72-1027 TN-68 AMENDMENT 1
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CHAPTER 8

OPERATING PROCEDURES

This chapter outlines a sequence of operations to be incorporated into operating procedures for the preparation for and loading, testing, storing, unloading, and maintaining the TN-68 cask. Maintenance activities to be performed during the storage period are described in Chapter 9.

8.1 Loading the Cask

8.1.1 General Description

This section provides a general description of the cask loading operations. More detailed steps are provided in Table 8.1-1.

The empty casks will be receipt inspected. The protective cover, overpressure system, top neutron shield, and lid will be removed. The cask will be lowered into the spent fuel pool. As it is lowered, the cask will be filled with pool water or demineralized water. Fuel assemblies will be loaded into the cask using the refueling platform main hoist fuel grapple or equivalent methods (may vary depending on plant design).

After the cask is loaded with spent fuel and the lid is placed on the cask, the cask will be lifted to the pool surface, the water in the cask cavity will be drained and the lid bolts will be installed.

The cask will be set down and decontaminated. Because of its smooth surfaces the cask is designed to facilitate decontamination. The lid bolts will be torqued to their final value. The cask will be dried using a vacuum system. The cavity will be filled with helium to design pressure. and the cask lid seal will be leak tested. The top neutron shield will be installed on the lid. The overpressure monitoring system will be installed, and the interspaces between the double metallic o-rings pressurized. The external radiation levels will be measured. If the external radiation levels above the neutron shield exceed the values in Technical Specification 5.2.3, a shield ring shall be installed on the cask.

The protective cover will be installed and the cask will be transferred to its permanent storage location at the ISFSI. (The protective cover can be installed at the ISFSI.)

The cask will be transferred to the ISFSI site by a transport vehicle. The cask will be set in its storage position. The cask overpressure monitoring system will be connected and a functional check of the monitoring system will be performed.

8.1.2 Flow Sheets

The suggested sequence of operations to be performed in loading fuel into the TN-68 storage cask and placing the cask into storage at the ISFSI is outlined in Table 8.1-1. Some variations in this sequence may be expected after site specific procedures are developed by TN-68 users.

Details of the number of personnel and the time required for the various operations are given in Tables 10.3-1 and –2 as part of the radiation exposure determinations discussed in Chapter 10. The data is based on Transnuclear's experience with transport cask operations and will vary for an individual licensee. Temporary shielding, measures to facilitate surface decontamination and minimization of operation time will maintain operational doses ALARA as discussed in the flow sheets.

8.1.3 Vacuum Drying System

A vacuum drying system is utilized to remove residual moisture from the cask cavity, after the cask has been drained. This method is successfully used by Transnuclear on both its transport casks and storage casks.

After a loaded cask is removed from a pool and drained, it is placed under a vacuum. After bolting the lid, residual water is removed by the following or equivalent method:

a) Using a wand attached to the vacuum system, remove excess water from the seal areas through the passageways at the overpressure, drain and vent ports.
b) Remove the quick disconnect from the drain port, and install the drain port cover.
c) With the quick disconnect removed to improve evacuation, install a flanged vacuum connector over the vent port, purge or evacuate the helium supply lines, and evacuate the cask to 4 millibar (4×10^{-4} MPa) or less. Make provision to prevent or correct icing of the evacuation lines.
d) Isolate the vacuum pump. If, in a period of 30 minutes, the pressure does not exceed 4 millibar (4×10^{-4} MPa), the cask is adequately dried. Otherwise, repeat vacuum pumping until this criterion is met.
e) Backfill the evacuated cask cavity with helium (minimum 99.99% purity) to slightly above atmospheric pressure, remove the vacuum connector, and immediately install the quick disconnect fitting.
f) Attach the vacuum/backfill manifold to the fitting, purge or evacuate the helium supply lines, and re-evacuate the cask to below 100 mbar.
g) Isolate the vacuum pump, backfill the cask cavity to above atmospheric pressure with helium (minimum 99.99% purity), and leak test. (See Section 8.1.4).

The evacuation and backfill process is repeated if the cask cavity is exposed to the atmosphere.

8.1.4 Leak Detection

After backfill, the cask is leak tested by helium mass spectrometry by pressurizing the annular space and measuring the total leak rate of all seals, both inner and outer, including the overpressure system. This conservative leak rate must be less than 1 x 10^{-5} ref-cm^3/sec (1.0 x 10^{-5} mbar-l/sec). Leak test procedures make provision for cases where a quick disconnect fitting may prevent communication between the cask cavity and the inside of a port inner seal.

Failure to meet the leak test acceptance criterion requires evaluation of the leak location, for example by the use of the helium mass spectrometer in the "sniffer" mode, examination of sealing surfaces, replacement of the leaking seal(s), and re-performance of the leak test. Replacement of the main lid seal requires reflooding of the cask and removal of the lid, similar to the steps described under Section 8.2.

8.1.5 Major Tools and Equipment

The following tools and equipment are normally required for loading and unloading the TN-68 casks:

- A transport frame which is used to transport the empty cask from the manufacturer's facility to the utility. The transport frame is not important to safety, since it is only used in conjunction with an empty cask.
- A spreader lift beam to connect the cask to the crane hook. The lift beam is used to remove the cask from the transport frame, to move the cask into the pool, into the processing stations such as the decontamination area and eventually to a location where the cask can be lifted by the cask transporter. This lift beam is designed and fabricated in accordance with ANSI N14.6.(1) The load bearing components of the lift beam are evaluated by the user under its heavy lifting program in accordance with NUREG-0612(3).
- A vertical cask transporter. The cask transporter is set to ensure that the loads from a postulated drop accident will be bounded by the maximum analyzed loads and given in Technical Specifications 4.1.2 and 5.2.2. The cask transporter is used to move the cask from the cask loading bay to the storage pad or from the pad back to the plant. The cask transporter may be self-propelled or be pulled by a tow vehicle to the ISFSI. The cask transporter is not important to safety, since the cask is analyzed to withstand an 18 inch drop onto a concrete pad which is bounding for the transfer path. The cask transporter is designed to lift the cask by means of the top trunnions.
- A lid lifting system. This may consist of a set of slings threaded into the top of the lid or a lifting pintle. The load bearing components of the lid lifting system are evaluated by the user under its heavy lifting program in accordance with NUREG-0612.
- Helium leak detector including port connectors. The leak detector is designated as not important to safety, but will be calibrated.
- Vacuum drying system including hoses and connectors. The vacuum drying system is designated as not important to safety, but all appropriate gages will be calibrated.
- Pumps for removing water from the cask. The pumps are not important to safety.

- Calibrated torque wrenches for setting specified torque for cask bolts, screws and plugs (Not important to safety).
- Sockets and hex keys for removal and replacement of bolts, screws, coupling and connectors. These items are not important to safety.
- Helium cylinders and manifold with calibrated pressure gage for backfill of cask and overpressure system. These items are not important to safety.
- Temporary blind flange which can be used to replace the overpressure port cover for transfer of the cask to the spent fuel pool.

8.2 Unloading the Cask

This section describes the steps required to unload a TN-68 cask. Additional measures may need to be taken if damage to the cask has occurred due to accidents.

If the TN-68 cask needs to be unloaded for any reason, the sequence of operations described in Section 8.1 and listed in Table 8.1-1 will be essentially performed in reverse. The unloading steps are provided in Table 8.2-1.

The dry cask reflood process during unloading of BWR fuel has the potential to disperse crud into the fuel pool and the pool area atmosphere, thereby creating airborne exposure and personnel contamination hazards. Radiation monitoring will be required during reflooding operations. Site specific procedures will be prepared prior to first use of the cask to address these concerns.

If the overpressure system is known to be leaking and no longer above cavity pressure, the cask overpressure monitoring system is disconnected.

The cask will be moved from the ISFSI back into the spent fuel pool building using the cask transporter. The protective cover will be unbolted and removed. The overpressure system will be depressurized. The overpressure port flange, the overpressure tank and top neutron shield will be removed. The vent port cover will be removed and a cavity gas sample will be collected. The gas sample will be analyzed and any precautions necessary will be added based on the cavity gas sample results.

If degraded fuel is suspected, additional measures, appropriate for the specific conditions, are to be planned, reviewed and approved by appropriate plant personnel, and implemented to minimize exposures to workers and radiological releases to the environment. These additional measures may include provision of filters, respiratory protection and other methods to control releases and exposures ALARA.

The helium in the cavity will be depressurized to atmospheric pressure. The drain port cover will be removed. The lid lifting equipment will be attached and the lid bolts untorqued. Remove some of the lid bolts, but keep at least 6 equally spaced lid bolts installed.

Fill and drain lines are connected to the lid drain and vent ports. The quick disconnect fittings may be used or they may be removed. The cask may be filled before lowering the cask into the pool or with the cask partially submerged in the spent fuel pool.

Pool water or demineralized water will be added to fill the cask and to gradually cool the fuel in the cask. (See Figure 8.2-1). The pressure is monitored at the cask outlet, and the flow rate of the water is controlled to limit the internal pressure to below the design limit of 100 psig (114.7 psia). A flow restriction valve will be installed at the inlet to the cask to restrict cooling water

flow if the cask pressure exceeds the inlet water pressure (90 psia max.). The initial flow rate will be set at about 1.0 gallon per minute. Once the pressure falls below 50 psig and is maintained for a period of eighty minutes, the flow rate can then be gradually increased while monitoring the pressure at the outlet. If the pressure gage reading exceeds 55.3 psig (70.0 psia), close the inlet valve until the pressure falls below 50 psig (64.7 psia). Reflooding can then be resumed. (See Chapter 4 for the supporting calculation).

The water/steam mixture from the vent port discharge may contain some radioactive material. Gases shall be closely monitored to determine if there is a radiological hazard and appropriately processed. A typical set up for filling the cask is shown in Figure 8.2-1. The flow restriction valve and the monitoring of the exit pressure will ensure that the water vapor pressure generated during unloading does not exceed the cask design pressure.

When the cask is full of water, the fill and drain lines will be removed. The remaining lid bolts will be removed. The cask will then be lowered to the pool bottom where the lid would be removed making the fuel accessible for transfer.

Provided that the TN-68 cask is within its design life, the cask can be reused after unloading. Inspection procedures should verify that the cask is still in its design configuration after unloading.

The TN-68 cask is designed so that it will not need to be opened after it has been closed and leak tested until it is time to unload the fuel.

8.3 Surveillance and Maintenance

Chapters 9 and 12 discuss required surveillance and maintenance of the TN-68 cask. Most required activities are very simple and do not require additional detail here. The most complex surveillance and maintenance operation is overpressure system maintenance, which is discussed below.

The term "switches" in the following refers to switches or transducers, either of which are used to monitor the pressure in the overpressure tank.

Redundant overpressure system switches are mounted on the side of the cask, and communicate with the overpressure tank via stainless steel tubing which penetrates the weather protective cover. Each switch has an isolation valve and an access valve provided for the calibration and maintenance procedure. The access valve outside port may have a capped fitting or a quick connect fitting.

To verify the functioning of the switches, a Channel Operational Test (COT) shall be performed. A helium pressure source and the appropriate test equipment is required. A typical procedure outline is provided below.

a) Close the isolation valve.

b) Remove the cap from the access valve, and connect the test equipment while maintaining a slow helium purge.

c) Pressurize test manifold to about 75 psig from the helium cylinder, then isolate the helium source and open the access valve.

d) Open the bleed down valve, and reduce the pressure slowly (Radioactive gases are not expected. However, provisions should be made to prevent any potential releases). For transducers, verify the pressure reading on the transducers against the reference gauge at a number of points. For both switches and transducers, verify that the alarm is actuated at the correct pressure.

e) Adjust the set point or calibrate as required and repeat the above test.

f) Repeat the procedure for the second switch if in service.

g) Repressurize the manifold with helium to the original system pressure (73.5 psig), close the access valve, disconnect the test equipment, cap the access valve, and open the isolation valve.

h) If replacement of a switch is required, the switch must be leak tested after installation.

If there has been some reduction in system pressure, the entire overpressure system may also be re-pressurized to the original pressure during the channel operational test (73.5 psig) by opening the isolation valve at the beginning of step g) rather than at the end. The overpressure system may also be repressurized independently of a COT.

There is no requirement for periodic inspection or replacement of the elastomer o-ring seal on the protective cover. However, if any maintenance operation requires removal of the cover, the o-ring should be inspected at that time. If there are any signs of deterioration (hardening, cracking, permanent set) it should be replaced.

8.4 Contingency Actions

Routine surveillance activities may trigger contingency actions as identified in the Technical Specifications. Many of these actions, such as removal of storm debris, are simple and require no further detail here. This section provides guidance in the event of a low pressure alarm from the overpressure monitoring system. The margin between the set point and the confinement pressure provides ample time as provided in the Technical Specifications to assess and correct the condition.

First determine if there is a false indication. This could be due to alarm panel malfunction or a switch failure. Exceptionally cold weather may also cause a reduction in pressure and a consequent false alarm. This may be corrected by re-pressurizing the system as discussed at the end of Section 8.3.

If the alarm appears to be due to an actual leak, determine if there is a leak in the overpressure system. This may be done by checking the exterior plumbing, and then, if no leak is found, by removing the weather cover, and testing the tank and the overpressure port cover. A helium mass spectrometer system in either vacuum or sniffer mode may be used. If a leak is found, the overpressure system should be vented to atmospheric pressure to allow for repair work. Capture the helium in an evacuated cylinder to minimize the chance of radioactive effluents, and to provide a sample for testing. The overpressure system can then be repaired, reassembled, leak tested, and repressurized. A failure of the overpressure system for a period of 30 days has been evaluated as an off normal event. This should provide sufficient time to perform any repairs and testing. A temporary blind flange may be installed on the overpressure port during the repair.

If the alarm is not false, and there is no leak in the overpressure system, there may be a leak at the lid seal or the two port seals. Replacement of these seals will require returning the cask to an appropriate containment building.

After transfer, remove the weather cover, neutron shield, and the vent port. Vent the cavity to atmospheric pressure via the quick-connect coupling in the vent port. Capture a portion of the vented gas in a sample cylinder for analysis and vent the remainder to an appropriate area. Remove the drain port cover. Inspect the sealing surfaces and replace the seals and if necessary the covers. Repressurize the cask, assemble the port covers and leak test as required.

If after these steps, the cask still does not meet the leak tightness criterion, the lid gasket may be replaced. Proceed as for cask unloading, Section 8.2, up to the point of removing the lid. After the lid is removed and the fuel off-loaded, inspect the sealing surfaces, replace the seal, and reassemble the cask, proceeding in the normal sequence of loading operations.

8.5 Preparation of the Cask

The operations required for preparing the cask for transfer to the storage pad are provided in Table 8.1-1, Section C and D.

The following procedural steps shall be verified before moving the cask to the storage pad:

- The lid and penetration covers have been installed and torqued to their specified values.
- The cask has been vacuum dried and successfully dryness tested.
- The cask has been leak tested to ensure that the total leakage rate of both inner and outer seals is less than 1 x 10^{-5} ref-cm^3/sec (1.0 x 10^{-5} mbar-l/sec).
- The cask cavity has been backfilled to 2.0 atm abs (14.7 psig) with helium. The overpressure system has been backfilled to achieve an equilibrium pressure of about 6 atm abs (73.5 psig) with helium.
- The cask outside surfaces have been decontaminated. The surface contamination levels have been measured and do not exceed 20 dpm/ 100 cm^2 (alpha) or 1000 dpm/ 100 cm^2 (beta + gamma).
- The surface dose rates have been measured and do not exceed the technical specification limits provided in Chapter 12.

8.6 References

1. ANSI N14.6, "American National Standard for Radioactive Materials Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500 kg) or More," New York, 1986.

2. ANSI N14.5-1997 , "Leakage Tests on Packages for Shipment of Radioactive Materials," February 1998.

3. US Nuclear Regulatory Commission "Control of Heavy Loads at Power Plants, NUREG-0612, July, 1980.

TABLE 8.1-1
SEQUENCE OF OPERATIONS - LOADING

A. Receiving

1. Verify that records for the cask are complete and accurate and unload empty cask and seals at plant site.

2. Inspect for shipping damage. Check for shipment completeness and cleanliness.

3. Remove protective cover, overpressure system and top neutron shield.

4. Remove neutron shield pressure relief valve and install plug in neutron shield vent hole.

5. Remove lid bolts and lid.

Steps 6 through 11 may be performed in any order.

6. Replace lid seal by attaching new seal to lid by means of retaining screws. Inspect the lid sealing surface. Check for defects in the seal contact areas that may prevent a proper seal. (This step may be performed at any time prior to installing lid on loaded cask).

7. Replace seals in vent, drain and o.p. cover. Inspect the sealing surfaces. Check for defects in the seal contact areas that may prevent a proper seal. (This step may be performed at any time prior to installing covers on the loaded cask.)

8. Inspect cask for foreign material and handle, as appropriate.

9. Visually inspect the lid bolts and bolt hole threads to ensure they do not have any laps, seams, cracks or damaged threads.

10 Verify installation of a threaded plug in the vent hole of the neutron shield.

11. To minimize contaminants introduced into the spent fuel pool, with a clean hose, rinse the interior and exterior of the cask with demineralized water, if necessary.

12. Move cask to cask loading pool area.

13. At any time prior to loading, verify the basket type (B10 areal density in neutron absorber and outfitting for damaged fuel) from the cask serial number.

14. At any time prior to loading, verify that the fuel assemblies to be loaded meet the criteria of Technical Specification 2.1.1, corresponding to the basket type.

TABLE 8.1-1 (continued)
SEQUENCE OF OPERATIONS

15. Damaged fuel may only be loaded in the eight outermost compartments of a basket outfitted with damaged fuel compartment extensions. If damaged fuel is to be loaded, verify that damaged fuel bottom end caps are installed in those compartments that will be loaded with damaged fuel. This may be done at any time prior to loading the fuel.

<u>B. Cask Loading Pool</u>

1. Lower cask into cask loading pool while rinsing exterior of cask with demineralized water and fill interior with demineralized water or pool water.

2. Load preselected spent fuel assemblies into the basket compartments.

3. Verify identity of the fuel assemblies loaded into the cask. Install the top end caps on any compartments loaded with damaged fuel. Install hold down ring.

4. At least one lid penetration must be completely open (both cover and quick disconnect fitting removed) prior to installation of the lid. Lower lid and place on cask body flange over the two alignment pins.

5. Lift cask so that the top of the cask is above the water surface of pool and install some of the lid bolts. The lid bolts should be hand tight.

Note: Throughout this procedure, all bolt threads are to be coated with Nuclear Grade Neolube or equivalent.

6. Using the drain port in the lid, drain water from the cask in accordance with procedures. This may be done either before or after lifting the cask out of the pool. While lifting the cask out of the pool, the cask may be rinsed with clean deionized water to facilitate decontamination.

Note: In order to minimize internal hydrogen accumulation, the cask should be drained completely within 10 hours of the start of draining (see Section 3.4.1.4). If this period is exceeded, the cask cavity should be inerted by introduction of a continuous flow of nitrogen, argon, or helium at the open lid penetration while the draining proceeds. An initial inert gas flow rate of 0.6 m^3 per minute (21 cfm) will purge the cask cavity volume in about 10 minutes, after which the flow rate can be reduced to about 3 cfm until the draining is complete.

7. Disconnect hose(s) from the port(s).

8. Move cask to the decontamination area.

TABLE 8.1-1 (continued)
SEQUENCE OF OPERATIONS

C. Decontamination Area

Note: The maximum potential for worker exposure occurs during decontamination and for operations near the lid from the time that the water in the cask is pumped out until the time the neutron shield is in place, steps C1 through C7. Exposure can be minimized by use of temporary shielding (lead "bean bags", plastic neutron shielding), by measures to facilitate decontamination, and by minimizing time and maximizing distance. A shield ring is provided to reduce the dose rates on the side of the cask above the neutron shield.

1. Initiate decontamination of the cask until acceptable surface contamination levels are obtained.

Note: Previously installed bolts may be removed for drying of bolt holes if at least six bolts remain installed at all times.

2. Install remaining lid bolts and torque lid bolts to the value specified on Drawing 972-70-1. This should be accomplished in multiple passes in accordance with an appropriate torquing pattern. Perform a final pass to ensure proper torque. A circular pattern may be utilized to eliminate further bolt movement.

   If the drain port quick connect fitting was removed for draining, it need not be reinstalled. If the fitting is installed, the space between the fitting and the cover must be purged with helium as described in step 6 below for the vent port. Install the drain port cover and tighten the bolts to the value specified on drawing 972-70-1.

3. Remove plug from neutron shield vent and reinstall pressure relief valve.

4. Connect the Vacuum Drying System (VDS) to the vent port and establish a vacuum to evaporate residual cavity water. Limit the rate of evacuation or provide a heat source such as heat tape on the evacuation line as necessary to prevent blockage of the line by ice.

5. Evacuate cavity to remove remaining moisture and verify dryness in accordance with Section 8.1.3.

6. Backfill cask with helium and pressurize to 2.0 atm abs (14.7 psig). Install the vent port cover, purging the cavity below the cover with helium at a minimum flow rate of 80 cubic feet per hour for at least 20 seconds. A partial pressure of at least 50% helium will be obtained under the cover. Tighten the vent port cover bolts to the value specified on drawing 972-70-1.

TABLE 8.1-1 (continued)
SEQUENCE OF OPERATIONS

7. Helium leak test all lid and port cover seals. The acceptable total cask seal leakage (both inner and outer seals) is 1 x 10^{-5} ref-cm^3/sec (1.0 x 10^{-5} mbar-l/sec). The leak test shall be performed in accordance with ANSI N14.5[(2)].

   7A. If cask does not pass leak test, determine source of leak. If the leak is in a vent or drain cover, remove the cover and replace the seals. Also examine the sealing surface for any obvious indication of scratches or defects. Repeat leak test.

   7B. If the cask still does not pass leak test, evaluate test method or return cask to pool and replace seals.

   7C. At the option of the user, leak testing may be deferred until assembly of the overpressure system is completed.

8. Install top neutron shield.

Note: Installation of the overpressure system and protective cover could be done at a different location if restricted overhead clearances require transfer without these components in place. A temporary blind flange and metal seal will be installed on the overpressure port prior to transferring the cask without the overpressure system in place. Temporary weather protection will be provided as necessary.

9. Install overpressure system tank and port flange. The o.p. cover bolts should be torqued to the value specified on drawing 972-70-1.

Note: At the option of the user, leak testing of the overpressure system and subsequent re-pressurization of the overpressure system (step 11) may be deferred until the entire system is assembled (see steps 14 and 15).

10. Helium leak test the overpressure system. The leak rate of the overpressure system must be combined with the inner and outer seal leak rates and not exceed 1 x 10^{-5} ref cm^3/sec (1.0 x 10^{-5} mbar-l/sec). If the acceptance criterion is not met, locate the overpressure system leak, correct it, and retest.

11. Pressurize overpressure system (seal interspace) with helium to a pressure of about 6.0 atm abs (73.5 psig).

12. Install protective cover.

Note: The following step shall be performed in accordance with the timing set forth in the Technical Specifications.

TABLE 8.1-1 (continued)
SEQUENCE OF OPERATIONS

13. Verify that surface dose rates and surface contamination levels are within the limits set by the Technical Specifications. If the external dose rates above the neutron shield exceed the values in Technical Specification 5.2.3, install the shield ring (drawing 970-70-2, item 48) on the cask and re-measure the dose rates above the neutron shield. The user has the option to install this shield ring at an earlier stage in the loading operations, or to install the shield ring even if the measured dose rates without it are within the limits of Technical Specification 5.2.3.

    The neutron dose rate measuring instruments must be calibrated for a neutron energy spectrum appropriate to the exterior of the TN-68 cask.

Note: Steps 14 and 15 may be performed at the ISFSI if satisfactory lid and port cover seal testing is performed prior to moving the cask to the storage area.

14. Install pressure transducer/switch tubing on exterior of cask, and helium leak test to point of the valve at the protective cover. The total overpressure system leak rate combined with the inner and outer seal leak rates must be 1 x 10^{-5} ref cm^3c/sec (1.0 x 10^{-5} mbar-l/sec) or less. If the acceptance criterion is not met, locate the overpressure system leak, correct it and retest.

15. Backfill the external tubing with helium to a pressure of about 6.0 atm abs (73.5 psig) and open the valve at the protective cover.

16. Load cask on transporter.

17. Move cask to Storage Area.

D. Storage Area

1. Lower cask down onto storage pad in selected location. The cask spacing is controlled by the Technical Specifications.

2. Disconnect cask transporter.

3. Connect overpressure system to monitoring panel.

4. Perform Channel Operational Test (COT) to verify proper function of pressure switch/transducer.

TABLE 8.1-2

(DELETED)

TABLE 8.2-1
SEQUENCE OF OPERATIONS - UNLOADING

A. Storage Area

1. Disconnect overpressure system from monitoring panel.

2. Position cask transporter over cask.

3. Engage lifting arms and lift cask to designated lift height.

4. Move cask to spent fuel pool building.

B. Loading Area

1. Lower cask down onto floor, disconnect cask transporter and remove transporter.

2. Lift cask to decontamination area using lift beam and crane.

3. Remove neutron shield pressure relief valve and install plug in neutron shield vent hole.

4. Depressurize overpressure tank using the diaphragm valve, disconnect tubing at protective cover.

5. Remove protective cover.

6. Remove overpressure tank, overpressure port flange and top neutron shield.

7. Remove vent cover.

8. Collect a cavity gas sample through the vent port quick disconnect coupling.

9. Analyze the gas sample for radioactive material and add necessary precautions based on cavity gas sample results.

Note: If degraded fuel is suspected, additional measures, appropriate for the specific conditions, are to be planned, reviewed and approved by the designated approval authority, and implemented to minimize exposures to workers and radiological releases to the environment. These additional measures may include provision of filters, respiratory protection and other methods to control releases and exposures ALARA.

TABLE 8.2-1
SEQUENCE OF OPERATIONS - UNLOADING
(Continued)

10. In accordance with site requirements, vent cavity gas through the hose until atmospheric pressure is reached.

11. Remove vent port quick disconnect and drain port cover. Attach vent port adapter.

12. Loosen lid bolts and remove all but 6 approximately equally spaced lid bolts.

13. Attach cask to crane using lift beam. Attach lid lifting equipment.

14. Attach fill and drain lines to the drain quick disconnect coupling and the vent port adapter.

15. Ensure appropriate measures are in place to ensure proper handling of steam. Both fill and drain lines should be designed for steam at 100 psig minimum to prevent steam burns and radiation exposures due to line failure.

16. Lower cask into spent fuel pool/cask pit while spraying exterior of cask with demineralized water to minimize contamination. Lower until the cask top surface is just above the water level. Note: The cask may be filled before lowering the cask into the pool or with the cask partially submerged in the spent fuel pool.

C. Cask Loading Pool

Note: In BWR spent fuel pools, there may be significant amounts of fuel crud particulate material. Precautions should be taken to ensure that this particulate does not become airborne or become a radiation concern due to material floating on the surface of the water. Precautions may include enhanced filtering of the pool water during loading and unloading operations, increased ventilation and monitoring airborne contamination during all spent fuel pool activities.

1. Begin pumping pool or demineralized water into the cask through the drain port at a rate of 1 gpm while continuously monitoring exit pressure (See Setup shown in Figure 8.2-1). Continue pumping at a rate of about 1 gpm for at least eighty minutes. By this time, the water level in the cask will have reached the active fuel length.

2. The flow rate can then be gradually increased while monitoring the pressure at the outlet. If the pressure gage reading exceeds 55.3 psig, close the inlet valve until the pressure falls below 50 psig. Reflooding can then be resumed.

TABLE 8.2-1
SEQUENCE OF OPERATIONS - UNLOADING
(Continued)

3. Take a grab sample for chemistry analysis.

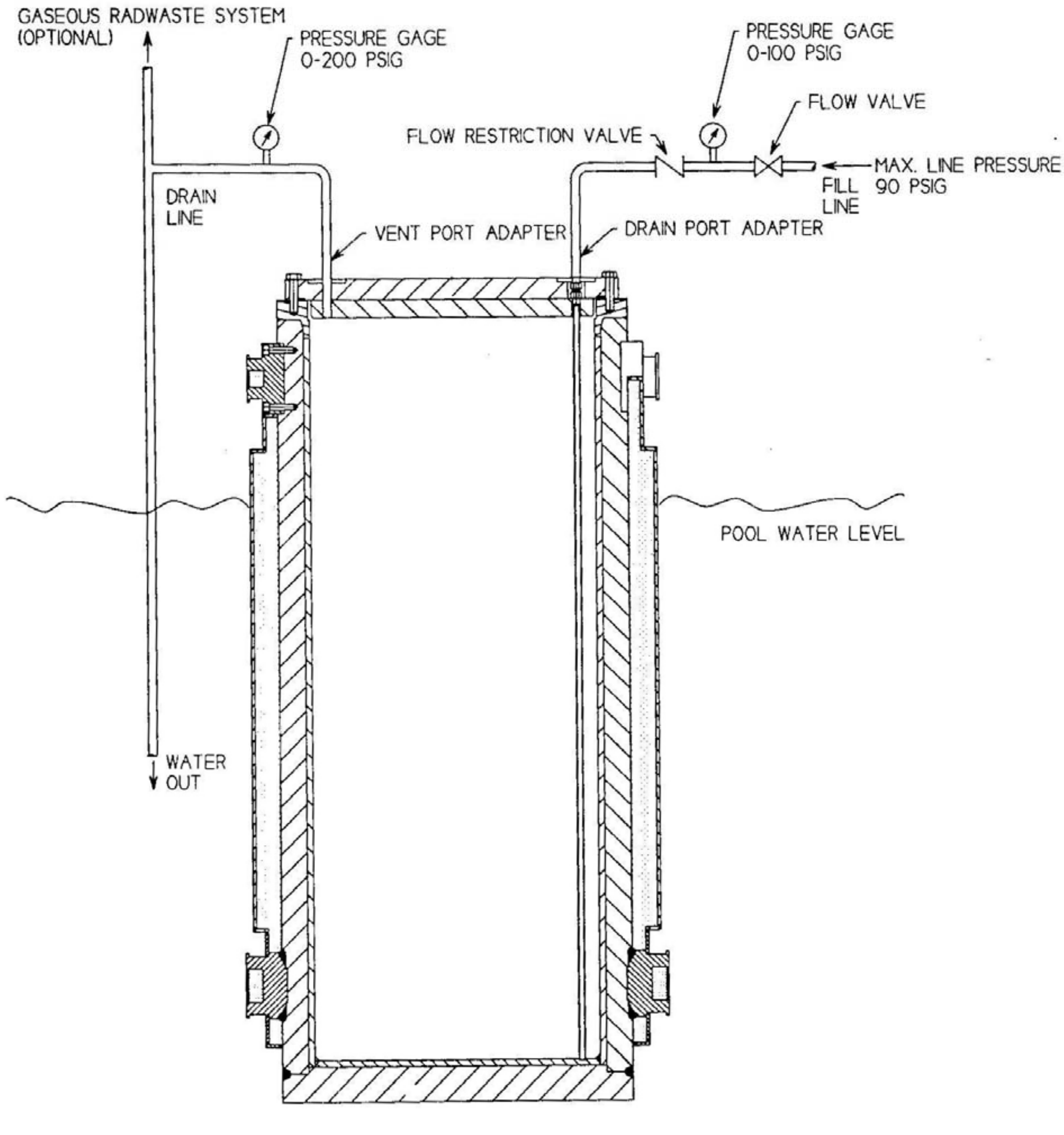
4. When the cask is full of water, remove the hose from the drain port and the hose and vent port adapter from the vent port. Remove the remaining 6 lid bolts.

5. Lower the cask and place it on the bottom of the pool/pit while rinsing the lift beam with demineralized water.

6. Raise the lift beam from the cask removing the cask lid.

7. Unload spent fuel assemblies in accordance with site procedures.

FIGURE 8.2-1.
TYPICAL SETUP FOR FILLING CASK WITH WATER



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