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OPERATOR DEVELOPMENT PROGRAM

NORTH ANNA POWER STATION

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SPENT FUEL DRY STORAGE CASK SYSTEM

Virginia Power
Nuclear Training

SPENT FUEL DRY STORAGE CASK SYSTEM

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SPENT FUEL DRY STORAGE CASK SYSTEM

MODULE DESCRIPTION

This module presents a general and detailed discussion of the Spent Fuel Dry Storage Cask System. Within the module, you will find major content sections relating to: The Dry Storage Cask and equipment and the Independent Spent Fuel Storage Facility. After completing this module, you will be able to:

A. State the purpose of the Spent Fuel Dry Storage Cask System and describe the various components.

B. Describe the operations associated with the Spent Fuel Dry Storage Cask System.

DIRECTIONS

Each content section consists of a list of performance objectives, related text material, and a review exercise. As you proceed through each section, be sure to:

1. Review the performance objectives.

2. Study the text material.

3. Accurately complete the review exercise.

4. Reread difficult portions of the text (as indicated by your ability to complete the review exercise).

5. Reference the Table and Figure sections at the end of the module where indicated in the text.

The final objective listed for each content section (printed in upper case and bold type) is considered the main objective of that section. Upon completion of the entire module, you will be expected to complete satisfactorily a test based on these objectives.

SPENT FUEL DRY STORAGE CASK SYSTEM

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SPENT FUEL DRY STORAGE CASK SYSTEM

THE TN-32 SPENT FUEL STORAGE CASK

Objectives

Upon completion of this section, you will be able to:

A. Briefly describe the design criteria for the TN-32 Spent Fuel Storage Cask, including:

  Heat rejection,

  Criticality safety, and

  Radiological protection,

B. Briefly describe the main components of the TN-32 cask system which includes:

  Cask body

  Fuel basket

  Lid

  Cask sealing system

  Cask auxiliaries

C. Summarize the Basic Operations with the TN-32 Dry Storage Cask.

D. Describe the operation and main components of the Dry Storage Cask Transporter.

E. Describe the TN-32 Dry Storage Cask, Including its Design Criteria, Major Components and Basic Operations.

TN-32 Design Criteria

The TN-32 spent fuel storage cask is a passive, essentially maintenance free storage device for spent nuclear fuel. Proper care in handling and assembling the cask will assure that the cask will perform its intended function. This section provides the general background information on the cask design, and operations.

The TN-32 cask is of cylindrical geometry and comprised of a carbon steel body, a stainless steel and borated aluminum fuel basket, and a carbon steel lid which seals and encloses the spent fuel within the cask. The general arrangement of the cask assembly is shown in Figure 78-1 and a cross section view is shown in Figure 78-2. The following is a summary of the key parameters of the TN-32 Topical Safety Analysis Report.

Heat Rejection - Decay heat is transmitted from up to 32 spent fuel assemblies, through the cask walls and to the environment. Typical fuel assemblies suitable for storage in this cask have an average burnup of 40,000 MWD/MT (Megawatt Days per Metric Ton), have been out of the reactor for at least 7 years, and produce up to 0.847 KW of decay heat per assembly. A helium atmosphere in the cask cavity enhances the overall heat transfer capability of this cask. The helium cover gas also provides an inert environment to inhibit fuel corrosion. The hottest fuel pin in the cask will not exceed 313°C (595°F), even when the cask is exposed to conservatively assumed adverse conditions such as a high ambient temperature of 100°F and daily solar insulation of 1475 BTU/ft^2.

Criticality Safety - The design of the stainless steel and borated aluminum fuel basket ensures that K_{eff} is maintained less than 0.95 even in the conservatively assumed conditions that all 32 fuel assemblies in the cask are undepleted 3.85 w/o average enriched, and the cask is flooded with water borated to 2000 ppm. Any array of an infinite number of casks will have no adverse impact on criticality safety.

Radiological Protection - The cask body provides shielding against penetrating radiation emanating from the fuel. The cask lid sealing system provides a barrier against leakage of radioisotopes from the cask interior. Metal boxes filled with polyester material are equally spaced around the cask body walls to provide neutron attenuation. The thick carbon steel walls of the cask body are sized to provide an overall reduction in exposure at the surface of the cask.

The design basis exposure for a loaded cask limits the external dose rate to less than 129.4 mrem/hr (side surface) and 54.9 mrem/hr (top surface). The cask sealing system consists of metal O-ring seals such that each leakage path from the cask cavity is obstructed by two metal O-rings acting in series. An arrangement of cover gas pressures and a pressure switch provides a means to continuously monitor the integrity of the sealing system. The design basis maximum leakage rate from the cask is specified as 10^{-5} millibar-liters per second (one bar = one atmosphere = 14.7 psi). The cask in reality may be considered as leak tight and the specified value provides a measurable acceptable criteria for verification purposes.

TN-32 Detailed Description

The main components of the TN-32 cask system are:

- Cask body
- Fuel basket
- Lid
- Cask sealing system
- Cask auxiliaries

A complete description of each major component is provided in the following sections.

<u>**Cask body**</u> - The cask body consists of a 1.5-inch carbon steel containment vessel and an 8-inch carbon steel gamma shield. The carbon steel exhibits good strength and ductility, as well as providing effective shielding. The gamma shield is surrounded by metal boxes containing 4.5 inches of a polyester resin neutron shield. Surrounding the metal boxes is a 0.5-inch carbon steel skin. The cask body wall thickness totals 14.5 inches. The overall external dimensions are 16 feet, 10 inches high and 8 feet, 2 inches in diameter. The inner diameter of the cavity is 5 feet, 9 inches and the bottom of the cask has a slight slope to facilitate water removal during the operational process of loading the cask. The body has precision machined

surfaces at the open (lid) end for positive gasket sealing. Bolt holes are also provided at these locations to secure the cask lid.

Two lifting trunnions are bolted at each end of the cask body. The external surfaces of the body are coated with an epoxy paint for corrosion protection and ease of decontamination. The internal cavity surfaces have a flame-sprayed aluminum coating. The sealing surfaces are clad with stainless steel.

<u>**Fuel Basket**</u> - The fuel basket is a cylindrical structure made of welded stainless steel and borated aluminum plates. The basket is comprised of an array of 32 square cavities which provide structural support and positive positioning of the fuel assemblies. The basket overall height is 13.3 feet. The basket outside diameter of 5 feet, 9 inches fits closely to the cask cavity inner diameter. A spacing of 3.25 inches is provided between the top of the fuel assemblies and the bottom of the lid (assuming a 160 inch fuel assembly). Actual assembly-to-cask structure clearance will of course depend on the characteristic post-irradiation dimensions for each fuel assembly.

A pipe with an inner diameter of 1.0 inches and an adaptor at the top, runs through one of the basket supports at the outer circumference of the basket. The location of this pipe corresponds to a quick connect penetration in the lid and the downhill side of the slope in the cask cavity. This pipe is used to fill and drain the cask.

The basket design assures a subcritical configuration under the most adversely assumed conditions, and the basket structure physically protects the fuel under normal and accident conditions. The basket and cask body may be considered as a single integral assembly for all operational purposes.

<u>**Lid**</u> - The carbon steel lid has a diameter of 6 feet, 7.5 inches and is 10.5 inches thick. Forty-eight (48) bolt holes are machined in the lid perimeter for the 1.5-inch bolts which secure the lid to the cask body. Two grooves located around the lid circumference, inside of the bolt circle are provided for the sealing gaskets. The grooves accept metal O-rings, secured by screws, which serves as the barriers between the stored fuel and the environment. A discussion

of the sealing principle of this design is provided later in this text. A 0.2-inch diameter penetration through the lid provides access to the annulus between the two seals to perform the post-assembly leak test. This penetration is also used to monitor the helium pressure between the two seals.

Two additional penetrations through the lid are provided for various operations. A 1.0-inch diameter penetration is used for water fill and drain operations. This penetration is located near the parameter of the lid and is sealed with one cover. This location corresponds to the drain pipe which is attached to the fuel basket. The cover is secured by eight (8) 0.75-inch socket head caps screws and sealed with two metal O-rings. The other penetration, of the same size and using the same cover, is also located near the lid perimeter, but 180° from the fill/drain penetration. The through lid penetration at this location is equipped with a quick disconnect fitting which is used for vacuum drying and backfilling with the inert cover gas.

Three threaded holes at the center of the lid are provided for attaching the lid lifting head. When installing or removing the lid, three alignment pins are attached to the cask using three lid bolt holes.

Cask Sealing System - The TN-32 seal system (see Figure 78-3) consists of multiple seals to assure the leak tightness of the cask. If defects should develop in individual fuel rods during long term storage, any activity released would be contained within the cask. Because each cask is fabricated as one piece, the lid of the cask is the only location where a leakage path could occur. The metal seals used in the design possess long-term stability and by virtue of the material chosen, have high corrosion resistance over the entire storage period. The annulus formed between the metal O-rings, along with the test penetration through the lid serves as the means to verify that a proper seal has been obtained. A factory test is performed to assure that a proper seal is possible, and the test is repeated using new metal gaskets, after fuel is loaded in the cask to verify proper field assembly of the lid and penetration covers. Proper care and preparation of the gaskets and sealing surfaces is an important factor in successfully obtaining a leak tight seal. Torquing the lid bolts to the correct value is also important in maintaining a long term seal during all normal and hypothetical accident conditions.

The sealing principle of the metallic O-ring used for the TN-32 cask is illustrated in Figure 78-4. The metallic seals are made up of a metal covering around the toroidal section of a helically wound spring. The sealing principle of the metallic seals is based on the plastic deformation of a lining material with greater ductility than the materials surrounding it. The aluminum covering material is deformed by the action of the cask and lid flange material on the outer surface of the O-ring and by the inconel helical spring on the inner surface of the O-ring. Permanent contact of the seal against the sealing surface is ensured because of the reaction caused by the radial elasticity of the spring giving a permanent compressive force on the lining. The use of a helical spring, with its cold compressed against each other as an elastic core, gives total independence on each coil during the radial compression of the section which in turn energizes the coils edgewise.

A monitoring scheme is also incorporated to ensure that corrective action can be taken in the unlikely event that a seal failure occurs during long-term storage. During cask assembly, an excess pressure is set up in the volume between the two lid O-ring seals. A leak in the inner seal would result in this excess pressure bleeding into the cask inner cavity. A leak in the outer seal would result in this inert gas escaping to atmosphere. In either case, a pressure sensor incorporated in the overpressure system provides an alarm function if a pressure reduction below a predetermined setpoint occurs in the inter-seal space. The gauge diaphragm prestressing and reference pressure is set at the factory and no periodic calibration is necessary. A functional test can be performed to verify operability and confirm the actuation setpoint. This is accomplished by monitoring the contact status with a voltmeter, then allowing the pressure in the monitored space to slowly bleed down until the contact changes state. The monitored operating space is then repressurized to the required value.

Cask Auxiliaries - Miscellaneous equipment is required to perform the various cask handling and loading operations. Equipment used for transport and lifting is described below and consists of the transport cradle, cask lifting yoke, and lid lifting tools and head.

A transport cradle is used for initial delivery of the cask to the site and can be used for moving the cask between work and storage locations on site. A spreader beam designed specifically for this cradle is used to lift the cradle with or without the cask in place (see Figure

78-5). Figure 78-6 shows this lifting arrangement along with the interconnecting cables and shackles supplied for this purpose. The cask is supported on the cradle by the lower trunnions and by the top of the cask. Removable trunnion caps at the cradle rear end and a metal band at the cradle front end are provided to positively secure the cask to the cradle.

A cask lifting yoke is used for lifting the cask off and on the cradle and for positioning the cask in various plant areas such as in the fuel pool (Figure 78-7). The yoke attaches to the upper trunnions of the cask with arms that are positioned with air operated cylinders to clear and capture the trunnions. When not in use, the yoke should be stored in a frame that supports it in a vertical position and allows easy access for attachment to the crane.

A lifting head and short and long lifting tools are also provided for the lid (Figure 78-8). All lifting tools and cranes are load tested annually and the Supervisor, Ops Support maintains this test data.

In order to reduce the forces resulting from a cask drop, an impact limiter is used on the bottom of the TN-32 cask (see Figure 78-9). The impact limiter consists of balsa enclosed in a steel-sheet structure. This structure is in the form of a cylindrical shell which encloses the bottom of the cask body.

Basic Cask Operations

This section provides a brief explanation of the various cask features and of the various operations performed in handling, loading and servicing the cask. This section is for trainee reference only. Approved plant procedures must be used when performing these evolutions. The following is a list of plant procedures that deal with operation on the TN-32 dry storage cask.

1. 0-OP-4.32 - Cask Transport from the ISFSI to the Crane Bay.
2. 0-OP-4.33 - Pre-Cask Loading Verification.
3. 0-OP-4.34 - Receipt of TN-32 Dry Storage Cask.
4. 0-OP-4.35 - TN-32 Loading and Handling.

5. 0-OP-4.36 - Cask Transport from Crane Enclosure to the ISFSI.
6. 0-OP-4.37 - Opening a Loaded TN-32 Cask.
7. 0-OP-4.38 - Inspection and Maintenance of Dry Storage Cask Llifting Yorke, Storage Stand, and Lid Lifting Tools.
8. 0-OP-4.39 - Dry Cask Transporter Operation.
9. 0-OP-4.40 - Repositioning a TN-32 Dry Storage Cask in the crane Bay or Decon Bay.

<u>Cask Receiving</u> - The cask is delivered to the plant site in a horizontal position, on the cask transport cradle, which in turn is secured to the heavy-haul transport trailer. Handling of the transport cradle is accomplished with the use of the cradle spreader beam and associated cables and shackles.

The cask is secured to the cradle by hold-down bolts mounted through the metal band at the front end, and by trunnion caps at the rear end. When the cask is to be removed from the cradle, the hold-down bolts, and trunnion caps are removed. The cask lifting yoke is attached to the cask upper trunnions and by a combination of raising the crane hook and moving the crane trolley, the cask is raised to the vertical position by rotating the cask about the lower trunnions in the cradle trunnion supports. The cask lifting yoke is attached to the crane hook by a 5.5 inch diameter pin which passes through the yoke and is secured in place by a ball-detent pin. The yoke is attached to the cask trunnions by swinging out the yoke arms and aligning the eccentric hole in each arm over the trunnion. A plant air supply of about 80 psi is connected to the air cylinders which allows the arms to be operated remotely. The cylinders require air to operate in both directions so that a failure of the air supply will not cause an inadvertent opening of the arms. Also, because of the relative dimensions between the hole in the arm and the flange on the trunnion, the arms are positively captured whenever the trunnion is seated on the load bearing surface of the arm.

Once the cask is positioned in the designated work area, a general inspection of the cask surfaces can be conducted. Also the cask exterior can be cleaned as necessary to satisfy any fuel pool requirements that may be specified. The cask must now be disassembled and prepared for insertion in the fuel pool.

Cask Preparation and Loading - The cask preparation consists of removing the lid, removing lid penetration covers, and inspecting sealing surfaces.

The first major step in cask preparation is removal of the lid. Three symmetrically located lid bolts are removed, and the three alignment guide pins are installed. The remaining bolts may then be removed. The penetration covers should be removed at this time or when the lid is in its temporary storage location. The three-way valve will be installed in the vent penetration at a later time for cask reassembly operations. It is necessary for the quick connect fitting to be removed so that the small orifice area of this fitting does not restrict the cask cavity vacuum drying process. The lid lifting head is then bolted to the lid, and the lid lifting tool is attached to the crane via a load scale. The purpose of the load scale is to detect any binding which may occur while the lid is being lifted. The lid is carefully lifted and placed at a temporary storage location where the metal O-rings are replaced. The storage location shall provide a wooden bearing surface to protect the underside of the lid. The cask gasket sealing surfaces are inspected.

As soon as the lid is removed, the gasket sealing surfaces should be inspected for scratches, dents, or other imperfections that might impair sealing. Note that factory tests are conducted prior to shipment which verify that a satisfactory seal can be achieved and by following reasonable precautions at the site, problems in this area are unlikely. Note that all gasket seals and surfaces must be handled very carefully. Any minor scars or scratches in the metal sealing surfaces may result in a leak rate which exceeds allowable limits.

Suitable lighting should be provided to inspect the cask cavity and each channel in the basket. The cask is lifted using the cask lifting yoke and slowly lowered into the spent fuel pool to allow it to fill slowly and prevent splashing of the water. When the cask is positioned at the bottom of the pool and the lifting yoke has been moved out of the way, the operation may proceed by inserting the fuel assemblies into the cask. Care must be exercised to prevent damage to the cask or basket during fuel handling operations. Data sheets should be completed during the loading process to record the fuel assembly serial number, orientation, and location within the cask. Once the cask is loaded, proceed with cask reassembly.

Cask Reassembly - This portion of the operation consists of retrieving the cask from the fuel pool, decontamination, dewatering, cover gas backfilling, reassembly, and seal testing. Since this process involves activities around the cask, with covers removed which normally provide shielding, all steps should be carefully planned to minimize personnel exposure. Calculations based on conservative assumptions project contact dose rates on the order of 50-100 mrem/hr at various cask locations. These values can be revised as operational data is collected.

The first step to be taken is installation of the lid to provide shielding when the loaded cask is removed from the pool. This is accomplished by attaching the lid lifting tool to the lid and lowering it into the pool and on the cask using the alignment guide pins. The long lid lifting tool must be used at this time because the short tool will not reach the cask when it is at the bottom of the pool.

Visual verification that no debris has settled on the seal flange is required before lowering the lid in place. Again, a load scale is used when placing the lid in place to check for binding. Care must be taken while installing the lid to prevent the O-rings from possibly shifting due to the hydraulic action of the water. Disconnect the crane from the lid lifting tool and connect the cask lifting yoke to the crane hook. Lower the yoke into the pool and using the air cylinders to activate the arms, remotely attach the yoke to the cask trunnions. The cask may now be slowly raised to the pool surface. Monitor area radiation levels as the cask is raised. Stop raising the cask when the top of the cask is about one foot out of the water. Depending on the contamination level in this area, the lid surfaces may be cleaned with a hydro-laser or simply hand dried. Using a suction lance, drain the water out of all bolt holes and install the lid bolts hand tight. Note that the cask, filled with water and fuel, with the lid in place will weigh about 118 tons (in air) including the lifting yoke. Cask dewatering (see Figure 78-10) is accomplished by connecting the drain pump suction hose to the fill/drain adapter. The pump is run until it loses its suction indicating the cavity is as dry as possible using the pump. Since it is not possible to remove all of the water using the pump, the vacuum drying system will be used to remove the 3 to 5 gallons expected to remain at the bottom of the cavity and adhering to the cask cavity and fuel surfaces. Figure 78-11 shows the equipment connections for the vacuum drying and inert gas backfilling processes. Cask integrity is maintained during these processes by using quick connect fittings that seal closed when not connected. The bolts are torqued to one-third the final value and the vacuum drying system is used to dry the cask cavity at his time. Once the drying is complete, the quick connect fitting is re-installed in the fill/drain penetration. A special adapter is then used to attach the auxiliary equipment to the quick connect fitting. The vacuum drying system is then used to dry the annulus between the O-ring seals. It is important that this annulus and the seal test penetration be thoroughly dry before connecting the helium leak detector because of the sensitivity of this instrumentation to moisture. When the seal annulus is dry, the lid bolts are torqued to the final value. The penetrations through the lid are now leak tested. As each penetration cover is installed, a helium pistol or similar method is used to establish a helium pocket in the space under each cover for leak testing purposes. A vacuum of about 3 mbar is established in the cask cavity and helium is then admitted to a pressure of about 2000 mbar. Heating of the initial gas fill by fuel decay heat will resulting a final equilibrium gas pressure of 2200 mbar. The lid seals are then tested. Equipment connections required to accomplish the seal testing.

The cavity internal pressure along with the Helium Leak Detecting System (HLDS) acting on the inter-gasket annulus results in a net driving pressure of about two atmospheres across the metal O-ring. The helium detector readout, corrected for the helium pressure inside the cask provides the seal leak rate.

The data from the penetration leak tests and the main seal test are combined to yield the overall leak rate, which must be below $1x10^{-5}$ mbar liter/sec.

At this point it is likely that all cask and lid surfaces are dry, however if there is any doubt, the vacuum drying system should be used to dry the inter-seal annulus before connecting the helium leak detector. When the lid seal integrity is confirmed, a final inter-seal helium pressure of 5500 $\pm$ 100 mbar is established. Cask assembly is now complete and transfer to the ISFSI can be performed.

<u>**Cask Transfer to the ISFSI**</u> - Transfer to the ISFSI may be accomplished using the cask transporter described later in this module. The cask is lifted from the Decon Building and

placed on the ground outside. The transporter is positioned over it and lifts the cask and holds it while it is moved to the ISFSI pad. The pressure monitoring gauge is then connected to the alarm system.

Cask Disassembly and Unloading - Should a situation arise that makes it necessary to remove the lid for fuel removal or other purposes, it is necessary to return the affected cask to the Fuel Building. This is accomplished using the same method and hardware used to transport the cask to the ISFSI.

Once the cask is placed at the desired work area, the cask surfaces should be cleaned, if necessary, to meet fuel pool cleanliness requirements. The cask cavity interior is sampled through the lid quick connect to verify that no abnormal conditions exist.

Connect the cask lifting yoke to the cask and transfer the cask to the fuel pool. Prior to lowering the cask into the pool, it is advisable to cool the fuel. This is accomplished by slowly admitting water to the cask cavity via the cask fill/drain adapter. A safety/relief valve is used to provide overpressure protection. When the water leaving the overflow line is cooled to about the temperature of the fuel pool water, the cooling water supply may be secured.

The lid bolts are then removed and the lid lifting device is attached and appropriate rigging used to allow lid removal after the cask is lowered into the pool. The cask is then lowered to the bottom of the pool and the lifting yoke is removed so that the lid can be lifted. The fuel is now accessible for removal or inspection as desired.

Technical Specifications - There are no restrictions placed on storage cask movement by the North Anna plant Technical Specifications. Technical specifications are imposed on storage cask operations by the ISFSI Technical Specifications, which are covered in the ISFSI section of this module.

Dry Storage Cask Transporter

Figure 78-12 shows a drawing of the cask transporter. The purpose of the transporter is to move the cask from the station to the Independent Spent Fuel Storage Installation (ISFSI) or vice versa.

The transporter is controlled by a hydraulic system. This system includes a power supply, control valve panel, cask lift cylinders, positioning cylinders, and restraint cylinder.

Hydraulic System - There are four control valves on the hydraulic system control panel. These control valves are used to direct hydraulic fluid to allow operation of the cylinders and brakes. The cask lift cylinders are used to lift and lower the cask. The positioning cylinder (lift cylinder tilt actuators) are used to position the lift cylinders to engage or disengage the cask. The restraint cylinder is used to secure the cask to prevent it from swinging after it has been lifted. The fourth control valve is for directing hydraulic fluid to overcome the spring pressure that actuates the transporter brakes.

The brake system is designed such that they are normally actuated and hydraulic pressure is needed to release them. This interlock ensures that the transporter will stop on a loss of hydraulic pressure or if the power supply to the hydraulic system should fail.

Power Supply - A small diesel generator is mounted on the transporter to provide electrical power to the hydraulic system. To start the unit up:

1. Verify proper oil reservoir level. Fill to the top of the sight gauge. Keep the filler/breather cap in place except when filling.

2. Jog the motor to check pump rotation, as shown by directional arrow on the top of the pump.

3. When pump rotation is determined to be correct, continue to jog the motor at increasingly longer intervals until the pump "primes". If difficulty is experienced in getting the pump to prime, it may be necessary to loosen a fitting in the pump discharge line to purge air from the pump.

4. When the pump is primed, let it continue to run to get all the air out of the pump and suction filter. The system will be noisy until all air is eliminated.

5. Check pump often in the first few minutes to ensure it is not overheating.

6. After the pump is safely "on line", the system pressure can be raised to the required level. Do not be alarmed by a higher noise level at higher pressures.

7. Machine may now be cycled. To eliminate air, open bleed ports on cylinders or slightly crack fittings in the highest portion of the system until air is removed.

8. After the machine is cycled several times, bring the oil level in the reservoir to the FULL level. After running the system for an hour, shut down the unit, remove the suction filter and clean the element to remove accumulated dirt.

9. The unit is designed to operate most efficiently at 100°F to 140°F.

<u>Operational Test of the Transporter</u> - To perform an operational test of the transporter, perform the following:

1. Connect the power source to the hydraulic unit.

2. With the steering wheels straight, "set" the brakes and then pull against them to check their holding power. "Releases" the brakes.

3. "Latch" then "release" the restraint cylinder to check its operation.

4. Actuate the positioning cylinder "in" and "out" to check its operation. Position the cylinder "IN".

5. Actuate the lift cylinders "up" then "down" to check their operation.

THE TN-32 SPENT FUEL STORAGE CASK

Review Exercise

Respond to each of the following questions or statements with an appropriate short answer. Check your answers with the key at the end of the module.

1. How long must spent fuel have been out of the reactor before it can be stored in the TN-32 Dry Storage Cask?

2. State two reasons why a Helium gas cover is used in the TN-32 Dry Storage Cask.

3. Explain why the bottom of the cask cavity has a slight slope to it.

4. Briefly describe the TN-32 sealing system.

5. Describe the monitoring scheme used for detecting leaks in the cask seal system.

6. ISFSI Technical Specifications require impact limiters to be installed if the cask is to be lifted higher than ________ anytime it is outside of the ________ ________ or ________ ________.

7. What is the purpose of the load scale used when installing or removing the lid from the cask?

8. What is the maximum allowable leakage from the cask?

9. Describe the operation of the cask transporter brake interlock.

SPENT FUEL DRY STORAGE CASK SYSTEM

INDEPENDENT SPENT FUEL STORAGE INSTALLATION

Objectives

Upon completion of this section, the trainee will be able to:

A. Summarize the function, layout, associated systems, maintenance and surveillance requirements, and decommissioning options for the Independent Spent Fuel Storage Installation (ISFSI) as described in the ISFSI facility design.

B. Summarize the analyses that were performed to demonstrate the Safety of the ISFSI.

C. Summarize the limitations imposed upon handling and storage of spent fuel cask by the ISFSI License.

D. **SUMMARIZE THE ISFSI FACILITY DESIGN, THE ISFSI SAFETY ANALYSIS AND THE ISFSI LICENSE REQUIREMENTS.**

ISFSI Facility Design Overview

Introduction - The purpose of this section is to inform personnel involved with the operation of the Independent Spent Fuel Storage Installation (ISFSI) of the facilities design. This knowledge will contribute to the overall awareness of the ISFSI's function, layout, associated systems, maintenance and surveillance requirements, and decommissioning options. The trainee will also benefit from this information by understanding how his/her particular duties and responsibilities fit into the "big picture" of spent fuel handling.

Function of the ISFSI - The North Anna ISFSI is located within the site boundary of the North Anna Power Station. The ISFSI is designed to store spent fuel assemblies which have been irradiated at North Anna's Unit 1 or Unit 2 reactor. Spent fuel at the ISFSI is stored in large dry storage casks. The casks are stored in rows on concrete pads within the fenced-in area of the ISFSI.

Like many other nuclear plants, the spent fuel pool at North Anna was designed for only short-term storage of spent fuel. The capacity of the pool is 1,737 assemblies and would have been completely filled in 1998. Structural limitations preclude further expansion of the spent fuel pool, and fuel reprocessing is not expected to become available in the near future. Interim storage at away-from-reactor facilities or federally operated permanent repositories is not currently available.

Therefore in order to maintain adequate storage capacity for spent fuel generated at North Anna and to avoid an early shutdown of the nuclear units, the ISFSI was constructed. The ISFSI is designed to store all the spent fuel from both units at North Anna in excess of that which can be stored in the spent fuel pool. The ISFSI has been designed to operate, if necessary, through the remaining life of both units of North Anna Power Station, i.e. 2020.

ISFSI Physical Design and Layout - The ISFSI is located about 2000 feet southwest of the North Anna Units 1 and 2 reactor buildings along the main access road. The ISFSI occupies about 11 acres.

Figure 78-13 shows the basic layout of the ISFSI. The ISFSI consists of room for three concrete pads. The concrete pads will be built in sequence as they are needed. Currently, only 1 pad is built. The pad dimensions are 224 feet by 32 feet by 2 feet thick with a 40-foot ramp on each end for vehicle access. A packed gravel road surrounds each pad. Each pad is designed to hold 28 upright casks spaced 8 feet apart surface-to-surface for a total of 84 casks. The casks are placed on the pads starting in the center and working towards both ends.

The primary purpose of the concrete pad is to provide a well defined and level support surface for the storage casks. It also serves as an aid in preventing tip over of the casks in the event of an earthquake. The casks are the only ISFSI components that serve a safety function and the support pads of the ISFSI are not considered important to safety.

Each concrete pad is surrounded by an inner and outer security fence which in turn are surrounded by a site perimeter fence. The entrance to the ISFSI is on the west side.

Electrical systems provided for the ISFSI include a lighting system for the area, a security system around the casks, power distribution for normal and emergency power for the lighting and security loads, and a communications (telephone) system. A cask alarm (pressure loss) system is provided local to the ISFSI area. These electrical systems will be discussed further later.

Once again, it is important to note that the only ISFSI components which serve a safety function are the storage casks themselves.

Sealed Surface Storage Casks - The storage casks are totally passive systems with natural convection cooling in air sufficient to maintain safe fuel clad temperatures. The cask walls provide adequate shielding and no radioactive products are released under any credible conditions.

The safe storage of the spent fuel assemblies depends only on the capability of the storage casks to fulfill their design function. The casks are designed to be self-contained and independent and do not rely on any other systems or components for their operation. Further information on the casks is provided in another section of this module.

ISFSI Electrical System - Electrical systems are provided for the ISFSI only Pad 1 is installed; however, as the second and third concrete pads are built, the electrical systems provided will be similar.

The nonsafety source of electrical power for the ISFSI is obtained from three 34.5/.48 kV transformers. The 34.5 kV line comes from a line at the NANIC. The transformers provides power to ISFSI loads through a separate feeder located near the ISFSI alarm panel.

Eventually, this distribution panel will provide feed to all three pads.

A backup power supply with an automatic transfer switch is provided, primarily to maintain security system operation. Backup power is supplied by a 60 kw diesel generator with a 280 gallon fuel tank. The diesel generator transfer switch and power distribution panel are sized to provide the loads for all three pads. The backup power supply provides power to the security components in the ISFSI area and the lighting.

Each pad is provided with general area lighting by 20 pole-mounted 1000W high-pressure sodium lamps. The poles are located along the side of the road around the cask pads, with ample space allowed so as not to interfere with cask placement. Lighting control is automatic from photoelectric cells or manual from a control switch on the lighting electrical panel.

During a loss of power to the ISFSI, some of the lamps are fed from the diesel generator. These emergency lights are designed to provide a minimum amount of lighting.

Outdoor 120 V ac convenience receptacles are located on all of the lighting poles within the ISFSI security fence. One welding receptacle is also provided on one of the poles.

Each concrete pad has an alarm panel for its casks. The panels are located next to the ISFSI entrance. The capability of connecting two points per cask is provided for on the ISFSI alarm panel. The particular parameters to be monitored for each type of cask will be selected based on recommendations made by the cask manufacturer. The monitoring devices will actuate a pressure or other parameter switch, as applicable, at a preset alarm level dependent on the cask type. Each of the cask alarms will initiate a LED alarm light in the local alarm panel at the ISFSI. The alarm point will indicate the specific cask and parameter in question. In addition, the initiation of any alarm or loss of power to the alarm panel will energize signals at the CAS and SAS. North Anna's ISFSI alarm panel will detect a decrease in pressure on the cask, which could indicate leaking seals.

If an alarm is initiated, the signals remain on until acknowledged at the alarm panel. When the alarm input for the cask is cleared, the LED alarm lights will go out when reset at the alarm panel.

It is important to remember that none of the electrical support systems provided are necessary for the accomplishment of the safety function of the ISFSI. The lighting system functions merely for convenience and visual monitoring and the instrumentation monitors the long-term performance of the casks with respect to heat transfer and leakage. A loss of these instruments will not affect the integrity of the casks, jeopardize the safe storage of the fuel, nor result in radiological releases. (The ISFSI electrical system is also covered in NCRODP-ZZ).

Cask Handling and Transport - Several steps are necessary for the loading and preparation of the casks which take place with in the North Anna Fuel and Decontamination Buildings. See the section of this module on storage cask operations for an overview of the handling and transport procedures.

The path followed by the trailer from the Fuel Building enclosure to the ISFSI is shown on Figure 78-14. The transfer path is mostly asphalt, but is compacted gravel inside the ISFSI.

ISFSI Maintenance and Surveillance - The ISFSI does not require the continuous presence of operators or maintenance personnel. Cask design features have been included to minimize or eliminate maintenance. Typical periodic maintenance and surveillance tasks would include:

Maintenance

1. Touch up defects in cask coating material, recoat.
2. Replacement or recalibration of monitoring instrumentation.
3. Periodic testing of instrumentation alarms, electrical and lighting systems, diesel.

Surveillance

1. Quarterly visual surveillance of each cask.

2. Security check each shift.

3. Quarterly calculation of perimeter fence radiation doses.

Decommissioning - The concept of dry cask storage of spent fuel features inherent ease and simplicity of decommissioning. Cask decommissioning could be accomplished by one of the following options:

1. The ISFSI cask, including the spent fuel stored inside, could be shipped to a suitable repository for permanent storage. A supplemental shipping container or overpack would be considered.

2. The spent fuel could be removed from the ISFSI cask and shipped to a suitable fuel repository. Cask decontamination could be accomplished by using conventional high-pressure water sprays. After decontamination, the ISFSI cask could be either cut up for scrap or partially scrapped and any remaining contaminated portions shipped as radwaste to a disposal facility.

Due to the zero-leakage design of the storage casks, no residual contamination is expected to be left behind on the concrete pads.

The spent fuel pool will remain functional until the ISFSI is decommissioned. This will allow the pool to be used to transfer fuel from the storage casks to shipping containers for shipment offsite if this decommissioning option is chosen.

ISFSI Safety Analysis Overview

This section is intended to provide an overview of the analysis which were performed to demonstrate the safety of the ISFSI, including the potential environmental impacts. These analyses are primarily contained in the Safety Analyses Report (SAR) and the Environmental Report (ER). Also, detailed information on the casks to be placed at the ISFSI is provided in the cask Topical Safety Analysis Reports. These analyses are principally directed towards analyzing the safety aspects of casks handling and storage once the storage casks have left the

Decontamination Building.

Regulatory Requirements - The basic requirements for the design and safety of an ISFSI are contained in 10 CFR Part 72, as opposed to the requirements for nuclear power plants, which are found in 10 CFR Part 50. NRC Reg Guide 3.62 provides guidelines for implementing 10 CFR 72 and details the type and extent of the safety analyses. Reg Guide 4.2 dictates the typical contents of an Environmental Report.

The ISFSI design is unique in that it allows for multiple cask types to be used. Each cask design is licensed for use by the NRC and a Topical Safety Analysis Report (TSAR) is prepared. The content of the cask TSAR is very similar to the ISFSI SAR and is intended to provide detailed cask design information. This detailed information supplements the more general ISFSI SAR and indicates how the cask design satisfies the facility design criteria.

Design Criteria - This section deals with the design criteria which were formulated prior to the design of the ISFSI. The design criteria dictate that the design of the ISFSI complies with certain pre-established standards and regulations. The ISFSI design complies with all applicable design criteria.

The ISFSI SAR and ER include a detailed evaluation of the site specific characteristics and environmental conditions which are significant to the design basis for the ISFSI. In general, these conditions are very similar to those used for design purposes of the North Anna Power Station.

The geography and population are evaluated.

The potential effects of explosions from chemicals, flammable gases, or natural gas pipelines were analyzed. Truck traffic along highway 208 was evaluated and the explosion of a gasoline tanker was analyzed.

Potential fires from various fuels and flammable liquids were reviewed for potential effects on the ISFSI.

The potential for aircraft accidents at the ISFSI was considered.

Information on typical weather conditions at the site were collected and reviewed. Temperature, humidity, rainfall, fog, wind speed and direction, atmospheric stability, and the amount of solar radiation (sunlight) were all reviewed.

Extreme or severe weather conditions were also analyzed. This included extreme wind speeds, tornado probability, the severity of past tropical storms and hurricanes, the amount of snowfall, the potential and level of flooding, and the frequency of thunderstorms.

Of particular importance was the geological and seismological history of the site area. Extensive review and analyses of past earthquakes in the eastern United States was conducted. Groundwater conditions and the potential for soil liquefaction were evaluated. Slope stability from construction of the ISFSI was defined.

As a result of this extensive review of site and environmental conditions, the following bounding factors were developed to be considered in the ISFSI design.

1.	Ambient Temperature	-20°F to 115°F
2.	Direct Exposure to Sunlight	800 cal/cm^2
3.	Ambient Humidity	0 to 100%
4.	Tornado Pressure Drop	3 psi in 3 seconds
5.	Tornado Wind Velocity	300 mph Rotational 60 mph Translational
6.	Maximum Winds	80 mph
7.	Maximum Flood Level	267 ft msl
8.	Explosive peak overpressure	1 psi
9.	Design Earthquake Peak	0.18g horizontal 0.12g vertical

The site and environmental conditions defined for the ISFSI were combined with cask-specific considerations to develop the overall design criteria for the ISFSI storage cask.

Design Criteria for Dry Sealed Surface Storage Casks

1.	Max weight with yoke	125 tons
2.	Max length	16 ft with covers removed
3.	Criticality with single active or credible passive failure	$k_{eff} < .95$
4.	Max surface dose	129 mrem/hr (avg side surface) 55 mrem/hr (avg top surface)
5.	Ambient Temperature	-20°F to 115°F
6.	Direct Exposure to sunlight	5kW over 10 hour period
7.	Ambient Humidity	0 to 100%
8.	Tornado Wind Velocity	300 mph Rotational 60 mph Translational
9.	Tornado Pressure Drop	3 psi in 3 seconds
10.	Maximum Winds	105 mph
11.	Gustiness Factor	1.3
12.	Explosive peak overpressure	1 psi
13.	Design Earthquake Peak	0.18g

14. Capable of being lifted by mobile crane or lifting rig.
15. Capable of being stored and transported in vertical or horizontal position.
16. Adequate provisions to monitor performance of casks.
17. Eighteen (18) inch drop onto concrete pad without compromising cask integrity and without physical damage to fuel or loss of subcriticality.
18. Capable of tipping over and rolling without exceeding expected damage for 18-inch drop onto concrete pad.
19. Designed, fabricated, delivered to site, and sealed according to recognized commercial codes and standards.
20. Construction materials to be compatible with each other and with expected radiation levels.
21. All surfaces contacting fuel assemblies to be free of burrs, sharp corners, edges, and weld beads that could mar or damage the fuel assembly surface or injure personnel.

22. Permanent identification of each fuel assembly storage location to be provided.

23. Leak tightness to be maintained under all operating conditions and credible events.

24. Leak tightness to be maintained following 18-inch drop, design earthquake, and other postulated site hazards.

25. All cutting and welding required for the handling of the casks not to result in damage to the fuel assemblies.

26. All surfaces (external) wetted by fuel pool water to be easily decontaminated. This includes lifting yoke.

As mentioned earlier, the primary purpose of the concrete pad is to provide a well defined and level support surface for the casks. They also serve as an aid in preventing cask tip-over during seismic event. However, since the casks themselves can withstand the design basis earthquake and postulated tip-over, the pads perform no safety function. Structural analyses were performed for the concrete pad to: (1) demonstrate that the pads, fully loaded with casks will withstand a design earthquake with no adverse effects either to the pad or to the casks, and (2) show that the casks remain upright during and after the seismic event.

The design earthquake peak acceleration used for the analysis of the concrete pad was the Safe Shutdown Earthquake (SSE) for Units 1 and 2.

The results of the detailed, finite-element analyses of the concrete pad allow the following conclusions to be made: (1) the soil stability analysis indicated that the factor of safety against a bearing failure is greater than 3, (2) the minimum factor of safety against the potential of liquefaction is 2, and (3) the factor of safety against cask tip-over was greater than 1.6. In all cases, the pad remained continuous with no loss of integrity. It was also shown that the pad could withstand the worst case soil settlement.

Once again, it is important to remember that despite the assurances that the casks will not tip over during the earthquake, additional analyses performed by the cask vendors verified that the casks can withstand a tip-over with no loss of function. Three issues are addressed in the cask vendor's analyses:

1. Criticality must be within acceptable limits.
2. Cask integrity must be maintained (no loss of confinement).
3. Any damage must be limited so as not to preclude the removal of fuel assemblies (basket integrity must be maintained).

Environmental Impacts of the ISFSI - The ISFSI Safety Analysis Report and Environmental Report include detailed evaluations of potential impacts resulting from construction and operation of the ISFSI. The impacts of site preparation and construction included:

1. The effects on land use of site clearing, excavation, etc. were determined to be negligible.

2. The effects on water bodies were also determined to be minimal. A temporary drainage system was used during construction to collect runoff and no dewatering was required.

3. A peak construction work force of only 20 people posed no major impacts. Because of the small size of the construction effort, the impacts of fugitive dust, construction noise, and traffic were found to be minimal. No impact on wildlife was anticipated. Also, the amount of resources (concrete) committed irretrievably to the ISFSI is relatively small and the economic and social effects of ISFSI construction were found to be negligible.

The radiological impacts of ISFSI construction and facility operation were probably the major focus of the SAR, requiring the most extensive analyses. The occupational doses to workers constructing the pads, loading and placing the casks, performing periodic maintenance and surveillance, and working in the site yard were evaluated. In addition, the potential offsite doses to the public were specified. Further information on this subject will be provided later in this module.

Once again the impacts on wildlife were found to be minimal and the evaluation of rainfall runoff concluded that it would not be contaminated since the casks are decontaminated prior to placement at the ISFSI. Decommissioning of the ISFSI was also evaluated as previously discussed.

The ISFSI has a number of design features which provide assurance that exposures are maintained As Low As reasonably Achievable:

1. The storage casks are the only radioactive components at the ISFSI. The casks are loaded with fuel assemblies, sealed, and decontaminated prior to transfer and emplacement at the ISFSI. Therefore, there will be minimal exposure from surface contamination associated with maintenance of equipment. The casks will not be opened while at the ISFSI. Should problems develop, the casks would first be transferred back to the decontamination building.

2. Storage of intact fuel assemblies in dry, sealed casks eliminates the possibility of leakage of contaminated liquids, and gaseous releases are not considered credible. The casks are heavily shielded to minimize external dose rates.

3. The instrumentation provided to monitor cask performance requires little maintenance and/or calibration. Surveillance is minimal. Also, the ISFSI will not be normally occupied. Therefore, no personnel areas, equipment decontamination areas, contamination control areas, or health physics facilities need be located at the ISFSI. These types of facilities are available at the station.

4. The casks are spaced 8 feet apart which allows for adequate clearance for cask surveillance and handling operations and heat dissipation. Also, the ISFSI is located at a sufficient distance from the station so that personnel exposures are minimized. The ISFSI fence is kept normally locked to control access.

5. As mentioned earlier, the ISFSI pads are constructed and the casks placed so as to minimize exposures. Pad 2 will not be used until Pad 1 is filled and, likewise, Pad 3 will not be used until Pad 2 is filled. Casks will be placed on a pad in

rows of two starting at the middle and moving to both ends. In this manner, personnel placing casks on the next available pad are closer to the older spent fuel and further from the younger spent fuel.

Neutron and gamma dose rates versus distance were evaluated to determine the exposures to ISFSI personnel, North Anna site personnel, and members of the public. Dose rates at the cask surface are taken from the cask TSAR. These casks surface dose rates were then multiplied by factors of 1.5 (side) and 3 (top) to envelop further cask designs and fuel characteristics. Presently, the dose rate analyses are based on representative North Anna Power Station fuel with an initial enrichment of 3.85 w/o U-235 and a burnup of 40,000 MWD/MTU. (These are ISFSI Technical Specification limits).

A minimum decay time for the spent fuel is required prior to placement in the casks. For the TN-32 cask, the fuel must have decayed for at least 7 years in the spent fuel pool prior to loading in the cask. For other casks, the decay time is from 5 to 10 years. The dose rate analyses also take into account the decay of the fuel after it has been placed at the ISFSI. Decay factors have been used assuming that eight casks are placed in the ISFSI every three years for 21 years.

The following shows the drop off in dose rate versus distance from the ISFSI.

1. TN-32 cask surface dose rates
   side - 7.9 mr/hr neutron, 78.3 mr/hr gamma
   top - 0.7 mr/hr neutron, 17.6 mr/hr gamma
2. Enveloping case (Factors of 1.5 and 3)
   side - 11.9 mr/hr neutron, 117.5 mr/hr gamma
   top - 2.1 mr/hr neutron, 52.8 mr/hr gamma
3. Maximum dose rates along ISFSI fence (all pads full) - 1.0 mr/hr
4. Maximum dose rate to North Anna yard area - 2.0 E-3 mr/hr
5. Maximum dose rate to nearest permanent resident (0.54 miles) - 2.93E-4 mr/hr

These calculated dose rates were used to estimate the collective dose assessment to onsite personnel and members of the public.

The occupational exposure for cask loading, transport and emplacement were also estimated (includes enveloping factors of 1.5 and 3):

North Anna Power Station (assume 84 casks on ISFSI)	3.0 person-rem
ISFSI Operation -	
cask preparation and placement	3.9 person-rem
(assumes 3 casks per year)	
Maintenance and surveillance	0.3 person-rem
TOTAL	7.2 person-rem

The results of the offsite dose assessment were as follows:

1. 299 Permanent residents within 2 miles.
2. Nearest resident at 0.54 miles - 2.93E-4 mr/hr
3. Collective Annual Dose from 84 casks - 0.77 E-1 person-rem
4. Maximum dose occurs from 84 casks; subsequently decreases due to decay.

<u>Accident Analyses</u> - Various potential accidents were analyzed in the SAR and ER to ensure that any individual located on or beyond the nearest boundary of the ISFSI controlled area will not receive a dose to the whole body or any organ greater than 5 rem. A total loss of electrical power is postulated to occur in the feeder cable which supplies the ISFSI. The loss of power could occur as a result of lightning or extreme wind or an electrical fault. As a result, the normal lighting and cask instrumentation would be lost, but the loss would be annunciated at the CAS and SAS. Following loss of power, plant maintenance would isolate the fault and restore service by conventional means. A loss of power will not affect the integrity of the casks, nor result in radiological releases.

The design earthquake (DE) is postulated to occur. As discussed previously, the DE is not capable of producing leakage from the casks and the pad will remain intact. There is no dose associated with this event.

The analysis for each cask demonstrates that extreme winds are not capable of overturning the cask nor of producing leakage from them. No resultant dose would occur.

The elevation of the ISFSI is about 312 feet above m sl. The maximum lake flood level is calculated to be 267 feet above msl. Therefore, the ISFSI is considered flood dry.

An explosion is postulated to on Route 208 about 1 mile from the ISFSI. A peak pressure wave of less than 1 psi is estimated. Cask tip-over due to an explosion is not capable of producing leakage and no resultant doses would occur.

The only combustible materials in the ISFSI pads are cable insulation and coating on the outside surface of the casks. The ISFSI area will be cleared of trees and seeded with grass. The diesel fuel oil tank is adequately separated. The casks have been shown to withstand fires and no resultant doses would occur.

The radiological consequences of dropping a fuel assembly during cask loading are less than those previously evaluated in the North Anna FSAR.

Fuel assemblies planned to be placed in the storage casks are verified that they do not exceed specified limits such as decay time, burnup, enrichment, heat generation, etc. Therefore, administrative controls are relied upon. However, the inadvertent loading of a fuel assembly not intended for storage in the cask will not result in unsafe fuel conditions or releases of radioactive products.

The casks feature redundant seals in conjunction with extremely rugged body designs. The fuel pellet matrix and zircaloy cladding are also barriers against radioactivity releases. As a result, no credible mechanisms that could result in leakage of radioactive products have been identified. Nevertheless, a complete loss of the cask confinement capability has been analyzed and the results found to be negligible. A worst case dose of less than 144 mrem at the closest site boundary would result.

The casks are designed to withstand drops of at least 18 inches without compromising cask integrity. Procedures preclude lifting the casks in excess of 18 inches at the ISFSI or en route to it. Detailed procedures are provided on how to respond to a cask drop.

ISFSI License Overview

Components of Facility License - This section is intended to familiarize personnel with the ISFSI license, issued by the NRC under 10 CFR Part 72. This license govern all activities concerning the spent fuel once it has been loaded into the storage casks and has been transported away from the Fuel Building. This section will help in the understanding of the limitations imposed upon the handling and storage of spent fuel casks.

General and Financial Information - Virginia Power has received a license from the NRC to operate an Independent Spent Fuel Storage Installation at the site of the North Anna Nuclear Power Station.

The function of the ISFSI is to store spent fuel (up to 839.04 metric tons of uranium) which has been irradiated at either unit of the North Anna Power Station and allowed to cool for a specified minimum time in the spent fuel pool of that facility. Spent fuel at the ISFSI is stored in dry casks, to be purchased from different manufacturers. The first casks are manufactured by the New York based company Transnuclear.

The North Anna ISFSI has been designed to operate, if necessary, through the life of the North Anna Power Station Units 1 and 2, i.e., years 2018 and 2020, respectively. The license is valid for 20 years.

The total cost of building and operating the ISFSI over the life-time of the project in 1994 base dollars would be $22.8 for capital expenditures with an operation and maintenance cost of $53.4 million.

Technical Qualifications - Virginia Power operates four nuclear power units. Experience and training has enabled Virginia Power to acquire expertise needed for constructing and operating the North Anna ISFSI in a manner that ensures the safety of the public and operating personnel.

Technical Information - Safety Analysis Report (SAR) - The North Anna ISFSI is designed to store all spent fuel resulting from the operation of North Anna Units 1 and 2 in excess of that which can be stored in its spent fuel pool. According to current refueling estimates, this will require a total of 57 casks each holding 32 assemblies. The total design capacity of the facility is 839.04 metric tons of uranium (TeU) based on 57 casks each holding 32 assemblies and each assembly containing 0.46 TeU.

The SAR for the ISFSI describes the design criteria to be met by the casks, the site, and all matters pertaining to the operation of the ISFSI. A detailed description of the TN-32 cask and how it meets the prescribed criteria is presented in the TN-32 TSAR. The combination of the SAR and any of the TSARs describing the casks provides all the information required in accordance with 10 CFR 72.15.

Conformity to General Design Criteria - Subpart F of 10 CFR Part 72 provides general design criteria to be met by an ISFSI. North Anna's ISFSI complies with all the applicable design criteria. The ISFSI's specific conformance to the general design criteria is covered in more detail in the SAR.

Operating Procedures - The ISFSI will be operated under the same management organization responsible for operation of the North Anna Power Station Units 1 and 2. Due to the passive nature of the ISFSI and its infrequent demands on personnel, it is expected that the ISFSI operations can be scheduled so that the existing station organization can easily accommodate the ISFSI responsibilities without the need for obtaining additional personnel.

Quality Assurance Program - All activities associated with the ISFSI that are considered important to safety will be conducted in accordance with the Virginia Power Topical Report VEP-1-5A, "Topical Report on Quality Assurance Program - Operating Phase."

Training Program - All personnel working at the North Anna ISFSI will receive training and indoctrination geared toward providing and maintaining a well-qualified work force for safe and efficient operation of the ISFSI. This module provides part of the training and indoctrination.

Inventory and Records Requirements - Records are kept identifying the spent fuel assemblies stored in each cask, manufacturer, date of manufacture, their storage location within the cask basket, initial enrichment, reactor exposure history, estimated burnup, time since discharge from the core, and the estimated heat rate. These records are retained as long as the stored fuel remains within the North Anna site and are kept in duplicate. Records are also kept of radiation measurements and of fuel transferred out of the ISFSI.

Physical Protection - In the design for physical protection, a ISFSI Security Plan has been developed to comply with the requirements of Subpart H to 10 CFR part 72.

Decommissioning Plan - The dry storage cask concept utilized at the ISFSI features inherent ease and simplicity of decommissioning. At the end of its service lifetime, decommissioning will be accomplished by removing the spent fuel from the casks, decontaminating all exposed surfaces by conventional means, and finally releasing them for either re-use or disposal.

It is estimated that the cask materials will be only very slightly activated as a result of their long-term exposure to the relatively small neutron flux emanating from the spent fuel and that the resultant activation level will be well below allowable limits for general release of the casks as non-controlled material. Hence, the casks may be decommissioned from nuclear service by surface decontamination alone.

Due to the zero-leakage design of the casks, no residual contamination is expected to be left behind on the concrete base pad. The base pad, fence, and peripheral utility structures are considered decommissioned when the last cask is removed.

Emergency Plan - The North Anna Power Station Emergency Plan is used to provide the necessary guidelines concerning responsibilities, authorities, actions, and resources required to cope with the range of occurrences which may arise at the ISFSI. To provide these guidelines, the North Anna Emergency Plan has been modified to reflect the actions to be taken during the events described in the North Anna ISFSI SAR. These modifications include the addition of the following ISFSI events to the list of events requiring a Notification Of Unusual Event to be declared at the site:

1. Cask seal leakage.
2. Cask drop or other handling mishap.

Virginia Power actions described in the North Anna Emergency Plan to respond to the various classes of events will not change due to the addition of the ISFSI events previously described.

VPAP-2802, Notifications and Reports. Section 6.13 of VPAP-2802 provides the requirements for making notifications which concern the ISFSI, in accordance with 10 CFR 72. This includes what information must be included in the report and the ISFSI incidents that require an immediate, a one-hour, a four-hour, and a twenty-four hour report.

Environmental Report - The environmental impacts of all aspects of the ISFSI have been found to be sufficiently small so as not to require the preparation of an environmental impact statement.

License Conditions - The license conditions for the ISFSI contain the Virginia Power commitments to take the actions specified during the entire life of the ISFSI from site selection through the subsequent phases of design, construction, operation, and ultimate decommissioning. These license conditions are classified into two broad categories:

1. Administrative and management organization and controls,
2. Technical specifications.

The ISFSI Technical Specifications are covered in more detail in the Tech Spec section of this module.

Review Exercise

Respond to each of the following questions or statements with an appropriate short answer. Check your answers with the key at the end of the module.

1. North Anna's ISFSI is designed to hold a total of ___ casks.

2. What component provides back-up electrical power for the ISFSI should the normal power supply be interrupted?

3. Describe the two possible options for decommissioning the spent fuel casks.

4. Assuming a complete loss of a cask confinement capability, what would be the expected dose rate at the closest site boundary?

5. Describe the ISFSI events that are included in the North Anna Emergency Plan.

SPENT FUEL DRY STORAGE CASK SYSTEM

PROCEDURES AND TECHNICAL SPECIFICATIONS

Objectives

Upon completion of this section, the trainee will be able to:

A. Discuss the normal Operating Procedures and the Abnormal Procedures dealing with Spent Fuel Shipping and Storage.

B. Discuss the requirements for handling Special Nuclear Material (SNM) as per VPAP-1406.

C. Discuss the Technical Specifications for fuel handling and the ISFSI.

D. Discuss Industry Events associated with the Spent Fuel Dry Storage Cask System.

E. DISCUSS THE PROCEDURES, REQUIREMENTS AND TECHNICAL SPECIFICATIONS ASSOCIATED WITH SPENT FUEL DRY STORAGE CASK SYSTEM.

Operating and Abnormal Procedures

Operating procedures that cover the handling and loading of the TN-32 casks have already been mentioned in their respective sections.

Abnormal Procedures - AP-22.00, Fuel Handling abnormal procedure, requires that if a fuel handling accident should occur, that all fuel handling operations be secured and the effected area be evacuated.

Special Nuclear Material Control (VPAP-1406)

Special Nuclear Material (SNM) is defined as a material that consist of plutonium, uranium 233, uranium enriched in isotope 233 or 235, or any other material that the NRC determines to be SNM,... Nuclear fuel, incore detectors, excore NI detectors, primary sources and radioactive devices containing plutonium are examples of SNM.

<u>Methods of physical inventory</u>

1. Physical inventories of SNM shall be conducted and documented in accordance with O-OSP-NM-002 and the results shall be sent to the Fuel Accountability and Inspection section of the Nuclear Analysis and Fuel Department.

2. When receiving new fuel, Operations Support personnel shall initiate a Nuclear Material Handling Report Cover Sheet, Fuel Handling Report, verify fuel movements, and process receipt documents, perform unloading of new fuel containers, fuel removal and fuel movement. They shall track new fuel movement until the fuel is stored then forward the completed documentation to Records Management.

3. Videotapes, photographs, core loading verification sheets, or other documentation of the final material balance before operation or storage is satisfactory for inventory of nuclear fuel assemblies in the core of a reactor or in ISFSI storage.

4. Applicable material control records shall be compared to physical inventories. A Deviation Report shall be initiated for any discrepancies between material records and the physical inventory and any discrepancy which cannot be promptly resolved shall be reported to the Station Manager and Manager Nuclear Analysis and Fuel.

5. Operations Support personnel shall conduct a physical inventory of the New Fuel Storage Area, and the Spent Fuel Pool after each refueling (and at intervals not to exceed 12 months). Inventories shall include a piece count and verification of serial numbers (refer to NCRODP-48 for information on location of serial numbers.)

6. The Supervisor Operations Support shall verify that a reactor core physical inventory is performed by the Fuel Accountability and Inspection Group during the refueling operation. Physical inventories shall verify fuel assembly serial number in accordance with Nuclear Analysis and Fuel procedures.

<u>**Special handling requirements for SNM**</u>

Operations Support Personnel shall:

1. Ensure that nuclear fuel is maintained in Item Control Areas except during receipt, transfer and storage operations.

2. Help maintain records of the location, identity and number of fuel assemblies at the Station from receipt until final disposal.

3. Ensure nuclear fuel is transferred in accordance with approved procedures.

4. Prior to transfer of SNM, item identity and count shall be documented. Written authorization from the Material Balance Area Custodian (Assistant Station Manager O&M), or his designee, shall be obtained prior to transfer.

5. The individual responsible for the transfer shall document it and forward documentation to the Supervisor Operations Support.

6. SNM storage areas shall be kept free of combustible materials.

7. The plastic covering on new fuel assemblies in dry storage should be opened at the bottom.

8. The location and identity of each fuel assembly or fuel element shall be recorded in the SNM Historical Data Base.

9. When fuel SNM movement is completed for the day or shift, update the status board, update the SNM Historical data Base.

Technical Specifications

There are no restrictions are placed on storage cask movement by the North Anna Station Technical Specifications.

ISFSI Technical Specifications - Since the ISFSI is independent of the plant, it has its own Technical Specifications which govern its operation.

Section 1.0 of the ISFSI Tech Specs includes;

1. Definitions,

2. Pre-operational license conditions, which require a dry run test of all cask loading and handling activities for each cask model,

3. General license conditions, which cover Quality Assurance, Administrative controls and Fuel And Cask Handling Activities.

Section 2.0, Functional and Operating Limits, includes;

1. The specifications for the fuel to be stored at the ISFSI,

2. The dry storage casks operating limits for the casks that are licensed to be used at North Anna's ISFSI,

3. Limiting conditions for cask handling height,

4. Limiting conditions for cask surface contamination,

5. Cask internal cover gas,

6. Limiting conditions for cask pressure monitoring device,

Section 3.0 covers the surveillance requirements.

1. Cask seal testing,

2. Cask contamination,

3. Cask surface dose rates,

4. Cask safety status surveillance,

5. Cask pressure monitoring,

6. ISFSI alarm board, and

7. Cask fuel parameters

Section 4.0 covers the design features of the site, casks, storage pads, and storage capacity.

Industry Events

OE-6952. In October of 1994, at the Brunswick power plant, while attempting to seat the closure head on a spent fuel cask, the head became cocked and required realignment. During the head list operation, the cask head became stuck on one side and two of the four lifting cables became over stressed and broke. The crane was not equipped with digital read out for positioning in the X, Y and Z directions. Match marks had been installed on the crane and were used to indicate proper crane alignment for cask head removal and installation. A common practice of traversing the crane several times from the match marks in an attempt to better align the head resulted in damage to the guide pins and sleeves. During this event the cask head had been lowered on the cask and the head lifting cables were slack. While viewing the gap between the cask and head, one side of the head lowered abruptly 1 to 2 inches. This caused the head to be cocked and stick on several of the closure studs. The crane hoist was raised to lift the closure head and the two cables on the low side of the head were over stressed and failed. The reactor building overhead crane was not equipped with a load cell to indicate excessive load.

Spent Fuel Pool Liner Punctured by Dropped Equipment (SER 15-95). At two plants, Hatch Nuclear Power Plant and Tricastin (France), equipment that dropped into the spent fuel pool punctured the pool's stainless steel liner plates. In one event, inadequate training of contract workers resulted in improper fabrication of a lifting sling. The sling failed while supporting a core shroud head bolt, and the bolt punctured the pool floor liner plate. In the second event, an unauthorized modification to a tool made it difficult to attach a safety lanyard. As a result, the lanyard was not installed, and the tool was inadvertently dropped and punctured the pool floor liner plate. During these events, plant personnel terminated spent fuel pool leakage prior to significant decrease in water level. These events are significant because dropped loads, which were not considered in the spent fuel pool safety analyses, punctured pool liner plates and resulted in pool leakage.

LESSONS LEARNED FROM THESE EVENTS:

1. Plant safety analyses for bounding the effects of a load dropped over the spent fuel pool may consider that a dropped fuel bundle is the worst case event. In these events, a reactor component and a tool, both much lighter than a fuel assembly, caused damage to the spent fuel pool liner when dropped from near the

surface of the spent fuel pool.

2. The weight, elevation, path of travel, and geometry of a suspended load need to be considered when evaluating the potential consequences of a dropped load.

3. Training contract workers on plant expectations and procedures applicable to assigned work continues to be an important method for ensuring high standards of performance are met. In one event, deficient contractor knowledge and understanding of utility requirements for lifting slings resulted in improperly constructed slings that failed under load.

Review Exercise

Respond to each of the following questions or statements with an appropriate short answer. Check your answers with the key at the end of the module.

1. Which casks are licensed for storage at the North Anna ISFSI?

2. What actions are required if a fuel handling accident should occur in accordance with AP-22.00?

3. How is a physical inventory of the fuel stored in an ISFSI cask performed?

4. In accordance with the ISFSI Tech Specs, what must be done prior to a cask model being licensed for use at the North Anna ISFSI?

SPENT FUEL DRY STORAGE CASK SYSTEM

ANSWERS KEYS TO REVIEW EXERCISES

The TN-32 Spent Fuel Storage Cask

1. Fuel must be out of the reactor for 7 years.

2. A helium gas cover is used to:
   a. enhance overall heat removal capability, and
   b. provide an inert environment to inhibit corrosion.

3. The slight slope on the cask cavity bottom facilitates water removal.

4. The TN-32 sealing system consist of multiple seals to contain any activity release within the cask. Metal seals are used for long-term stability and corrosion resistance

5. An excess pressure is established in the inter-seal space. If the inner seal were to leak this pressure would leak into the cask cavity. If the outer seal were leaking, the pressure would leak into atmosphere. In either case, a pressure sensing device incorporated into the inter-seal space would detect the decrease in pressure and provide an alarm function.

6. 18 inches, Fuel Building, Outside Crane Area.

7. The load scale monitors while removing the lid to detect any binding.

8. Leakage must be less than $1x10^{-5}$ mbar milliliter/sec.

9. The brake system is designed such that they are normally actuated and hydraulic pressure is needed to release them. This interlock ensures that the transporter will stop on a loss of hydraulic pressure or if the power supply to the hydraulic system should fail.

Independent Spent Fuel Storage Installation

1. 84

2. A 60 kw diesel generator with a 280 gallon fuel tank.

3. If an alarm is initiated, the annunciators in the CAS and SAS would be energized and remain on until the alarm is reset.

4. Cask decommissioning could be accomplished by one of the following options:
   a. The ISFSI cask, including the spent fuel stored inside, could be shipped to a suitable repository for permanent storage. A supplemental shipping container or overpack would be considered.
   b. The spent fuel could be removed from the ISFSI cask and shipped to a suitable fuel repository. Cask decontamination could be accomplished by using conventional high-pressure water sprays. After decontamination, the ISFSI cask could be either cut up for scrap or partially scrapped and any remaining contaminated portions shipped as radwaste to a disposal facility.

5. 144 mrem

6. A Notification Of Unusual Event would be declared if:
   a. Cask seal leakage developed, or
   b. A cask drop or other handling mishap occurred.

Procedures and Technical Specifications

1. At the present time, the TN-32, is licensed for use at North Anna's ISFSI.

2. All fuel handling operations should be stopped and the effected area evacuated.

3. Videotapes, photographs, core loading verification sheets, or other documentation of the final material balance before operation or storage is satisfactory for inventory of nuclear fuel assemblies in the core of a reactor or in ISFSI storage.

4. A dry run test of all cask loading and handling activities for the cask must be performed.

SPENT FUEL DRY STORAGE CASK SYSTEM

LIST OF SOURCES

ABNORMAL PROCEDURE AP-22.00

OPERATING PROCEDURES OP-4 Series

0-OSP-NM-002

TECHNICAL MANUALS

TN-32 Spent Fuel Dry Storage Cask Technical and Operations Manual

VPAP'S

1406 - Special Nuclear Material

2802 - Notifications and Reports

INDUSTRY EVENTS

OE-6952, Cables Break During Cask Lift

SER 95-15, Spent Fuel Pool Liner Punctured by Dropped Equipment

DESIGN CHANGE PACKAGES DCP 95-005 ISFSI Facility

SPENT FUEL DRY STORAGE CASK SYSTEM

LIST OF TABLES

Tables **Page**

SPENT FUEL DRY STORAGE CASK SYSTEM

LIST OF FIGURES

Figures

Lesson Plans

DRAFT

FOR INFORMATION

NORTH ANNA TRAINING CENTER TRANSNUCLEAR TN-32 DRY STORAGE CASK DOCUMENT REVISION RECORD			
REV. NO.	TIR NUMBER	REV. NO.	TIR NUMBER
0	N98-0582		

SPENT FUEL DRY STORAGE CASK SYSTEM

TRANSNUCLEAR TN-32 DRY STORAGE CASK

LESSON RESOURCES

Equipment and Facilities

- Standard Classroom
- Overhead projector

Trainee References

- None

Bibliography

- TN-32 Technical Manual
- TN-32 Topical Safety Analysis Report

Recommended Time

- 2 Hours

LESSON PLAN

Introduction

Technical Specifications require all personnel involved in the fuel handling field to be trained on all equipment. This lesson plan provides the required training on a new cask, the TRANSNUCLEAR TN-32 model which has been licensed for use at North Anna.

Objectives

After receiving this instruction, the trainee will be able to:

A. Summarize the design features of the major cask components.

B. Describe the components of the cask sealing system, including the function of the components in the cask sealing system.

C. Given a sketch or description of a piece of cask auxiliary equipment, identify the component including an explanation of its function.

D. State the cask performance requirements and their design basis assumptions established to satisfy federal regulations.

E. State the Technical Specification limits which have been incorporated in the North Anna ISFSI license to insure that safety analysis results remain valid.

F. Summarize the normal operational activities which are performed to store spent fuel in the TN-32 cask.

G. State the actions to be taken in response to a cask seal monitoring system alarm.

H. Summarize the steps to be performed in opening a loaded cask.

I. Describe the TN-32 cask including it's components, auxiliaries, performance requirements, design basis assumptions, and cask operations.

Presentation

Distribute handouts to trainees.

Refer to/display H/T-1.0, Objectives, and go over objectives with trainees.

A. Design Features

1. Cask body design features

Refer to/display H/T-1.1, Cask Body Design Features.

a. Multi-layered body, 16 feet, 10 inches high, 8 feet, 2 inches in diameter.

b. Walls thickness, 1.5 inch steel containment vessel, 8 inch forged steel gamma shield, 4.5 inch neutron shield.

c. Bottom thickness, 1.5 inch steel containment vessel, 8.75 inch forged steel gamma shield.

d. Cavity diameter, 5 feet, 9 inches.

e. No exterior heat transfer fins.

f. Neutron shielding is a borated polyester resin compound surrounding the body.

g. Two trunnions provided at cask upper end for lifting.

h. Two trunnions provided at cask lower end for support in horizontal orientation and rotation to/from vertical orientation.

i. Sealing surfaces clad with stainless steel for leak-tight sealing capability.

j. Drain the cavity through the lid.

k. Cask body materials:

(1) inner containment shell of rolled carbon steel plate

(2) outer shield shell of forged carbon steel

(3) the trunnions are carbon steel

l. Fully loaded in the pool with water in it and the yoke attached, the cask weighs 247,260 lbs. A loaded cask without water in it, but with the yoke and impact limiters weighs 238,460 lbs.

The cask with the lid, protective cover and the impact limiter and yoke on it weighs 241,390 lbs.

Refer to/display H/T-12.2, Cask Weights.

2. Fuel basket design features

Refer to/display H/T-1.3, Fuel Basket Design Features.

a. 13 feet, 4 inches high, and 4 feet, 10 inches across.

b. Fuel cavities are 8.70 inches square (approximately 0.25" larger than nominal fuel assembly.)

c. Provides locations for 32 fuel assemblies.

d. Provides for fuel assembly support, spent fuel decay heat transfer and criticality control.

e. Made of stainless steel, aluminum and borated aluminum.

3. Lid design features

Refer to/display H/T-11.4, Lid Design Features.

a. 10.5 inches thick, 79.5 inches in diameter.

b. Made of carbon steel.

c. Secured to the cask by 48 bolts at 930 ft-lbs.

d. Double metallic "O" ring with screws for retention to lid.

e. Two penetrations for venting and draining.

f. One penetration for overpressure system.

g. Weighs 12,760 lbs.

B. Cask Sealing System

1. Purpose

Refer to/display H/T-1.5, Sealing System Design Objectives.

a. Provide a "leak-tight" and redundant barrier between the stored fuel and the environment for the licensed storage period.

b. Provide a method to verify a proper seal is established during cask assembly.

c. Provides access penetrations for cask assembly operations.

d. Provides self-monitoring of seal integrity during the storage period.

2. Sealing system component functions

Refer to/display H/T-1.6, Sealing System Component Function.

a. Metal seals

(1) Metal seals are "leak tight" for the storage period.

(2) Redundancy - two metal seals exist in every possible leak path between the fuel and the environment.

b. Drain and vent ports and covers.

(1) Provide access to the cask cavity for draining, vacuum drying, helium backfill and cask reflood

(2) Leak-tight/redundancy: covers over ports have double metal seals.

c. Overpressure system penetration and flange.

(1) Provide access to the space between o-rings for seal monitoring and leak testing.

(2) Leak-tight/redundancy: flange has double metal seals.

C. Cask Auxiliaries

This section will summarize the function of the auxiliary equipment.

Refer to/display H/T-1.7, Auxiliary Equipment Function Summary, to review and summarize the function of the auxiliary equipment.

1. Universal cask lifting yoke - In-plant handling

2. TN-32 impact limiter - In-plant handling

3. Universal lid lifting tools - Long: lid handling in Fuel Pool
   Short: all other lid handling

4. TN-32 lid alignment pins - Lid installation and removal

5. TN-32 vent port connector A & B - Cavity drying and helium backfill

6. Leak test cover - Verify cask leak tightness

7. Overpressure port test connector - Drying of volume between lid seals and leak testing

8. Vent port reflood adaptor - cask cavity water fill when fuel is in the cask

D. Cask Performance requirements and design basis assumptions.

Refer to/display H/T-1.8, Cask Performance Requirements.

Refer to/display H/T-1.9, Heat Transfer Analysis for Fuel Integrity.

1. To insure fuel integrity, peak fuel clad temperature shall not exceed 313°C (595°F) with a helium cover gas.

   The design basis assumptions are;

   a. 38°C (100°F) ambient temperature.

   b. Thermal load from solar heating.

   c. Helium cover gas.

   d. Spent fuel decay heat = 0.847 kilowatt per fuel assembly.

Refer to/display H/T-1.10, Criticality Analysis.

2. To prevent criticality, Keff shall remain ≤ 0.95 under all conditions. The design basis assumptions are;

   a. Fresh, undepleted fuel with 3.85 w/o U-235 enrichment.

   b. Optimum moderation (wet loading conditions, water borated to 2000 ppm).

Refer to/display H/T-1.11, Shielding Analysis for Direct Radiation Exposure.

3. To limit radiation exposure:

a. direct radiation average surface dose (neutron + gamma) shall be ≤ 54.9 mrem/hr top and ≤ 129.4 mrem/hr on side.

b. Activity release shall be insured by seal leakage ≤ 1×10^{-5} mbar-liter/second.

c. The design basis assumptions are;

(1) Maximum initial enrichment is 3.85 w/o U-235

(2) 40,000 MWD/MTU max burnup

(3) Seven year minimum decay time

d. Based on fuel assumptions above, dose rates should be:

Side: 8 mrem/hr neutron
78 mrem/hr gamma

Top: 1 mrem/hr neutron
21 mrem/hr gamma

Refer to/display H/T-1.12, Structural Analysis For Cask Integrity.

4. Cask structural integrity shall be maintained under all conditions (allowable stresses are not exceeded). The design basis analysis is;

a. Environmental conditions

(1) Tornado

(2) Seismic

(3) Fire

(4) Explosion

b. Postulated accidents, cask drop or tipover onto storage pad.

E. Technical Specification limits

> Refer to/display H/T-1.13, North Anna Station ISFSI.

1. Fuel Specifications

a. Only fuel irradiated in North Anna 1 and 2.

b. Unconsolidated and intact (264 fuel or dummy rods)

c. No structural defects or gross cladding failure.

2. Cask operating limits

a. 3.85 w/o U-235 maximum initial enrichment.

b. 40,000 MWD/MTU maximum burnup.

c. Seven year minimum cooling time.

d. 0.847 kilowatt maximum decay heat.

e. Maximum lifting height over ISFSI storage pad:

(1) 5 feet with non-redundant lifting device and impact limiter

(2) 18 inches without impact limiter.

f. Average surface dose rates (neutron + gamma)

(1) ≤ 90.6 mrem/hr side

(2) ≤ 75.9 mrem/hr top

g. Seal leak tightness: $\leq 1\text{x}10^{-5}$ mbar-liter/second.

h. Peak fuel clad temperature: 348°C (658°F)

i. Cask cavity environment:

(1) Vacuum dry at ≤ 3 mbar holding for 10 minutes.

(2) Helium cover gas at 2230 ± 100 mbar .

F. Loading and Handling Procedure

Refer to/display H/T-1.14, Loading And Handling Procedure.

1. Initial conditions - Empty cask in vertical position in crane enclosure.

2. Transfer cask with impact limiter to North Bay.

3. General cask preps

   a. Remove bolts.

   b. Install lid alignment pins.

   c. Remove lid.

   d. Check sealing surface and basket.

4. Transfer cask and impact limiter to the Fuel Pool operating deck and detach impact limiter.

5. Lower cask into Fuel Pool, flood cask with borated water and lower cask to bottom of pool.

6. Load fuel into cask.

7. Lid preparations - in the crane enclosure,

   a. replace lid metal seals and remove port covers.

   b. Prepare vent and drain ports.

8. Install lid and raise cask to Fuel Pool surface. Install all lid bolts to handtight.

9. Dry bottom of cask and attach impact limiter.

10. Transfer loaded cask to North Bay.

11. Cask Preps for Storage:

    a. Remove drain port quick connect fitting.

    b. Remove any residual water from the cask cavity using the drain straw through the drain port.

    c. Remove lid alignment ping.

    d. Remove lid bolts, dry bolts and holes. Install lid bolts and torque to 300, 600 and 930 ft-lbs.

    e. Install drain port cover and torque bolts to 30 and 60 ft-lbs.

    f. Install vent Port Connector A (VPCA)

    g. Connect VDS to VPCA and start cavity drying.

    h. Test cavity dryness.

    i. Install OP port test flange and dry inner seal area.

    j. Leak test inner seal (without helium).

    k. Backfill cavity to 10-20 mbar above atmospheric pressure.

l. Remove VPCA and install VPCB.

m. Backfill cavity with helium to 2230 mbar.

n. Remove VPCB.

o. Leak test inner seal (with helium).

p. Spray helium under vent port cover for 30 seconds and install vent port cover, and torque bolts to 30 and 60 ft-lbs.

q. Leak test vent port cover inner seal.

r. Remove OP port test flange.

s. Install upper neutron shield.

t. Install OP tank, mating OP tank flange with the OP port.

u. Install leak test cover.

v. Evacuate under test cover to 500 mbar.

w. Leak test outer seal system (without helium).

x. Backfill OP tank to 1500 mbar and leak test outer seal system (with helium).

y. Remove test cover.

z. Test operation of pressure switches to ensure alarm at 3250 ± 150 mbar.

aa. Backfill OP system with helium to 5500 ± 200 mbar.

bb. Install protective cover.

12. Transfer cask with impact limiter to crane enclosure.

13. Detach impact limiter.

14. Place cask at suitable location for transfer to ISFSI.

G. Seal Monitoring System Alarm

1. Initial condition - Seal monitoring system alarm at ISFSI pad. Reset at alarm panel doesn't work.

2. Prep for testing - Connect test device to electrical terminal strip.

3. Contacts open?

a. YES, check second pressure switch.

b. If either pressure switch inoperable or contacts open, transport cask to station.

c. If both pressure switches operable and contacts closed, check cables and alarm system and restore cask.

H. Opening a loaded cask

Refer to/display H/T-1.16, Loaded Cask Opening Procedure.

1. Initial conditions - A loaded cask with a seal problem in the crane enclosure.

2. Survey cask for contamination. Clean cask to fuel pool requirements.

3. Transfer cask with impact limiter to North Bay.

    a. Check pressure switches. If OP tank pressure > 3400 mbar and no audible tone from pressure switches, replace inoperable switches.

    b. Determine total leak rate.

    c. If leak rate less than allowable restore cask to service.

    d. If leak rate more than allowable, lid seals must be replaced.

4. Transfer cask to Fuel pool operating deck and detach impact limiter.

5. Lower cask into Fuel Pool.

    a. remove drain and vent ports and install reflood adaptor.

    b. Flood cask using reflood equipment and borated water.

    c. Remove remaining lid bolts.

d. Lower cask to bottom of fuel pool.

e. Remove lid and transfer to crane enclosure.

f. Decon lid as needed and install new O-rings.

7. Reassemble cask per OP.

Summary

The trainees should now be familiar with the TN-32 cask components, it's auxiliaries, the design requirements and analysis and associated operating procedures.

INSTRUCTIONAL AIDS

Handout/Transparency Masters

- H/T-1.0 Objectives
- H/T-1.1 Cask Body Design Features (2 pages)
- H/T-1.2 Cask Weights Vessel
- H/T-1.3 Fuel Basket Design Features
- H/T-1.4 Lid Design Features
- H/T-1.5 Sealing System Design Objectives
- H/T-1.6 Sealing System Component functions
- H/T-1.7 Auxiliary Equipment Function Summary
- H/T-1.8 Cask Performance Requirements
- H/T-1.9 Heat Transfer Analysis for Fuel Integrity
- H/T-1.10 Criticality Analysis
- H/T-1.11 Shielding Analysis for Direct Radiation Exposure
- H/T-1.12 Structural Analysis for Cask Integrity
- H/T-1.13 Surry Station ISFSI
- H/T-1.14 Loading and Handling Procedure (4 pages)
- H/T-1.15 Seal Monitoring System Alarm Response Procedure
- H/T-1.16 Loaded Cask Opening Procedure (2 pages)

Additional Instructional Aids

- None

OBJECTIVES

After receiving this instruction, the trainee will be able to:

A. Summarize the design features of the major cask components.

B. Describe the components of the cask sealing system, including the function of the components in the cask sealing system.

C. Given a sketch or description of a piece of cask auxiliary equipment, identify the component including an explanation of its function.

D. State the cask performance requirements and their design basis assumptions established to satisfy federal regulations.

E. State the Technical Specification limits which have been incorporated in the Surry ISFSI license to insure that safety analysis results remain valid.

F. Summarize the normal operational activities which are performed to store spent fuel in the TN-32 cask.

G. State the actions to be taken in response to a cask seal monitoring system alarm.

H. Summarize the steps to be performed in opening a loaded cask.

I. Describe the TN-32 cask including it's components, auxiliaries, performance requirements, design basis assumptions, and cask operations.

BODY DESIGN FEATURES

Dimensions

- 16 feet, 10 inches high and 8 feet, 2 inches in diameter
- Wall thickness, 1.5 inch steel containment vessel, 8 inch forged steel gamma shield, 4.5 inch neutron shield.
- Bottom thickness, 1.5 inch steel containment vessel, 8.75 inch forged steel gamma shield.
- Cavity diameter, 5 feet, 9 inches

Features

- No exterior heat transfer fins
- Neutron shielding is provided by a borated polyester resin compound poured into aluminum containers
- 2 trunnions provided at cask upper end for lifting
- 2 trunnions provided at cask lower end for support in horizontal orientation and rotation to/from vertical orientation
- Sealing surfaces clad with stainless steel for leak-tight sealing capability
- Vent/drain cavity through lid

Materials

- Cask body: inner containment shell of rolled carbon steel plate and outer shield shell of forged steel
- Trunnions: Carbon Steel

TN-32 WEIGHTS

	Component	Weight
In Pool with Water	Cask Body	149,400
	Lid	12,760
	Basket and Rails	16,900
	32 Fuel Assemblies	48,800
	Water in Cavity	12,200
	Yoke	7,200
		247,260
Transfer From Pool	Cask Body	149,400
	Lid	12,760
	Basket and Rails	16,900
	32 Fuel Assemblies	48,800
	Impact Limiter	3,400
	Yoke	7,200
		238,460
Lift From North Bay	Cask Body	149,400
	Lid	12,760
	Basket and Rails	16,900
	32 Fuel Assemblies	48,800
	Resin Disk	1,490
	Overpressure Tank	60
	Protective Cover	1,380
	Impact Limiter	3,400
	Yoke	7,200
		241,390

FUEL BASKET DESIGN FEATURES

Dimensions

- 13 feet, 4 inches high and 4 feet, 10 inches across
- Fuel cavities are 8.70 inches square (approximately 0.25" larger than nominal fuel assembly)

Features

- Cavities provided for 32 fuel assemblies
- Provides for fuel assembly support, spent fuel decay heat transfer and criticality control

Materials

- Stainless steel, aluminum and borated aluminum

LID DESIGN FEATURES

Primary Lid

- 10.5 inches thick by 79.5 inches in diameter, carbon steel
- 48 bolts to 930 ft-lbs.
- Double metallic O-ring with retaining screws
- 2 penetrations for drying, helium backfill, leak testing
- 1 penetration for overpressure tank
- Weighs 12,760 lbs.

TN-32
SEALING SYSTEM DESIGN OBJECTIVES

- Provide a "leak-tight" and redundant barrier between the stored fuel and the environment for the licensed storage period

- Provide a method to verify a proper seal is established during cask assembly

- Provide access penetrations for cask assembly operations

- Provide self-monitoring of seal integrity during the storage period

SEALING SYSTEM COMPONENT FUNCTIONS

Metal Seals

- Metal seals are "leak-tight" for the storage period

- Redundancy - two metal seals exist in every possible leak path between the fuel and the environment

Drain and Vent Ports and Covers

- Provide access to the cask cavity for draining, vacuum drying, leak testing and helium backfill

- Leak-tight/redundancy: covers over ports have metal seals

AUXILIARY EQUIPMENT FUNCTION SUMMARY

Item	Function
Universal cask lifting yoke	In-plant handling
TN-32 impact limiters	In-plant handling
Universal lid lifting tools	Long: lid handling in Fuel Pool Short: all other lid handling
TN-32 lid alignment pins	Lid installation and removal.
TN-32 Vent Port A&B Connectors	Cavity drying and helium backfill
Leak test cover	Verify cask leak tightness
Overpressure Port Test Connector	Drying of volume between lid seals, leak testing
Vent Port Reflood Adaptor	Cask cavity water fill when fuel is in the cask

CASK PERFORMANCE REQUIREMENTS

Performance Category	Performance Requirement
Fuel Integrity	Peak fuel clad temperature not to exceed 313°C (595°F) with a helium cover gas
Criticality Safety	$K_{eff} \leq 0.95$ under all conditions
Radiation Exposure	
Direct Radiation, Average Surface Dose (Neutron + Gamma)	≤75.9 mrem/hr top ≤90.6 mrem/hr side
Activity Release	Seal leakage $\leq 1 \times 10^{-5}$ mbar-liter/second
Cask Integrity	
Environmental Effects Normal Handling Postulated Accidents	Structural integrity is maintained under all conditions

HEAT TRANSFER ANALYSIS FOR FUEL INTEGRITY

Performance Requirement

313 °C (595°F) maximum fuel clad temperature

Design Basis Assumption:

a. 38°C (100°F) ambient temperature.

b. Thermal load from solar heating.

c. Helium cover gas.

d. Spent fuel decay heat = 0.847 kilowatt per fuel assembly

CRITICALITY ANALYSIS

Performance Requirement

Keff shall remain $\leq$ 0.95 under all conditions.

Design Basis Assumption:

a. Fresh, undepleted fuel with 3.85 w/o U-235 enrichment.

b. Optimum moderation (wet loading conditions, water borated to 2000 ppm).

c. Infinite array of casks.

SHIELDING ANALYSIS FOR DIRECT RADIATION EXPOSURE

Performance Requirement:

$\leq$75.9 mrem/hr average on top surface

$\leq$90.6 mrem/hr average on side surface

Sum of neutron and gamma

Design Basis Assumptions

- Maximum initial enrichment is 3.85 w/o U_{235} (2.61)
- 40,000 MWD/MTU maximum burnup
- Seven year minimum decay time

Based on fuel assumptions above, dose rates should be:

- Side: 8 mrem/hr neutron
  78 mrem/hr gamma
- Top: 1 mrem/hr neutron
  21 mrem/hr gamma

Based on actual fuel parameters, dose rates should be about half of that predicted

STRUCTURAL ANALYSIS FOR CASK INTEGRITY

Performance Requirement

Cask structural integrity shall be maintained under all conditions (allowable stresses are not exceeded).

Design Basis Assumption:

1. Environmental conditions

   Tornado

   Seismic

   Fire

   Explosions

2. Postulated accidents

   Cask drop or tipover onto storage pad.

NORTH ANNA STATION ISFSI

A. Fuel Specifications

1. Only fuel irradiated in North Anna 1 and 2.
2. Unconsolidated and intact (264 fuel or dummy rods)
3. No structural defects or gross cladding failure.

B. Cask operating limits

1. 3.85 w/o U-235 maximum initial enrichment.
2. 40,000 MWD/MTU maximum burnup.
3. Seven year minimum cooling time.
4. 0.847 kilowatt maximum decay heat.
5. Maximum lifting height over ISFSI storage pad:
   (1) 5 feet with non-redundant lifting device and impact limiter.
   (2) 18 inches without impact limiter.
6. Dose rates (neutron + gamma)
   (1) ≤90.6 mrem/hr side
   (2) ≤75.9 mrem/hr top
7. Seal leak tightness: $\leq 1 \times 10^{-5}$ mbar-liter/second.
8. Peak fuel clad temperature: 340°C (644°F)
9. Cask cavity environment:
   (1) Vacuum dry at 3 mbar holding for 10 minutes
   (2) Helium cover gas at 2229 ± 100 mbar

LOADING AND HANDLING PROCEDURE

<u>Initial Condition</u>

- Empty cask in vertical position in Crane Enclosure

Transfer cask with impact limiter to North Bay

<u>General Cask Preparation</u>

- Install lid alignment pins
- Remove lid
- Check sealing surface and basket

Transfer cask to Fuel Pool operating deck and detach impact limiter.

<u>Fuel Pool</u>

- Lower cask into Pool, flood <u>with borated water</u> and lower to bottom of Pool
- Load fuel into cask

Lid Preparation

- In Crane Enclosure, replace lid metal seals and remove port covers
- Prepare vent and drain ports
- Install lid and raise cask to surface
- Install six lid bolts to 100 ft-lbs
- Pump water through lid to Fuel Pool (1500 gallons)

Dry bottom of cask and attach impact limiter. Transfer loaded cask to North Bay.

Cask Prep for Storage

a. Remove drain port quick connect fitting.

b. Remove any residual water from the cask cavity using the drain straw through the drain port.

c. Remove lid alignment ping.

d. Install lid bolts and torque to 300, 600 and 930 ft-lbs.

e. Install drain port cover and torque bolts to 30 and 60 ft-lbs.

f. Install vent Port Connector A (VPCA)

g. Connect VDS to VPCA and start cavity drying.

h. Test cavity dryness.

i. Install OP port test flange and dry inner seal area.

j. Leak test inner seal (without helium).

k. Backfill cavity to 10-20 mbar above atmospheric pressure.

l. Remove VPCA and install VPCB.

m. Backfill cavity with helium to 2230 mbar.

n. Remove VPCB.

o. Leak test inner seal (with helium).

p. Spray helium under vent port cover while installing vent port cover, and torque bolts to 30 and 60 ft-lbs.

q. Leak test vent port cover inner seal.

r. Remove OP port test flange.

s. Install upper neutron shield.

t. Install OP tank, mating OP tank flange with the OP port.

u. Install leak test cover.

v. Evacuate under test cover to 500 mbar.

w. Leak test outer seal system (without helium).

x. Backfill OP tank to 1500 mbar and leak test outer seal system (with helium).

y. Remove test cover.

z. Remove test cover.

aa. Test operation of pressure switches.

bb. Leak test OP tank diaphragm valve.

cc. Install protective cover.

Transfer cask with impact limiter to Crane Enclosure. Detach impact limiter. Place cask at suitable location for transfer to ISFSI.

SEAL MONITORING SYSTEM ALARM RESPONSE PROCEDURE

Initial condition - Seal monitoring system alarm at ISFSI pad. Reset at alarm panel doesn't work.

Prep for testing - Connect test device to electrical terminal strip.

Contacts open on either pressure switch?

a. YES, transport cask to station.

b. NO, check cables and alarm system and restore cask.

LOADED CASK OPENING PROCEDURE

Initial Condition

- Loaded cask with seal problem in Crane Enclosure

Survey cask for contamination. Clean cask to Fuel Pool requirements. Transfer cask with impact limiter to North Bay.

North Bay

- Check pressure switches for operation.

- Check OP tank pressure. If pressure >3400 mbar, and no audible tone from pressure switch, replace pressure switch. Determine inner and outer seal total leak rates. If leak rates less than allowable restore cask to service. If leak rates more than allowable, lid seals must be replaced.

- Loosen all lid bolts and remove all but six

- Install lid alignment pins

Transfer cask to Fuel Pool operating deck and detach impact limiter.

LOADED CASK OPENING PROCEDURE (Continued)

Fuel Pool

- Lower cask into Fuel Pool
- Remove drain and vent port covers and install reflood adaptor
- Flood cask using reflood equipment and borated water
- Remove remaining lid bolts
- Lower cask to bottom of Fuel Pool
- Remove lid and transfer to Crane Enclosure. Decon lid as needed and install new O-rings.

Reassemble cask per OP

Job Performance Measures

DRAFT

TASK

Operate the Spent Fuel Cask Crane Remotely (0-OP-4.3).

FOR INFORMATION

PREREQUISITES

Completed the approved Crane and Hoist training course (VPAP-0810)

Completed the Fuel Handling Qualiifcation program

Complete the medical examination as required by VPAP-0810 (Crane Operator)

OBJECTIVES

Describe the design and construction of the cask crane.

Describe the control and instrumentation associated with the cask crane.

Describe which VPAP covers operation of the cask and what guidance the VPAP provides for crane operation

Describe the proper method for inspection of the Cask Crane and associated equipment.

CONDITIONS

Spent Fuel Cask Crane needed for cask movement.

STANDARDS

Task was performed as directed by the procedure referenced in the task statement within parentheses (one of the underlined procedures if several are cited)

Self checking practices were used throughout task performance

Verbal communication related to any of the following modes was conducted in accordance with VPAP 1407

- Emergency communication
- Face to face communication
- Giving and acknowledging orders

- Phonetic alphabet
- Telephone communication systems

Work was performed in compliance with the Radiation Work Permit; exposure to surface and airborne contamination was minimized; and ALARA principles were applied

TOOLS AND EQUIPMENT

None

EVALUATION METHOD

Demonstration

PERFORMANCE STEPS

- Verify Initial Conditions are met, and review Precautions and Limitations.
- Ensure Crane/Hoist Operating Permit has been obtained.
- Energize the crane.
- Complete *Crane Inspection* and *Crane/Hoist Operator's Checklist* Attachments.
- Ensure appropriate disconnect switches and breakers are closed.
- Operate the crane as directed by the designated supervisor.

When shutdown of crane is desired then perform the following:

- Raise both hoists near the upper limit, without activating the limit.
- Park the trolley.
- Clean up the work area and return tools to storage.
- Secure crane control.

- Open disconnect switch.
- Store hand held transmitter in its designated storage location.

DRAFT

FOR INFORMATION

TASK

Transport the Dry Storgae Cask to the Decontamination Building Crane Bay (0-OP-4.32).

PREREQUISITES

Completed the approved Crane and Hoist training course.

Completed the Fuel Handling Qualiifcation program

OBJECTIVES

Explain the importance of maintaining proper vertical alignment of cask and crane during the tilt maneuver.

Explain how the cask is protected by the impact limiters.

Identify the requirements for the upper and lower impact limiters to be in place.

Explain the criticality of the 2-point lift beam air system position when attaching/detaching the impact limiters.

CONDITIONS

Transfer of spent fuel to Dry Cask Storage is desired

STANDARDS

Task was performed as directed by the procedure referenced in the task statement within parentheses (one of the underlined procedures if several are cited)

Self checking practices were used throughout task performance

Verbal communication related to any of the following modes was conducted in accordance with VPAP 1407

- Emergency communication
- Face to face communication
- Giving and acknowledging orders

- Phonetic alphabet
- Telephone communication systems

Work was performed in compliance with the Radiation Work Permit; exposure to surface and airborne contamination was minimized; and ALARA principles were applied

TOOLS AND EQUIPMENT

None

EVALUATION METHOD

Verbal/Visual

PERFORMANCE STEPS

Prepare for Transport

- Record the serial number and storage location of the cask to be transported.
- Ensure the transporter is ready for use.
- Raise the transporter header beam to clear the top of the cask.
- Position the lift links to the fully extended position.
- Lubricate both the lift link bearing surfaces and the dry storage cask trunnions.
- Remove the rear box beam.
- Position the transporter over the specified dry storage cask.
- Lower the lift cylinders.
- Position the lift links over the cask trunnions.
- Raise lift cylinders until contact is made.
- Verify lift links are aligned with the trunnions.

- Raise the cask to the maximum height.
- Adjust cask height to the desired travel height.
- Center the cask between the bumpers.
- Extend the hydraulic cylinders for the cask restraint sling.
- Hold cask tightly against the bumpers.
- Install the rear box beam.

Performing Transport

- Notify the Control Room that the cask move will start.
- Slowly transport the cask from the ISFSI to the crane bay.
- Position the cask under the spent fuel crane.
- Remove the rear box beam.
- Remove the cask restraint sling.
- Retract the cask restraint hydraulic cylinders.
- Lower the cask onto the Crane Bay floor.
- Lower the lift links until clear of the trunnions.
- Position the lift links away from the dry storage cask.
- Move the transporter out of the Crane Bay.
- Notify the Control Room that the cask is in the Crane Bay.
- Fully lower the lift cylinders.
- Install the rear box beam.

- Store and shut down the transporter.

DRAFT

TASK

Prepare for Dry Storage Cask Pre-Load (0-OP-4.35).

FOR INFORMATION

PREREQUISITES

Completed the approved Crane and Hoist training course.

Completed the Fuel Handling Qualiifcation program

OBJECTIVES

Describe the capacity of the Transnuclear TN-32 Dry Storage Cask.

Identify the design basis fuel storage capacity of the ISFSI.

Describe the type of spent fuel which can be stored at the ISFSI according to Technical specifications.

CONDITIONS

Transfer of spent fuel to Dry Cask Storage is desired

STANDARDS

Task was performed as directed by the procedure referenced in the task statement within parentheses (one of the underlined procedures if several are cited)

Self checking practices were used throughout task performance

Verbal communication related to any of the following modes was conducted in accordance with VPAP 1407

- Emergency communication
- Face to face communication
- Giving and acknowledging orders
- Phonetic alphabet

- Telephone communication systems

Work was performed in compliance with the Radiation Work Permit; exposure to surface and airborne contamination was minimized; and ALARA principles were applied

TOOLS AND EQUIPMENT

None

EVALUATION METHOD

Verbal/Visual

PERFORMANCE STEPS

- Unbolt and remove the protective cover.
- Remove the neutron shield.
- Label the vent and drain port covers.
- Detention each vent port cover bolt.
- Remove the vent port cover.
- Inspect the vent port and cover sealing surfaces.
- Detention each drain port cover bolt.
- Remove the drain port cover.
- Inspect the drain port and cover sealing surfaces.
- Remove the quick connect coupling from the vent port.
- Remove the quick connect coupling from the drain port and install the drain port adapter.
- Remove the relief valve.

- Install plug in neutron shield vent hole.
- Remove lid bolts and install alignment pins.
- Put the lid lifting head into position.
- Lubricate the three lifting head bolts, and attach the lifting head to the lid.
- Attach the load scale.
- Center the short lid lifting tool.
- Attach the short lid lifting tool to the lifting head.
- Engage the tool with the lifting head.
- Remove the lid from the cask.
- Position the lid away from the work area.
- Lubricate the threaded lid bolt holes.
- Inspect the cask lid seal surface.
- Inspect each cell in the fuel basket.
- Set lid on the cask.

DRAFT

TASK

Transfer the Empty Dry Storgae Cask from Decon Bay to Fuel Building Cask Pit (0-OP-4.35).

PREREQUISITES

FOR INFORMATION

Completed the approved Crane and Hoist training course.

Completed the Fuel Handling Qualiifcation program

OBJECTIVES

Describe the design and construction of the Spent Fuel Pool associated with dry storage cask evolutions.

Describe the operation of the Spent Fuel Pool associated with dry storage cask evolutions.

Describe the design and construction of the cask crane.

Describe the control and instrumentation associated with the cask crane.

Describe which VPAP covers operation of the cask and what guidance the VPAP provides for crane operation.

CONDITIONS

Transfer of spent fuel to Dry Cask Storage is desired

STANDARDS

Task was performed as directed by the procedure referenced in the task statement within parentheses (one of the underlined procedures if several are cited)

Self checking practices were used throughout task performance

Verbal communication related to any of the following modes was conducted in accordance with VPAP 1407

- Emergency communication
- Face to face communication
- Giving and acknowledging orders
- Phonetic alphabet
- Telephone communication systems

Work was performed in compliance with the Radiation Work Permit; exposure to surface and airborne contamination was minimized; and ALARA principles were applied

TOOLS AND EQUIPMENT

None

EVALUATION METHOD

Verbal/Visual

PERFORMANCE STEPS

- Attach the 10-ton pneumatic chain hoist.
- Center the short lid lifting tool.
- Attach the short lid lifting tool to the lifting head.
- Engage the tool with the lifting head.
- Slowly remove the lid from the cask.
- Move the lifting yoke to the cask in the Decon Bay.
- Attach the lifting yoke arm air controller.
- Attach the lifting yoke arms to the cask trunnions.
- Attach a tag line to each lifting yoke arm.
- Notify a unit SRO that the cask will be moved to the Fuel Building.

- Raise the cask and impact limiter.
- Position the cask at the edge of the Cask Pit.
- Lower the cask until the impact limiter contacts the floor.
- Release the impact limiter from the cask.
- Raise the cask.
- Position the cask over the Cask Pit.
- Lower the cask.
- Spray the cask with PG water as the cask is lowered into the Cask Pit.
- Lower the cask to maintain a controlled flow rate until it is filled.
- Lower the cask to the cask loading area.
- Open the lifting yoke arms.
- Raise the lifting yoke.
- Rinse the hook and lifting yoke.
- Allow excess water to drain from the hook and lift beam.
- Position the lid for seal replacement.

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TASK

DRAFT

Load the Dry Storgae Cask (0-OP-4.35).

FOR INFORMATION

PREREQUISITES

Completed the approved Crane and Hoist training course.

Completed the Fuel Handling Qualiifcation program

OBJECTIVES

Describe the design and construction of the Spent Fuel Pool associated with dry storage cask evolutions.

Describe the operation of the Spent Fuel Pool associated with dry storage cask evolutions.

Describe the Technical Specification seal leakage limit for the Transnuclear TN-32 Dry Storage Cask penetration test.

Identify the design basis fuel storage capacity of the ISFSI.

Describe the type of spent fuel which can be stored at the ISFSI according to Technical specifications.

CONDITIONS

Transfer of spent fuel to Dry Cask Storage is desired

STANDARDS

Task was performed as directed by the procedure referenced in the task statement within parentheses (one of the underlined procedures if several are cited)

Self checking practices were used throughout task performance

This is the JPM for Section 5.3
(Loading the Cask)

Verbal communication related to any of the following modes was conducted in accordance with VPAP 1407

- Emergency communication
- Face to face communication
- Giving and acknowledging orders
- Phonetic alphabet
- Telephone communication systems

Work was performed in compliance with the Radiation Work Permit; exposure to surface and airborne contamination was minimized; and ALARA principles were applied

TOOLS AND EQUIPMENT

None

EVALUATION METHOD

Demonstration

PERFORMANCE STEPS

- Remove the Cask Pit Gate.
- Load the cask.
- Verify that each fuel assembly and insert component is the correct one.
- Install the Cask Pit Gate.

TASK

DRAFT

Set the Dry Storgae Cask Lid (0-OP-4.35).

FOR INFORMATION

PREREQUISITES

Completed the approved Crane and Hoist training course.

Completed the Fuel Handling Qualiifcation program

OBJECTIVES

Identify the purpose of the load scale while performing a cask primary lid removal or installation.

Explain the possible adverse effects of the water's hydraulic action during lid installation to the lid "O" rings.

Explain the purpose of de-watering the cask bolt holes.

Identify the purpose of the dual "O" ring arrangement.

Explain the purpose of the metallic "O" ring, including its characteristics which allow it to form a leak-tight seal.

Explain the purpose of the elastomer "O" ring.

CONDITIONS

Transfer of spent fuel to Dry Cask Storage is desired

STANDARDS

Task was performed as directed by the procedure referenced in the task statement within parentheses (one of the underlined procedures if several are cited)

Self checking practices were used throughout task performance

Verbal communication related to any of the following modes was conducted in accordance with VPAP 1407

- Emergency communication
- Face to face communication
- Giving and acknowledging orders
- Phonetic alphabet
- Telephone communication systems

Work was performed in compliance with the Radiation Work Permit; exposure to surface and airborne contamination was minimized; and ALARA principles were applied

TOOLS AND EQUIPMENT

None

EVALUATION METHOD

Demonstration

PERFORMANCE STEPS

Prepare to set Cask Lid

- Adjust the height of the lid to allow changing the seals.
- Remove the seal retaining screws.
- Remove and discard the seal.
- Inspect the seal groove in the lid.
- Mark the underside of the lid for each penetration passageway.
- Raise the seal ring into position.
- Install the seal retaining screws.

- Pierce a hole through the aluminum backing for the vent, drain, and overpressure ports.

<u>Set Cask Lid</u>

- Adjust the lid height not to exceed 7'6" above the floor.
- Move the lid into the Fuel Building.
- Move the Cask Crane to lower the auxiliary hook. Place the lid on the lid supports.
- Disconnect the short lid tool.
- Connect the long lid lifting tool to the hoist.
- Engage the long lifting head with the long lid lifting tool.
- Lift the lid.
- Position the lid over the center of the cask.
- Set the lid on the cask.
- Disengage the lifting tool.
- Return the long lid lifting tool to the storage location.

TASK

DRAFT

Transfer the Dry Storgae Cask from the Fuel building Cask Pit to the Decon Bay (0-OP-4.35).

PREREQUISITES

FOR INFORMATION

Completed the approved Crane and Hoist training course.

Completed the Fuel Handling Qualiifcation program

OBJECTIVES

Describe the design and construction of the Spent Fuel Pool associated with dry storage cask evolutions.

Describe the operation of the Spent Fuel Pool associated with dry storage cask evolutions.

Describe the design and construction of the cask crane.

Describe the control and instrumentation associated with the cask crane.

Describe which VPAP covers operation of the cask and what guidance the VPAP provides for crane operation.

Explain the importance of maintaining proper vertical alignment of cask and crane during the tilt maneuver.

Explain how the cask is protected by the impact limiters.

Identify the requirements for the upper and lower impact limiters to be in place.

CONDITIONS

Transfer of spent fuel to Dry Cask Storage is desired

STANDARDS

Task was performed as directed by the procedure referenced in the task statement within parentheses (one of the underlined procedures if several are cited)

This is the JPM for Section 5.6
(Transfer to Decon Bay)

Self checking practices were used throughout task performance

Verbal communication related to any of the following modes was conducted in accordance with VPAP 1407

- Emergency communication
- Face to face communication
- Giving and acknowledging orders
- Phonetic alphabet
- Telephone communication systems

Work was performed in compliance with the Radiation Work Permit; exposure to surface and airborne contamination was minimized; and ALARA principles were applied

TOOLS AND EQUIPMENT

None

EVALUATION METHOD

Verbal/Visual

PERFORMANCE STEPS

- Center lifting yoke over the cask.
- Attach lifting yoke to the cask.
- Slowly raise the cask.
- Remove the three alignment pins.
- Install all lid bolts hand tight.
- Torque six bolts to 100 ft-lbs.
- Connect pump and clear discharge hose to the drain port adapter.
- Direct the discharge hose to the cask pit and start the pump.

- Remove tag lines.
- Stop the pump.
- Raise and wash down the cask with PG water.
- Allow the residual water to drip from the cask.
- Notify a Unit SRO that the cask will be moved from the fuel building to the Decon Bay.
- Position the cask over the impact limiter.
- Lower the cask onto the impact limiter.
- Attach the impact limiter.
- Raise the cask and impact limiter.
- Move the cask to the Decon Bay.
- Lower the cask.
- Disengage the lifting yoke.
- Position the cask crane for decontaminating the lifting yoke.

FOR INFORMATION

DRAFT

TASK

Assemble the Dry Storgae Cask (0-OP-4.35).

PREREQUISITES

Completed the approved Crane and Hoist training course.

Completed the Fuel Handling Qualiifcation program

OBJECTIVES

Describe the Transnuclear TN-32 Dry Storage Cask operating parameters to include cask cavity pressure, low pressure alarm setpoint, and type of inert gas.

Explain the purpose of de-watering the cask bolt holes.

Identify the requirements for the upper and lower impact limiters to be in place.

Explain the criticality of the 2-point lift beam air system position when attaching/detaching the impact limiters.

CONDITIONS

Transfer of spent fuel to Dry Cask Storage is desired

STANDARDS

Task was performed as directed by the procedure referenced in the task statement within parentheses (one of the underlined procedures if several are cited)

Self checking practices were used throughout task performance

Verbal communication related to any of the following modes was conducted in accordance with VPAP 1407

- Emergency communication
- Face to face communication
- Giving and acknowledging orders
- Phonetic alphabet

- Telephone communication systems

Work was performed in compliance with the Radiation Work Permit; exposure to surface and airborne contamination was minimized; and ALARA principles were applied

TOOLS AND EQUIPMENT

None

EVALUATION METHOD

Demonstration

PERFORMANCE STEPS

- Remove the plug in the neutron shield vent and install the relief valve.
- Remove the drain port adapter.
- Remove residual water from the cask.
- Torque each bolt to 300 ft-lbs. Make one additional pass torquing each bolt to 600 ft-lbs.
- Torque each bolt to 930 ft-lbs.
- Verify cask dewatered and remove drain straw rig.
- Inspect drain port and cover sealing surfaces.
- Install a new metallic O-ring on the drain port cover.
- Lubricate the drain port cover bolts.
- Install the drain port cover bolts hand tight.
- Torque each bolt to 30 ft-lbs.
- Torque each bolt to 60 ft-lbs.
- Inspect the Vent Port Connector A (VPCA) gasket.

- Install the VPCA to the vent port.
- Lubricat⌣ the vent port cover bolts.
- Install the vent port cover bolts hand tight.
- Torque each bolt wrench tight.
- Install the vacuum drying block valve and vacuum drying hose to the VPCA.
- Connect the vacuum hose to the Helium Drying System (HDS).
- Open the suction valve for the running pump.
- When cavity pressure reaches 60 mbar, open 0-HVD-23, close 0-HVD-22 and 0-HVD-24.
- When cavity pressure reaches 3 mbar, close 0-HVD-17, stop the vacuum pump.
- Close 0-HVD-15 and remove vacuum drying hose.
- Install the overpressure port test connector and vacuum hose to the overpressure port.
- Dry the inner seal area.
- Stop the vacuum pump and remove the vacuum hose.
- Do the inner seal system leak check.
- Attach the helium hose to the cask.
- Backfill the cavity with helium.
- Isolate the helium supply, close the block valve, and remove the helium hose.
- Apply thread sealant to the vent port quick connect fitting.
- Remove VPCA from the vent port, and install the quick connect fitting.
- Attach the helium supply hose and Vent Port Connector B (VPCB) to the vent port quick connect fitting.

- Back-fill the cask to a stable pressure of 2230 mbar.
- Remove hose and VPCB.
- Install VPCA.
- Do the inner seal system leak check.
- Remove VPCA.
- Inspect the seal contact area.
- Install a new metallic O-ring in the vent port cover.
- Attach a helium pistol and a rotameter to the helium supply hose.
- As the cover is being put in position, admit helium under the vent port cover.
- Install the vent port cover bolts hand tight.
- Torque each bolt to 30 ft-lbs.
- Torque each bolt to 60 ft-lbs.
- Align the leak detector to the overpressure port test connector and open all in-line valves.
- Determine the vent port cover inner seal leak rate.
- Remove the overpressure port test connector.
- Inspect the overpressure port and overpressure port cover seal surfaces.
- Install a new O-ring in the overpressure port cover.
- Install the upper neutron shield and overpressure tank on the cask.
- Carefully mate the overpressure port cover with the overpressure port.
- Lubricate the overpressure port cover bolts.
- Install the overpressure port cover bolts hand tight.

- Torque each bolt to 60 in-lbs.
- Torque each bolt to 144 in-lbs.
- Lubricate the neutron shield bolts.
- Install the neutron shield bolts hand tight.
- Torque each bolt to 50 ft-lbs.
- Torque each bolt to 90 ft-lbs.

DRAFT FOR INFORMATION

TASK

Leak Test the Outer Seal System (0-OP-4.35).

PREREQUISITES

Completed the approved Crane and Hoist training course.

Completed the Fuel Handling Qualiifcation program

OBJECTIVES

Explain the purpose of the metallic "O" ring, including its characteristics which allow it to form a leak-tight seal.

Explain the purpose of performing cask evacuation.

Describe the design and construction of the Helium Vacuum Drying System.

Explain the purpose of the gas ballast valve on the Helium Vacuum Drying System.

Explain the purpose and operation of the vacuum pump filter on the Helium Vacuum Drying System.

Explain the purpose of the vacuum system refrigerant unit on the Helium Vacuum Drying System.

Describe the modes of operation of the Ultratest F Helium Leak Detection System.

CONDITIONS

Transfer of spent fuel to Dry Cask Storage is desired

STANDARDS

Task was performed as directed by the procedure referenced in the task statement within parentheses (one of the underlined procedures if several are cited)

Self checking practices were used throughout task performance

Verbal communication related to any of the following modes was conducted in accordance with VPAP 1407

- Emergency communication
- Face to face communication
- Giving and acknowledging orders
- Phonetic alphabet
- Telephone communication systems

Work was performed in compliance with the Radiation Work Permit; exposure to surface and airborne contamination was minimized; and ALARA principles were applied

TOOLS AND EQUIPMENT

None

EVALUATION METHOD

Demonstration

PERFORMANCE STEPS

- Open the Over Pressure Tank diaphragm valve.
- Install a hose between the Over Pressure Tank diaphragm valve and the test cover quick connect fitting.
- Lubricate the protective cover bolts.
- Install the test cover.
- Install the protective cover bolts wrench tight.
- Install a vacuum hose between the vacuum manifold and the test cover penetration.
- Start a vacuum pump. Evacuate the area under the test cover to approximately 500 mbar.
- Determine the outer seal system leak rate.
- Isolate and disconnect the helium leak detector from the test cover.

- Do Calibration Verification 2.
- Reduce test cover pressure to atmospheric pressure.
- Remove bolts from the test cover.
- Raise the test cover.
- Remove the test cover and put in storage.

DRAFT

TASK

Perform the Over Pressure System Backfill and Pressure Switch Test (0-OP-4.35).

FOR INFORMATION

PREREQUISITES

Completed the approved Crane and Hoist training course.

Completed the Fuel Handling Qualiifcation program

OBJECTIVES

Explain the purpose of the cask seal monitoring device pressure switch.

Identify the pressure switch actuation setpoint for the Transnuclear TN-32 Dry Storage Cask.

Explain why an operational test of the pressure switch is performed.

Describe the process of performing a ftinctional test of the electronic test device used to test the dry storage cask pressure switches.

CONDITIONS

Transfer of spent fuel to Dry Cask Storage is desired

STANDARDS

Task was performed as directed by the procedure referenced in the task statement within parentheses (one of the underlined procedures if several are cited)

Self checking practices were used throughout task performance

Verbal communication related to any of the following modes was conducted in accordance with VPAP 1407

- Emergency communication
- Face to face communication
- Giving and acknowledging orders

- Phonetic alphabet
- Telephone communication systems

Work was performed in compliance with the Radiation Work Permit; exposure to surface and airborne contamination was minimized; and ALARA principles were applied

TOOLS AND EQUIPMENT

None

EVALUATION METHOD

Verbal/Visual

PERFORMANCE STEPS

- Connect the helium supply line to the Over Pressure Tank diaphragm valve.
- Pressurize the Over Pressure Tank to 5500 mbar.
- Test the operation of each pressure switch.
- Isolate the helium supply, close the Over Pressure Tank diaphragm valve, and disconnect the helium supply hose.

DRAFT

FOR INFORMATION

TASK

Perform the Over Pressure System Diaphragm Valve Leak Test (0-OP-4.35).

PREREQUISITES

Completed the approved Crane and Hoist training course.

Completed the Fuel Handling Qualiifcation program

OBJECTIVES

Explain the purpose of the cask seal monitoring device pressure switch.

Identify the pressure switch actuation setpoint for the Transnuclear TN-32 Dry Storage Cask.

Explain why an operational test of the pressure switch is performed.

Describe the process of performing a ftinctional test of the electronic test device used to test the dry storage cask pressure switches.

CONDITIONS

Transfer of spent fuel to Dry Cask Storage is desired

STANDARDS

Task was performed as directed by the procedure referenced in the task statement within parentheses (one of the underlined procedures if several are cited)

Self checking practices were used throughout task performance

Verbal communication related to any of the following modes was conducted in accordance with VPAP 1407

- Emergency communication
- Face to face communication

- Giving and acknowledging orders
- Phonetic alphabet
- Telephone communication systems

Work was performed in compliance with the Radiation Work Permit; exposure to surface and airborne contamination was minimized; and ALARA principles were applied

TOOLS AND EQUIPMENT

None

EVALUATION METHOD

PERFORMANCE STEPS

- Connect the helium leak detector to the diaphragm valve.

- Determine the leak rate across the diaphragm valve.

- Do the Calibration Verification 3.

- Disconnect the helium leak detector and remove the vacuum hose.

FOR INFORMATION

TASK

DRAFT

Install the Protective Cover on the Dry Storage Cask(0-OP-4.35).

PREREQUISITES

Completed the approved Crane and Hoist training course.

Completed the Fuel Handling Qualiifcation program

OBJECTIVES

Describe the Transnuclear TN-32 Dry Storage Cask operating parameters to include cask cavity pressure, low pressure alarm setpoint, and type of inert gas.

Describe the design and construction of the ISFSI.

CONDITIONS

Transfer of spent fuel to Dry Cask Storage is desired

STANDARDS

Task was performed as directed by the procedure referenced in the task statement within parentheses (one of the underlined procedures if several are cited)

Self checking practices were used throughout task performance

Verbal communication related to any of the following modes was conducted in accordance with VPAP 1407

- Emergency communication
- Face to face communication
- Giving and acknowledging orders
- Phonetic alphabet
- Telephone communication systems

Work was performed in compliance with the Radiation Work Permit; exposure to surface and airborne contamination was minimized; and ALARA principles were applied

TOOLS AND EQUIPMENT

None

EVALUATION METHOD

Demonstration

PERFORMANCE STEPS

- Connect both pressure switched to the pigtail lead.
- Lower the protective cover until seated on the cask.
- Lubricate the protective cover bolts.
- Install the protective cover bolts hand tight.
- Torque each bolt to 30 ft-lbs.
- Torque each bolt to 80 ft-lbs.
- Connect one of the pressure switch pigtails to the temporary alarm panel.
- Notify a Unit SRO to monitor the temporary alarm panel.

TASK

DRAFT

FOR INFORMATION

Transfer the Dry Storgae Cask from the Decon Bay to Yard Area (0-OP-4.35).

PREREQUISITES

Completed the approved Crane and Hoist training course.

Completed the Fuel Handling Qualiifcation program

OBJECTIVES

Describe the design and construction of the Spent Fuel Pool associated with dry storage cask evolutions.

Describe the operation of the Spent Fuel Pool associated with dry storage cask evolutions.

Describe the design and construction of the cask crane.

Describe the control and instrumentation associated with the cask crane.

Describe which VPAP covers operation of the cask and what guidance the VPAP provides for crane operation.

Describe the design and construction of the Dry Storage Cask Transporter.

Describe the hydraulic system associated with the Dry Storage Task Transporter.

Identify the power supply to the various components of the Dry Storage Cask Transporter

Describe the Dry Storage Cask Transporter brake interlock.

Describe the dry storage cask transporting evolution to include vehicle arrangement, approved routes, and required route inspections.

Identify the Technical Specification limitation for cask lifting height during movement with and without impact limiters installed.

CONDITIONS

Transfer of spent fuel to Dry Cask Storage is desired

STANDARDS

Task was performed as directed by the procedure referenced in the task statement within parentheses (one of the underlined procedures if several are cited)

Self checking practices were used throughout task performance

Verbal communication related to any of the following modes was conducted in accordance with VPAP 1407

- Emergency communication
- Face to face communication
- Giving and acknowledging orders
- Phonetic alphabet
- Telephone communication systems

Work was performed in compliance with the Radiation Work Permit; exposure to surface and airborne contamination was minimized; and ALARA principles were applied

TOOLS AND EQUIPMENT

None

EVALUATION METHOD

Verbal/Visual

PERFORMANCE STEPS

- Lower the lift beam to the cask connect elevation.
- Attach Service Air lines to the lift beam.
- Connect the lifting yoke to the cask.

- Notify a Unit SRO that the cask will be moved from the Decon Bay to the Crane Bay.
- Raise the cask with the impact limiter attached.
- Position the cask to remove the impact limiter.
- Lower the cask.
- Release the impact limiter.
- Raise the cask and position it so the transporter can be attached.
- Lower the cask.
- Open the lifting yoke arms.
- Raise the lifting yoke and close the lifting yoke arms.
- Put the lifting yoke in the storage stand.
- Park the cask crane.

FOR INFORMATION

DRAFT

TASK

Prepare for Transporting the Dry Storage Cask to the Independent Spent Fuel Storage Installation (0-OP-4.36).

PREREQUISITES

Completed the approved Crane and Hoist training course.

Completed the Fuel Handling Qualiifcation program

OBJECTIVES

Describe the design and construction of the Spent Fuel Pool associated with dry storage cask evolutions.

Describe the operation of the Spent Fuel Pool associated with dry storage cask evolutions.

Describe the design and construction of the cask crane.

Describe the control and instrumentation associated with the cask crane.

Describe which VPAP covers operation of the cask and what guidance the VPAP provides for crane operation.

Describe the design and construction of the Dry Storage Cask Transporter.

Describe the hydraulic system associated with the Dry Storage Task Transporter.

Identify the power supply to the various components of the Dry Storage Cask Transporter

Describe the Dry Storage Cask Transporter brake interlock.

Describe the dry storage cask transporting evolution to include vehicle arrangement, approved routes, and required route inspections.

Identify the Technical Specification limitation for cask lifting height during movement with and without impact limiters installed.

CONDITIONS

Transfer of spent fuel to Dry Cask Storage is desired

STANDARDS

Task was performed as directed by the procedure referenced in the task statement within parentheses (one of the underlined procedures if several are cited)

Self checking practices were used throughout task performance

Verbal communication related to any of the following modes was conducted in accordance with VPAP 1407

- Emergency communication
- Face to face communication
- Giving and acknowledging orders
- Phonetic alphabet
- Telephone communication systems

Work was performed in compliance with the Radiation Work Permit; exposure to surface and airborne contamination was minimized; and ALARA principles were applied

TOOLS AND EQUIPMENT

None

EVALUATION METHOD

Verbal/Visual

PERFORMANCE STEPS

- Ensure transporter is ready for use.
- Raise transporter header beam to clear the top of the cask.
- Position the lift links to the fully extended position.
- Lubricate lift link bearing surfaces and cask trunnions.

- Remove rear box beam.
- Position transporter over dry storage cask.
- Lower the lift cylinders.
- Position lift links over cask trunnions.
- Verify links are aligned with the trunnions.
- Raise cask to maximum height and verify level.
- Adjust cask height to a level less than 15 inches.
- Ensure cask is centered between bumpers.
- Attach and tighten cask restraint sling.
- Install rear box beam.

DRAFT

TASK

Transport the Dry Storage Cask to the Independent Spent Fuel Storage Installation (0-OP-4.36).

PREREQUISITES

FOR INFORMATI...

Completed the approved Crane and Hoist training course.

Completed the Fuel Handling Qualiifcation program

OBJECTIVES

Describe the design and construction of the Dry Storage Cask Transporter.

Describe the hydraulic system associated with the Dry Storage Task Transporter.

Identify the power supply to the various components of the Dry Storage Cask Transporter

Describe the Dry Storage Cask Transporter brake interlock.

Identify the lifting height restrictions for loaded cask handling outside of the crane enclosure both with and without impact limiters.

Describe the dry storage cask transporting evolution to include vehicle arrangement, approved routes, and required route inspections.

Identify the Technical Specification limitation for cask lifting height during movement with and without impact limiters installed.

CONDITIONS

Transfer of spent fuel to Dry Cask Storage is desired

STANDARDS

Task was performed as directed by the procedure referenced in the task statement within parentheses (one of the underlined procedures if several are cited)

Self checking practices were used throughout task performance

Verbal communication related to any of the following modes was conducted in accordance with VPAP 1407

- Emergency communication
- Face to face communication
- Giving and acknowledging orders
- Phonetic alphabet
- Telephone communication systems

Work was performed in compliance with the Radiation Work Permit; exposure to surface and airborne contamination was minimized; and ALARA principles were applied

TOOLS AND EQUIPMENT

None

EVALUATION METHOD

Verbal/Visual

PERFORMANCE STEPS

- Assign an operator to walk beside the transporter to operate the brakes.
- Notify the Control Room that a cask move will start.
- Slowly move the transporter and cask from the crane bay to the ISFSI.
- Position cask over designated storage location at the ISFSI.
- Remove rear box beam.
- Remove cask restraint sling.
- Lower cask onto pad.
- Position lift links away from dry storage cask.

- Move transporter away from cask.
- Fully lower the lift cylinders.
- Notify the Control Room that the cask is on the ISFSI pad.
- Install the rear box beam.
- Store and shut down the transporter.
- Have the electricians connect the cask monitoring cables.

DRAFT

TASK

Perform the Dry Cask Transporter Pre-trip Inspection (0-OP-4.39).

PREREQUISI TES

Completed the approved Crane and Hoist training course.

Completed the Fuel Handling Qualiifcation program

OBJECTIVES

Describe the design and construction of the Dry Storage Cask Transporter.

Describe the hydraulic system associated with the Dry Storage Task Transporter.

Identify the power supply to the various components of the Dry Storage Cask Transporter

Describe the Dry Storage Cask Transporter brake interlock.

Identify the lifting height restrictions for loaded cask handling outside of the crane enclosure both with and without impact limiters.

Describe the dry storage cask transporting evolution to include vehicle arrangement, approved routes, and required route inspections.

Identify the Technical Specification limitation for cask lifting height during movement with and without impact limiters installed.

CONDITIONS

Transfer of spent fuel to Dry Cask Storage is desired

STANDARDS

Task was performed as directed by the procedure referenced in the task statement within parentheses (one of the underlined procedures if several are cited)

This is the JPM for Section 5.3
(Pre-trip Inspection)

Self checking practices were used throughout task performance

Verbal communication related to any of the following modes was conducted in accordance with VPAP 1407

- Emergency communication
- Face to face communication
- Giving and acknowledging orders
- Phonetic alphabet
- Telephone communication systems

Work was performed in compliance with the Radiation Work Permit; exposure to surface and airborne contamination was minimized; and ALARA principles were applied

TOOLS AND EQUIPMENT

None

EVALUATION METHOD

Demonstration

PERFORMANCE STEPS

- Ensure parking brake is on.
- Ensure battery is installed.
- Ensure diesel fuel tank greater than half full.
- Ensure engine oil level greater than halfway between add and full marks.
- Ensure coolant level is between low and full marks.
- Ensure proper hydraulic oil level.
- Ensure suction line ball valve at the reservoir is open.
- Perform transporter inspection for leaks, foreign material, or damage.

TASK

DRAFT

Operate the Dry Cask Transporter (0-OP-4.39).

PREREQUISITES

FOR INFORMATIO..

Completed the approved Crane and Hoist training course.

Completed the Fuel Handling Qualiifcation program

OBJECTIVES

Describe the design and construction of the Dry Storage Cask Transporter.

Describe the hydraulic system associated with the Dry Storage Task Transporter.

Identify the power supply to the various components of the Dry Storage Cask Transporter

Describe the Dry Storage Cask Transporter brake interlock.

Identify the lifting height restrictions for loaded cask handling outside of the crane enclosure both with and without impact limiters.

Describe the dry storage cask transporting evolution to include vehicle arrangement, approved routes, and required route inspections.

CONDITIONS

Transfer of spent fuel to Dry Cask Storage is desired

STANDARDS

Task was performed as directed by the procedure referenced in the task statement within parentheses (one of the underlined procedures if several are cited)

Self checking practices were used throughout task performance

This is the JPM for Section 5.5
(Transporter operation)

Verbal communication related to any of the following modes was conducted in accordance with VPAP 1407

- Emergency communication
- Face to face communication
- Giving and acknowledging orders
- Phonetic alphabet
- Telephone communication systems

Work was performed in compliance with the Radiation Work Permit; exposure to surface and airborne contamination was minimized; and ALARA principles were applied

TOOLS AND EQUIPMENT

None

EVALUATION METHOD

Demonstration

PERFORMANCE STEPS

For Startup Perform the Following

- Prepare either the electric or motor driven hydraulic pump for use.
- Verify parking brake light is lit.
- Ensure the mechanical steering is locked.
- Perform the lift cylinder retract test.
- Perform the side shift function test.
- Perform the restraining strap cylinder test.
- Perform the steering function test.

For Operation Perform the following

- Ensure tow bar is attached to tow vehicle.
- For mechanical steering, ensure steering lock pin is installed and hydraulic steering is disengaged.
- For hydraulic steering, ensure lock pin is removed and hydraulic steering is engaged.
- Pull brake switch out to release the brakes.
- Operate the transporter as required by cask movement procedure .

When Ready For Shutdown Perform the Following

- Place transporter in desired storage location.
- Ensure emergency brake is on.
- Ensure steering lock pin is installed and hydraulic steering is disengaged.
- Stop the motor driven or diesel hydraulic pump.
- Relieve hydraulic pressure by moving the lift cylinder control levers.
- If desired, disconnect transporter from tow vehicle.

TASK

DRAFT

Reposition a TN-32 dry storage cask (0-OP-4.40).

PREREQUISITES

FOR INFORMATION

Completed the approved Crane and Hoist training course.

Completed the Fuel Handling Qualiifcation program

OBJECTIVES

Describe the process of performing a ftinctional test of the electronic test device used to test the dry storage cask pressure switches.

Describe the design and construction of the Dry Storage Cask Transporter.

Describe the hydraulic system associated with the Dry Storage Task Transporter.

Identify the power supply to the various components of the Dry Storage Cask Transporter

Describe the Dry Storage Cask Transporter brake interlock.

Identify the lifting height restrictions for loaded cask handling outside of the crane enclosure both with and without impact limiters.

Describe the dry storage cask transporting evolution to include vehicle arrangement, approved routes, and required route inspections.

CONDITIONS

Transfer of spent fuel to Dry Cask Storage is desired

STANDARDS

Task was performed as directed by the procedure referenced in the task statement within parentheses (one of the underlined procedures if several are cited)

Self checking practices were used throughout task performance

Verbal communication related to any of the following modes was conducted in accordance with VPAP 1407

- Emergency communication
- Face to face communication
- Giving and acknowledging orders
- Phonetic alphabet
- Telephone communication systems

Work was performed in compliance with the Radiation Work Permit; exposure to surface and airborne contamination was minimized; and ALARA principles were applied

TOOLS AND EQUIPMENT

None

EVALUATION METHOD

Verbal/Visual

PERFORMANCE STEPS

- Position spent fuel cask over the lifting yoke.
- Lightly coat lifting yoke and cask trunnions with anti-seize lubricant.
- Attach air lines to lifting yoke and open lifting yoke arms.
- Align and engage the lifting yoke arms with the cask trunnions.
- Attach impact limiter to cask if required.
- Move the cask to desired location.
- Open the lifting yoke arms and raise the lifting yoke clear of the trunnions.
- Close yoke arms, disconnect air lines, and put yoke in storage stand.