

Appendix C

Cask and Canister Handling Processes

Process Steps and Photographs Provided by Xcel Energy

TN-40 and TN-40HT Loading Operations

Cask Loading

Cask loading includes physically placing the fuel assemblies into the cask, draining, decontamination, securing the lid, and drying, and includes the following sequence of events:

1. Stage the cask inside the rail bay of the Auxiliary Building (Figure C-1).
2. Lift the empty cask by its lifting lugs and place it vertically in cask decontamination area.



Figure C-1: Rail Bay Staging

3. Remove the lid and perform inspection.
4. Engage the lifting yoke with the cask upper trunnions.
5. Lift the cask up to the spent fuel pool.
6. Lower cask into the pool.
7. Load the spent fuel assemblies into the cask.
8. Install the lid underwater.
9. Engage the lifting yoke and lift the cask out of the pool.



Figure C-2: Cask Wash Down

10. Drain water from the cask.
11. Wash down the exposed portions of the cask (Figure C-2).
12. Move to cask decontamination area. (Figure C-3).



Figure C-3: Cask in Decontamination Area

13. Decontaminate outer surfaces of cask.
14. Torque lid bolts.
15. Install drain port cover.
16. Connect the vacuum drying system to the vent port.
17. Perform vacuum drying.
18. Backfill cask with helium.
19. Install vent port cover.
20. Perform helium leak test of lid seals.

Transport to the ISFSI

Cask transport operations include transferring the loaded cask to the cask transport vehicle (CTV), installing the top neutron shield, transporting the cask to the ISFSI, and connecting the pressure monitoring system. The sequence of events includes:

21. Engage the lifting yoke with cask upper trunnions.
22. Place the cask into the CTV.
23. Install top neutron shield drum.
24. Pressurize the overpressure system.
25. Perform leak test on overpressure system.
26. Install protective weather cover.
27. Use the CTV and tow vehicle to transfer the cask to the ISFSI (Figure C-4).



Figure C-4: Cask Transport Vehicle (CTV)

28. At the ISFSI, position the cask over the desired pad location.
29. Lower the cask onto the ISFSI pad.
30. Rotate the CTV rear wheels to the unloading position (Figure C-5).



Figure C-5: ISFSI Storage Pad

31. Remove the CTV.
32. Connect the seal pressure monitoring instrumentation.

Canister Loading Operations – Horizontal Overpack (Orano NUHOMS Example)

Canister Loading

Canister loading includes physically placing the fuel assemblies into the canister, decontamination, draining, drying, and seal-welding, and includes the following sequence of events:

1. Stage the transfer cask and canister inside the truck bay door of the plant.
2. Lift the empty canister by its lifting lugs and place it vertically in the transfer cask.
3. Install the pneumatic seal between the cask and the canister and fill the canister with water.
4. Engage the lifting yoke with the cask upper trunnions.
5. Lift the transfer cask and canister up to the fuel pool.
6. Lower cask into the pool.
7. Load the spent fuel assemblies into the canister (Figure C-6).

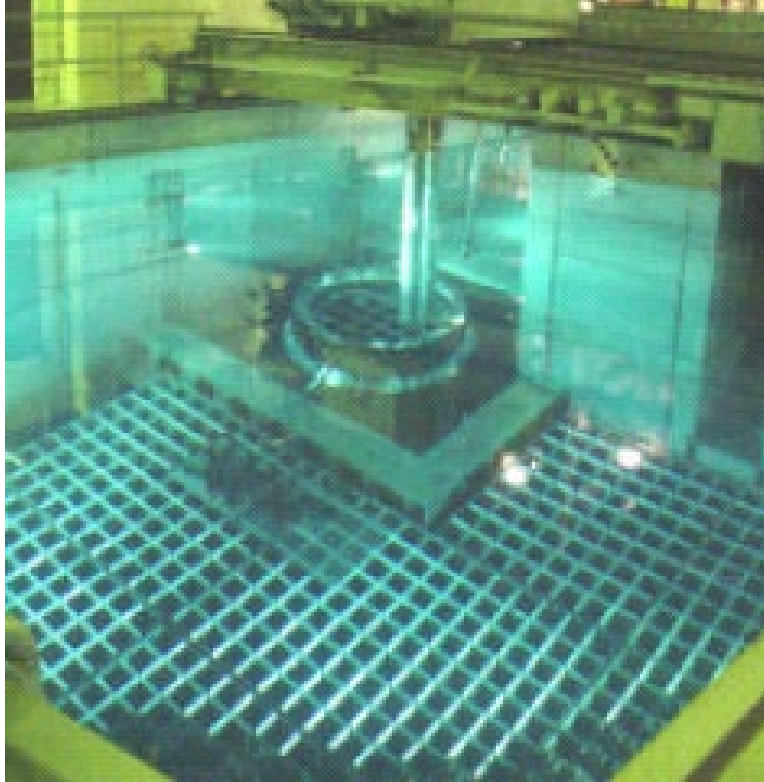


Figure C-6: Loading Fuel into Canister

8. Install the canister shield plug underwater.
9. Lift the transfer cask out of the pool.
10. Drain water as required before the welding operation.
11. Wash down the exposed portions of the transfer cask.
12. Move to cask decontamination area (Figure C-7).



Figure C-7: Lowering Transfer Cask to Decontamination Area

13. Lift the automatic welding machine (AWM) and install it over the inner top cover plate. Lift AWM and inner top cover together and install them over the canister.
14. Perform inner top cover weld.
15. Connect the vacuum drying system to the vent and siphon ports.
16. Remove bulk water from the canister using pressurized air.
17. Perform vacuum drying and helium backfilling.
18. Install and seal weld the vent and siphon port covers.
19. Mount the AWM and outer cover plates on the canister.
20. Weld the canister outer top cover plate.
21. Lift the transfer cask and move it to the loading bay.

Transport to the ISFSI

Canister transfer operations include transferring the loaded transfer cask to the on-site transport trailer, transporting the transfer cask and canister to the ISFSI, and inserting the canister into the storage module. The sequence of events includes:

22. Set the lower trunnions of the transfer cask into the support skid on the trailer.



Figure C-8: Lowering Cask onto Trailer

23. Rotate the transfer cask to a horizontal orientation (Figure C-8).
24. Use the on-site trailer to transfer the cask and canister to the ISFSI.

25. At the ISFSI, back the trailer and align the transfer cask with the storage module (Figure C-9).



Figure C-9: Alignment of Transfer Cask with Storage Module

26. Remove the hydraulic arm access cover, the transfer cask lid, and the storage module door.
27. Use the hydraulic arm to insert the canister into the storage module.
28. Install the storage module door.

Canister Loading Operations – Vertical Overpack (Holtec HI-Storm Example)

Canister Loading

Canister loading includes physically placing the fuel assemblies into the canister, draining, decontamination, closure, and canister transfer into the overpack and includes the following sequence of events:

1. Place the empty canister into the transfer cask.
2. Lift the transfer cask and place it vertically in the cask decontamination area.
3. Fill the transfer cask annulus with demineralized water and install the annulus seal.
4. Engage the lifting yoke with the transfer cask lift lugs.
5. Lift the transfer cask and canister up to the spent fuel pool (Figure C-10).



Figure C-10: Transfer Cask and Canister Movement to the Spent Fuel Pool

6. Lower transfer cask into the pool (Figure C-11).

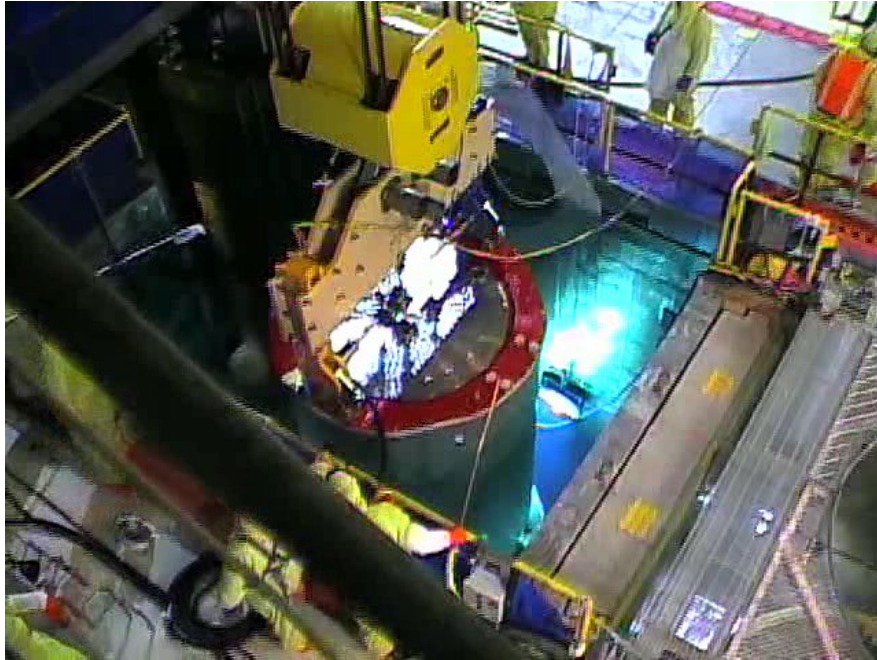


Figure C-11: Transfer Cask and Canister Lowered into Spent Fuel Pool

7. Load the spent fuel assemblies into the canister.
8. Install the canister lid underwater.
9. Engage the lifting yoke and lift the transfer cask and canister out of the pool.
10. Move to cask decontamination area.
11. Perform decontamination.
12. Perform canister closure welding (inner lid).
13. Perform canister draining, drying, and backfill with helium (Figure C-12).



Figure C-12: Helium Backfilling

14. Complete canister closure welding (outer lid) (Figure C-13).
15. Install the canister lift cleats.

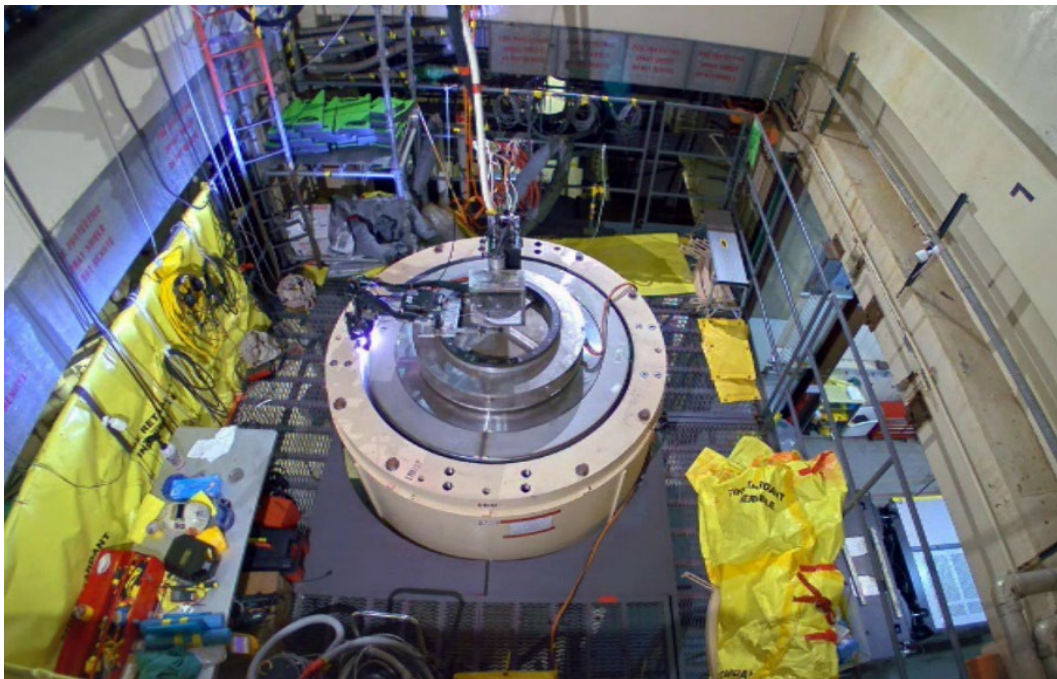


Figure C-13: Final Canister Closure Welding Using Automatic Welding System

Transport to the ISFSI

16. Position the empty concrete overpack on a specialized crawler (Figure C-14).



Figure C-14: Overpack on Crawler

17. Position the empty overpack in the truck bay.
18. Remove the overpack lid.
19. Install the mating device on the overpack (Figure C-15)



Figure C-15: Overpack, Mating Device, and Transfer Cask

20. Raise transfer cask from the decontamination area and place it on the mating device (Figure C-16).

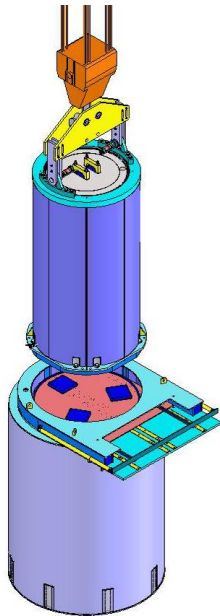


Figure C-16: Placement of Transfer Cask on Overpack with Mating Device

21. Attach the downloader slings between the lift yoke and the canister lift cleats.
22. Raise canister slightly.
23. Remove the transfer cask bottom lid bolts.
24. Open mating device to remove transfer cask bottom lid.
25. Lower the canister into the overpack (Figure C-17).

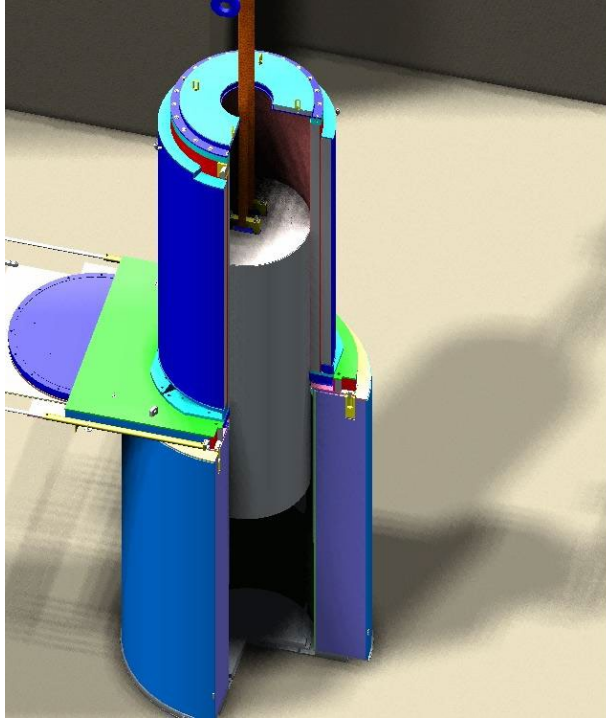


Figure C-17: Lowering of Canister into Overpack

26. Disconnect the downloader slings from the lift yoke.
27. Remove transfer cask from mating device.
28. Disconnect downloader slings and lift cleats from canister (Figure C-18).

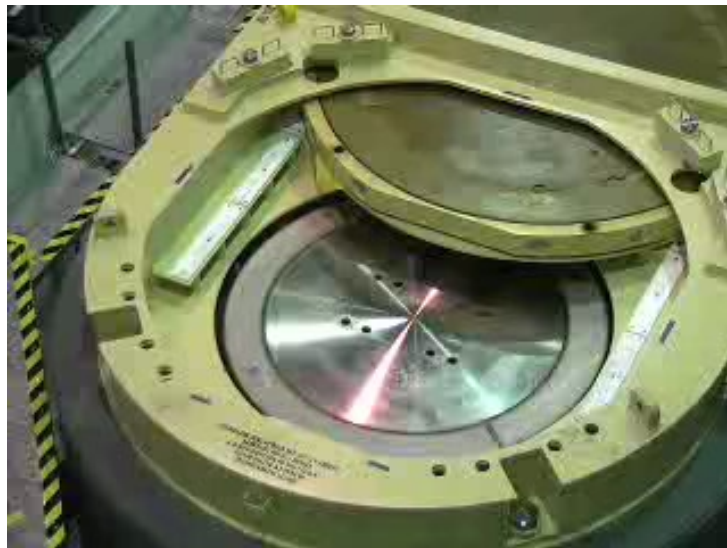


Figure C-18: Canister Lowered into Overpack; Lift Cleats and Downloader Slings Removed

29. Remove the mating device.
30. Install the overpack lid.
31. Place the overpack and canister on the ISFSI pad (Figure C-19).



Figure C-19: Overpack and Canister Movement to ISFSI Pad Using Transporter