TABLE OF CONTENTS

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1. INTRODUCTION AND GENERAL DESCRIPTION OF INSTALLATION

1.1 Introduction

The U.S. Department of Energy (DOE) has chosen a modified NUHOMS® spent fuel storage system, designated NUHOMS®-12T, which will be used at an independent spent fuel storage installation (ISFSI) to be constructed at the Idaho National Engineering and Environmental Laboratory (INEEL). The INEEL was formerly known as the Idaho National Engineering Laboratory (INEL) and is so noted on some figures and references. This ISFSI will be constructed at the Idaho Nuclear Technology and Engineering Center (INTEC) site within the INEEL for interim storage of Three Mile Island Unit 2 (TMI-2) core and core handling debris. The INTEC was formerly known as the Idaho Chemical Processing Plant (ICPP) and is so noted on some figures and references. The TMI-2 core debris is currently in stainless steel canisters which are stored in a fuel pool at another site, Test Area North (TAN), within the INEEL. Each NUHOMS®-12T module will provide for the horizontal dry storage of up to 12 TMI-2 canisters inside a dry shielded canister (DSC) which is placed inside a concrete horizontal storage module (HSM). This Safety Analysis Report (SAR) describes the design of the INEEL TMI-2 ISFSI and the NUHOMS®-12T system and is submitted by the DOE to fulfill the requirements of 10 CFR 72.24 "Contents of Application: Technical Information."

The INEEL TMI-2 ISFSI design is based on the currently licensed NUHOMS® system. The NUHOMS® system has an extensive licensing and technical basis. The original NUHOMS® Topical Report (NUH-001, Revision 1A, NRC Project No. M-39) was approved by the United States Nuclear Regulatory Commission (NRC) on March 28, 1986 for storage of seven spent pressurized water reactor (PWR) fuel assemblies per DSC and HSM (NUHOMS®-07P) [1.1, 1.2].

The NUHOMS® Topical Report was revised (NUH-002, Revision 0, NRC Docket No. M-49) to provide the generic design criteria and safety analysis for the larger 24 spent PWR fuel assembly design (NUHOMS®-24P) and its associated on-site transfer cask. NRC approval of the NUHOMS®-24P Topical Report was granted on April 26, 1989 [1.3, 1.4]. The standardized NUHOMS® design has since been expanded to include the NUHOMS®-52B for dry storage and on-site transfer of 52 boiling water reactor (BWR) fuel assemblies [1.5]. The NRC has issued Certificate of Compliance 72-1004, dated January 23, 1995, for the standardized NUHOMS® system, addressing both the NUHOMS®-24P and the NUHOMS®-52B systems. The approved NUHOMS®-24P Topical Report forms the basis for the NUHOMS®-12T system presented in SAR. The NUHOMS®-12T system has been adapted for TMI-2 canister use and the system can accommodate the internal baskets designed specifically to hold TMI-2 canisters.

The INEEL TMI-2 ISFSI will be located on a DOE facility operated under DOE Regulations, Orders and Directives. For the INEEL TMI-2 ISFSI, NRC regulations shall apply and have precedence over DOE Orders, Requirements and Guidelines. The INEEL TMI-2 ISFSI is exempted from those DOE Orders that duplicate or overlap NRC requirements.

To facilitate direct referencing, the format, the numbering system, the section headings, and the content follow NRC Regulatory Guide 3.48 [1.6]. Numbers in brackets indicate references which are listed at the end of each chapter. The international system of units [Systême International d'Unités (SI)] and commonly used U.S. units are used to the maximum practical extent for general data presented in the SAR. For calculations, the data is presented in the units used by generally accepted practice in the U.S.

The remainder of this chapter provides a general overview of the INEEL TMI-2 ISFSI and summarizes the contents of this SAR.

1.1.1 Principal Function of the Installation

The TMI-2 canisters are currently stored in a fuel pool at the INEEL Test Area North (TAN). Since the TAN Hot Shop is scheduled for decommissioning as part of the overall INEEL plan, dry storage of the TMI-2 canisters has been selected as the interim storage approach. NUHOMS® is a proven system for dry storage which has been in use at reactor sites since March of 1989. The INEEL TMI-2 ISFSI is designed to provide temporary dry storage for 100% of the TMI-2 canisters. The ISFSI design includes an extra HSM with a pre-installed DSC overpack in case a challenged canister needs additional confinement. The INEEL TMI-2 ISFSI and NUHOMS®-12T components are also designed to allow retrieval of the TMI-2 canisters for further processing, alternate storage, or disposal.

As stated, the dry storage for the TMI-2 canisters will utilize an adaptation of the standardized NUHOMS® system. The most notable differences between the TMI-2 canisters and commercial fuel assemblies are:

- TMI-2 core debris is canisterized whereas commercial fuel is clad. The canisters contain TMI-2 core debris and debris from core handling equipment resulting from the 1979 TMI-2 accident. (In the balance of this SAR, these canisters are generally referred to as "TMI-2 canisters" except when detailed discussion dictates otherwise.) The TMI-2 canisters and contents are described in more detail in Chapter 3 of this SAR.

- The TMI-2 canisters provide a much stronger structural element, as compared to commercial fuel assemblies, for support within the DSC basket.

- The heat load for the TMI-2 canister (maximum 60 watts, average 29 watts) is much less than a commercial spent fuel assembly (approximately 1000 watts).

- The TMI-2 canisters have the potential for hydrogen gas generation due to radiolysis. Gas generation due to radiolysis is described in Appendix C of this SAR.

Based on these considerations, the NUHOMS® system is modified to accommodate these conditions. Specifically, the NUHOMS®-12T DSC will be modified to include venting of the DSC through high efficiency particulate air (HEPA) grade filters during storage. The vent system, which is further discussed in Section 4.3.1 of this SAR, will allow for release of the hydrogen gas and will allow for monitoring and/or purging of the system during operation.

DOE's schedule for licensing, construction and operation of the INEEL TMI-2 ISFSI has been established by the Settlement Agreement [1.7] entered into by the State of Idaho, the Department of Energy, and the Department of Navy. The Settlement Agreement was signed in October 1995 and fully resolves all issues in the actions Public Service Co. of Colorado v. Batt, No. CV 91-0035-S-EJL (D. Id.) and United States v. Batt, No. CV-91-0065-S-EJL (D. Id.). Within the Settlement Agreement, paragraph E7 states:

> "DOE shall complete construction of the Three Mile Island dry storage facility by December 31, 1998. DOE shall commence moving fuel into the facility by March 31, 1999, and shall complete moving fuel into the facility by June 1, 2001."

DOE seeks to comply with the following key milestone dates in order to meet the schedule requirements of the Court Order:

October 1996:	DOE-ID submit license application to NRC
April 1997:	NRC Completes EA/FONSI*
April 1997:	Begin Procurement/Construction activities
March 1998:	NRC Issues ISFSI license*
September 1998	Complete ISFSI construction
December 1998	Complete system testing
February 1999	Begin Transport operations
June 2001	Complete transport operations

* Anticipated need dates to meet the Settlement Agreement milestones.

The various components of the NUHOMS®-12T system are briefly described in Sections 1.2 and 1.3. The design and conservative analyses of the system components are described in detail in the remainder of this SAR.

1.1.2 Location of the ISFSI

The TMI-2 ISFSI is located within the INEEL, a DOE-controlled site occupying 571,800 acres within Butte County and surrounding counties in eastern Idaho. The INEEL has nine primary facility areas situated on an expanse of otherwise undeveloped, high-desert terrain. The INEEL TMI-2 ISFSI is sited within the boundaries of the INTEC, a facility with the mission to receive and store nuclear fuels and radioactive wastes. The INTEC occupies about 120 acres of the south-central portion of the INEEL, and is located 42 miles west of Idaho Falls. The INEEL TMI-2 ISFSI is sited in a two acre dedicated area within the INTEC boundaries. Figure 1.1-1 shows the location of the ISFSI within the INTEC. The site characteristics are discussed in Chapter 2.

The TAN facility, which is also located within the INEEL, is approximately 30 miles north of INTEC. Transportation of the cask from TAN to INTEC will include travel over 5 miles (8 km) of Idaho Highway 33 and then over 25 miles (40 km) of restricted access DOE-controlled highway. This transportation will be treated in accordance with 10 CFR Part 71 as an off-site transport operation or in accordance with 10 CFR 72 as an on-site transport operation. This SAR provides the information necessary for the transportation from TAN to INTEC using the NRC 10 CFR 71 certified MP-187 transportation system. Appendix E of this SAR provides detailed information necessary for the transportation from TAN to INTEC using the NRC 10 CFR 72 approved OS-197 Transfer Cask. Movement and transfer of loaded casks within the TAN Hot Shop will be conducted in accordance with INEEL procedures and DOE Orders, whereas, movement and transfer of the cask outside of the TAN Hot Shop and within the INTEC and ISFSI fences will be treated as on-site transfer operations according to 10 CFR Part 72. Both of these fenced areas have restricted public access.

1.1.3 TMI-2 ISFSI Site Characteristics

Chapter 2 of this document provides the site characteristics relating to the Idaho National Engineering and Environmental Laboratory (INEEL), the Idaho Nuclear Technology and Engineering Center (INTEC), and the INEEL TMI-2 ISFSI. It includes the meteorology, hydrology, seismology, geology, and volcanism of the area. It describes the geographical location, the population distribution within and around the INEEL, land and water use, and associated site activities. It also provides an evaluation of the site with respect to plant safety. Following is a summary of TMI-2 ISFSI site conditions:

- Probable Maximum Flood (PMF) Plain Elevation (Feet): 4917.0 above sea level (ASL)
  - Ambient Temperature (Extremes):
    - Highest: 103^{0}F.
    - Lowest: Minus 50^{0}F.
  - Average Monthly Temperature Extremes:
    - Maximum: 87^{0}F (in July).
    - Minimum: 4^{0}F (in January)
  - Annual Precipitation:
    - Average: 8.71 inches
    - Highest: 14.40 inches
    - Lowest: 4.50 inches
    - Average Yearly Snowfall: 26 inches
  - Seismic Zone 2B per the Uniform Building Code
  - Design Basis Tornado:
    - Maximum wind speed: 200 mph
    - Rotational speed: 160 mph
    - Translational Speed: 40 mph
    - Pressure Drop: 1.5 psi
  - Snow Load: 30 pounds per square foot (psf)
  - Frost Depth: 5 feet
  - Existing Ground Level Elevation (Feet): 4915 (ASL).

1.1.4 Activities and Facilities to be Licensed

The activities and facilities to be licensed pursuant to the requirements of 10 CFR Part 72 commence with the movement of loaded shipping cask from the TAN Hot Shop. However, certain steps in TAN procedures (including some activities in the TAN Hot Shop) implement requirements of the licensed system and these procedure steps are subject to change control under 10 CFR 72.48 (see 9.4.1). The licensed activities include the transportation to INTEC, and include all subsequent receipt, handling, storage, surveillance, and maintenance activities within the ISFSI. The licensed facility includes the structures and equipment that comprise the INEEL TMI-2 ISFSI.

1.1.5 Waste Product Generation

Chapter 6 of this document addresses site-generated waste confinement and management. In summary, cask transfer operations and maintenance of the HEPA grade filters in the dry shielded canister (DSC) vent system are the only activities that will generate waste during the operating design life of the system. This waste will be in the form of dry radioactive waste. On the average, the filters could be replaced five times during the 50-year life of the system. It is estimated this would consist of about one cubic foot per DSC over the design life of the TMI-2 ISFSI (a total of less than 30 ft^3). Decommissioning activities at the time of TMI-2 ISFSI closure is estimated to generate less than 10 ft^3 per module (a total of less than 300 ft^3). The horizontal storage module (HSM) and concrete basemat would be disposed of as clean free release material after radiological surveys and any necessary decontamination.

1.1.6 Activities Conducted at INTEC that may affect TMI-2 ISFSI Operations

The TMI-2 ISFSI will be located within the site boundaries of the INTEC with several other DOE owned facilities and DOE managed programs. The INEEL has its own large security police force, a fire department, medical staff, emergency response teams, and full-time INTEC shift plant supervision. Thus, the INEEL infrastructure will be considered to serve equivalent functions as independent local agencies (similar to local city or county) do for typical commercial licensed sites.

Normal INTEC operations will not affect operation of the TMI-2 ISFSI. Emergency situations, unrelated to the TMI-2 ISFSI operations, which would require personnel to evacuate the plant area, or take cover, could cause temporary interruptions to normal TMI-2 ISFSI operations (loading, unloading and surveillance). The interruptions would not compromise safety.

1.1.7 Quality Assurance Program

The QA Program selected for this project satisfies the requirements of 10 CFR Part 72, Subpart G. The QA Program will ensure that essential technical and quality requirements for structures, systems, and components (SSCs) classified as important to safety are achieved and documented throughout all design, fabrication, construction, testing, operations, modifications and decommissioning activities. Chapter 11 of this document provides a detailed description of the QA program.

The basic quality assurance program is the DOE's Office of Civilian Radioactive Waste Management's Quality Assurance Requirements and Description, DOE/RW-0333P, Revision 5 (QARD). All SSCs are analyzed to determine whether their functions or physical characteristics are essential to the safety function. Those items are classified as "important to safety", and are subject to the applicable requirements of the QARD. The program will be implemented through use of approved, controlled implementing procedures.

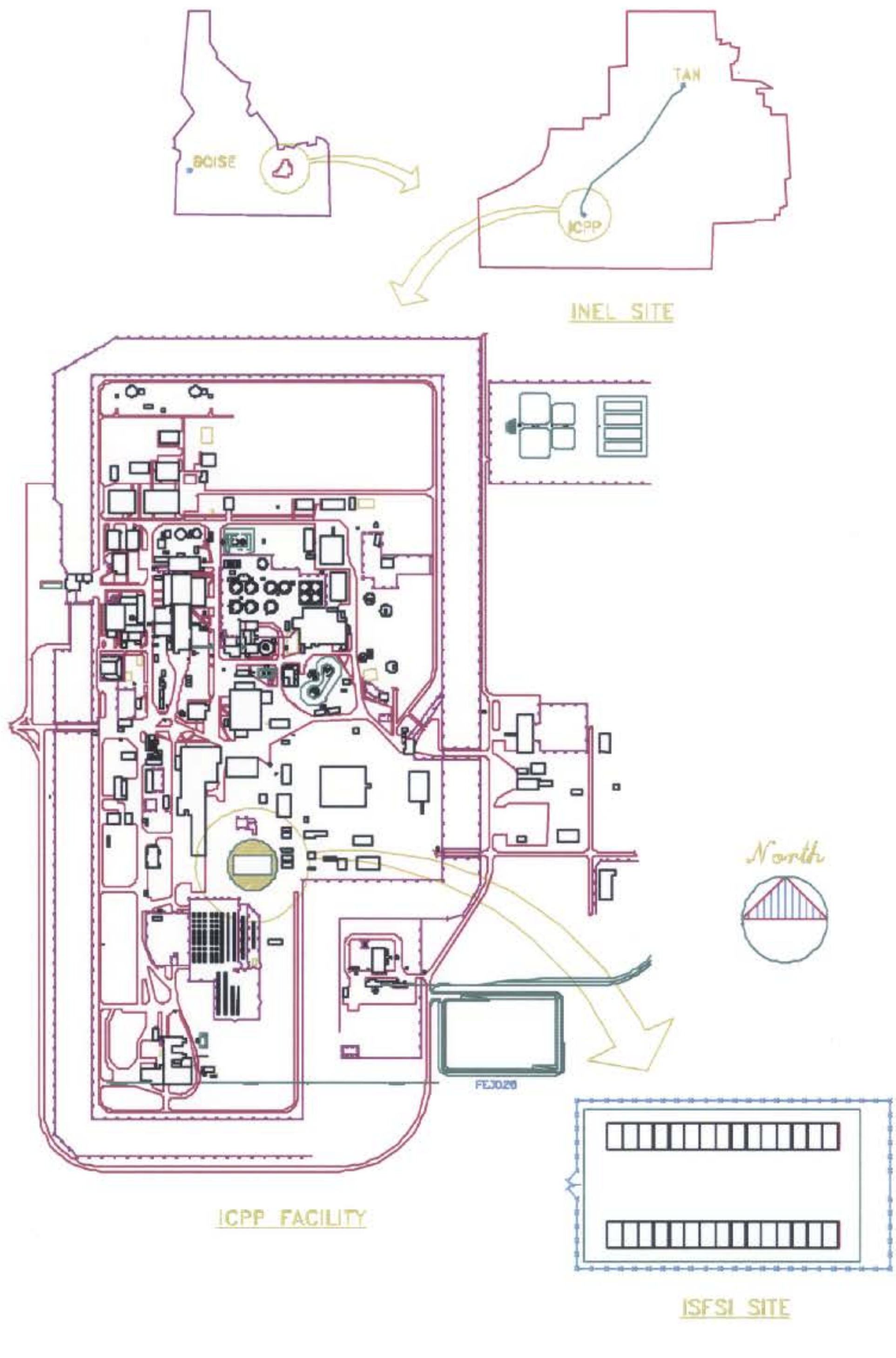


Figure 1.1-1
Location of the INEEL TMI-2 ISFSI

1.2 General Description of Installation

1.2.1 Arrangement of Major Structures and Equipment

The INEEL TMI-2 ISFSI utilizing the NUHOMS®-12T system provides for the horizontal, dry storage of canisterized TMI-2 core debris in a concrete HSM. The storage system components for NUHOMS®-12T consist of a reinforced concrete HSM and a DSC with an internal basket assembly which holds the TMI-2 canisters.

In addition to these storage system components, the NUHOMS®-12T system utilizes transfer equipment to move each DSC from the TAN Facility (where they are loaded with TMI-2 canisters and readied for storage) to the HSMs where they are stored. This transfer system includes the transfer or transportation cask, lifting slings, a hydraulic ram system, a prime mover for towing, a transport trailer, a cask transportation skid, and a skid positioning system. This transfer system interfaces with the existing INEEL TAN Hot Shop cask handling crane. Auxiliary equipment such as a vacuum drying system and an automated welding system are also used to facilitate DSC loading, purging and sealing operations. This SAR primarily addresses the design and analysis of the storage system components, including the DSC and the HSM, which are important to safety in accordance with 10 CFR Part 72. Sufficient information for the transfer system and auxiliary equipment is also included to describe the adequacy of measures that will be taken to ensure safe loading and transfer operations. The NUHOMS®-12T transfer system arrangement is illustrated in Figure 1.2-1.

The INEEL TMI-2 ISFSI layout is based on the use of 30 HSMs, 29 which will be loaded, and one extra. The prefabricated HSM used to form HSM arrays is shown in Figure 1.2-2. Each of 29 HSMs holds a NUHOMS®-12T DSC containing up to 12 TMI-2 canisters. The NUHOMS®-12T DSC assembly is shown in Figure 1.2-4. An extra HSM serves as a backup in case a challenged DSC needs additional confinement. This extra HSM will include a cylindrical overpack so that it can be used to provide an additional barrier for a challenged DSC.

1.2.2 Principal Design Criteria

The principal design criteria are provided in Chapter 3, but are summarized, along with nominal component dimensions, in Table 1.2-1.

Horizontal Storage Module: The HSM is a low profile, reinforced concrete structure designed to withstand all normal condition loads as well as the abnormal condition loads created by earthquakes, tornadoes, and other natural phenomena. The HSM is also designed to withstand abnormal condition loadings postulated to occur during design basis accident conditions.

Dry Shielded Canister: The DSC design addresses the postulated design basis transfer cask drop accident (described in Section 8.2.5). The DSC shell, and the closures on each end, ensure that the intended safety functions of the system are not impaired following a postulated transfer cask drop accident. The limits established for equivalent decelerations due to a postulated drop accident envelop a range of conditions such as the cask handling operations, the type of handling equipment used, the cask on-site transport route, the maximum feasible drop height and orientation, and the conditions of the impacted surface. The structural safety features of the NUHOMS®-12T system are described in Chapters 4 and 8. Nuclear Criticality Safety is also ensured in the design of the DSC as described in Section 3.3.4.

Decay Heat Removal: The decay heat of the TMI-2 core debris is rejected from the DSC shell to the HSM walls by radiant heat transfer. The heat is conducted through the HSM walls and removed from the HSM outer surfaces by natural convection and by radiant heat transfer to the ambient air. Under worst case extreme summer ambient conditions, thermal calculations show that no cooling air vents are required to remove the decay heat generated from the TMI-2 core debris. The thermal performance features of the NUHOMS® system are described in Chapters 4 and 8.

External Atmosphere Criteria: Given the corrosion resistant properties of materials used for construction of the NUHOMS®-12T system components, and the dry environment which exists within the HSM, no limits on the range of acceptable external atmospheric conditions are required. All metal components are steel and are coated with inorganic coatings or galvanized where practicable. Hence, all metallic materials are protected against corrosion wherever possible. However, a corrosion allowance is included in the structural evaluation of the carbon steel components. The interior of the HSM is a concrete surface and is void of any substance which would be conducive to the growth of organic or vegetative matter. Chapter 2 of this SAR provides a detailed discussion of climatic conditions.

DSC Venting: Each DSC will be vented to prevent the accumulation of gases generated due to radiolysis. Although the TMI-2 canisters contain hydrogen recombiners, the vent system design conservatively assumes that the recombiners are not functional relative to reducing hydrogen concentrations. A vent assembly with HEPA grade filters will be installed on each DSC, with access through a small vented door in the rear of the HSM. The design features, operations, surveillance and maintenance plans are developed to assure that the system can be tested and monitored for gas accumulation in the DSCs. Although no significant release of radioactive gases or particulate are anticipated, monitoring of air and gases vented through the HEPA filters is also addressed in the surveillance and maintenance plans.

Table 1.2-1
Key Design Parameters for the NUHOMS®-12T System

Category	Criteria or Parameter (Dimensions are Nominal)	Value
TMI-2 Canister[(1)] Criteria:	Maximum Canister Weight	1,327 Kg (2926 lbs.)
	Size (Nominal):	
	Length	3.81 m (150 in.)
	Diameter	35.6 cm (14 in.)
	Initial Maximum Enrichment (weight percent (w/o) U-235)	2.98%
	Fuel Burnup (MWD/MTU)	3,175
	Gamma Radiation Source (photons/sec/canister)	6.37 E+14 (19 year cooled)
	Neutron Radiation Source (neutron/ sec./canister)[3]	6.90 E+5 (19 year cooled)
	Thermal Characteristics:	
	Max. Decay Heat Power per TMI-2 Canister	60 W
	Average Decay Heat Power per TMI-2 Canister	15 W
	Thermal Design Basis:	
	Max. Decay Heat Power for one TMI-2 Canister	80 W
	Total Decay Heat Power for DSC with 12 Heaviest Loaded TMI-2 Canisters	860 W
Dry Shielded Canister:	No. of TMI-2 Canisters per DSC	up to 12
	Size (Nominal):	
	Overall Length	4.15 m (163.5 in.)
	Outside Diameter	1.71 m (67.2 in.)
	Shell Thickness	15.9 mm (5/8 in.)
	Heat Rejection	860 W
	Internal Atmosphere	Air

Table 1.2-1

Key Design Parameters for the NUHOMS®-12T System

(continued)

Category	Criteria or Parameter (Dimensions are Nominal)	Value
Dry Shielded Canister: (Concluded)	Design Pressure	15 psig
	Equivalent Cask Drop Deceleration	75g Vertical (End) and Horizontal (Side), 25g Oblique (Corner)
	Materials of Construction	Carbon Steel
	Service Life	50 Years
Cask[(2)]:	Payload Capacity	37,000 kg (82,000 lbs.)
	Gross Weight	113,000 kg (250,000 lbs.) (handling) 109,000 kg (240,000 lbs.)(transport) 123,000 Kg (271,200 lbs.) (transport with impact limiters)
	Equivalent Cask Drop Deceleration	75g Vertical (End) and Horizontal (Side) 25g Oblique (Corner)

Table 1.2-1
Key Design Parameters for the NUHOMS®-12T System
(concluded)

Category	Criteria or Parameter (Dimensions are Nominal)	Value
Horizontal Storage Module:	Capacity	One DSC per HSM
	Array Size	Two rows of 15 Modules
	HSM Size (Nominal):	
	Length	5.54 m (18'-2")
	Height	4.42 m (14'-6")
	Width	3.12 m (10'-3")
	Surface Dose Rate	ALARA
	Heat Rejection Capacity	860 Watts
	Materials of Construction	Reinforced Concrete and Structural Steel
	Service Life	50 years

(1) Enveloping design basis fuel.

(2) Design Basis of MP187 Cask [1.9, 1.10].

(3) Neutron source term for each of two canisters, one stored in DSC 1/HSM 4 and another stored in DSC 5/HSM 22, is 8E6 neutrons/canister due to the presence on AmBeCm startup source material. [1.11]

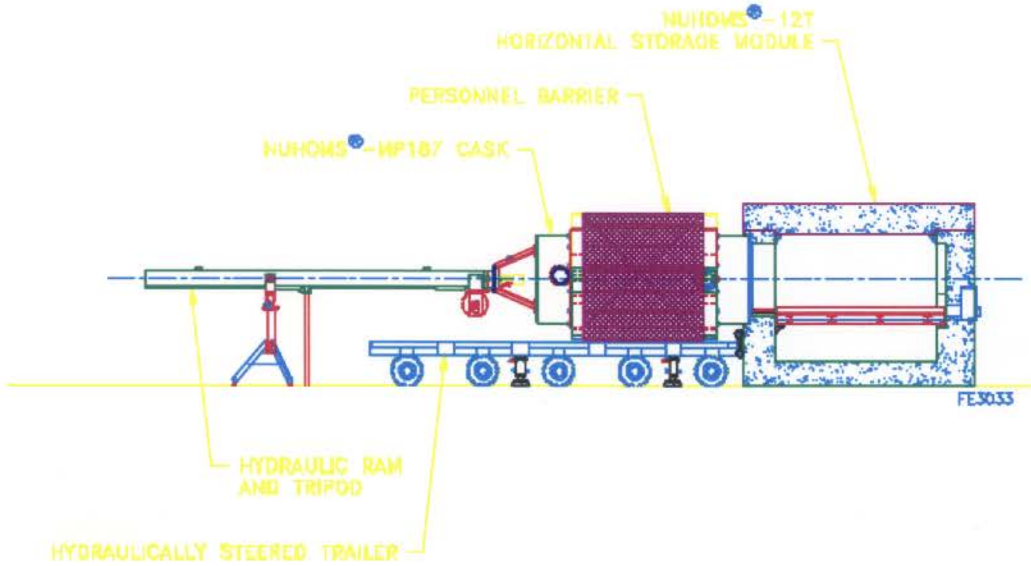
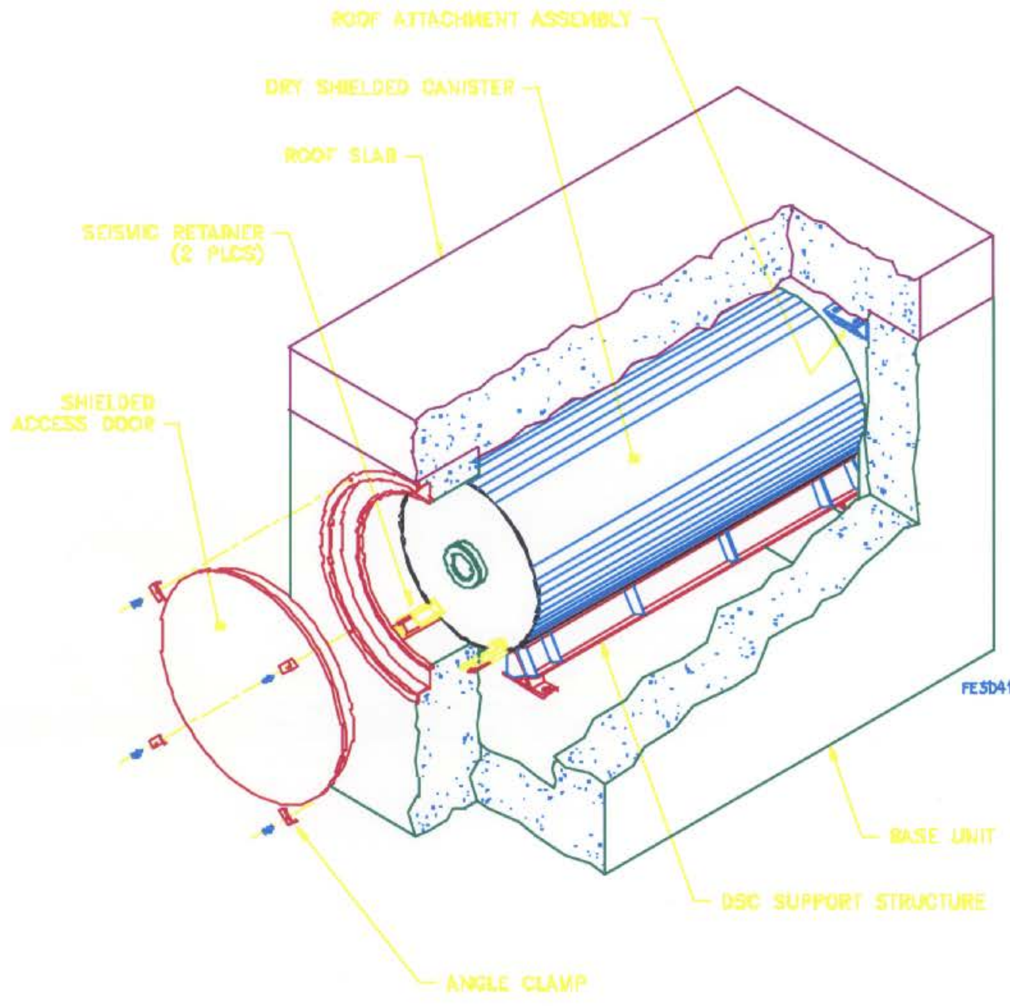


Figure 1.2-1

NUHOMS®-12T System Components, Structures, and Transfer Equipment - Elevation View



NOTE: Nominal Dimensions are shown in Table 1.2-1

Figure 1.2-2
Prefabricated NUHOMS®-12T Horizontal Storage Module
Front View
(Sheet 1 of 2)

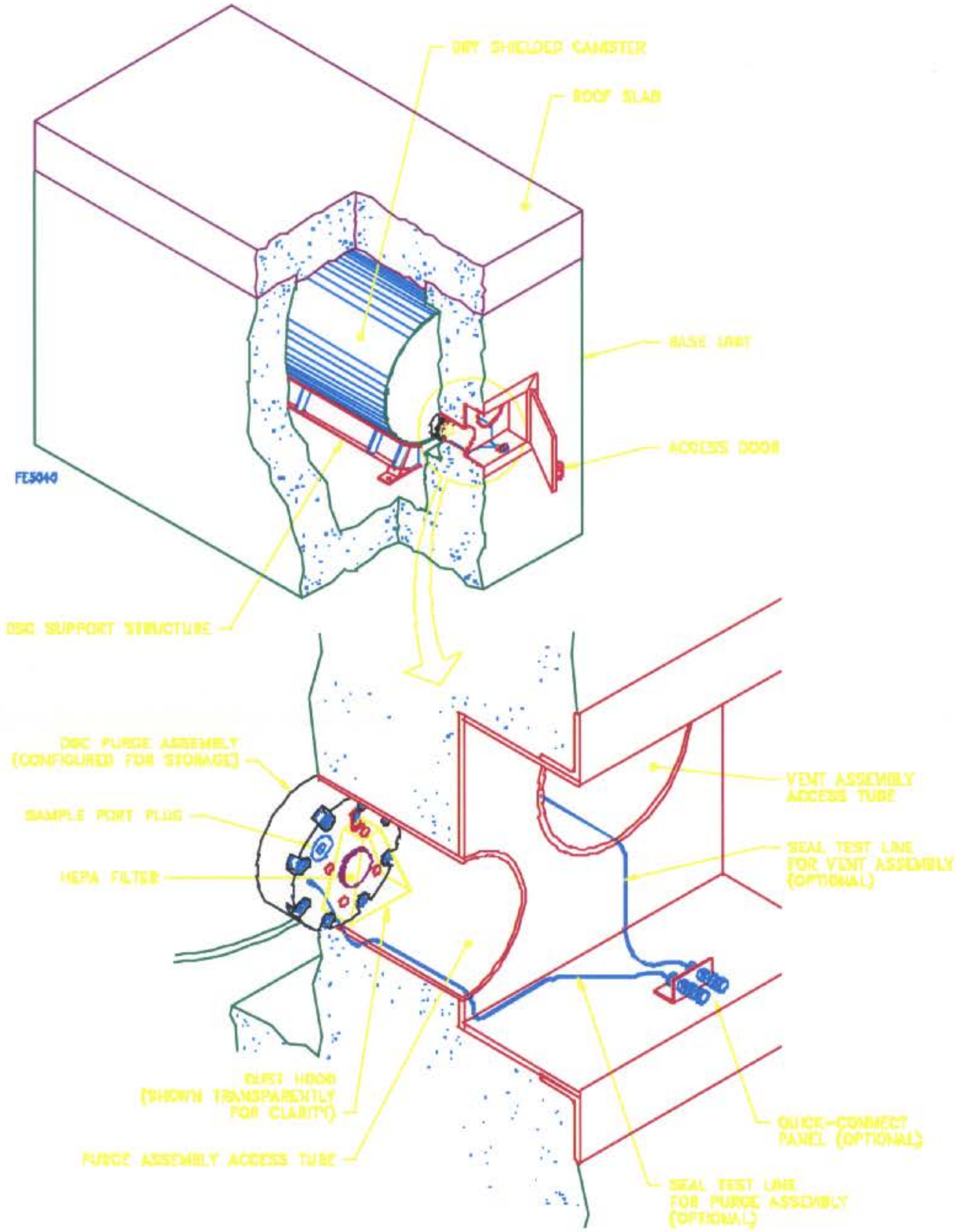


Figure 1.2-3

Prefabricated NUHOMS®-12T Horizontal Storage Module

Rear View

(Sheet 2 of 2)

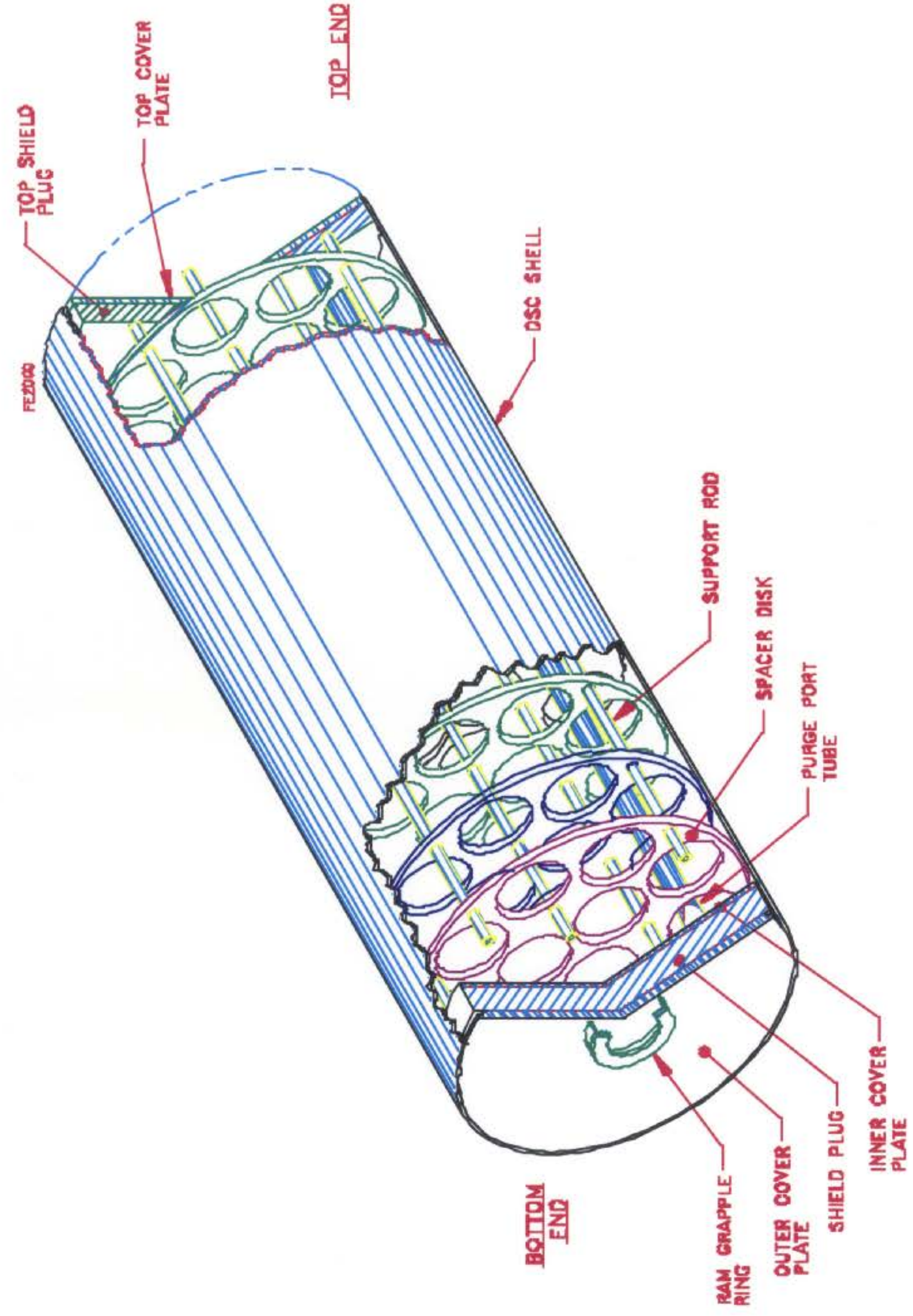


Figure 1.2-4
NUHOMS®-12T Dry Shielded Canister Assembly Components

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1.3 General Systems Description

The following subsections briefly describe the features and operation of the INEEL TMI-2 ISFSI utilizing the NUHOMS®-12T system elements.

1.3.1 Storage Systems

1.3.1.1 Dry Shielded Canister

The DSC assembly is illustrated in Figure 1.2-4. The DSC shell, the top and bottom cover plates, and the top shield plug form the confinement boundary for the spent fuel. The DSC shield plugs at each end are provided to minimize the occupational doses during sealing and handling operations.

The DSC has seal welds which join the shell, the top and bottom cover plates and the top shield plug to form the confinement boundary. The bottom end assembly confinement boundary welds are made during fabrication of the DSC. The top end assembly confinement boundary welds are made after TMI-2 canister loading. Both top plug penetrations (purge and vent ports) are mechanically sealed with a vent/filter housing installed after loading operations are complete. Transportation covers with mechanical seals are used to cover the vent/filter housing during the 10 CFR 71 transport of the DSC from TAN to INTEC and are removed to allow venting of the DSC during the storage mode. As documented in Chapter 8 of this SAR, there are no credible accidents which could breach the confinement boundary of the DSC.

The DSC internal basket consists of circular spacer disks and longitudinal support rods. These combine to provide support for the TMI-2 canisters under normal operating conditions of loading, transport, and storage. However, the internal basket assembly is not required to maintain criticality control as fixed geometric spacing of the TMI-2 canisters is not required for criticality control during transportation or storage.

1.3.1.2 Horizontal Storage Module

Isometric views of a prefabricated HSM utilized to form an array of HSMs are shown in Figure 1.2-2. Each HSM provides a self-contained modular structure for storage of TMI-2 core debris canisterized in a DSC. The HSM is constructed from reinforced concrete and structural steel. The thick concrete roof and walls of the HSM provide substantial neutron and gamma shielding.

The nominal thickness of the HSM roof and exterior walls of an HSM array for biological shielding ranges from two to three feet. Thick concrete side walls provide sufficient shielding between HSMs in an HSM array to prevent scatter in adjacent HSMs during loading and retrieval operations.

TMI-2 core debris decay heat is removed by a combination of radiant, conductive, and convective heat transfer mechanisms. No cooling air vents are required to remove the decay heat generated by the TMI-2 core debris. Decay heat is rejected from the DSC shell to the HSM walls by radiant heat transfer. The heat is conducted through the HSM walls and removed from the HSM outer surfaces by natural convection and by radiant heat transfer to the ambient air. Passive cooling is sufficient to maintain peak core debris temperatures below limits set forth in the design criteria.

The INEEL TMI-2 ISFSI HSMs provide an independent, passive system with substantial structural capacity to ensure the safe dry storage of the TMI-2 canisters. To this end, the HSMs are designed to ensure that normal transfer operations and postulated accidents or natural phenomena do not impair the DSC or pose a hazard to facility personnel, or the public.

The HSMs are placed on, but not physically anchored to, a load bearing reinforced concrete basemat. The HSMs are located in a fenced, secured location with controlled access.

1.3.2 Transfer Systems

1.3.2.1 Transfer/Transport Cask

The NUHOMS®-12T DSCs can be moved using any NRC 10 CFR Part 72-approved transfer cask or a NRC 10 CFR 71 certified transportation system. This SAR provides the information necessary for the transportation from TAN to INTEC using the NRC 10 CFR 71 certified MP-187 transportation system. Appendix E of this SAR provides the detailed information necessary for the transportation from TAN to INTEC using the 10 CFR 72 approved Transfer Cask. The major difference between the two transportation approaches is that the NRC 10 CFR 72 approved OS-197 Transfer Cask does not require impact limiters, evacuation and helium backfill of the DSC, leak testing of the DSC closure weld, or installation of the vent/filter housing transportation covers. The MP187 is being licensed to 10 CFR Part 71 and 10 CFR Part 72 transport/transfer requirements; that is, the MP187 may be used for over-the-road transportation under 10 CFR Part 71 conditions, with impact limiters installed, and also for the on-site transfer of the DSC under 10 CFR Part 72 conditions. A sketch of the MP187 is provided in Figure 1.3-1. The MP187 design is provided in the NUHOMS®-MP187 SAR [1.9]. Drawings of the MP187 are also provided for reference in Appendix B of this SAR.

The MP187 cask is designed to provide sufficient shielding to ensure that dose rates meet regulatory limits and are as low as reasonably achievable (ALARA). Two lifting trunnions are provided for handling the cask at the TAN Hot Shop using a lifting yoke and an overhead crane. Lower support trunnions are provided on the cask for pivoting the cask from/to the vertical and horizontal positions on the support skid/transport trailer.

1.3.2.2 Transfer Equipment

Transport Trailer: The transport trailer consists of a heavy industrial trailer. The trailer transports the cask transportation skid and the loaded cask between the TAN Hot Shop and the ISFSI. The trailer is designed to ride as low to the ground as possible to minimize the cask height during transport and DSC transfer operations. The trailer is equipped with hydraulic leveling jacks to provide for alignment of the cask with the HSM. The trailer is towed by a conventional heavy haul truck tractor or other suitable prime mover. The nominal trailer bed height during DSC transfer to the HSM is such that the cask is elevated less than 1.68m (5'-6") above grade as measured from the lowest point on the cask. This is well below the 2.0m (80 inch) drop height used as the 10 CFR Part 72 accident drop design basis of the cask and DSC.

Cask Transportation Skid: The cask transportation skid is similar in design and operation to other transportation cask skids used for shipment of fuel. The key differences are:

1. There is no ancillary equipment mounted on the skid.

2. The skid is mounted on a surface with sliding support bearings and hydraulic positioners to provide alignment of the cask with the HSM. Brackets with locking bolts are provided to prevent movement during trailer towing.

3. The cask transportation skid is mounted on a heavy haul industrial trailer.

The TAN Hot Shop crane is used to place the cask onto the transportation skid which is secured to the transport trailer. DOE safety requirements apply to the specific details of this operation at the TAN Hot Shop.

Hydraulic Ram: The hydraulic ram system consists of a hydraulic cylinder with a capacity and a reach sufficient for DSC loading and unloading to and from the HSM. The design of the ram support system provides a direct load path for the hydraulic ram reaction forces during DSC transfer. The system uses an adjustable rear ram support for alignment at the rear of the ram, and a fixed set of trunnion towers as a front support. The design provides positive alignment of the major components during DSC transfer. During DSC transfer, the ram reaction forces are transferred through the frame support into the cask, and from the cask to the HSM through the cask restraints.

1.3.3 Auxiliary Systems

Auxiliary systems are used during the DSC sealing and testing operations; they are:

Vacuum Drying System (VDS): The VDS provides a means for evacuating the DSC, and backfilling it with helium if required. The VDS can also be used to backfill the transfer/transport cask with helium if required for 10 CFR Part 71 leak testing. The vacuum drying system may be used during DSC storage if it is determined that purging of the DSCs is required to control the accumulation of gases generated from radiolysis. The VDS is described in Chapter 4 of this SAR.

Welding System: DSCs are seal welded using an automated or manual welding system. The welding system is described in Chapter 4 of this SAR.

Waste Processing Systems: There are no waste processing systems required for the ISFSI. VDS exhaust and general cask decontamination waste are generated during DSC evacuation and sealing operations as well as during the normal storage mode where periodic purging of the DSC may be required. Both waste streams will be managed in accordance with established waste processing practices at INEEL. These wastes are discussed in Chapter 6.

1.3.4 System Operation

The operations for the NUHOMS®-12T system are described in Chapter 5 of this SAR. The following overview of operations is provided for general introduction and description of the INEEL TMI-2 ISFSI.

Cask Preparation: Cask preparation includes exterior washdown and interior decontamination. These operations are performed on an as-needed basis. The operations are performed by INEEL facility personnel using INEEL procedures.

DSC Preparation: The internals and externals of the DSC are thoroughly washed or wiped down on an as-needed basis. This ensures that the newly fabricated DSC will meet existing facility cleanliness requirements.

Cask Movement from Transportation Skid to an Upright Position: The cask is moved into the TAN Hot Shop, unloaded from the trailer, and placed on the turning skid. The cask is lifted to an upright position using the TAN Hot Shop crane and transferred to a work stand.

Placement of DSC in Cask: An empty DSC is inserted into the cask. Proper alignment is assured by a matching key and slot on the DSC and cask and also by visual inspection of the alignment match marks on the DSC and cask.

TMI-2 Canister Loading into DSC: Previously dewatered and dried TMI-2 canisters are placed into the DSC basket.

Removing TMI-2 Canister Fittings: The canister fittings are removed to allow for venting of the TMI-2 canisters during the storage mode.

DSC Top Shield Plug Placement: The DSC top shield plug is placed onto the DSC using the TAN Hot Shop crane.

DSC Sealing, Welding, and Testing: The DSC top shield plug and top cover plate are each installed and welded in place, with examination of each weld.

Install DSC Vent Housing Assemblies: The vent housings are installed and leak tested, and if a 10 CFR 71 transport is to be performed, the vent transportation covers are installed.

Cask Cover Plate Placement: The top internal spacer and cask top cover plate are put in place using the TAN Hot Shop crane. The cask lid is bolted closed for subsequent handling operations.

Placement of Cask on Transport Trailer Skid: The TAN Hot Shop crane is used to remove the transport cask from the work stand, move it to the turning skid, and downend the cask from the vertical to a horizontal position. The cask is then placed on the transportation skid on the transport trailer and readied for subsequent transport operations. If a 10 CFR Part 71 transport is to be performed, leak testing and installation of impact limiters is performed.

Transport of Loaded Cask to HSM: Once loaded and secured, the transport trailer is towed to the ISFSI along a predetermined route. Upon entering the ISFSI secured area, the impact limiters are removed and the transport cask is positioned and aligned with the particular HSM in which a DSC is to be transferred.

Cask/HSM Preparation: At the ISFSI, with the transport cask positioned in front of the HSM, the cask top cover plate and the HSM door are removed. The skid positioning system is then used for the final alignment and docking of the cask with the HSM.

Loading DSC into HSM: After final alignment of the transport cask, HSM, and hydraulic ram, the DSC is pushed by the hydraulic ram into the HSM.

Storage: After the DSC is inside the HSM, the hydraulic ram is disengaged from the DSC and withdrawn through the cask. The transfer trailer is pulled away, the DSC seismic restraint is installed, and the HSM shielded access door installed.

Vent System Connection: The access door in the rear wall of the HSM is opened, the transportation covers if installed are removed from the vent assemblies, and the access door is closed and locked. The DSC is now in safe storage within the HSM.

Retrieval of the DSC: If retrieval from the HSM is required for any reason, transfer operations can be performed in the reverse manner as previously described. The system is designed to allow the hydraulic ram to pull the DSC out of the HSM back into a transfer/transport cask. Once inside the transfer/transport cask, the DSC can be transferred to the DSC overpack for storage, or transferred to another suitable facility for further processing, alternate storage, or disposal.

1.3.5 Arrangement of Storage Structures

The DSC containing the TMI-2 canisters is transferred to, and stored in, the HSM in the horizontal position. HSMs are arranged within the ISFSI site on a concrete pad with the entire area enclosed by a security fence. Individual HSMs are not anchored to the pad but arranged adjacent to each other, with a nominal six inch gap between modules. Figure 1.3-2 shows the layout for the INEEL TMI-2 ISFSI. In planning the installation layout, the parameters of interest are: the configuration of the HSM array, an area in front of each HSM to provide adequate space for backing and aligning the transport trailer, and an area for access to the HSM rear walls to access the vent system and to perform periodic monitoring of the DSC and vent system.

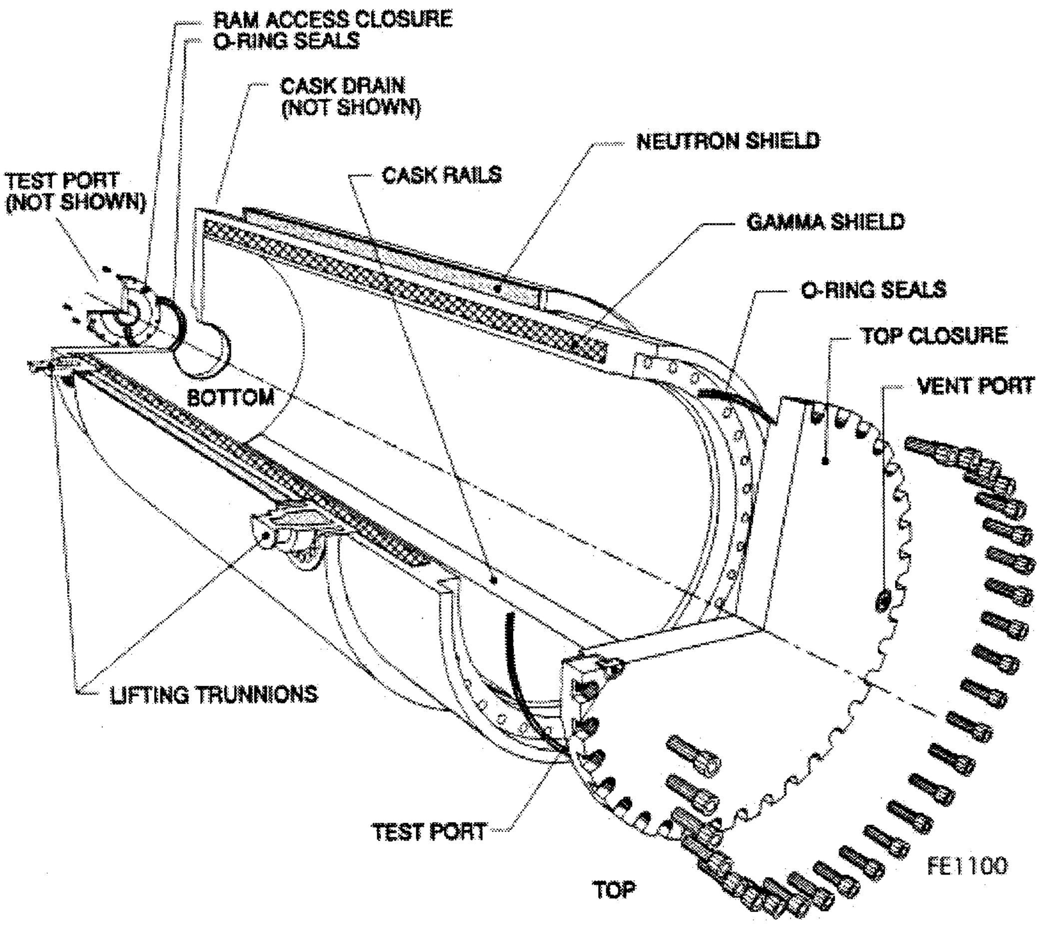

Figure 1.3-1
NUHOMS®-12T MP187 Cask

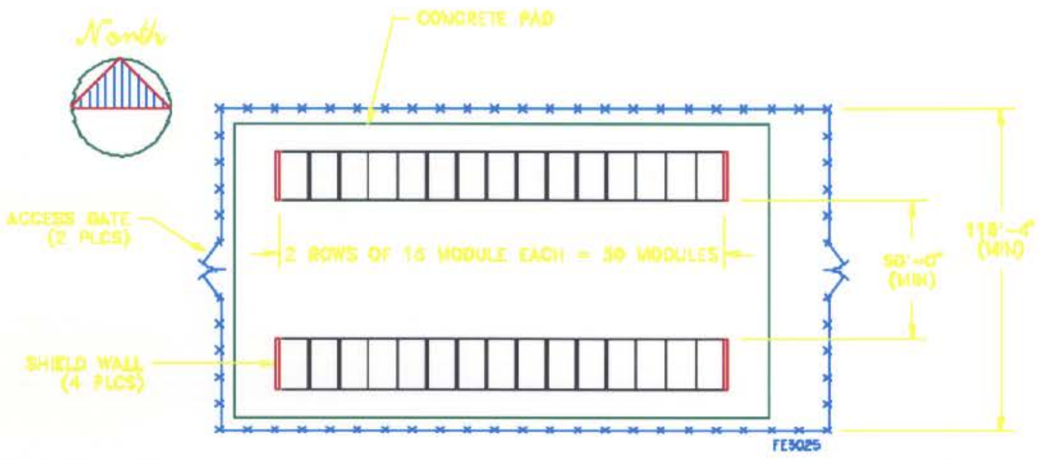

Figure 1.3-2
Module Layout for INEEL TMI-2 ISFSI

1.4 Identification of Agents and Contractors

The Department of Energy, Idaho Operations Office (DOE-ID), under authorization by DOE Headquarters (HQ), has overall responsibility for the engineering, design, licensing, construction, operation and decommissioning of the INEEL TMI-2 ISFSI. The DOE utilizes its Management & Operating (M&O) contractor for the operation, maintenance and support of activities at the DOE Idaho National Engineering Laboratory (INEEL), including the TMI-2 ISFSI. The M&O contractor at the INEEL is currently Bechtel BWXT Idaho, LLC.

The lead contractor for the design, safety analysis, and construction of the INEEL TMI-2 ISFSI is Newport News Shipbuilding (NNS) of Newport News, Virginia. NNS has subcontracted with Transnuclear West (TNW) of Fremont, California, and SCIENTECH, Inc. of Idaho Falls, Idaho, for design, safety analysis, and licensing support. TNW is the subcontractor for design and safety analysis of the NUHOMS® system components. SCIENTECH is the subcontractor responsible for design review and licensing support activities.

NNS and TNW will subcontract selected portions of the fabrication and on-site construction to qualified firms later in the construction phase of the project.

1.5 Material Incorporated by Reference

Efforts have been made to make this SAR a self-contained document with reference to other documents such as the standardized NUHOMS®-24P SAR [1.5] as a minimum. Several other documents related to the licensing of the INEEL TMI-2 ISFSI are being submitted with the 10 CFR Part 72 license application and are referenced throughout this SAR.

The Sacramento Municipal Utility District (SMUD) Rancho Seco ISFSI SAR [1.10], presents the bounding operating loading conditions for the MP187 cask and contents when operated as an on-site transfer cask. The NUHOMS®-MP187 Transportation Cask Safety Analysis Report is referenced in this SAR in instances where transportation requirements bound those imposed by 10 CFR Part 72.

An amendment to the NUHOMS®-MP187 Transportation Cask Safety Analysis Report [1.9] will be submitted to the NRC Transportation Branch in conjunction with this application. It will contain descriptions and analyses of the cask for transportation conditions specific to the INEEL TMI-2 ISFSI and will be submitted for review under 10 CFR, Part 71.

1.6 References

1.1 VECTRA Technologies, Inc., "Topical Report for the Nutech Horizontal Modular Storage System for Irradiated Nuclear Fuel," NUH-001, Revision 2A, San Jose, California, NRC Docket No. M-39.

1.2 U. S. Nuclear Regulatory Commission, Office of Nuclear Materials Safety and Safeguards, "Safety Evaluation Report for Nutech Horizontal Modular System for Irradiated Fuel Topical Report," NRC Docket No. M-39, March 28, 1986.

1.3 VECTRA Technologies, Inc., "Topical Report Amendment 2 for the NUTECH Horizontal Modular Storage System for Irradiated Nuclear Fuel - NUHOMS® -24P," Revision 2A, File No. NUH002.0103, NRC Docket No. M-49.

1.4 U. S. Nuclear Regulatory Commission, Office of Nuclear Materials Safety and Safeguards, "Safety Evaluation Report Related to the Topical Report for the Nutech Horizontal Modular Storage System for Irradiated Nuclear Fuel NUHOMS®-24P Submitted by Nutech Engineers, Inc.," NUH-002, Revision 1A, NRC Docket No. M-49, April 1989.

1.5 "Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel," NUH-003, Revision 4A, VECTRA Technologies, Inc., File No. NUH003.0103, NRC Docket No. 72-1004, June 1996.

1.6 U.S. Nuclear Regulatory Commission, "Standard Format and Content for the Safety Analysis Report for an Independent Spent Fuel Storage Installation (Dry Storage)," Regulatory Guide 3.48, U.S. NRC, 1989.

1.7 DOE 1995b, *"Settlement Agreement"* between the State of Idaho, Department of the Navy, and the Department of Energy." October 16, 1995.

1.8 U.S. Government, "Licensing Requirements for the Storage of Spent Fuel in An Independent Spent Fuel Storage Installation," Title 10 Code of Federal Regulations, Part 72, Office of the Federal Register, Washington D.C.

1.9 "Safety Analysis Report for the NUHOMS®-MP187 Multi-Purpose Cask," NUH-005, Revision 2, VECTRA Technologies, Inc., NRC Docket Number 71-9255, February 1996.

1.10 Safety Analysis Report for the Rancho Seco Independent Spent Fuel Storage Installation, Sacramento Municipal Utility District, NRC Docket Number 72-11, October 1993.

1.11 Hall, G. G., "Impact of AmBeCm Sources on the TMI-2 ISFSI Design Basis," Engineering Design File No. 1973, Revision 4, March 15, 2001.