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July 12, 1986

TMI-2 Cleanup Project Directorate
Attn: Dr. W. D. Travers
Director
US Nuclear Regulatory Commission
c/o Three Mile Island Nuclear Station
Middletown, PA 17057

Dear Dr. Travers:

Three Mile Island Nuclear Station, Unit 2 (TMI-2)
Operating License No. DPR-73
Docket No. 50-320
Annual Update of the System Description for the
TMI-2 Defueling Canisters Dewatering System

Pursuant to NRC letter dated February 4, 1982, the annual update to the System Description for the TMI-2 Defueling Canister Dewatering System is forwarded for your information. This update, which incorporates revisions 3 and 4, includes the following changes:

- o The pressurization sequence for dewatering a filter canister has been revised to include methods other than flow through the sightglass for increasing argon gas pressure in a controlled manner.
- o The maximum dewatering pressure has been increased from 10 psi to 20 psi. This increase is within the 25 psi setpoint for the defueling canisters.
- o A description of the flow indicator on the sample return line has been added.
- o The dewatering end point criteria has been revised to reflect that canister dewatering is verified by observation of a steady flow of argon gas through flow indicators FI-3A/B in addition to the presence of gas bubbles in the sightglass.

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- Section 5.0, "Maintenance," has been revised to indicate that the section will not be expanded to include detailed information on system maintenance. Maintenance of the system is performed in accordance with approved procedures and vendor manuals.

The above changes reflect modifications to the system, resulting from start-up and test operations, that are designed to increase the operational efficiency of the system.

Sincerely,

F. R. Standerfer
Vice President/Director, TMI-2

FRS/RDW/eml

Attachment

GPU Nuclear

S D 15737-2-M72-DS01 REV. 4

ISSUE DATE January 8, 1985

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TMI-2

DIVISION

SYSTEM DESCRIPTION

FOR

Dewatering System

for Defueling Canisters

(ECA-3255-84-0087)

COG ENG C. L. Rid DATE 1/8/85

RTR R L Mays DATE 1/7/85

COG ENG MGR. C. L. Rid for R. L. Rida DATE 1/8/85

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Rev.	SUMMARY OF CHANGE
1	Added section 3.7.3 (pg. 3); Added ref. 23-30, changed ref. 7, clarified ref. 2, 5 and 22 (Sect. 1.2); Added V016A/B and bypass spool piece para., updated relief valve para., and venting to SDS offgas, changed "flapper" to "paddle" in reference to sightglass (Sect. 1.3.1); Deleted breather vent filter, updated pump and crane info. (Sect. 1.3.2); Changed pressures (Sect. 1.4); Added sentence on location of controls (Sect 1.5 and 1.6.1); Changed "reachrods" to "extension stems", added sentence on V047 (Sect. 1.5 and 1.6.2); Changed HS-9A/B to HIS-9A/B (Sect. 1.6.1 and 3.3.5); Added "after dewatering and also prior to shipping" (Sect. 1.6.4); Clarified venting in item 1 (Section 1.7); Changed cover gas pressure (Sect. 2.1 and 3.3.3); Added sentence for R-3 and "above the bottom of the tank" (Sect. 2.2); Added "to the holdup tank (T-1), which in turn is vented" (Sect. 2.3); Added para. on dewatering last canister, changed initial pressure (Sect. 3.3.2.1); Changed initial pressure (Sect. 3.3.2.2); Changed V004A/B to V016A/B (Sect. 3.3.6); Deleted valve V026 (Sect. 3.4); Added sentence for transfer and drain lines (3.5); Changed "flapper" to "paddle" (Sect. 3.7.1); Changed "15" to "13" and "SDS offgas system" to "holdup tank" (Sect. 3.7.2); Added section 3.7.3; Deleted item 6 (Sect. 4.1, 4.2, and 4.3); Changed "color coded" to "different sizes" and "approximately four" to "several", deleted sentence on location (Sect. 7.0).
2	Added "V002A and V002B", sentence on filter pressure drop, jib crane information, information on tank effluent concentration and dilution, "V041", the design pressure and temperature, deleted information on argon manifold meeting CGA standards, changed "recirculation" to "backflush" (Sect. 1.3.1); Added "Division I, Part UW (lethal) (1983)" (Sect 1.3.2); Added "V002A and V002B," "V041," and "V017" (Sect. 1.6.1); Deleted phrase about V047 having a standard handle (Sect. 1.5 and 1.6.2); Added "V017", changed "inside to "at" (Sect. 1.6.4); Added fifth system interface (Sect. 1.7); Added "V002A and V002B" (Sect. 3.3.2.1, 3.3.2.2, and 3.3.6); Added filter canister differential pressure limitation and minimum weight loss (Sect. 2.1); Added effluent concentration information (Sect. 3.3.5); Revised the second sentence (Sect. 3.5); Changed leak criteria (Sect. 3.3.6); Deleted sentence on opening V025 to backflush, added sentence on how backflush line is filled (Sect. 3.7.1); Revised rewetting method (Sect. 3.7.3); Changed "six" to "five", moved "and" (Sect. 4.1).
3	Added information about flow indicator on sampling return line (Sect. 1.3.1 and 1.6.4); Revised Section 5.0 to delete forthcoming information.
4	Revised pressurization sequence for dewatering a filter canister, increased maximum dewatering pressure, revised dewatering end point criteria.

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1.0 Design Description

1.1 Summary

The Dewatering System is a recovery system which removes and filters the water from submerged defueling canisters and provides a transfer path to the Defueling Water Cleanup (DWC) system for processing. The Dewatering System also provides the cover gas for canister shipping.

The water is removed from the defueling canisters to 1) reduce the weight of the canisters for shipping, and 2) prevent the hydrogen/oxygen catalysts from being submerged. The cover gas of argon is provided to 1) reduce water intrusion when the canister is in the water, 2) reduce air intrusion when the canister is out of the water, and 3) reduce the pyrophoricity potential of the debris within the canister.

1.2 References

1. Bechtel Drawing 15737-2-M74-DS01, Piping and Instrument Diagram-Dewatering System
2. Bechtel Drawing 15737-2-P60-DS01, Piping Isometric-Dewatering System, Fuel Handling Bldg. Fl. El. 347'-6"
3. Bechtel Drawing 15737-2-POA-6401, General Arrangement-Fuel Handling Building Plan El. 347'-6"
4. Safety Evaluation Report for Defueling the TMI-2 Reactor Vessel, Doc. No. 15737-2-G07-107
5. Bechtel Drawing 15737-2-COP-6201, Dewatering System Platform
6. Bechtel Drawing 15737-2-C64-DS01, Pipe Supports for Isometric 15737-2-P60-DS01
7. DCN No. 2R-950-21-001-5-5, P&ID Composite-Submerged Demineralizer System
8. Instrument Index, Doc. No. 15737-2-J16-001
9. Design Engineering Valve List, Doc. No. 15737-2-P16-001
10. Mechanical Equipment List, Doc. No. 15737-2-M16-001
11. Standard for Piping Line Specifications, Doc. No. 15737-2-P-001
12. Piping Line Index, Doc. No. 15737-2-P-002
13. Intermediate Evaluation of Special Safety Issues Associated with Handling the TMI-2 Core Debris, prepared by Rockwell Hanford Operations, Document No. SD-WM-TA-005.

14. Bechtel Drawing 15737-2-J78-DS01, Level Setting Diagram

15. Bechtel Drawing 15737-2-J74-DS01, Instrument Installation Detail

16. Bechtel Drawing 15737-2-J74-DS02, Instrument Installation Detail

17. Bechtel Drawing 15737-2-E76-DS01, Pump Schematic Diagram

18. Bechtel Drawing 15737-2-J77-DS01, Pump Logic Diagram

19. Bechtel Drawing 15737-2-E0R-6401, Fuel Handling Building EL. 347'-6" Electrical Physical Drawing

20. Bechtel Drawing 15737-2-E21-010, Single Line Diagram

21. ECA-3221-84-0111 Standby RC Pressure Control (SPC) Surge Tank Removal

22. ECA-3255-84-0087 Dewatering System Design

23. Bechtel Drawing 15737-2-P60-DS02, Piping Isometric - Dewatering System, Dewatering Canister Inlet and Outlet Piping

24. Bechtel Drawing 15737-2-P60-DS03, Piping Isometric - Dewatering System, Offgas & Sample Piping

25. Bechtel Drawing 15737-2-P60-DS04, Piping Isometric - Dewatering System, Tank DS-T-1 Connections and Miscellaneous Details

26. Bechtel Drawing 15737-2-P60-DS05, Piping Isometric - Dewatering System, Argon Supply Piping, Fuel Handling Bldg. Pool "A"

27. Bechtel Drawing 15737-2-C64-DS02, Pipe Supports for Isometric 15737-2-P60-DS02.

28. Bechtel Drawing 15737-2-C64-DS03, Pipe Supports for Isometric 15737-2-P60-DS03.

29. Bechtel Drawing 15737-2-C64-DS04, Pipe Supports for Isometric 15737-2-P60-DS04.

30. Bechtel Drawing 15737-2-C64-DS05, Pipe Supports for Isometric 15737-2-P60-DS05.

1.3 Detailed System Description

1.3.1 Description

The Dewatering System (DS) is designed to remove and filter water from the three types of defueling canisters - fuel, knockout, and filter canisters. The water removed from the canisters is transferred to the DWC system for processing through the DWC ion exchanger K-2. The DS also provides the argon cover gas for canister shipping. The DS is shown schematically in Reference 1.

Removal of the water in the defueling canisters will reduce the weight of the canisters to meet shipping requirements. At least half of the hydrogen/oxygen catalysts in the canisters will not be submerged; this will ensure that the catalysts remain effective. Argon cover gas, at approximately 2 atmospheres absolute, prevents air or water intrusion. When a canister is submerged, water intrusion may raise the water level in the canister above the catalysts, making them inoperable. When the canister is out of the water, air intrusion increases the pyrophoricity potential of the defueling debris within the canister. For more information on catalysts, pyrophoricity and the use of argon within the defueling canisters, refer to Reference 13.

High pressure argon from cylinders is supplied through a manifold which regulates the pressure to approximately 45 psig. The argon supply line then branches to provide a source of gas for two dewatering and gas covering trains. A pressure regulator for each train V002A and V002B, (PCV-1A and PCV-1B) is supplied so that dewatering one canister while covering a second canister may be accomplished simultaneously and independently. An ASME Section VIII Code relief valve (R-3) prevents the argon supply lines and the defueling canisters from being pressurized above 110 psig. The canisters are ASME Section VIII Code vessels and, therefore, must be protected against overpressurization as stated in part UG-125 of the Code. R-3 is provided to meet this requirement. R-1A and R-1B, located downstream of V002A and V002B (PCV-1A and PCV-1B), are set to relieve at 55 psig. This set pressure prevents the possibility of a 60 psi pressure drop across the filter media in a filter canister which could damage the media.

Valves (V004A and V004B) shut off the argon flow to the canisters. The pressure indicators (PI-2A and PI-2B) are located upstream of these valves so that the pressure may be adjusted to the correct setting before allowing argon to flow into the canisters.

A flow indicator for each train (FI-3A and FI-3B) indicates when gas flow into the canisters has stopped; this signals the need to increase the pressure to continue dewatering or that the effluent path is blocked.

Pressure indicators (PI-12A and PI-12B) are only used to measure the cover gas pressure in the defueling canisters immediately following dewatering and just prior to canister shipping. V016A and V016B are immediately upstream of the indicator takeoffs. V016A or V016B is closed when the canister pressure is checked prior to shipping. This way the argon supply line through the control manifold to V016A or V016B is not pressurized by the canister and effects on canister pressure should be minimized.

Hoses with Hansen quick disconnect couplings connect the argon supply lines and effluent paths to the defueling canisters with the aid of remote handling tools (furnished under the canister task). A jib crane is mounted on the DS platform to handle DS tools and assist in maintenance and repair activities. The jib crane meets ANSI B30.11-1980 and TMI-2 Lifting and Handling Program requirements. Sight flow indicators with internal paddles (FG-5A and FG-5B) are located in the effluent lines. Gas bubbles in a sight flow indicator indicate that the canister is dewatered to the extent possible. If the internal paddle is motionless, it is an indication that either the canister drain is clogged or that the canister is at an equilibrium state. The argon gas that enters the effluent lines is vented to the DS holdup tank (DS-T-1) via automatic vent valves (V011A and V011B).

The effluent water is filtered through a filter canister (F-1), which has a 0.5 micron nominal rating, and stored in the hold up tank (T-1). When the system is in the recirculation mode (see Section 3.3.5), the differential pressure across the filter, F-1, for all practical purposes can be read from pressure indicator, PI-4, since the hold up tank, T-1, is under a slight negative pressure (i.e. <12 inches water). When the pressure drop across the filter canister, F-1 reaches 45 psi, the filter canister is fully loaded and must be replaced. The tank is vented to the SDS offgas filter and has an overfill line to the spent fuel pool which prevents water from entering the SDS offgas vent piping. A submerged inlet, with isolation valves V018 and V059, has been provided on the tank to allow the addition of borated pool water into the tank. Borated pool water may be needed in the tank for the backflushing operation if the amount of water in the tank from dewatering is not sufficient, and for diluting the effluent in the tank. A bubbler indicates the water level in the tank.

The pumps (P-1A and P-1B) are submersible horizontal centrifugal pumps. Because the pumps are located underwater where maintenance and repair are impractical, two 100% capacity pumps are provided. The pumps are manually controlled by HIS-9A and HIS-9B with an interlock that trips the pumps on low level in the tank, T-1. The pumps transfer the water in the hold up tank to the DWC system for processing. The flow is directed to the DWC ion exchanger K-2.

The transfer pumps have a recirculation line back to the filter, F-1, with a sample line that runs to DWC Sample Box No. 1. This provides the ability to further filter the effluent, and the opportunity to sample the effluent before transferring it to the DWC ion exchanger. The concentration of the effluent from the tank should be below 0.84 $\mu Ci/cm^3$ Cs-137 prior to transferring the effluent to the DWC ion exchanger. Flow indicator, FI-16, on the return line from the sample box provides confirmation of flow in the sample line and indicates the rate of flow.

The backflush line provides the ability to reverse the flow of water back into a defueling canister to clear a drain screen that has become clogged (i.e., to backflush). The backflush line is filled from valves V005A and V005B to valve V043 by opening valve V022. Valve V022 is then closed and the line is pressurized with argon by opening the supply line with valve V043 which simultaneously closes the vent line. The argon pressure is controlled by pressure regulator V041 (PCV-10) and measured by pressure indicator PI-14. The three-way plug valve, V005A or V005B, is positioned so that the appropriate canister is backflushed. The volume of backflush water is limited to the amount of water in the pipe from valve V043 to valves V005A and V005B, which is less than 5 gallons. The operating pressure for backflushing is controlled by the operator and maintained below 10 psig. The relief valve, R-2, is set at 10 psig. The filter media in a filter canister can be damaged if the differential pressure during reverse flow exceeds 10 psi. A backflush pressure of less than 10 psi ensures that the ΔP cannot exceed 10 psid.

The argon supply lines into the canisters have a branch which provides a flow path for gas and water which exits the canister during backflushing. This flow path is opened with the three-way plug valve, V006A or V006B, which also isolates the argon supply line. An automatic vent valve, V008, vents gas from backflushing to the holdup tank, T-1. Water from backflushing is routed back to the filter, F-1, and into the hold up tank, T-1, for transfer to the DWC system.

Above each canister in the dewatering system canister racks is an array of four ion chambers mounted 90° apart. This array is mounted between the top of the canister and the surface of the water. After the canister is dewatered, it is raised through the array and the ion chambers provide readings to a data logger for the gamma field detected along the entire length of the canister. These readings will be used to provide a curie estimate for each canister.

A connection consisting of an isolation valve and a Hansen quick disconnect coupling is provided on each effluent line and the vent line to the SDS offgas system. These connections are provided so that the system can be flushed to reduce dose rates in the system. By-pass spool pieces are provided to connect canister inlet and outlet lines without using a canister. These by-pass spool pieces facilitate flushing, provide a storage location for connection tools, and enable the last defueling canister to be dewatered directly to the holdup tank. Water which meets Technical Specification requirements shall be used for flushing.

All DS piping is designed in accordance with ANSI B31.1, 1983 Power Piping.

The design pressure and temperature of the DS piping is 50 psig at 100°F.

1.3.2 Major System Components

F-1 Filter
Type: Defueling Canister with Sintered Metal Pleated Filter
Mfr/Model: B&W and Pall/----
Rating: .5 micron nominal
Code: ASME VIII, Division I, Part UW (lethal)(1983)

P-1A and P-1B Transfer Pumps
Type: Submersible Horizontal Centrifugal (Canned Motor)
Mfr/Model: Lawrence Pump & Engine Co./A1MD
Material: Stainless Steel
Rating: 60 gpm @ 100' TDH

T-1 Holdup Tank (Previously used as SPC-T-3)
Materials: Stainless Steel
Dimensions: 54.17" O.D., 166.55" High
Rating: 2735 psig, 300°F
Volume: 900 gallons
Code: ASME III, Class 2

A-1 Crane
Type: Jib
Mfr/Model: Air Technical Industries/JC-22020
Rating: 1 Ton
Code: ANSI B30.11-1980

1.4 System Performance Characteristics

The dewatering and covering operations are performed at the following argon supply pressures:

1. Cover gas pressure	12-13 psig
2. Dewatering gas pressure	
A. Filter canister	3-20 psig
B. Knockout canister	3-20 psig
C. Fuel canister	3-20 psig
3. Argon supply manifold pressure	45 psig
4. Backflush pressure	<10 psig

The transfer pumps operate at 100 feet TDH at 60 gpm

1.5 System Arrangement

The DS platform is located at the northeast end of Spent Fuel Pool "A" and the top of the platform is at elevation 331'-3" (See Reference 3). The platform is designed to support the activities required to handle two defueling canisters during dewatering and gas covering. Instrumentation and controls for the argon supply are located at a DS control area on 347'-6" in the vicinity of the northeast end of Spent Fuel Pool "A". Instrumentation and controls for pumping operations are located at the west end of the intermediate DS platform at elevation 341'-3" in the northeast end of Spent Fuel Pool "A".

The system equipment is located underwater in this area except for: 1) the argon manifold and supply lines up through valves V016A and V016B, 2) portions of the DWC tie-in, 3) the sight flow indicators (FG-5A and FG-5B), and 4) the majority of valves. The majority of valves are located above the water level but below the DS platform. All valves below the platform are manually operated by extension stems. Piping that is not underwater and contains radioactive fluid will be shielded to limit dose rates to 2.5 mrem/hr.

The platform consists of removable sections so that the valves and equipment are accessible for maintenance and repair.

1.6 Instrumentation and Controls

1.6.1 Controls

The controls for the argon supply are located on elevation 347'-6" in the vicinity of the northeast end of Spent Fuel Pool "A" at a DS control area. Instrumentation and controls for pumping operations are located at the westend of the intermediate DS platform at elevation 341'-3" in the northeast end of Spent Fuel Pool "A". All operations are manual, except for an interlock with the holdup tank level indicating switch, LIS-8, that trips the pumps, P-1A and P-1B.

The argon supply to the dewatering canisters is controlled by the on-off valves, V001A and V001B. The argon pressure to the dewatering canisters is regulated by pressure regulators V002A and V002B (PCV-1A and PCV-1B), and the flow is controlled by valves V004A and V004B. The argon pressure for backflushing is regulated by pressure regulator V041 (PCV-10). The argon supply to the backflush line is controlled by the three-way plug valve V043.

The transfer pumps are manually operated by HIS-9A and HIS-9B with an interlock that trips the pumps on low level in the tank, T-1. The air supply pressure for the holdup tank water level measuring device is regulated by the pressure regulator V017 (PICV-6), and the air flow for the bubbler is regulated by the purge rotameter, FICV-7.

1.6.2 Valves

All valves are manually operated. Valves below the DS platform are operated by extension stems from the DS platform.

1.6.3 Power

480V, 3 phase starters are located at the DWC motor control center, DWC MCC 2-32C, for the transfer pumps, P-1A and

P-1B. 120 VAC power will be available for lights and remote cameras.

1.6.4 Monitoring

The argon supply pressure and flow to the dewatering canisters are monitored by pressure indicators, PI-2A and PI-2B, and flow indicators, FI-3A and FI-3B. The canister pressure, after dewatering and also prior to shipping, is monitored by the pressure indicators PI-12A and PI-12B.

The argon pressure for backflushing is monitored by pressure indicator PI-14.

Pressure regulator V017 (PICV-6) and purge rotameter FICV-7 monitor the pressure and flow of the instrument air for the level indicator (bubbler).

Level indicating switch, LIS-8, displays the water level in the holdup tank.

Pressure indicator PI-4 measures the pressure of the recirculation line. Flow indicator FI-11 monitors the water flow to the DWC system and water flow during the recirculation mode.

Pressure indicator PI-13 measures the pressure in the sample line at the sample box, while flow indicator FI-16 monitors the flow of water in the sample line return.

The sight glasses (FG-5A and FG-5B) with the use of remote cameras provide indication of gas flow or no flow conditions in the effluent line.

All instruments are located above the water level.

1.6.5 Lights

Lights are mounted below the DS platform structure to improve visibility of the sight glasses.

1.6.6 Trips and Interlocks

The DS transfer pumps, P-1A and P-1B, are provided with low level setpoint trips for the holdup tank, T-1, to ensure that the pumps do not run dry.

The transfer pumps are also equipped with temperature switches that trip the pumps on high temperature.

1.7 System Interfaces

The DS interfaces with five systems;

1) Submerged Demineralizer System (SDS)

The DS vents excess argon gas through automatic vent valves to the holdup tank (T-1). The tank is then vented to the SDS offgas filter via a tie-in to the 6" offgas line.

2) Defueling Water Cleanup (DWC) System

The DS transfers water from the holdup tank, T-1, to the DWC system for processing. The tie-in is made upstream of the DWC ion exchanger K-2. The DWC motor control center, DWC MCC 2-32C, supplies 480V, 3 phase power for the DS transfer pumps. Instrument air is supplied from a DWC Instrument Air Manifold No. 3 outlet for tank water level indication. DWC Sample Box No. 1 is used for the DS sample connection location.

3) The Fuel Handling Building Canister Handling Bridge and Trolley

The bridge and trolley locate the defueling canisters which are to be dewatered and covered. The DS platform is designed to provide the necessary clearances to accommodate the canister transfer shield and shield collar.

4) Defueling Canisters

The DS and associated platform are designed to accommodate the defueling canisters which are designed by B&W. The DS connections will be operated by long handled tools also designed by B&W. The defueling canisters have a 14 inch nominal O.D. and 150 inch maximum length. The maximum design wet weight of the canisters is 3355 lbs. The canister shell will be straight to within 0.125 inches per 12 feet.

5) Fuel Handling Building Heating and Ventilation System

The relief valves (R-1A, R-1B, R-2, and R-3) on the argon supply lines discharge into a fuel handling building ventilation duct.

2.0 System Limitations, Setpoints and Precautions

2.1 Limitations

The argon cover gas pressure shall be limited by the operators to a maximum 20 psig for all defueling canisters. The argon pressure for backflushing shall be limited by the operator to less than 10 psig.

The transfer pump flow rate is limited to a maximum 30 gpm by DWC flow control valve DWC-V085 (FV-15) when the water is pumped to the DWC ion exchanger K-2.

The DS filter canister, F-1, is limited to a 45 psid pressure differential. When the pressure drop across F-1 approaches this differential, the filter canister is replaced.

The weight of a filter canister after dewatering must be at least 345 lbs less than before dewatering. A value less than this is an indication that a filter media bubble point break may have occurred. The filter media must be rewetted (Sect. 3.7.3) and the canister dewatered again.

2.2 Setpoints

The pressure safety valve R-3, which is between the argon bottles and the pressure regulators, is set to relieve at 110 psig. The pressure safety valves, R-1A and R-1B, on the argon supply lines to the dewatering canisters are set to relieve at 55 psig. The pressure safety valve, R-2, on the argon line for backflushing is set to relieve at 10 psig.

The level indicating switch, LIS-8, trips the pumps when the hold up tank water level drops to 24 inches above the bottom of the tank.

The temperature switches, TS-15A and TS-15B trip the pumps when the pumps reach 212°F.

2.3 Precautions

The DS operators should visually inspect the hose and fittings which are connected to the defueling canisters prior to dewatering.

Because argon is an asphyxiant, the relief valves on the supply lines discharge to the Fuel Handling Building ventilation exhaust; argon used to dewater is vented to the holdup tank (T-1), which in turn is vented to the SDS offgas system.

3.0 Operations

3.1 Initial Fill

Borated water from Spent Fuel Pool "A" is introduced into the holdup tank through valves V018 and V059. A transfer pump, P-1A or P-1B, circulates the water through all the system piping, except for the argon supply lines, and the piping is vented.

3.2 Startup

The DS has no unique startup procedures.

3.3 Normal Operations

3.3.1 Pre-Dewatering Checkout Requirements

Prior to the start of dewatering the following requirements must be completed:

1) Recording the weight of the canister,

2) Placing the canister in the support racks, using the canister handling trolley,

3) Connecting the argon supply line and effluent line to the canister, using the dewatering connection tools and DS jib crane,

4) Isolating the recirculation line and the backflush vent/drain line from the supply and effluent lines, and

5) Isolating the canister train which is not being dewatered from the train which is being dewatered.

3.3.2 Canister Dewatering

3.3.2.1 Filter Canister Dewatering

Argon is introduced into the filter canister at an initial pressure of 3 psig. The argon pressure is then increased 1 psi, using V002A/B (PCV-1A/B) and indicator PI-2A/B, whenever gas flow, indicated by FI-3A/B, reaches one-half of its previous maximum value. However, gas flow rate is not allowed to drop below 0.5 scfm. This pressurization sequence continues until gas bubbles are visible in the sight glass, FG-5A/B, at approximately 20 psig. These bubbles, along with a steady flow of argon through FI-3A/B, indicate the canister is dewatered to the extent possible.

The last defueling canister to be dewatered will be the DS filter canister, DS-F-1. This canister is moved to a dewatering location and the by-pass spool piece for DS-F-1 is connected. The same procedure as above is then used.

3.3.2.2 Knockout and Fuel Canister Dewatering

Argon is introduced into the knockout and fuel canisters at an initial pressure of 3 psig. The argon pressure is then raised, using V002A or V002B (PCV-1A or PCV-1B), until gas bubbles are visible in the sight glass FG-5A or FG-5B, at approximately 20 psig. These bubbles, along with a steady flow of argon through FI-3A/B, indicate the canister is dewatered to the extent possible. The knockout and fuel canisters do not have restrictions on the rate the pressure is increased during dewatering.

3.3.3 Canister Gas Covering

When the gas bubbles appear in the sight glass, FG-5A or FG-5B, valve V004A or V004B is closed and the drain port (effluent line) is disconnected. The canister is filled with argon, the cover gas, at a maximum 13 psig. Covering the canister with argon is complete when the flow indicator FI-3A or FI-3B reads zero. Valve V004A or V004B is then closed. The canister pressure can be recorded from pressure indicator PI-12A or PI-12B by opening valve V014A or V014B. The argon supply line is then disconnected.

3.3.4 Post Covering Checkout Requirements

The sequence for removing canisters after completing covering operations is as follows:

1) Ensure supply and effluent lines are disconnected,

2) Measure the radiation field values of the canister as the canister is removed,

3) Record the canister weight,

4) Reduce pressure in argon supply line to 1 psig by bleeding argon through valve V006A or V006B, and

5) Close valve V014A or V014B to isolate pressure indicator PI-12A or PI-12B.

3.3.5 Transfer to DWC

The water from the defueling canisters is stored temporarily in the DS holdup tank. When the tank becomes full, a transfer pump, P-1A or P-1B, is started with HIS-9A or HIS-9B and the water is recirculated through filter F-1 by opening valve V025 and closing valves V013A and V013B. This operation filters the water in a more efficient manner than occurs during the effluent's first pass. The water is sampled through the sample line by opening valves V028, V029 and the appropriate valves in the sample box. The concentration of the water from the tank should be below 0.84 $\mu Ci/cm^3$ CS-137 prior to transferring the water to DWCS. The water is transferred to the DWC ion exchanger, K-2, by opening valve V030, and closing the recirculation line by closing valve V025. The sample line is closed by closing valves V028 and V029. When the tank level drops between 24 and 36 inches, the pump is stopped with the appropriate switch, HIS-9A or HIS-9B and valves V013A and V013B are opened.

Canisters cannot be dewatered during pump operations because the effluent lines are isolated from the filter, F-1. The canisters can be covered with argon gas during pump operation.

3.3.6 Canister Pressure Check

The DS will be used to check the pressure of a defueling canister previously dewatered and covered. The defueling canister is placed in either of the two canister locations used for dewatering. Valve V016A or V016B is closed, and the appropriate argon supply line is connected. The canister pressure is read from pressure indicator PI-12A or PI-12B by opening valve V014A or V014B. The cover gas reading may vary from the value recorded when the canister was initially covered because of vaporization of water, heating of the cover gas or cooling of the cover gas. The cover gas pressure is adjusted to the original value by adjusting the pressure regulator, V002A or V002B (PCV-1A or PCV-1B), and opening valve V016A or V016B. The argon isolation valve, V016A or V016B, is then closed. The cover gas pressure is monitored by pressure indicator PI-12A or PI-12B for a minimum of ten minutes. In this time period if the pressure drops more than 0.2 psi and/or bubbles from the canister are visible from the DS platform, the canister will not be shipped. The leak will be located and repaired, and the canister will be repressurized and pressure checked again before shipping. Repair procedures for a leaking canister are not within the scope of this document.

3.4 Shutdown

The DS is shutdown by:

1) Isolating the argon gas from the supply line, and

2) Stopping the transfer pump (if operating) and closing the DWC and SDS tie-in valves, V030 and V027.

3.5 Draining

Draining of the DS is not expected during the life of the system. However, the majority of the piping between the dewatering canisters and the hold up tank can be drained to the holdup tank. Then the tank can be pumped down. The transfer line and sample lines are provided with low point drains.

3.6 Refilling

See Section 3.1, Initial Fill

3.7 Infrequent Operations

3.7.1 Backflushing

During dewatering, it may become necessary to unclog a drain screen in either a fuel or knockout canister. The following conditions would indicate the existence of this situation:

1) A sufficiently high dewatering supply pressure (e.g., 20 to 25 psig),

2) A stationary sight glass paddle,

3) No gas bubbles visible in the sight glass, and

4) No argon flow through FI-3A/B.

Backflushing is required to clear a blocked canister drain. The backflush vent/drain line is opened for the appropriate train, while the argon supply line for that train is isolated with the three-way plug valve V006A or V006B. The backflush argon supply line is isolated, while the line to vent valve V044 is opened with the three-way plug valve V043. The transfer line and the effluent lines must be isolated by closing valves V030, V013A, and V013B respectively. The backflush line is filled by one of two ways: 1) A transfer pump, P-1A or P-1B, is dead headed against V030 and V025 with V022 open to fill the line back to V044; or 2) A transfer pump, P-1A or P-1B, is started with V025 open so that the system is in the recirculation mode; then V022 is opened to fill the line back to V044. Valve V022 is then closed and the argon supply pressure is adjusted. The three-way plug valve, V043, is positioned to open the argon line and close the vent line. Transfer pump, P-1A or P-1B is stopped and valve V015 is closed. The three-way plug valve, V005A or V005B, is positioned to allow the backflush water into the appropriate canister. When backflushing is completed, valve V025 is closed, valves V015, V013A and V013B are opened, and the three-way plug valves V043, V005A, V005B, V006A, and V006B are adjusted to their normal positions as shown on Reference 1.

3.7.2 Canister Pressure Reduction

If a defueling canister is inadvertently overpressurized (i.e., P > 13 psig), the pressure may be reduced by bleeding off argon from the canister, through valve V006A or V006B, and the automatic vent valve, V008, to the holdup tank.

3.7.3 Rewetting Filter Media

If the filter media bubble point is broken, then the filter canister cannot be effectively dewatered and the media must be rewetted. This situation will be detected by weight measurement after the dewatering canister is disconnected from the DS and is being raised by the CHB (See Sect. 2.1). The canister is relocated in a DS rack and a Hansen 1/4 inch tool with a socket is used to flood the canister. A one hour period is allowed to let the water adhere to the filter media before attempting dewatering again.

4.0 Casualty Events and Recovery Procedures

4.1 Casualty Events

The following five events will shutdown the DS:

1) A loss of power will render the transfer pumps, lights, and cameras inoperable,

2) A line break disrupts the dewatering flow paths,

3) A loss of instrument air prevents the tank level indicator from working,

4) Canister handling accidents can damage the canister, tools or portions of the DS, and

5) Filter canister filter media rupture will spread fuel fines throughout the system piping.

4.2 Design Features to Mitigate Effects of Casualty Events

The DS mitigates the effects of the events listed in Section 4.1 as follows;

1) Loss of Power -

   Adverse conditions would not result, but the system should be shutdown (see Section 3.4).

2) Hose or Line Break -

   Armored hose is being used where possible to reduce the possibility of a hose rupture. This is not a radiological or safety concern because any loss of contaminated water from the DS is insignificant compared with the large volume of borated pool water.

3) Loss of Instrument Air -

   Adverse conditions would not result, but the system should be shutdown (see Section 3.4).

4) Canister Handling Accident -

   Canister handling accidents, including drops, are addressed in a separate analysis (See Reference 4).

5) Filter Canister Filter Media Rupture -

   The maximum pressure in the system is 55 psig. This is below the operating differential pressure capability of the filter.

4.3 Recovery Procedures

Recovery procedures for the casualty events listed in Section 4.1 are as follows;

1) Loss of Power - The system is shutdown (see Section 3.4), power is restored, and normal operations resume (see Section 3.3).

2) Line or Hose Break - The system is shutdown, the pipe or hose is replaced, and normal operations resume.

3) Loss of Instrument Air - The system is shutdown, the air supply is restored, and normal operations resume.

4) Canister Handling Accident - The system is shutdown, if necessary, the damage is repaired, and normal operations resume.

5) Filter Media Rupture - The filter, F-1, is replaced and the system is run in the recirculation mode (see Section 3.3.5) before normal operations resume.

5.0 Maintenance

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

6.0 Testing

6.1 Hydrostatic Testing

All piping and hose will be hydrostatically or pneumatically pressure tested to meet the requirements of ANSI B31.1 1983 Power Piping.

6.2 Instrument Testing

All instruments will be calibrated by the field and verified operational after installation.

6.3 Periodic Testing

No periodic tests are required.

7.0 Human Factors

The argon supply hose and effluent hose are different sizes for identification of inlet and outlet canister connections.

Quick disconnects are used for canister connections to facilitate hook-up operations.

All instruments, valves and equipment have name plates for identification. Controls and instruments are mounted several feet above the floor or the platform.