2. FACILITY DESCRIPTION

CONTENTS

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2. FACILITY DESCRIPTION

2.1 Introduction

The facility and operation of the DCSA are described in this chapter. These descriptions provide the information necessary to support and understand the hazard and accident analyses presented in Chapter 3. The text and figures in this chapter are presented as an aid for the reader and are for descriptive purposes only.

A portion of the DCSA is within the existing CPP-749 facility security fence. A new security fence will be constructed that separates the two facilities. The CPP-749 facility is not addressed in this Preliminary Documented Safety Analysis (PDSA). The common interfaces between CPP-749 and CPP-2707 are identified and described in this chapter.

2.2 Requirements

The design criteria for CPP-2707[1] were based on the design codes, standards, regulations, and DOE orders existing at the time the design was initiated. Design requirements used in the evaluation of the CPP-2707 safety basis in this PDSA are contained in the following DOE directives:

- DOE Order 420.1A, "Facility Safety"[2]
- DOE-ID AE, "DOE-ID Architectural Engineering Standards."[3]

Additional design codes, standards, regulations, and DOE orders that were used in the design and evaluation of CPP-2707 are referred to where applicable in this chapter.

2.3 Facility Overview

The CPP-2707 facility is located within the INTEC area of the INEEL. A plan view of the facility is shown in Figure 2-1.

The cask pad is scheduled to be placed into service during 2004, and has a specified design life of 40 years.[1] The purpose of the DCSA is to provide an interim storage location for casks containing spent nuclear fuel. Currently, only 8 casks have been identified for storage on this new pad, although it can accommodate more as needed. Long-term effects of storing dry casks containing spent nuclear fuel, particularly, the potential for hydrogen generation, are considered in the hazard and accident analyses in Chapter 3.

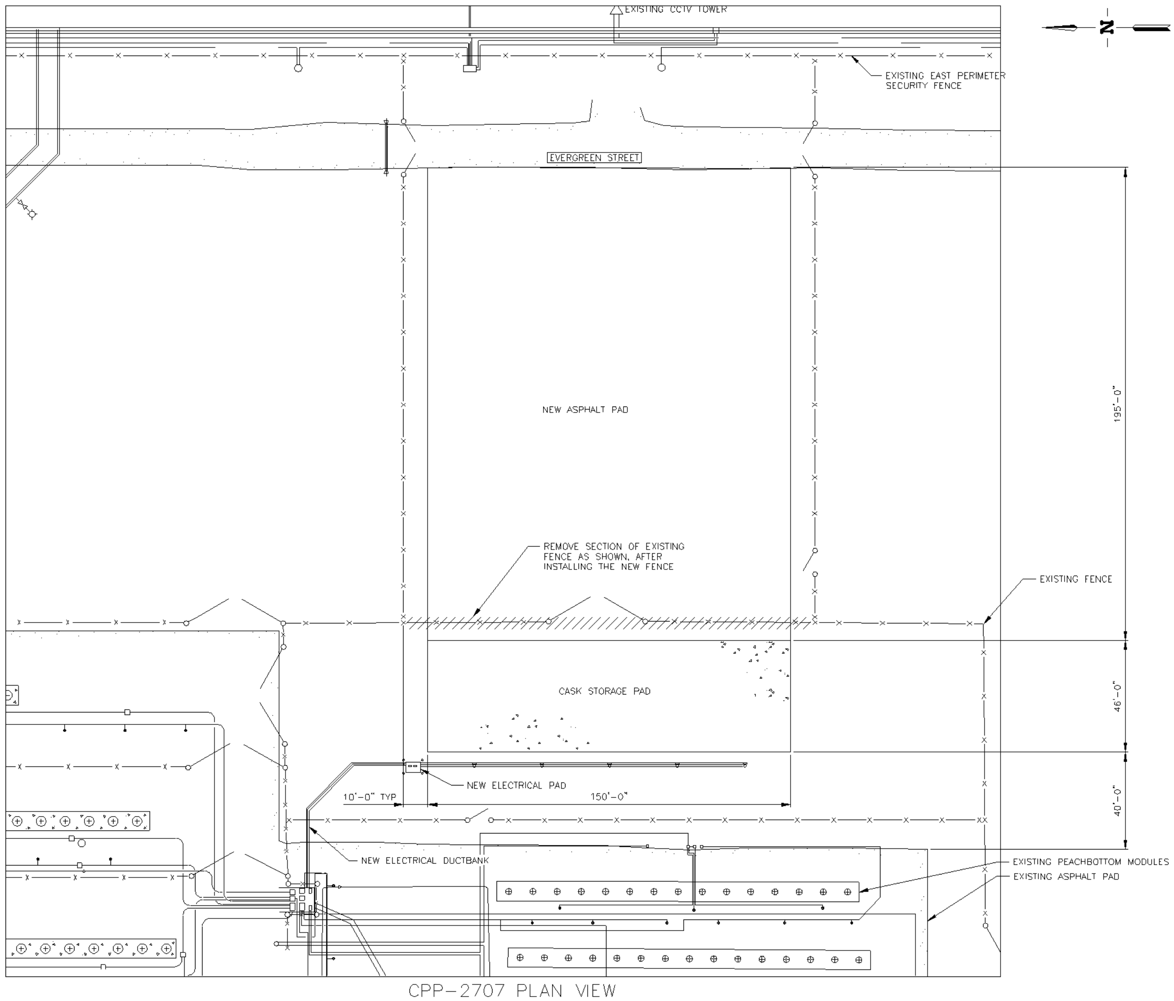

Figure 2-1. DCSA (plan view).

DCSA functions include receiving spent nuclear fuel-loaded casks, unloading casks from transport vehicles (tractor/trailer or spent fuel cask transporter [SFCT]), positioning casks on the pad, and performing surveillance/monitoring activities on casks as determined by sampling/monitoring plans. Activities that involve changes to the cask configuration (such as, lid removal) are excluded from the scope of this evaluation. Figure 2-2 illustrates cask unloading operations and cask placement on the DCSA.

The only casks specified in this PDSA that are approved for receipt and storage on the new pad include the Castor V/21, MC-10, NuPac 125B, REA-2023, TN-24P, VSC-17 (Concrete Storage Cask), TN-REG, and TN-BRP. Additional casks may be stored on the pad after completion of additional analysis and evaluation. The approved casks are derived from a technical basis that is maintained in existing files and includes fuel data and analyses. In cases where fuel data are incomplete, conservative assumptions and analyses are used. Since casks on the pad will not be opened for fuel handling activities, specific details relative to fuel and equipment configurations within casks are not described herein.

DCSA functional areas include the asphalt pad apron and the concrete cask storage pad. These areas are surrounded with a security fence. The facility may also contain portable or permanent cask sampling equipment and collection points to ensure proper disposal of wastes generated in the DCSA.

The primary DCSA operations include positioning cask transport vehicles, unloading casks from transport vehicles, placing casks on the concrete storage pad, performing monitoring activities such as taking pressure readings, performing radiological monitoring, taking gas samples, and performing leak testing.

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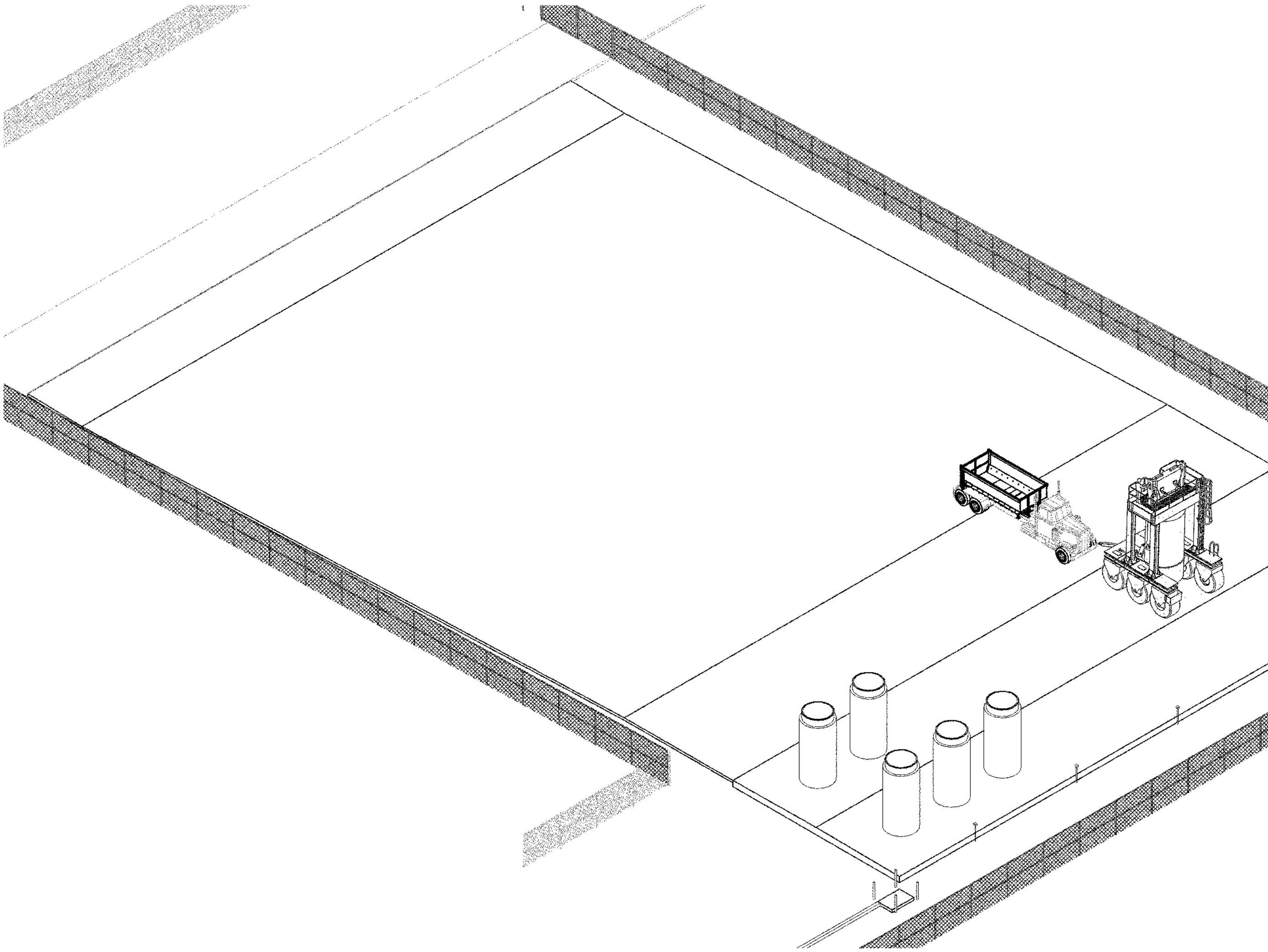

Figure 2-2. DCSA cask placement using SFCT.

DCSA operations may generate gaseous, liquid, and solid waste materials that must be properly disposed of. Gaseous and liquid wastes are collected and filtered by portable or permanent sampling equipment. Solid waste in the form of personal protective equipment (PPE) and decontamination supplies are collected and disposed of per applicable waste handling procedures.

Utilities, auxiliary systems, and special support functions including electrical power, portable lighting as needed, storm water drainage, and portable personnel communication systems are provided.

2.4 Facility Structure

CPP-2707, which includes the asphalt pad apron and the concrete cask storage pad, consists of an area covering approximately 36,150 ft^2 in the southeast quadrant of the INTEC at the southeast corner of CPP-749.[4,1] The eastern 29,250 ft^2 of the facility is constructed using 24 in. of compacted backfill, covered by 36 in. of gravel, covered by 7-in.-thick asphalt. The westernmost 30 by 150-ft area of the asphalt apron is level, then slopes downward at 3% to the eastern edge. The western 6,900-ft^2 portion of the facility is constructed using 24 in. of compacted backfill, covered by 25 in. of gravel, covered by 18-in.-thick reinforced concrete.[5] The facility also includes a perimeter security fence with gated entry/exit locations.

Section 2.4.1 describes the functional areas of the DCSA and the interfaces with CPP-749. Section 2.4.2 describes the structural design of the DCSA. A description of the casks to be handled and stored at the DCSA is provided in Section 2.4.3. The SFCT is described in Section 2.4.4.

2.4.1 DCSA Description

The DCSA asphalt apron area is used to accommodate transport vehicles that are capable of lifting casks with a maximum weight of 140 ton. This area is used to position transport vehicles to facilitate cask placement on the storage pad.

The concrete pad area is used for storage casks containing spent nuclear fuel. Currently, 8 casks have been identified for placement on the concrete pad. The pad size is sufficient to accommodate additional casks.

Interfaces between CPP-2707 and CPP-749 are the common security fence closing the two areas and the electrical distribution system. Electrical power is supplied from CPP-749 into CPP-2707.

2.4.2 Facility Structural Design

This section discusses the structural design of the DCSA with respect to withstanding postulated design or evaluation basis natural phenomena and potential operational loads important to the safety analysis.

Natural phenomena hazards (threats) pertinent to the DCSA design are identified in Table 1-1 of Chapter 1, "Site Characteristics," along with the original and current design and evaluation criteria for each hazard.

Equipment derived loads for the DCSA were limited to dead loads and loads from normal operation, such as casks, and transport vehicles. The DCSA design meets those for a PC-0 facility.

2.4.2.1 Flood Design. The DCSA is being designed for a PMF with a 10,000-yr recurrence interval. The PMF has the potential to result in water level at 4,916.6 ft above mean sea level (MSL), assuming a 35,000-ft^3/s flood crest. Flood protection for the DCSA is provided by the following features:

- Concrete pad is located above the expected PMF elevation, at elevation 4,917.0 ft or higher
- The westernmost 30 ft of the asphalt apron area is also located above the expected PMF, at elevation 4,917.0 ft or higher.

In addition to the PMF criteria, the current design criteria also includes a 25-yr (recurrence interval), 6-hr storm that results in 1.4 in. of rainfall. The potential hazard is localized flooding. Protection against localized flooding is provided by the INTEC site and DCSA drainage systems.

2.4.2.2 Snow Design. The DCSA is being designed for a snow loading of 30 lb/ft^2.

2.4.2.3 Operational Loads. In addition to providing protection against postulated design or evaluation basis natural phenomena, the structural design of the DCSA provides the capability to withstand operational loads, including normal loads, impact, or dropped loads. The operational design loads important to the safety analysis are discussed below.

1. Asphalt Apron Area. This area is sized to accommodate cask transport vehicles weighing up to 180 ton when loaded with a cask and cask sampling equipment.
2. Concrete Cask Pad Area. This area is sized to accommodate up to 20 casks, each weighing up to 140 ton, with a maximum diameter of 9 ft. The concrete pad is designed to support the combined weight of 20 casks, transport vehicles, and cask sampling equipment.

2.4.3 Casks

Irradiated fuel is transported in casks that are received at the DCSA. There are many different casks designed to transport different types of fuel. The only casks authorized for handling and storage on the DCSA pad are the Castor V/21, MC-10, NuPac 125B, REA-2023, TN-24P, VSC-17 (Concrete Storage Cask), TN-REG, and TN-BRP. A description of each cask is provided in this Section. Additional details for each of the 8 casks are provided in the cask-specific Safety Analysis Reports for Packaging (SARPs) and/or Topical Safety Analyses.[6,7,8,9,10,11,12,13]

2.4.3.1 Castor V/21 Cask. The General Nuclear Systems (GNS) CASTOR V/21 cask is a thick-walled, nodular cast-iron cylinder approximately 7.87 ft in diameter; it weighs approximately 113 ton. The cask has a cylindrical cavity that holds a fuel basket designed to accommodate up to 21 pressurized water reactor (PWR) spent nuclear fuel assemblies. The cask cavity is 5 ft wide and 13.78 ft long, with side walls 1.3 ft thick. The cask contains multiple containment barriers.

The internal heat transfer medium of the cask is an inert gas (helium or nitrogen). Gamma and neutron radiation is shielded by the cast-iron wall of the cask, which includes sections of neutron-moderating material. The maximum expected dose rate on the surface of the cask is less than 200 mR/h and less than 10 mR/h at 2 m. Gas intake and exhaust air are accommodated via a valve in the primary shield cover. The cover system is fitted with a leak-testing device and has a multiple seal consisting of metal and elastomer O-rings. Features of the GNS CASTOR V/21 cask and closure system are shown in Figure 2-3. The main components of the GNS CASTOR V/21 cask are described in a Topical Safety Analysis Report (TSAR) in January 1985.[6]

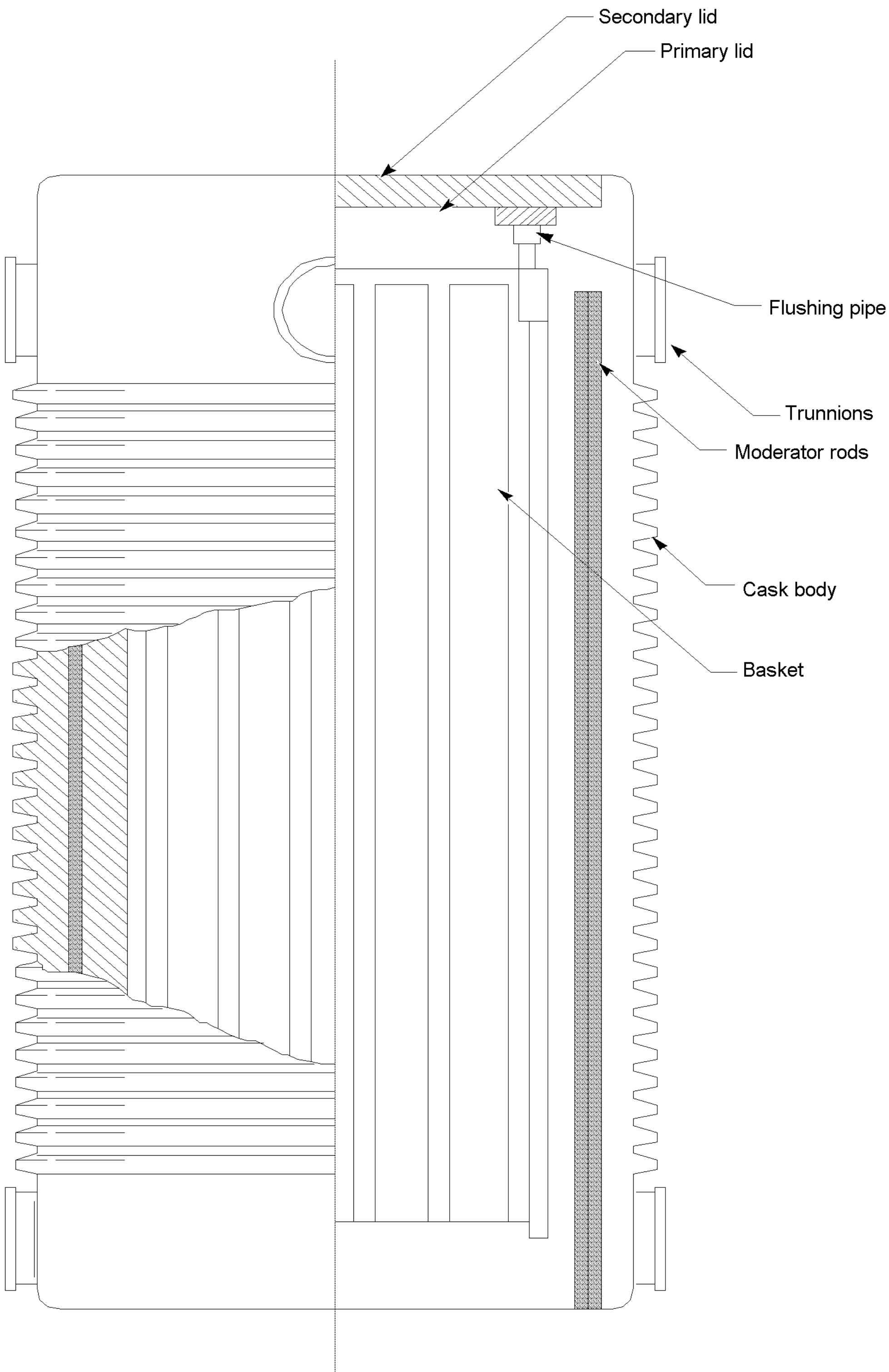

Figure 2-3. Castor V/21 cask.

2.4.3.2 ***MC-10 Cask.*** The Westinghouse MC-10 cask is used for storage of up to 24 spent nuclear fuel assemblies or 24 canisters of consolidated spent nuclear fuel rods. The MC-10 cask consists of 24 stainless-steel cells in an aluminum basket structure. Each cell consists of an enclosure, neutron poison material, and limiter blocks. The enclosure is formed to provide an 8.75-in.-inside square envelope for spent nuclear fuel assembly storage.

The cask vessel is a forged-steel container with an integrally welded, forged-steel bottom. The cask cavity is 188 in. long, 88 in. in diameter, and has a side wall thickness of 10 in. Stainless-steel neutron-absorbing material jackets the outside surfaces of the vessel wall and base. The maximum expected dose rate on the surface of the cask is less than 100 mR/h. Twenty-four nickel-plated fins project through the jacket on the vessel walls to increase heat dissipation from the cask.

The vessel closure system is a series of four covers: (1) a shield cover, a 5 × 75.5-in. plate of low-alloy steel bolted to the cask vessel; (2) a primary cover, a 3.5 × 85.88-in. plate of carbon steel located atop the shield; (3) a seal cover, a 1× 87.12-in. plate of carbon steel mounted over the other two covers; and (4) a closure cover, a 5 × 94.5-in. stainless-steel weldment containing neutron-absorbing shielding material placed atop the seal cover.

When fully loaded, the total weight of the MC-10 cask is approximately 113.3 tons. An illustration of an MC-10 cask is shown in Figure 2-4 and a more detailed description is provided in a TSAR dated November 1987.[7]

2.4.3.3 ***NuPac 125B-2 Cask.*** The NuPac 125B-2 fuel shipping cask is used for interim storage of the two Three-Mile Island (TMI)-2 fuel canisters that contain epoxy (D-153 and D-388). The NuPac 125B-2 fuel shipping cask is a rail cask designed to transport up to seven canisters containing portions of the TMI core, and was licensed and used for that purpose in the 1980s, as authorized by the cask SARP.[8]

The NuPac 125B-2 cask consists of an inner vessel and outer (lead-shielded) cask, as shown in Figures 2-5 and 2-6, respectively. The outer cask exterior dimensions have a 65.5-in. diameter and a 207.5–in. length and it consists of concentric Type 304 stainless-steel shells (1.0-in.-thick inner shell and 2.0-in.-thick outer shell) that sandwich a cast-lead shell (3.88 in. thick). The outer cask containment boundary consists of the 7.5-in.-thick stainless-steel bottom, the 1.0-in.-thick stainless-steel inner shell, the upper forging, and the 7.5-in.-thick cask lid, complete with two neoprene O-ring seals.[8] Thirty-two A320 carbon-steel closure bolts secure the outer cask lid to the outer cask body.

The outer cask cavity is 51.25 in. in diameter by 192.5 in. long. The outer cask has two lifting and four tie-down trunnions. The inner vessel structure is a hub, spoke, and wheel arrangement, consisting of a Type 304 stainless-steel containment boundary made up of seven individual tubes (14.5 in. inside diameter [ID]) with 1.81-in.-thick bottom plates atop forging, to which the tubes are welded, and a 5-in.-thick closure lid, complete with two neoprene O-ring seals.[8] Twenty-four A320 carbon-steel closure bolts secure the inner vessel lid to the inner vessel body. On the closure lids of both the inner vessel and the outer cask are a seal test port, a combination vent/sampling port, and a rupture disc to preclude catastrophic damage to the package, should inadvertent overpressurization occur. The inner vessel vent/sampling port will remain open, for gas monitoring of the cask cavity during interim storage. The two canisters contained in the NuPac 125B-2 cask will vent to the inner vessel during interim storage.

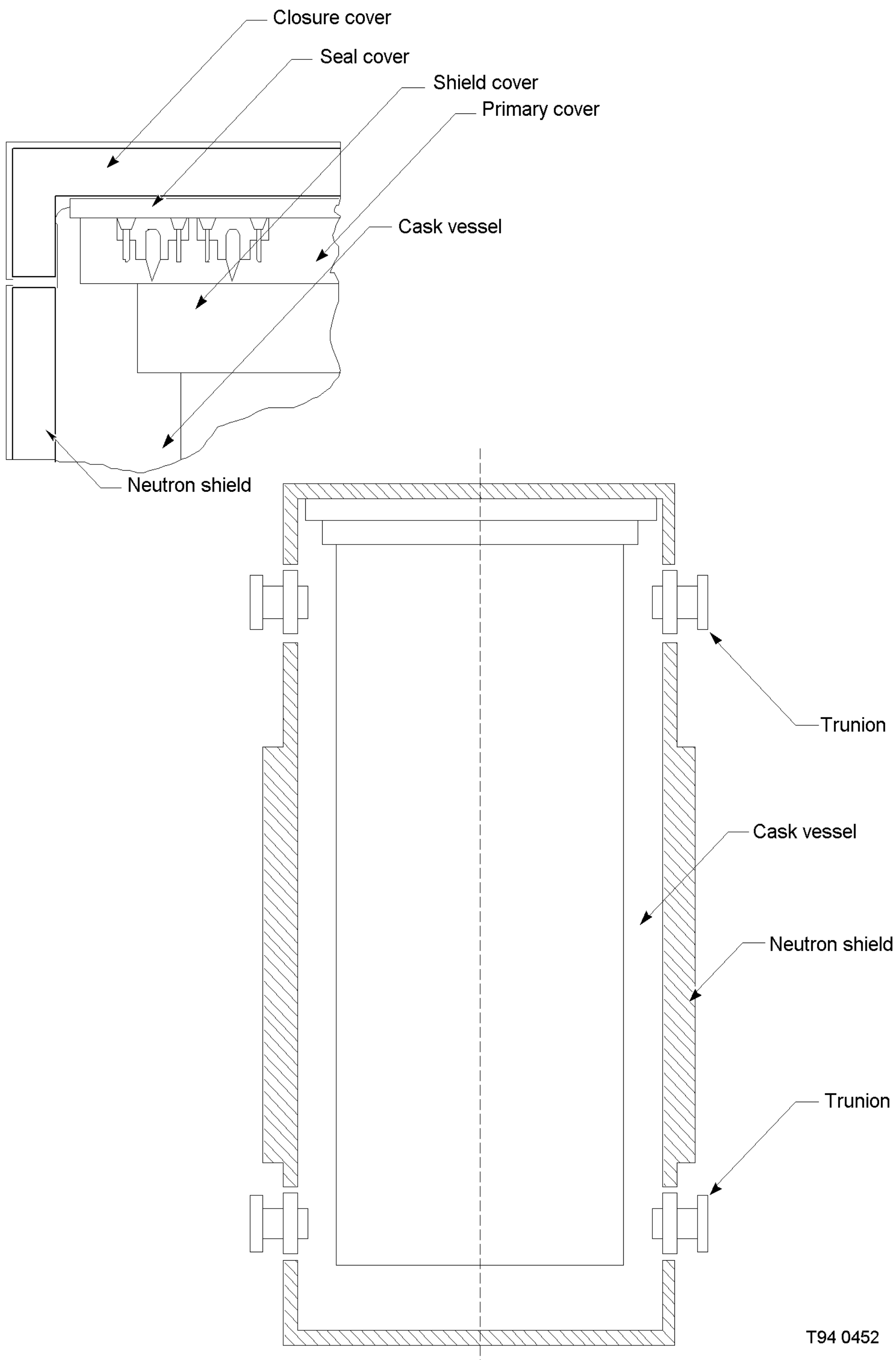

Figure 2-4. MC-10 cask.

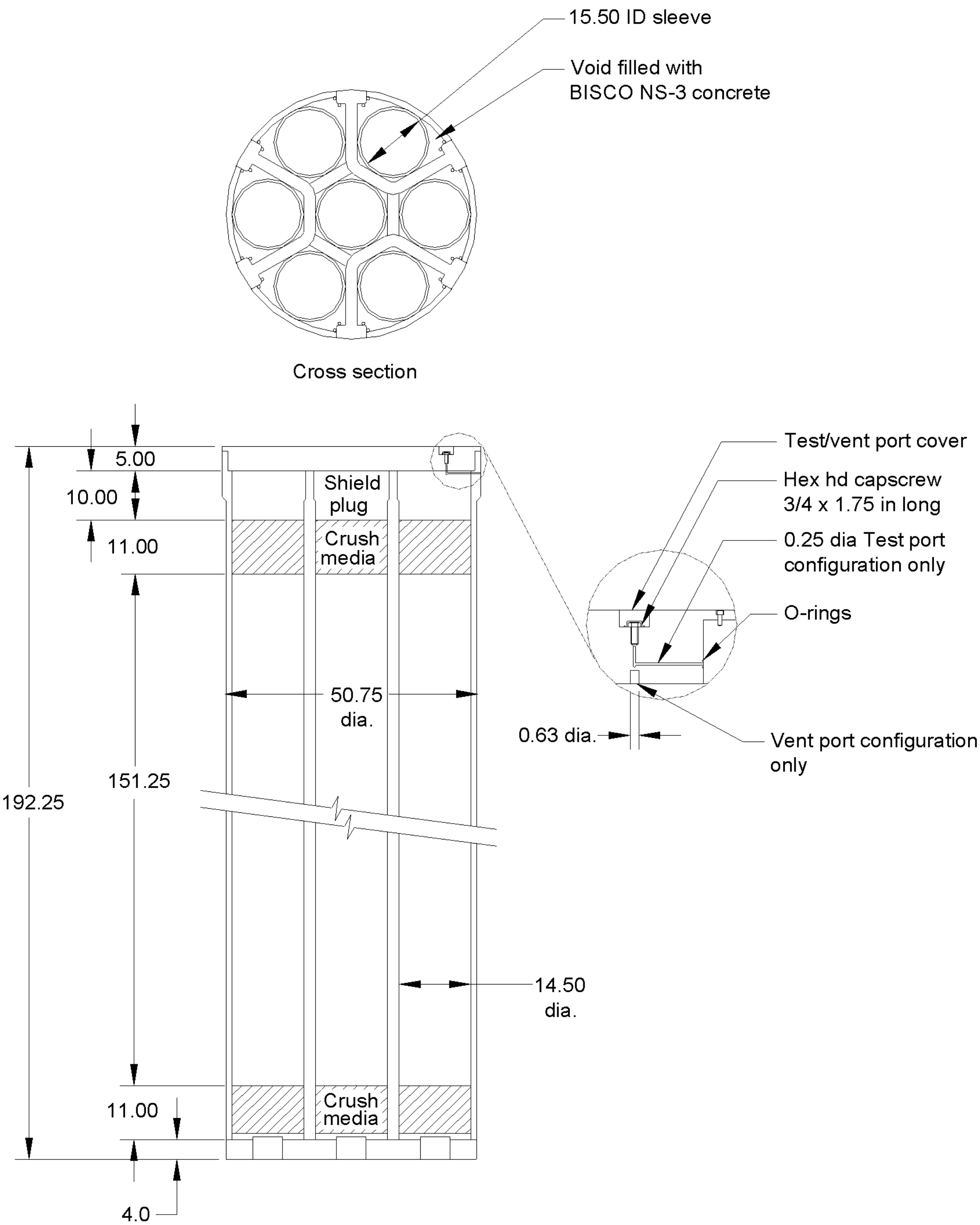

Figure 2-5. 125B-2 inner vessel (dimensions in inches).

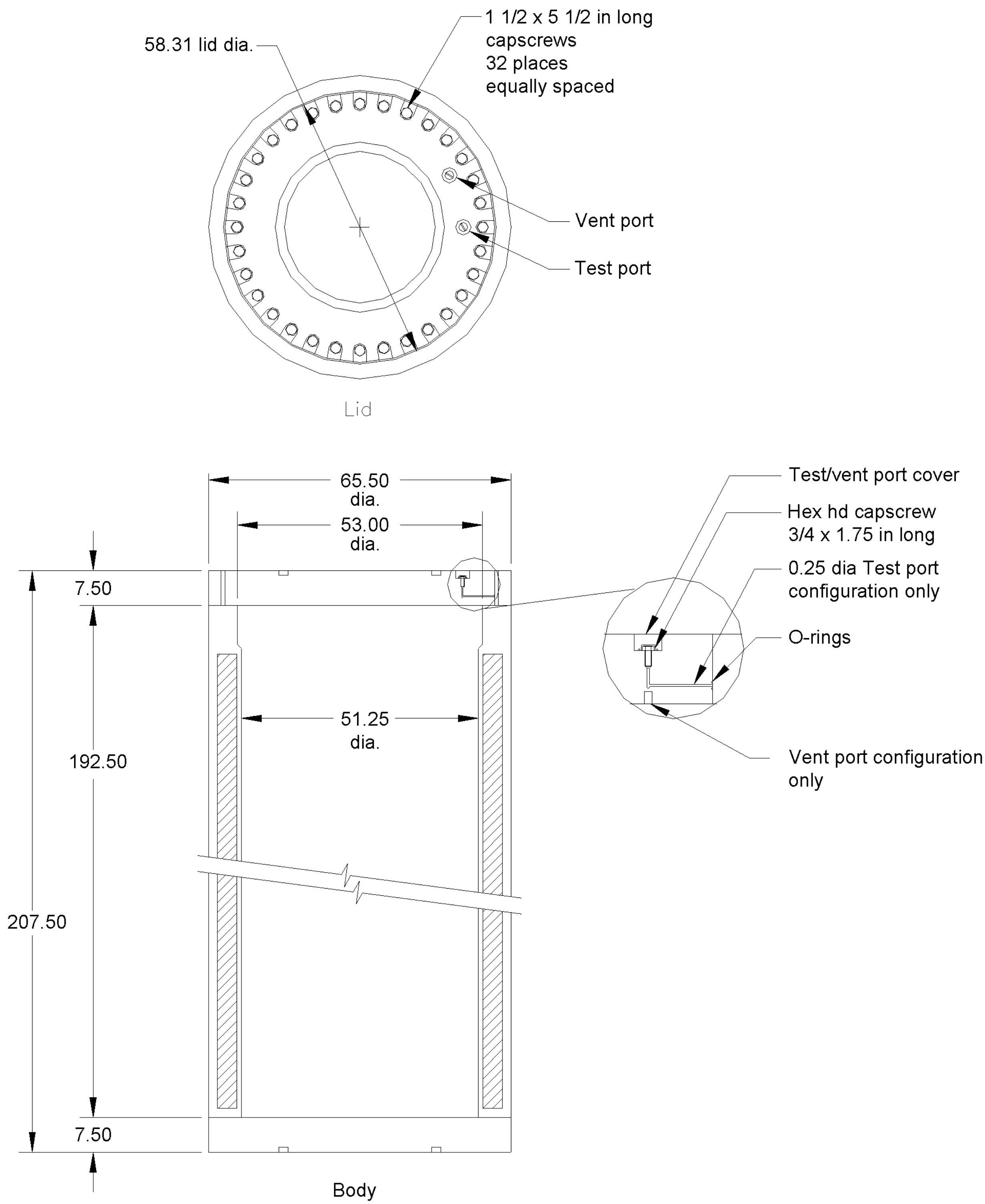

Figure 2-6. 125B-2 outer cask (dimensions in inches).

The inner vessel design includes the use of stainless-steel-encased aluminum honeycomb energy-absorbing impact limiters at the bottom of each tube, integral shield plug/impact limiters at the top of each tube, and neutron moderator and poisoning materials within the interstices of the tubes. The weight of the cask loaded with the two TMI-2 canisters containing epoxy, without external overpacks, is approximately 70 ton.

Each canister is loaded into one position (that is, tube) of the NuPac 125B-2 inner vessel. At the time of loading, a verification was performed to ensure that the NuPac 125B-2 contained the licensed insert (poisoned inner vessel) prior to loading with TMI canisters. The inner vessel tubes into which these two canisters are loaded also contain bottom internal impact limiters and top shield plug/impact limiters, below and above the canisters, respectively. It is not necessary to install the internal impact limiters into the five other inner vessel tube positions that will remain empty. The inner vessel closure lid is installed using the 24 closure bolts in accordance with the NuPac 125B cask SAR torque guidance.[8] It is not necessary to inspect or replace the inner vessel gasket seal, because the inner vessel vent/sampling port will remain open to the cask cavity; and therefore, a leaktight seal on the inner vessel is not relied upon for interim storage of these two canisters.

From the original cask transport SAR,[8] the maximum expected dose rate on contact with a fully loaded (7 worst-case TMI fuel canisters) cask is less than 100 mR/h. The maximum expected internal normal operating pressure for the cask is 125 psig.

The NuPac 125B-2 cask design was originally for transportation with the use of external impact limiters; and therefore, has been designed and analyzed[8] for the normal cross-country rail transport loads, as well as for the severe hypothetical transportation accidents; including 30-ft end, side, and corner drops onto an unyielding surface, and side and end puncture drops. The structural analyses concluded that for these severe accidents (with external impact limiters), neither the cask structural integrity nor the cask containment capability was compromised. The cask closure bolts and the containment seal did not fail and the cover gas within the cask cavity was retained for these drop accidents. For storage operations in the vertical configuration, the NuPac 125B-2 cask was analyzed for seismic response, and was shown to be seismically stable.[14]

The two O-ring seals of the outer cask were replaced prior to installation of the outer cask lid using the 32 closure bolts in accordance with the NuPac 125B cask SAR torque guidance.[8] After closure of the outer cask lid, the cask cavity was filled with an inert cover gas and leak tested. During interim storage, periodic cask atmospheric sampling is performed to assess hydrogen buildup within the cask, potentially resulting from epoxy degradation. The maintenance and testing that is specified in the NuPac 125B cask SAR[8] is not applicable for the interim storage of the two TMI-2 canisters in the NuPac 125B-2. This is because the testing program is based on transportation requirements and assumes testing is performed during down periods when the cask is not being used for transport and does not contain fuel. An evaluation[15] of the outer cask seal replacement life was completed and concluded that new outer cask O-ring seals should be installed prior to using the NuPac 125B-2 cask for interim storage, and that helium leak testing of the outer cask seal (lid seals and rupture disk) be performed every five years to ensure seal integrity.

2.4.3.4 ***TN-REG Cask.*** The TN-REG cask has a 71.74-in.-diameter cavity with a 9.25-in.-thick carbon-steel shell. The cask has 40 fuel baskets to hold Robert E. Ginna (REG) fuel assemblies. The rectangular baskets are 8.05 in. square inside with 0.276-in.-thick borated stainless-steel plates assembled in an "egg-crate" configuration.

The TN-REG cask was designed for and contains 40 REG fuel assemblies, so there is no need for spacers. The REG fuel assemblies are approximately the same as the internal length of the TN-REG cask; therefore, there is only one fuel assembly per basket compartment. Basket peripheral inserts are installed at locations formed by the interface between the fuel basket and the cask cavity wall.

The basic structure of the TN-REG packaging includes a thick-walled, forged-steel containment vessel consisting of the right circular cask body and closure lid. Impact limiters are attached to both ends of the cask during shipment. The total empty weight of the TN-REG transportation package is approximately 181,000 lb, with a gross payload capacity of 52,360 lb, including fuel assemblies and end caps. The overall dimensions of the TN-REG package are 234 in. long and 131 in. in diameter, including impact limiters. With impact limiters removed, the external dimensions are 180 in. long and 90.25 in. in diameter.

The maximum expected dose rate on the surface of the cask is less than 200 mR/h (23.4 mR/h calculated for this loading) and less than 10 mR/h at 2 m. The maximum normal operating pressure is 0.41 atm gauge (6.0 psig) for the TN-REG cask. The maximum allowable cask cavity pressure has been calculated to be 45 psig. The spent fuel payload is shipped in a nitrogen atmosphere. The heat generated by the spent fuel assemblies is rejected to the surrounding air by convection and radiation. No forced cooling or cooling fins are required. In accordance with Title 10 Code of Federal Regulations (CFR) Part 1.43(g) the maximum temperature of accessible package surfaces in the shade is below 185°F. The calculated maximum surface temperature for the TN-REG cask is 156°F.[12]

Acceptable performance of the containment boundary seal material (Viton) is demonstrated at temperatures down to -15°F[12] and in Engineering Design File (EDF)-1720.[16] The results of EDF-1720 demonstrate that the Viton O-ring temperatures will be above 15°F for a 24-hr average ambient temperature of -28°F and greater than -10°F for a short-term minimum ambient of -49°F.

The containment vessel is constructed of 9.25-in.-thick forged steel. The 82.25-in.-diameter lid, with a maximum thickness of 8.5 in., is bolted to the cask with 48, 1-5/8-in.-diameter steel bolts. The cask is sealed with a Viton o-ring mounted in a groove machined in the underside of the lid. A second metallic O-ring is provided to leak test the Viton O-ring. The containment vessel is provided with access and vent ports in the lid and two gas-sampling ports and a research instrument port in the cask body. All of the penetrations are sealed using Viton O-rings. The TN-REG cask is illustrated in Figure 2-7. Additional information can be found in SAR-165, "Safety Analysis Report for the TN-BRP and TN-REG Cask Operations at the INTEC."[17]

2.4.3.5 ***TN-BRP Cask.*** The TN-BRP cask has a 64-in.-diameter cavity with a 9.625-in.-thick carbon-steel shell. The cask has 85 fuel baskets to hold Big Rock Point (BRP) fuel assemblies. Two vertically stacked BRP assemblies fit within one basket. The rectangular baskets are 6.8 in. square inside 0.276-in.-thick borated stainless-steel plates assembled in an egg-crate configuration. Peripheral inserts are installed at locations formed by the interface between the fuel basket and cask cavity wall.

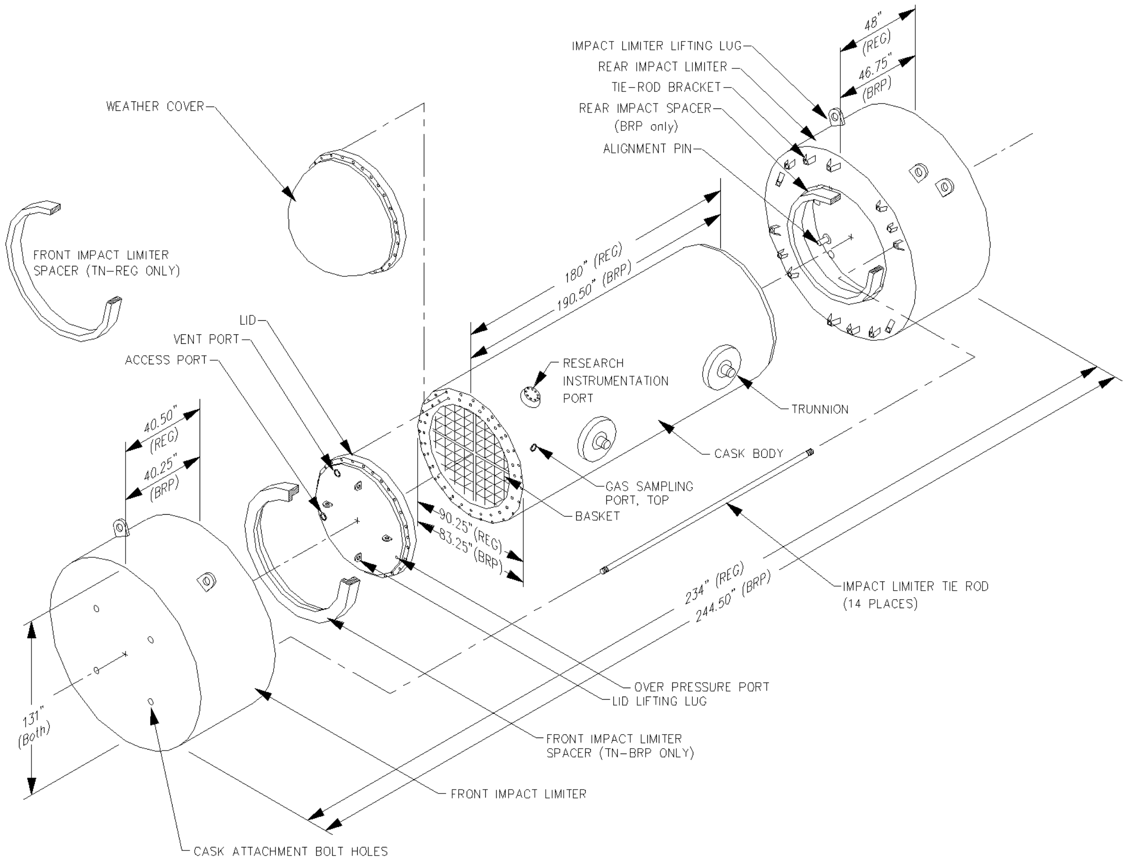

Figure 2-7. TN-REG/BRP cask package, isometric view.

The TN-BRP cask was designed to contain up to 88 boiling-water reactor (BWR) fuel assemblies stacked 2 high in the 44 storage basket compartments. There are only 85 BRP fuel assemblies; so one basket compartment will be left empty and one compartment will contain one fuel assembly with a spacer installed in the bottom position to minimize axial movement of the fuel assembly.

The basic structure of the TN-BRP packaging includes a thick-walled, forged-steel containment vessel consisting of the right circular cylindrical cask body and closure lid. Impact limiters consisting of balsa and redwood encased in carbon-steel shells are attached to either end of the cask. A fuel basket inside the cask cavity provides compartments for the transported payload. The total empty weight of the TN-BRP transportation package is approximately 179,600 lb, with a gross payload capacity of 43,170 lb, including fuel assemblies, spacers and end caps. The overall dimensions of the TN-BRP package are 244.5 in. long and 131 in. in diameter, including impact limiters. With impact limiters removed, the external dimensions of the TN-BRP cask are 190.5 in. long and 83.25 in. in diameter.

The containment vessel is constructed of 9.62-in.-thick forged steel. The 74.75-in.-diameter lid is bolted to the cask with 48, 1-5/8-in.-diameter steel bolts. The cask is sealed with a Viton O-ring mounted in a groove machined in the underside of the lid. The containment vessel is provided with access and vent ports in the lid, and two gas-sampling ports and a research instrument port in the cask body.

The maximum expected dose rate on the surface of the cask is less than 200 mR/h (19.7 mR/h calculated for this loading) and less than 10 mR/h at 2 m. The maximum normal operating pressure is 0.54 atm gauge (7.9 psig) for the TN-BRP. The maximum allowable cask cavity pressure has been calculated to be 45 psig. The spent fuel payload is shipped in a nitrogen atmosphere. The heat generated by the spent fuel assemblies is rejected to the surrounding air by convection and radiation. No forced cooling or cooling fins are required. In accordance with 10 CFR 71.43(g) the maximum temperature of accessible package surfaces in the shade is below 185°F. The calculated maximum surface temperature for the TN-BRP cask is 173°F.[13] Acceptable performance of the containment boundary seal material (Viton) is demonstrated at temperatures down to -15°F.[13,16] The results of EDF-1720 demonstrate that the Viton O-ring temperatures will be above 15°F for a 24-hour average ambient temperature of -28°F and greater than -10°F for a short-term minimum ambient of -49°F. The TN-BRP cask is illustrated in Figure 2-7. Additional information can be found in the TN-BRP spent nuclear fuel SAR,[13] and SAR-165.[17]

2.4.3.6 ***VSC-17 Cask (concrete).*** The VSC-17 cask is a dry storage system using a concrete storage cask and a steel, multiassembly sealed basket (MSB) to safely store canisters of consolidated irradiated spent nuclear fuel. The VSC system can hold 17 PWR assemblies or 17 consolidated spent nuclear fuel canisters. This is the only type of fuel approved for storage in this cask without further analysis. Administrative controls limit storage to consolidated spent nuclear fuel canisters with at least 399 fuel rods per canister.

The VSC-17 cask structure consists of an outer shell assembly, which is fabricated from pressure vessel steel, a weather cover, and a shielding lid. Concrete walls provide structural support and enough shielding to limit the exterior surface radiation dose rates to 50 mrem/h or less. Natural convection inside the cask allows decay heat to be removed from around the metal walls of the cask liner and MSB. A 0.75-in.-thick steel-disk weather cover is bolted to the metal inner liner of the concrete shell of the cask, with an elastomer gasket between the two, to prevent water intrusion (see Figure 2-13). The shield lid is made of one 4.5-in.-thick steel disk and one 6-in.-thick disk, which sandwich a 2-in.-thick section of neutron shielding. These assemblies are welded together to produce one lid.

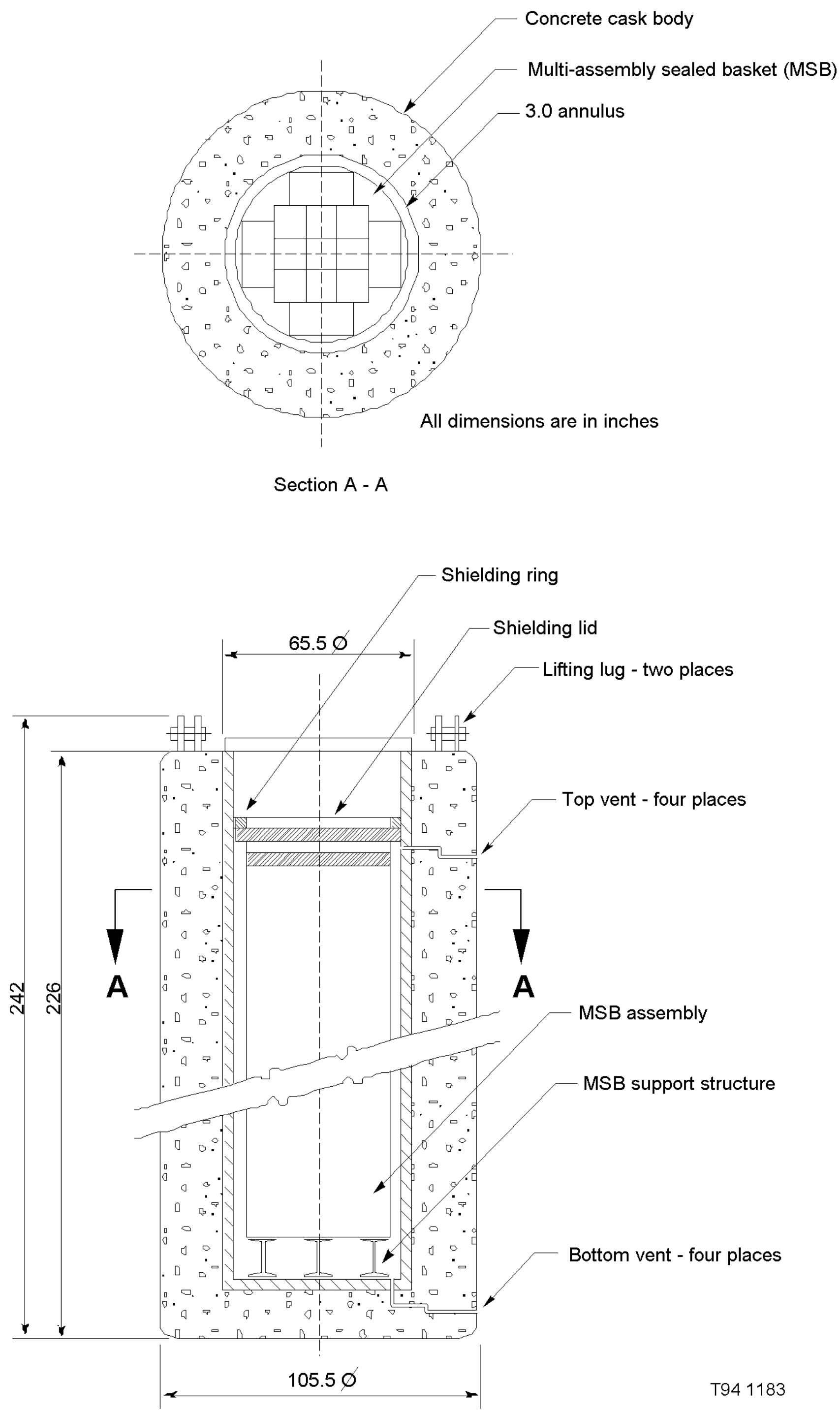

Figure 2-8. VSC-17 cask (concrete).

The internal cavity of the concrete cask is formed by a 3.5-in.-thick steel cylinder. The MSB is a welded assembly fabricated from square steel tubes. The MSB is fabricated from 0.5-in. carbon steel and coated with a nonorganic, radiation-resistant, high-temperature, hard-surface coating to prevent oxidation. A 0.375-in-diameter metal O-ring and a 0.275-in.-diameter EPDM (ethylene propylene dimonomer) O-ring located in the MSB shielding lid ensure closure of the MSB. Additional information can be found in the TSAR for the ventilated storage cask system.[11]

2.4.3.7 REA-2023 Cask. The REA-2023 cask (see Figure 2-9) is an approximately 16-ft-high × 8-ft-diameter stainless-steel cylinder weighing approximately100 ton,[9] which uses an all-welded sealing method and passive heat dissipation design for dry storage of irradiated fuel assemblies. This cask consists of a double-containment design with a welded final closure on the secondary cover.

The all-welded cask sealing method and passive heat dissipation modes are unique features of the REA-2023 cask. This passive design for dry storage of spent nuclear fuel minimizes the requirements for maintenance and surveillance.

The various components include a smooth stainless-steel outer skin, a lead and stainless-steel gamma shield, a borated water and glycol neutron shield, and a basket constructed of copper, stainless-steel, neutron-absorbing plates, and a stainless-steel primary containment vessel. The cask body surrounds a cask insert designed for maintaining separation of fuel assemblies. The REA-2023 cask was designed to contain fuel that is up to 3.5% enriched, but has been analyzed for its current loading, which includes spent nuclear fuel that exceeds 3.5%. The shielding walls and ends were designed to provide a maximum outside surface dose rate (with the neutron shielding) of less than 20 mR/h for a fuel loading of 52 BWR assemblies with at least 5 years out-of-reactor time.

LOFT FP-1 and FP-2 center assemblies, commercial fuel assemblies and fuel rods, and encapsulated commercial fuel rods are packaged in the REA-2023 cask.[18] Additional information concerning the REA-2023 dry storage cask can be found in the TSAR for the REA-2023 dry storage cask[9] and the August 22, 2002 REA-2023 storage cask loading operations report.[9,18]

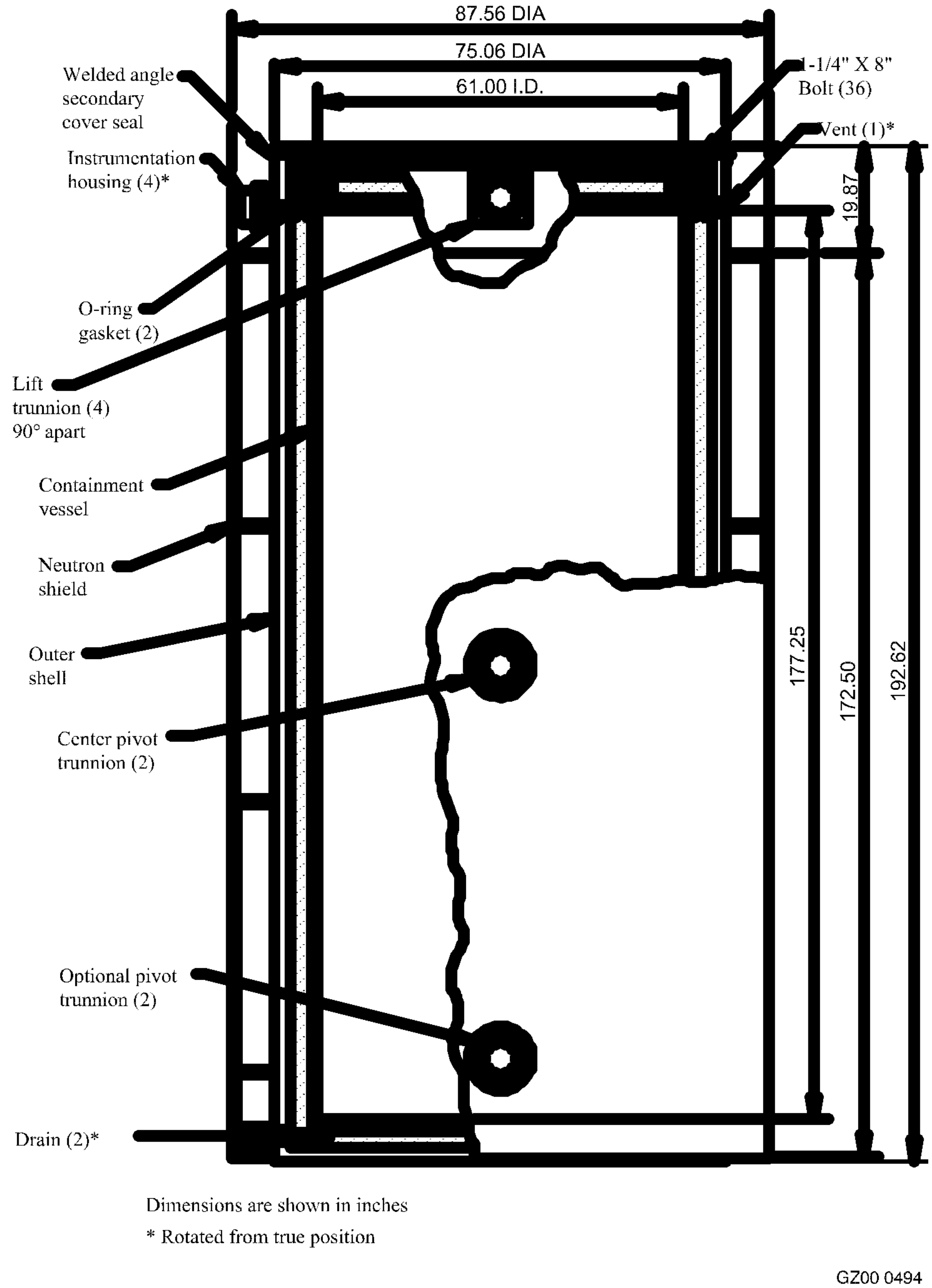

Figure 2-9. REA-2023 dry storage cask.

2.4.3.8 ***TN-24P Cask.*** The Transnuclear (TN)-24P cask is designed for storage of up to 24 PWR spent nuclear fuel assemblies or 24 canisters of consolidated nuclear fuel rods. The total weight of the cask when fully loaded is approximately 86 ton. The overall containment vessel is 16.6 ft long and the side wall is 9.5 in. thick. The cylindrical cask cavity is 13.8 ft long and 4.8 ft in diameter. The TN-24P cask is illustrated in Figure 2-10.

The TN-24P cask contains 24 Loss-of-Fluid Test (LOFT) intermediate fuel assembly (IFA) spent fuel assemblies and canisters of consolidated spent nuclear fuel. The TN-24P cask provides safe interim storage of the consolidated fuel canisters and the LOFT IFAs until a long-term storage option becomes available.

The basic structure of the TN-24P cask is a cask body of thick-walled forged steel with an integrally welded forged bottom and a flanged and bolted forged top. The spent nuclear fuel is stored in an inert gas atmosphere. Heat generated by the spent nuclear fuel assemblies is rejected to the surrounding air by convection and radiation. No forced cooling or cooling fins are required. A neutron shield drum is installed on the cask lid to provide extra shielding. The shielding walls and ends were designed to provide a maximum outside surface dose rate of less than 100 mR/h for a fuel loading of 24 PWR assemblies with an out-of-reactor time of 5 yr and maximum burnup of 35,000 mwd/MTU. A protective cover is installed as a weather shield during storage. A more detailed description of the TN-24P cask is provided in the TSAR for the TN-24 dry storage cask[10] and Addendum 2 of the LOFT IFA TN-24P fuel storage cask loading operations report.[19]

2.4.4 Cask Transport Vehicles

Several types of cask transport vehicles may be used to position casks on the DCSA. These include the SFCT and associated heavy-haul truck. The transport vehicles arrive at CPP-2707 and are used to position the casks in the final storage location.

2.4.4.1 ***Spent Fuel Storage Cask Transporter.*** The SFCT (see Figure 2-11) may be used to move (via towing) various sizes of storage casks on the DCSA. The cask transporter design, safety features, and operations meet the standards listed in the Specifications for the INEL/TAN Dry Spent Fuel Storage Cask Transporter Operation and Maintenance Manual. A detailed description and instructions for operation and maintenance of the cask transporter is also in the Dry Spent Fuel Storage Cask Transporter Operation and Maintenance Manual. The SFCT has standard railing and ladder access to both top and main transporter levels, as shown in Figure 2-11.

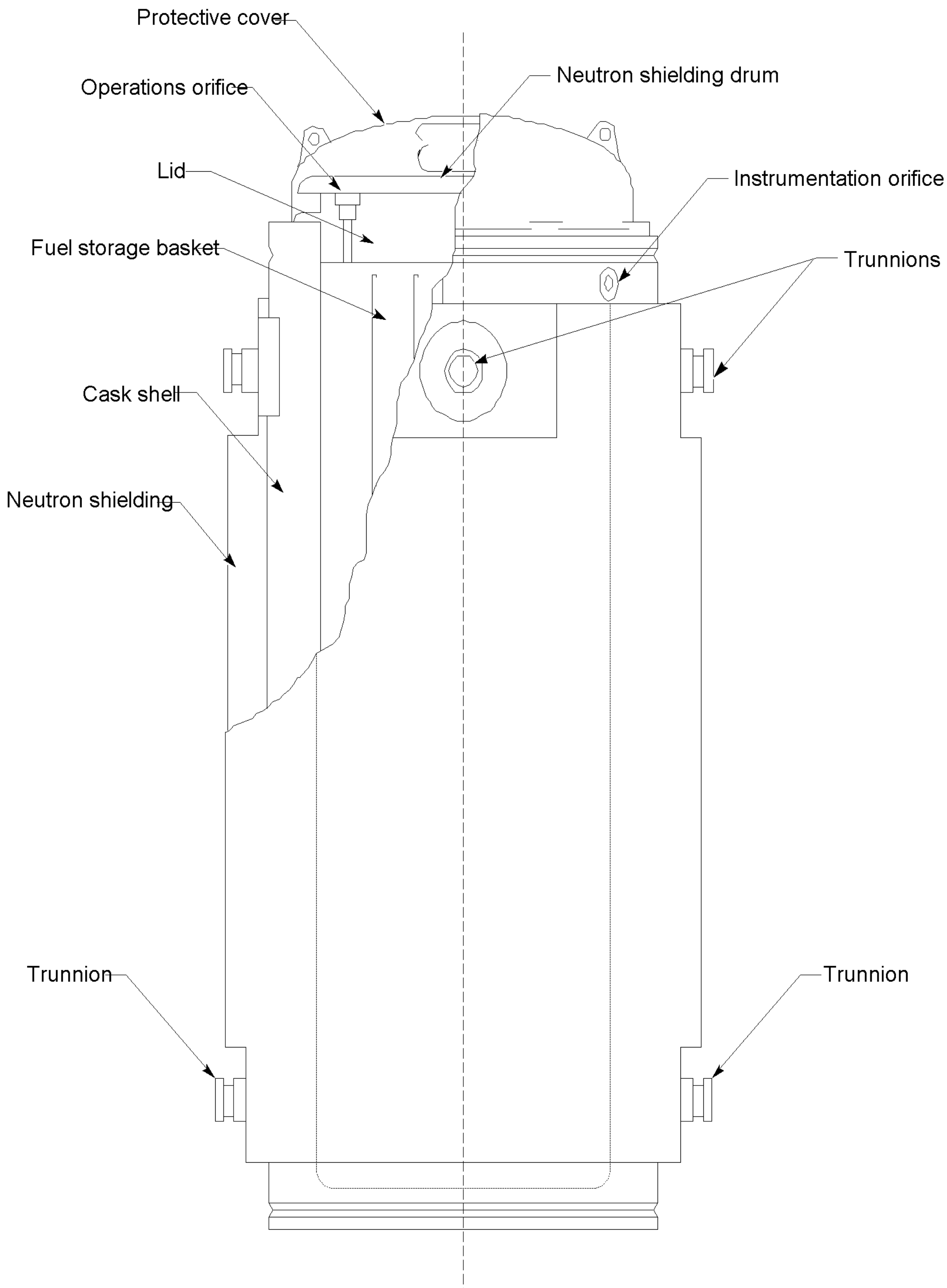

Figure 2-10. TN-24P cask.

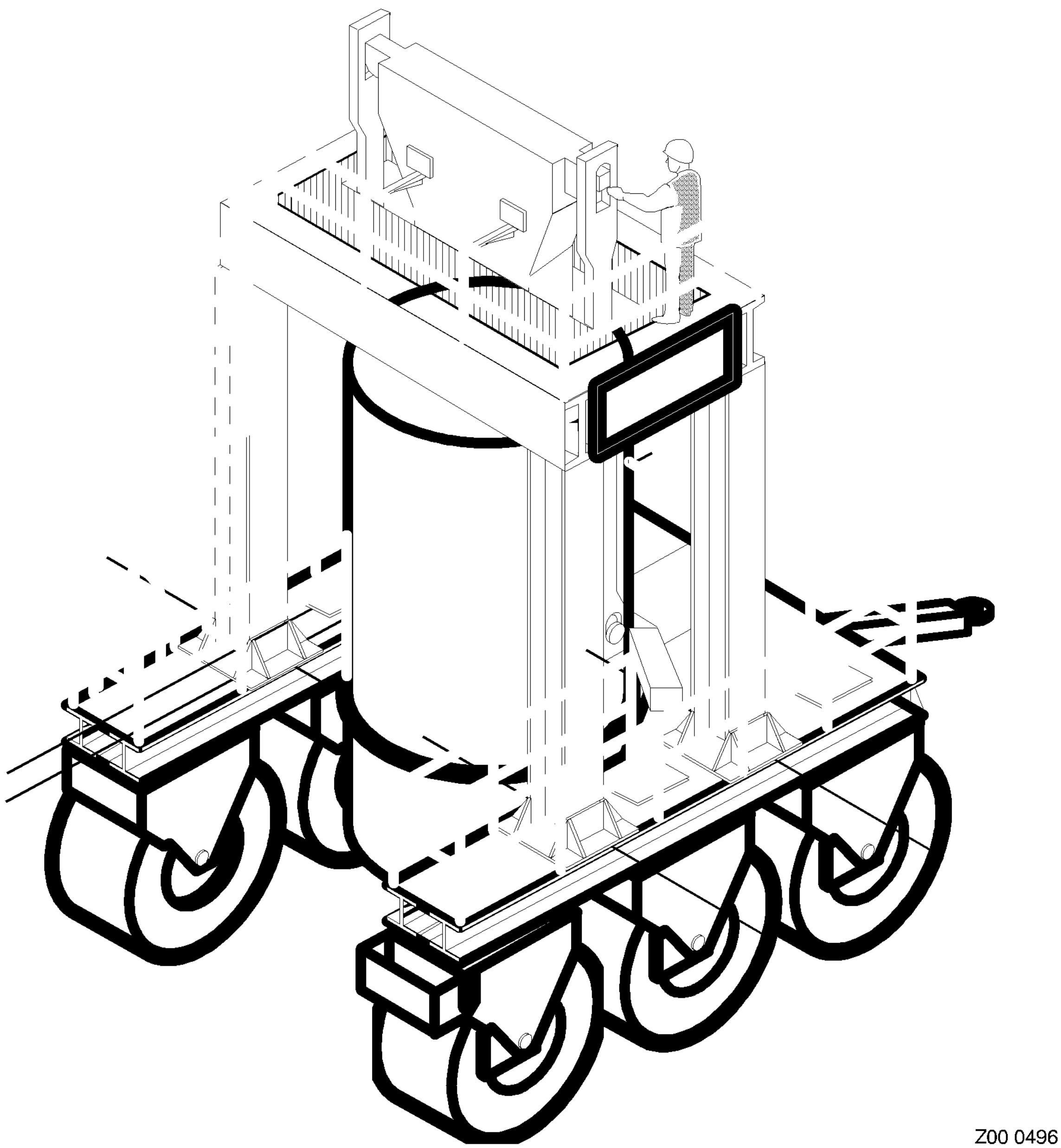

Figure 2-11. Spent fuel cask transporter.

2.5 Process Description

The operations conducted at the DCSA include receiving fuel-loaded casks, removing casks from transport vehicles, placing casks on the DCSA, and monitoring (taking gas samples) the casks for hydrogen generation.

The asphalt apron area is used to receive transport vehicles and casks. After transport vehicles carrying casks arrive at the INTEC, a radiation survey is performed to establish contamination and radiation levels.

Casks are placed a minimum of 1 ft from the western edge of the concrete pad and may be in two rows in a north/south orientation. The casks are spaced on the pad to allow performance of cask monitoring activities on a given cask without interference from adjacent casks. Casks are positioned on the concrete storage pad using the SFCT.

Casks may be periodically sampled as required by an approved cask sampling program. The frequency and stringency of sampling is determined by the Engineering organization and is specified by a facility-specific sampling program. Figure 2-12 provides an illustration of the cask sampling equipment.

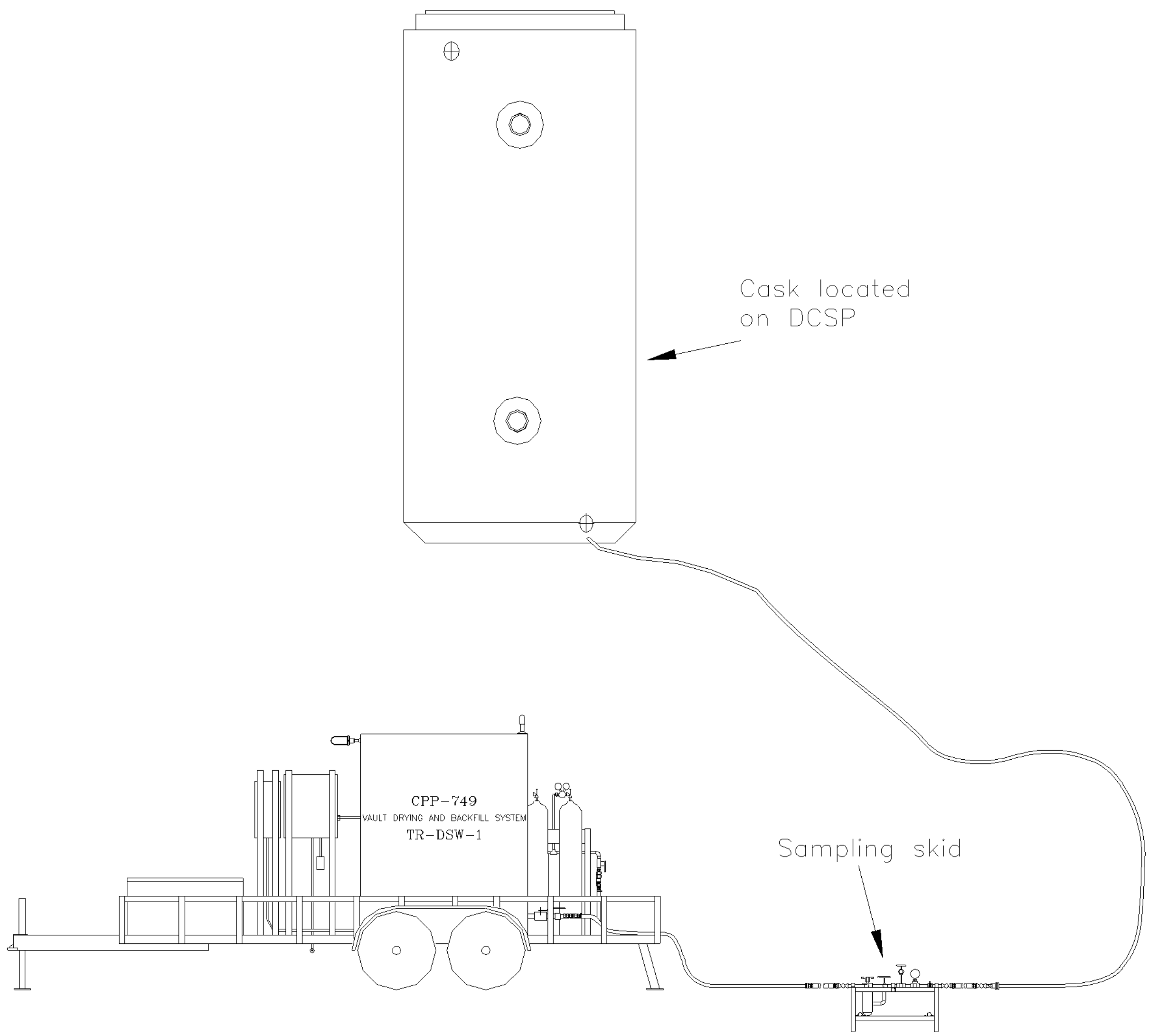

Figure 2-12. Cask sampling equipment.

2.6 Containment Systems

At the DCSA, two or more barriers are generally present to limit potential releases of radioactive material. The DCSA provides no containment for potential radioactive material releases; however, the fuel cladding/packaging and fuel casks include the following design features or systems for containment of radioactive materials:

- **Fuel cladding and/or fuel packaging** — Some of the fuel and/or packaging equipment provides containment for potential releases of radioactive material.
- **Fuel Storage casks** — The fuel storage casks are designed to provide shielding and, in some cases, confinement or containment of gases, liquids, or solids. Casks approved for storage on the DCSA are listed in Chapter 6. Other casks may be stored on the DCSA after completion of additional analysis and evaluation.

2.7 Safety Support Systems

No DCSA safety-support systems have been identified.

2.8 Electrical Utility Distribution Systems

This section describes the electrical power system for the DCSA, including normal and standby power. The main electrical system as currently envisioned is shown in Figures 2-13 and 2-14.

2.8.1 Normal Power

Normal (commercial) electric power is supplied to the DCSA from the INTEC electrical distribution system to a subpanel located in the DCSA area. This subpanel receives power from a power control center located inside a fenced electrical area south of the Light-Water Breeder Reactor (LWBR) storage facility.

The 480-V receptacles located on the storage pad are fed from the power control center. This circuit is comprised of a 30-AMP, three-phase power feed. The primary purpose of this circuit is to provide electrical power to cask sampling equipment. The cask sampling equipment includes a 2-hp vacuum pump, associated indicator lighting, and receptacles.

A transformer and power panel provide single-phase 120-V and 240-V power to receptacles located on the storage pad. This transformer is fed from PCC-SFE-238 Circuit #14. The 120/240-V secondary feed from the transformer is provided by the electrical panel within the DCSA. The primary purpose for this circuit is to provide electrical power to the SFSCT, which includes a 3-hp electric motor, a 2-KW tank heater, and associated control wiring. 120-V power is provided by the electrical panel within the DCSA. The primary purpose of this circuit is to provide electrical power for portable power tools and other incidental use on the cask pad. Ground fault circuit interrupter (GFCI) protection is provided for the receptacles on the cask storage pad.

Receptacles are located in a row near the west edge of the new cask storage pad. Five mounting posts are positioned on 28-ft centers in a north-south orientation. Each of the mounting posts are located 2 ft from the west edge of the pad. Two 120-V duplex receptacles, a single 240-V receptacle, and a single 480-V receptacle are mounted on each post.

If normal power to the cask storage pad is lost, portable generators can be staged on the pad to provide power to cask sampling equipment, the SFCT, and other equipment as necessary.

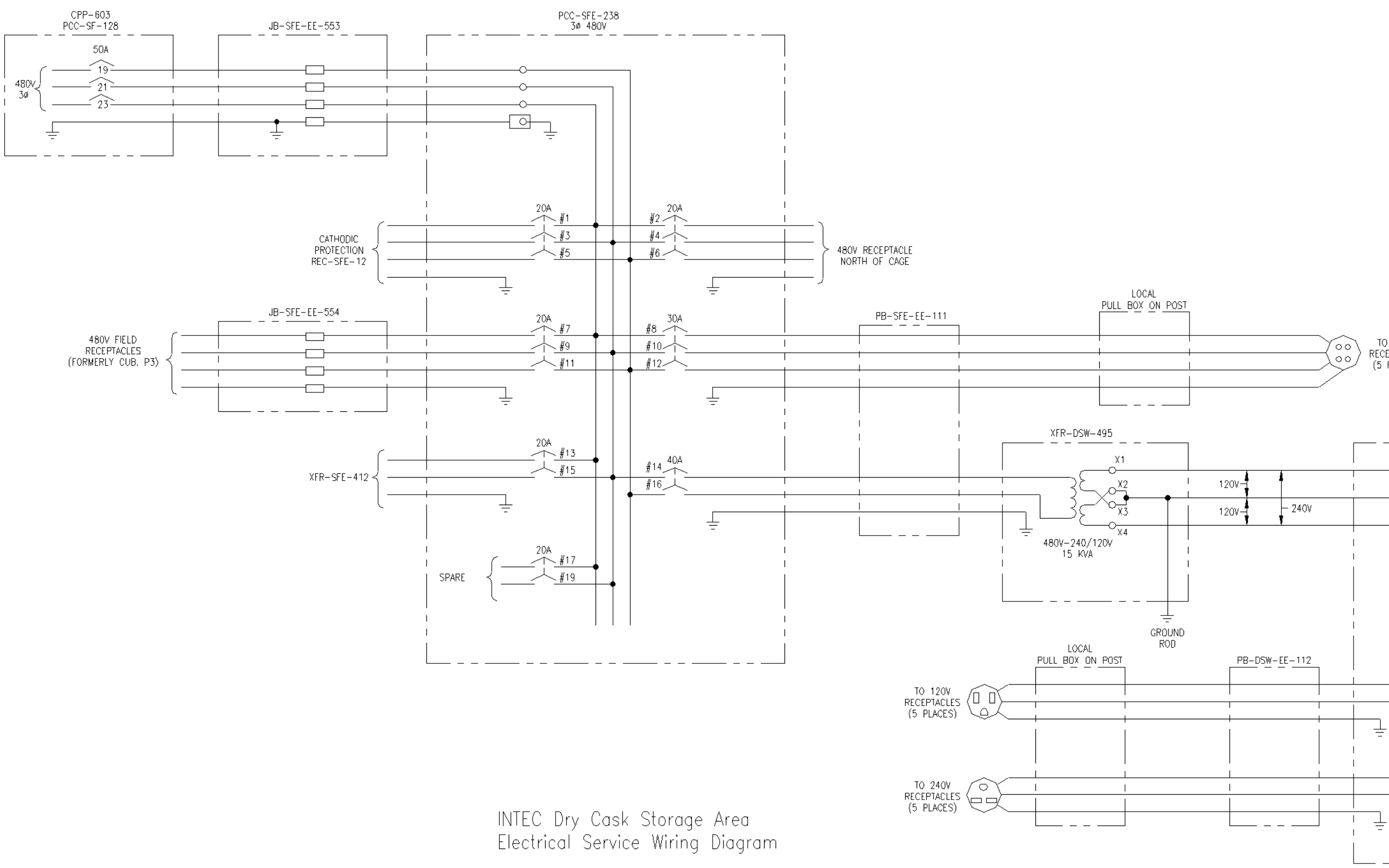

Figure 2-13. DCSA electrical power system diagram.

SAR-164.R0/CH02/07-30-03/SA

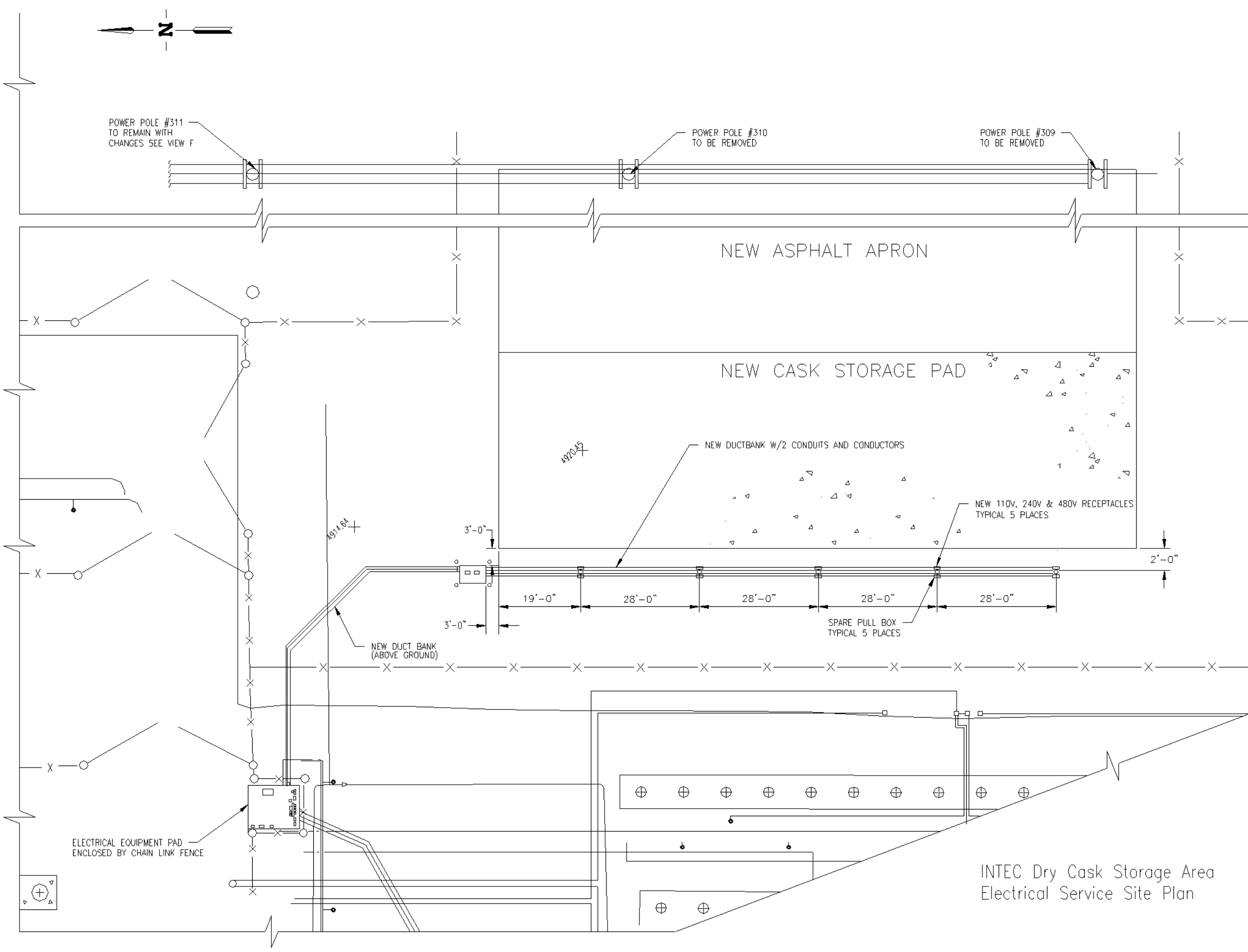

Figure 2-14. DCSA electrical service site plan.

2.9 Auxiliary Systems and Support Facilities

Descriptions of the auxiliary systems for the DCSA are presented in the following sections. These include storm water drainage, compressed air, nitrogen, communications and alarms, and fire protection.

2.9.1 DCSA Storm Water Drainage

The DCSA is constructed such that storm water due to rain water and snow/ice melting is diverted east and west off the concrete pad, then south outside of the CPP-2707 facility. Storm water from the DCSA does not affect any of the CPP-749 underground fuel storage vaults due to relative elevations and drainage paths.

2.9.2 Compressed Air

Compressed air may be used for miscellaneous air-operated tools. If compressed air is needed, a portable air compressor may be brought into the DCSA.

2.9.3 Nitrogen

Compressed purified nitrogen bottles are used to provide nitrogen in the DCSA area to purge and backfill casks as a result of monitoring activities.

2.9.4 Communications and Alarms

Permanent communications and alarms are not provided in the DCSA area. However, portable communication systems (cell phones and hand-held two-way radios) are available for use by personnel in the area. INTEC-wide emergency alarms are audible in the DCSA area and provide a means to warn personnel of emergency conditions.

2.9.5 Fire Protection

The CPP-2707 area is covered almost completely by asphalt and concrete. There is no means to accumulate significant quantities of combustible materials in the DCSA area. Minor accumulation of dry weeds is not a concern relative to cask-related fires. Therefore, fire suppression systems are not used at the DCSA. Portable fire fighting equipment (extinguishers) is available on an as needed basis for the DCSA. Portable extinguishers are also located in mobile equipment. INEEL fire fighting equipment is also available on an as needed basis. Table 2-8 summarizes the potential fires for the DCSA area and the provisions for fighting such fires.[20]

Table 2-1. Evaluation of potential for major fire in the DCSA.

Location	Potential for Fire in Area	Fire Protection
Fuel Storage Area		
Asphalt apron area	Potential for fire involving fossil fuel, motor oil, and rubber.	Portable fire extinguish
Cask storage area	Characteristics of fire similar to asphalt apron area.	Portable fire extinguish
Electrical panel and outlets	Overloading of electrical circuits.	Portable fire extinguish available as needed.

2.10 References

1. TFR-161, "Specific Requirements for the INTEC Dry Cask Storage Area," Rev. 1, March 6, 2003.

2. DOE Order 420.1A, "Facility Safety," U.S. Department of Energy, May 20, 2002.

3. DOE-ID AE, "DOE-ID Architectural Engineering Standards," U.S. Department of Energy Idaho Operations Office, Rev. 29, November 2001.

4. EDF-2544, "INTEC Dry Cask Storage Pad (CPP-2707) Siting Study," Rev. 0, R. D. Denney, October 2, 2002.

5. EDF-3421, "Concrete Pad Design," Rev. 0, J. R. Bisset, March 13, 2003.

6. General Nuclear Systems, INC., "Topical Safety Analysis Report For The Castor V/21 Independent Spent Fuel Storage Installation (Dry Storage)," Rev. 1, January 1985.

7. "Topical Safety Analysis Report For The Westinghouse MC-10 Cask For An Independent Spent Fuel Storage Installation (Dry Storage)," Rev. 2A, November 1987.

8. Nuclear Packaging, Inc., "Consolidated Safety Analysis Report For The NuPac 125-B Fuel Shipping Cask," Docket No. 71-9200, April 1991.

9. Ridihalgh, Eggers, and Associates, "Topical Report for the REA-2023 Dry Storage Cask for BWR Spent Fuel," April 6, 1983.

10. Transnuclear, Inc., "TN-24P Dry Storage Cask Topical Safety Analysis Report," E-7107, August 30, 1985.

11. Pacific-Sierra Nuclear Associates, "Topical Safety Analysis Report For The Ventilated Storage Cask System," Rev. 0, February 1989.

12. Transnuclear, Inc., "TN-REG Spent Nuclear Fuel Package Safety Analysis Report for Transport," Rev. 10, October 2000.

13. Transnuclear, Inc., "TN-BRP Spent Nuclear Fuel Package Safety Analysis Report for Transport," Rev. 7, October 2000.

14. EDF-1739, "Removal of Sintered Metal Filters in 125B Cask–Cask 125B Seismic Tip Over Analysis," Rev. 0, R. F. Lippert, January 10, 2001.

15. EDF-2181, "NuPac 125B Cask Lid Seals and Rupture Disk Design Life Study," Rev. 0, F. J. Rios, May 21, 2002.

16. EDF-1720, "Reliability of Viton Seals Subjected to Radiation and Temperature Fluctuations," Rev. 0, K. M. Wendt, March 1, 2001.

17. SAR-165, "Safety Analysis Report for the TN-BRP and TN-REG Cask Operations at the INTEC," Rev. 2, April 4, 2003.

18. INEEL, *REA–2023 Fuel Storage Cask Loading Operations*, INEL-94/0163 Addendum 3, Rev. 1, August 22, 2002.

19. INEEL, *LOFT IFA TN-24P Fuel Storage Cask Loading Operations*, INEL-94/0163 Addendum 2, Rev. 1, August 27, 2002.

20. HAD-237, "CPP-2707 Dry Cask Storage Area Fire Hazard Analysis," Rev. 0, April 30, 2003.