switch	Controls MDH-V1 (was tagged DC-FHS-7086)	PNL. 8A	Pushbutton w/R&G Ltgs.	N/A	N/A	N/A
MDH-FHS-2	Hand Switch	Controls MDH-V2 (was tagged MDL-FHS-3189)	PNL. 15	Pushbutton w/R&G Ltgs.	N/A	N/A	N/A
MDH-PI-1A	Press. Indication	MDH-HX-1A Inlet Pressure	Local Rack	Press. Gauge	0-200 psig	0-200 psig	N/A
MDH-PI-1B	Press. Indication	MDH-HX-1B Inlet Pressure	Local Rack	Press. Gauge	0-200 psig	0-200 psig	N/A
MDH-TE-1A	Temperature Element	MDH-HX-1A Inlet Temperature	Piping	RTD	0-200°F	92.93-136.49 ohms	N/A
MDH-TI-1A-1	Temperature Indicator	MDH-HX-1A Inlet Temperature	PNL. 1	Process Monitor	92.93-136.49 ohms	0-200°F	175°F
MDH-TI-1A-2	Temperature Indicator	MDH-HX-1A Inlet Temperature	PNL. 2	Process Monitor	92.93-136.49 ohms	0-200°F	175°F
MDH-TE-2A	Temperature Element	MDH-HX-1A Outlet Temperature	Piping	RTD	0-200°F	92.93-136.49 ohms	N/A
MDH-TIAH-2A-1	Temperature Indicator/Alarm	MDH-HX-1A Outlet Temperature	PNL. 1	Process Monitor	92.93-136.49 ohms	0-200°F	170°F
MDH-TIAH-2A-2	Temperature Indicator/Alarm	MDH-HX-1A Outlet Temperature	PNL. 2	Process Monitor	92.93-136.49 ohms	0-200°F	170°F
MDH-TE-1B	Temperature Element	MDH-HX-1B Inlet Temperature	Piping	RTD	0-200°F	92.93-136.49 ohms	N/A

TABLE 6

Instrumentation Controls and Alarms

Identification	Description	Function	Location	Type	Input Range	Output Range	Setpoint
MDH-TI-1B-1	Temperature Indication	MDH-HX-1B Inlet Temperature	PNL. 1	Process Monitor	92.93-136.49 ohms	0-200°F	175°F
MDH-TI-1B-2	Temperature Indication	MDH-HX-1B Inlet Temperature	PNL. 2	Process Monitor	92.93-136.49 ohms	0-200°F	175°F
MDH-TE-2B	Temperature Element	MDH-HX-1B Outlet Temperature	Piping	RTD	0-200°F	92.93-136.49 ohms	N/A
MDH-TIAH-2B-1	Temperature Indicator/Alarm	MDH-HX-1B Outlet Temperature	PNL. 1	Process Monitor	92.93-136.49 ohms	0-200°F	170°F
MDH-TIAH-2B-2	Temperature Indicator/Alarm	MDH-HX-1B Outlet Temperature	PNL. 2	Process Monitor	92.93-136.49 ohms	0-200°F	170°F
MDH-PI-2A-1	Press. Ind.	MDH-P-1A Suction Pressure	Local Rack	Bourdan Tube	0-200 psig	0-200 psig	N/A
MDH-PT-2A	Press. Transmitter	MDH-P-1A Suction Pressure	Local Rack	Bailey KS67221	0-200 psig	4-20 MADC	N/A
MDH-PI-2A-2	Pressure Indication	MDH-P-1A Suction Pressure	PNL. 1	Process Monitor	4-20 MADC	0-200 psig	Low 16 psig
MDH-PI-2A-3	Pressure Indication	MDH-P-1A Suction Pressure	PNL. 2	Process Monitor	4-20 MADC	0-200 psig	Low 16 psig
MDH-PI-3A-1	Pressure Indication	MDH-P-1A Discharge Pressure	Local Rack	Bourdon Tube	0-300 psig	0-300 psig	N/A
MDH-PT-3A	Press. Transmitter	MDH-P-1A Suction Pressure	Local Rack	Bailey KS67221	0-300 psig	4-20 MADC	N/A
MDH-PI-3A-2	Pressure Indication	MDH-P-1A Discharge Pressure	PNL. 1	Process Monitor	4-20 MADC	0-300 psig	Hi 220 psig

TABLE 6

Instrumentation Controls and Alarms

Identification	Description	Function	Location	Type	Input Range	Output Range	Setpoint
MDH-PI-3A-3	Pressure Indication	MDH-P-1A Discharge Pressure	PNL. 2	Process Monitor	4-20 MADC	0-300 psig	Hi 220 psig
MDH-PI-2B-1	Pressure Indication	MDH-P-1B Suction Pressure	Local Rack	Bourdon Tube	0-200 psig	0-200 psig	N/A
MDH-PT-2B	Press. Transmitter	MDH-P-1B Suction Pressure	Local Rack	Bailey KS67221	0-200 psig	4-20 MADC	N/A
MDH-PI-2B-2	Pressure Indication	MDH-P-1B Suction Pressure	PNL. 1	Process Monitor	4-20 MADC	0-200 psig	Low 16 psig
MDH-PI-2B-3	Pressure Indication	MDH-P-1B Suction Pressure	PNL. 2	Process Monitor	4-20 MADC	0-200 psig	Low 16 psig
MDH-PI-3B-1	Pressure Indication	MDH-P-1B Discharge Pressure	Local Rack	Bourdon Tube	0-300 psig	0-300 psig	N/A
MDH-PT-3B	Press. Transmitter	MDH-P-1B Discharge Pressure	Local Rack	Bailey KS67221	0-300 psig	4-20 MADC	N/A
MDH-PI-3B-2	Pressure Indicator	MDH-P-1B Discharge Pressure	PNL. 1	Process Monitor	4-20 MADC	0-300 psig	Hi 220 psig
MDH-PI-3B-3	Pressure Indicator	MDH-P-1B Discharge Pressure	PNL. 2	Process Monitor	4-20 MADC	0-300 psig	Hi 220 psig
MDH-CS-1	Hand Switch W/Ind. Lights	Controls MDH-P-1A	PNL.1	GE CR2940 US2D3E	N/A	N/A	INTLK with Pumps DH-P-1A, 1B
MDH-CS-2	Hand Switch W/Ind. Lights	Controls MDH-P-1A	PNL.2	GE CR2940 US2D3E	N/A	N/A	INTLK with Pumps DH-P-1A, 1B

TABLE 6

Instrumentation Controls and Alarms

Identification	Description	Function	Location	Type	Input Range	Output Range	Setpoint
MDH-CS-3	Hand Switch w/Ind. Lights	Controls MDH-P-1B	PNL.1	GE CR2940 US20JE	N/A	N/A	INTLK with Pumps DH-P-1A, 1B
MDH-CS-4	Hand Switch w/Ind. Lights	Controls MDH-P-1B	PNL.2	GE CR2940 US20JE	N/A	N/A	INTLK with Pumps DH-P-1A, 1B
MDH-FHS-18	Pushbutton w/R&G Lights	Controls MDH-V18 (was tagged DC-FHS-7069)	PNL. 8A	Mercury E-30	N/A	N/A	N/A
MDH-FHS-19	Pushbutton w/R&G Lights	Controls MDH-V19 (was tagged MDL-FHS-1332)	PNL. 15	Mercury E-30	N/A	N/A	N/A
MDH-FHS-21	Handswitch Keylock	Controls MDH-V21 (Demineralized Water Supply Valve)	PNL. 1	GE CR2940 UN20DD	N/A	N/A	N/A
MDH-FHS-22	Handswitch Keylock	Controls MDH-V22 (drain valve)	PNL. 1	GE CR2940 UN20DD	N/A	N/A	N/A
MDH-FHS-28	Handswitch Keylock	Controls MDH-V28 (MDH-F-1 Bypass Valve)	PNL. 1	GE CR2940 UN20DD	N/A	N/A	N/A
MDH-FHS-29	Handswitch Keylock	Controls MDH-V29 (MDH-F-1 Downstream Isolation Valve)	PNL. 1	GE CR2940 UN20DD	N/A	N/A	N/A
MDH-FHS-30	Handswitch Keylock	Controls MDH-V30 (MDH-F-1 Upstream Isolation Valve)	PNL. 1	GE CR2940 UN20DD	N/A	N/A	N/A

TABLE 6

Instrumentation Controls and Alarms

Identification	Description	Function	Location	Type	Input Range	Output Range	Setpoint
MDH-FHS-32	Handswitch Keylock	Controls MDH-V32 (MDHR System Vent Valve)	PNL. 1	GE CR2940 UN2000	N/A	N/A	N/A
MDH-FHS-34	Handswitch Keylock	Controls MDH-V34 (Demineralized Water Supply Valve)	PNL. 1	GE CR2940 UN2000	N/A	N/A	N/A
MDH-FHS-35	Handswitch Keylock	Controls MDH-V35 (MDH-F-1 Upstream Isolation Valve)	PNL. 1	GE CR2940 UN2000	N/A	N/A	N/A
MDH-FHS-36	Handswitch Keylock	Controls MDH-V36 (MDH-F-1 Downstream Isolation Valve)	PNL. 1	GE CR2940 UN2000	N/A	N/A	N/A
MDH-DPIS-103	Differential Pressure Indicating Switch	Indicate & Alarm high differential pressure across MDH-F-1A and MDH-F-2A filters	F.H. Bldg. El. 280'6" A66 ✦ 13' AH ✦ 4'	Magnehelic gage (300KSR)	--	0-6" H_2O	3.3" W.G
MDH-DPAH-103	Differential Pressure Alarm High (Amber Lt.)	Annunicate high D/P across MDH-F-1A and MDH-F-2A filters	PNL. 1	G.E. CR2940	N/A	N/A	3.3" W.G
MDH-DPIS-104	Differential Pressure Indicating Switch	Indicate & Alarm high differential pressure across MDH-F-1B and MDH-F-2B filters	F.H. Bldg. El. 280'6" A66 ✦ 17' AH ✦ 19'	Magnehelic gage (300KSR)	--	0-6" H_2O	3.3" W.G
MDH-DPAH-104	Differential Pressure Alarm High (Amber Lt.)	Annunicate high D/P across MDH-F-1B and MDH-F-2B filters	PNL. 1	G.E. CR2940	N/A	N/A	3.3" W.G

TABLE 6

Instrumentation Controls and Alarms

Identification	Description	Function	Location	Type	Input Range	Output Range	Setpoint
MOH-FHS-105	Handswitch Keylock	Provide control of MOH-E-1A and supply/ discharge dampers (MOH-MV-101/110)	PNL. 1	G.E. US 203E	N/A	N/A	--
MOH-FHS-106	Handswitch Keylock	Provide control of MOH-E-1B and supply/ discharge dampers (MOH-MV-102/111)	PNL. 1	G.E. CR2940 US 203E	N/A	N/A	N/A
MOH-FE-107	Annubar Flow Element	Measure discharge flow from MOH-E-1A and MOH-E-1B	Ducting	--	--	--	N/A
MOH-FISL-107	Flow Indicating Switch (Low)	Indicating discharge flow from MOH-E-1A and MOH-E-1B and alarm low flow	Ducting A66 + 11' AK + 2'	Magnahelic gage (3001SR)	--	0-1" H_2O	1760 SCFM
MOH-FAL-107	Flow Alarm Low (Amber Lt.)	Annunicate low discharge flow from MOH-E-1A or MOH-E-1B	PNL. 1	G.E. CR2940	N/A	N/A	1760 SCFM
MOH-UA-107	Annunicator	Alarm low discharge flow from MOH-E-1A or 1B and high DP across filter trains "HVAC TROUBLE"	PNL. 2	G.E. C2940	N/A	N/A	1760 SCFM Manual 3.3" W.G.
MOH-RAH-108	Annunicator	Alarms high airborne radiation from MOHR Pump Cubical Filtration System	Adjacent to PNL. 1	--	N/A	N/A	Later
MOH-UA-108	Annunicator	Alarms high airborne radiation from MOHR Pump Cubical Filtration System	PNL. 2	--	N/A	N/A	Later

TABLE 6

Instrumentation Controls and Alarms

Identification	Description	Function	Location	Type	Input Range	Output Range	Setpoint
MDH-RMI-108P	Radiation Monitor with Indicator/ Alarm	Indicate particulate airborne radiation from MDHR Pump Cubicle Filtration System + Alarms: Hi-Red, Alert-Amber, Fail-Green	F.H. 280' el. Local	Victoreen 842-11	--	$10-10^6$ cpm	
MDH-RMI-108I	Radiation Monitor with Indicator/ Alarm	Indicate iodine airborne radiation from MDHR Pump Cubicle Filtration System + Alarms: Hi-Red, Alert-Amber, Fail-Green	F.H. 280' el. Local	Victoreen 842-31	--	$10-10^6$ cpm	
MDH-RMI-108G	Radiation Monitor with Indicator/ Alarm	Indicate Noble gas airborne radiation from MDHR Pump Cubicle Filtration System Alarms: Hi-Red, Alert-Amber, Fail-Green	F.H. 280' el. Local	Victoreen 842-11	--	$10-10^6$ cpm	
MDH-RIA-108P-1	Radiation Indicator/ Alarm	Indicate particulate airborne radiation from MDHR Pump Cubical Filtration System + Alarms for High-Red, Alert-Amber, and Fail-Green	Adj Pnl. 1 A66 + 4' AP + 0'	Victoreen 844-18			
MDH-RIA-108I-1	Radiation Indicator/ Alarm	Indicate iodine airborne radiation from MDHR Pump Cubical Filtration System + Alarms for High-Red, Alert-Amber, and Fail-Green	Adj Pnl. 1 A66 + 4' AP + 0'	Victoreen 844-18			
MDH-RIA-108G-1	Radiation Indicator/ Alarm	Indicate Noble gas airborne radiation from MDHR Pump Cubical Filtration System + Alarms for High-Red, Alert-Amber, and Fail-Green	Adj Pnl. 1 A66 + 4' AP + 0'	Victoreen 844-18			
MDH-RIA-108P-2	Radiation Rateneter/ Alarm	Indicate particulate airborne radiation from MDHR Pump Cubical Filtration System + Alarms for High-Red, Alert-Amber, and Fail-Green	Pnl. 2	Victoreen 908428		$10-10^6$ cpm	

TABLE 6

Instrumentation Controls and Alarms

Identification	Description	Function	Location	Type	Input Range	Output Range	Setpoint
MOH-RIA-1081-2	Radiation Ratemeter/ Alarm	Indicate iodine airborne radiation from MOHA Pump Cubical Filtration System + Alarms for High-Red, Alert-Amber, and Fail-Green	Pnl. 2	Victoreen 908428		$10-10^6$ cpm	
MOH-RIA-1085-2	Radiation Ratemeter/ Alarm	Indicate noble gas airborne radiation from MOHA Pump Cubical Filtration System + Alarms for High-Red, Alert-Amber, and Fail-Green	Pnl. 2	Victoreen 908428		$10-10^6$ cpm	
MOH-VE-1A	Accelerometer Sensor	MOH-P-1A bearing housing vertical radial vibration	MOH-P-1A brg. housing	Vibra-Metrics #6022	0 - 25 g	0 - 2500 mv	N/A
MOH-VE-2A	Accelerometer Sensor	MOH-P-1A bearing housing horizontal radial vibration	MOH-P-1A brg. housing	Vibra-Metrics #6022	0 - 25 g	0 - 2500 mv	N/A
MOH-VE-1B	Accelerometer Sensor	MOH-P-1B bearing housing vertical radial vibration	MOH-P-1B brg. housing	Vibra-Metrics #6022	0 - 25 g	0 - 2500 mv	N/A
MOH-VE-2B	Accelerometer Sensor	MOH-P-1B bearing housing horizontal radial vibration	MOH-P-1B brg. housing	Vibra-Metrics #6022	0 - 25 g	0 - 2500 mv	N/A
MOH-VIAM-1	Annunciator Lights & Velocity Indication	A) CHANNEL 1 - MOH-P-1A bearing vertical radial vibration "ALERT" LIGHT (Low Alarm-White Lt.)	Adjacent to PNL.1 A66 + 3' AM + 6'	Vibralarm Model No. VA 102-2	N/A	N/A	2-3 times above initial level
		CHANNEL 1 - MOH-P-1A bearing housing vertical radial vibration "SHUTDOWN" LIGHT (High Alarm-Red Lt.)	Adjacent to PNL.1 A66 + 3' AM + 6'	Vibralarm Model No. VA 102-2	N/A	N/A	4-5 times above initial level

TABLE 6

Instrumentation Controls and Alarms

Identification	Description	Function	Location	Type	Input Range	Output Range	Setpoint
MDH-VIAH-1	Annunciator Lights & Velocity Indication	B) CHANNEL 2 - MDH-P-1A bearing horizontal radial vibration "ALERT" LIGHT (Low Alarm-White Lt.)	Adjacent to PNL.1 A66 + 3' AH + 6'	Vibralarm Model No. VA 102-2	N/A	N/A	2-3 times above initial level
		CHANNEL 2 - MDH-P-1A bearing housing horizontal radial vibration "SHUTDOWN" LIGHT (High Alarm-Red Lt.)	Adjacent to PNL.1 A66 + 3' AH + 6'	Vibralarm Model No. VA 102-2	N/A	N/A	4-5 times above initial level
		C) System Malfunction Light (amber)	Adjacent to PNL.1 A66 + 3' AH + 6'	Vibralarm Model No. VA 102-2	N/A	N/A	N/A
		D) CHANNEL 1 & 2 Velocity meter	Adjacent to PNL.1 A66 + 3' AH + 6'	Vibralarm Model No. VA 102-2	0 - 2500 mv	0.0.7 in/sec	N/A
MDH-VIAH-2	Annunciator Lights & Velocity Indication	A) CHANNEL 1 - MDH-P-1B bearing housing vertical radial vibration "ALERT" LIGHT (Low Alarm-White Lt.)	Adjacent to PNL.1 A66 + 3' AH + 8'	Vibralarm Model No. VA 102-2	N/A	N/A	2-3 times above initial level
		CHANNEL 1 - MDH-P-1B bearing housing vertical radial vibration "SHUTDOWN" LIGHT (High Alarm-Red Lt.)	Adjacent to PNL.1 A66 + 3' AH + 8'	Vibralarm Model No. VA 102-2	N/A	N/A	4-5 times above initial level
		B) CHANNEL 2 - MDH-P-1B bearing housing horizontal radial vibration "ALERT" LIGHT (Low Alarm-White Lt.)	Adjacent to PNL.1 A66 + 3' AH + 8'	Vibralarm Model No. VA 102-2	N/A	N/A	2-3 times above initial level

TABLE 6

Instrumentation Controls and Alarms

Identification	Description	Function	Location	Type	Input Range	Output Range	Setpoint
MDH-VIAH-2	Annunciator Lights & Velocity Indication	CHANNEL 2 - MDH-P-1B bearing housing horizontal axial vibration "SHUTDOWN" LIGHT (High Alarm-Red Lt.)	Adjacent to Pnl..1 A66 + 3' AH + 8'	Vibralarm Model No. VA 102-2	N/A	N/A	4-5 times above initial level
		C) System Malfunction Light (amber)	Adjacent to Pnl..1 A66 + 3' AH + 8'	Vibralarm Model No. VA 102-2	N/A	N/A	N/A
		D) CHANNEL 1 & 2 Velocity meter	Adjacent to Pnl..1 A66 + 3' AH + 8'	Vibralarm Model No. VA 102-2	0 - 2500 mv	0.0.7 in/sec	N/A
MDH-VAH-1	Annunicator Light	High Vibration of MDH-P-1A or 1B bearing housing or system malfunction	Pnl. 2		N/A	N/A	See MDH-VIAH-1 & 2
MDH-DPT-37	D/P Transmitter	Measure Differential Pressure across MDH-F-1	Piping A66' + 12' AF + 8'	Foxboro N-E11DM-HA82	0-120 psid	10-50 ma	N/A
MDH-DPS-37	D/P Pressure Switch	High D/P Alarm Signal across MDH-F-1 to MDH-DPAH-37	Pnl. 1	Foxboro 63J-BT-DHBR	10-50 ma	N/A	____ma
MDH-DPAH-37-1 & 2	Annunicator Light/Horn	Alarm High D/P across MDH-F-1 (Amber Lt.)	Pnl. 1 & Pnl. 2	G. E. Type CR2940	N/A	N/A	65 psid above initial filter clean d/
MDH-DPI-37	D/P Indicator	Indicate Differential Pressure Across MDH-F-1	Pnl. 1	Westinghouse VX252	10-50 ma	0-120 psid	N/A

TABLE 6

Instrumentation Controls and Alarms

Identification	Description	Function	Location	Type	Input Range	Output Range	Setpoint
MDH-FI-6	Flowmeter	Indicate Demineralized water flow to MDH-P-1A seal block	Piping	Matheson FM-1100	0.3-3.0 gpm	0.3-3.0 gpm	1 to 1.5 gpm
MDH-FI-7	Flowmeter	Indicate Demineralized water flow to MDH-P-1B seal block	Piping	Matheson FM-1100	0.3-3.0 gpm	0.3-3.0 gpm	1 to 1.5 gpm
MDH-TVC-1	T.V. Camera	Monitor MDH-P-1A & 1B pump cubicles	F.H. Bldg. El. 280'-6 A66 + 18' AF + 3'	Diamond Elec. ST-11 Camera PT-1050-L Pan/ Tilt 30-150, MM Zoom Lens	N/A	N/A	N/A
MDH-TVC-2	T.V. Camera	Monitor MDH-HX-1A & 1B heat exchange room	F.H. Bldg. El. 280'-6 A67 + AF	Diamond Elec. ST-11 Camera PT-1050-L Pan/ Tilt 30-150, MM Zoom Lens	N/A	N/A	N/A
MDH-RACK-TV1	T.V. Monitor & Controls	Monitor for MDH-TVC-1 and controls for Pan-Tilt mechanism with zoom/ focus controls	Cont. Bldg El. 305'-0" CA7 + 0' CC + 9'	Con-Rack 14" B & W Receivers and Control Modules	N/A	N/A	N/A

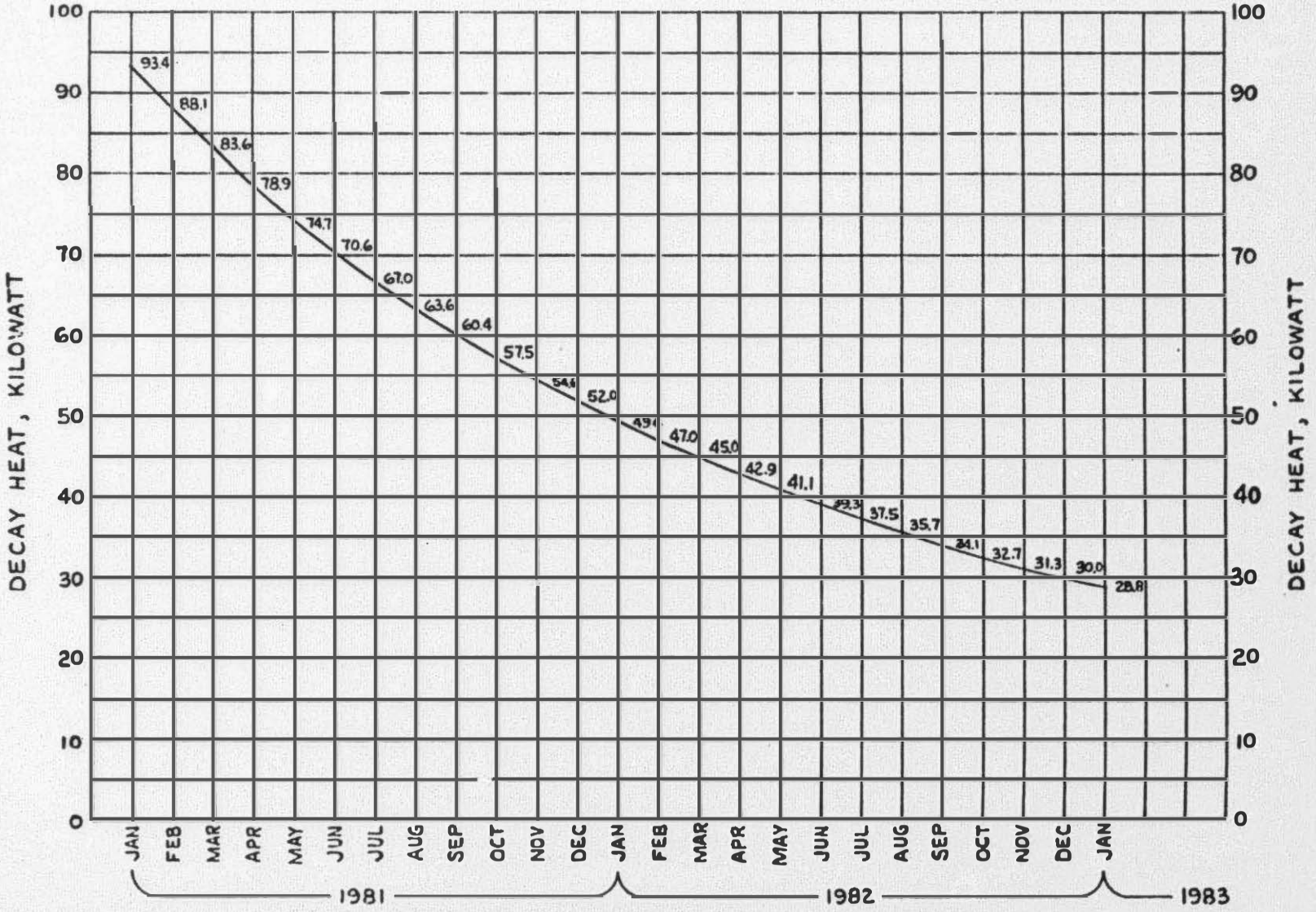
TABLE 6

Instrumentation Controls and Alarms

Identification	Description	Function	Location	Type	Input Range	Output Range	Setpoint
MDH-RACK-TV2	T.V. Monitor & Controls	Monitor for MDH-TVC-2 and controls for Pan-Tilt mechanism with zoom/ focus controls	Cont. Bldg El.305'-0" C47 + 0' CC + 9'	Con-Rack 14" B & W Receivers and Control Modules	N/A	N/A	N/A

FIGURE 1

TMI-2 EXPECTED DECAY HEAT LOAD vs TIME



TYPICAL MDHR PUMP CHARASTERISTIC CURVE (MDH -1A & MDH-P-1B)
FIGURE #2