

**CERTIFICATE OF COMPLIANCE  
FOR SPENT FUEL STORAGE CASKS**

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The U.S. Nuclear Regulatory Commission is issuing this Certificate of Compliance pursuant to Title 10 of the Code of Federal Regulations, Part 72, "Licensing Requirements for Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste" (10 CFR Part 72). This certificate is issued in accordance with 10 CFR 72.238, certifying that the storage design and contents described below meet the applicable safety standards set forth in 10 CFR Part 72, Subpart L, and on the basis of the Final Safety Analysis Report (FSAR) of the cask design. This certificate is conditional upon fulfilling the requirements of 10 CFR Part 72, as applicable, and the conditions specified below.

Certificate No.	Effective Date	Expiration Date	Docket Number	Amendment No.	Amendment Date	Package Identification No.
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Issued To: (Name/Address)

Transnuclear, Inc.  
4 Skyline Drive  
Hawthorne, NY 10532

Safety Analysis Report Title

Transnuclear, Inc.  
Final Safety Analysis Report for the TN-32 Dry Storage Cask  
Docket No. 72-1021

CONDITIONS:

This certificate is conditioned upon fulfilling the requirements of 10 CFR Part 72, as applicable, the attached Appendix A (Technical Specifications), and the conditions specified below:

1. CASK

a. Model Nos.: TN-32 (standard TN-32, TN-32A, and TN-32B)

The TN-32 dry storage cask consists of a cask and basket assembly. The TN-32A is identical to the standard TN-32 except that it has a shorter lid assembly and longer cavity. The top and bottom plates on the top neutron shield are made correspondingly thicker to provide the same total shielding as the standard TN-32 design. The TN-32B is identical to the standard TN-32 except that the top lifting trunnions are single failure proof. The TN-32 is designed to contain up to 32 intact, unconsolidated pressurized water reactor (PWR) fuel assemblies.

b. Description

The cask which is being certified is described in the Safety Analysis Report (SAR) and in NRC's Safety Evaluation Report (SER) accompanying the Certificate of Compliance. The TN-32 dry storage cask was designed by Transnuclear to store irradiated PWR spent fuel assemblies at an independent spent fuel storage installation (ISFSI).

The TN-32 cask body is a right circular cylinder composed of the following components: confinement vessel with bolted lid closure, basket for fuel assemblies, gamma shield, trunnions, neutron shield, overpressure monitoring system, and weather cover.

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1. b. Description (continued)

The confinement vessel consists of an inner shell which is a welded, carbon steel cylinder with an integrally-welded, carbon steel bottom closure; a welded flange forging; a carbon steel lid with closure bolts and inner metallic seal; and vent and drain covers with closure bolts and inner metallic seals.

The basket consists of an assembly of stainless steel cells which are welded together and separated by aluminum and neutron absorber plates. The aluminum provides heat conduction paths from the fuel assemblies to the cask cavity and the neutron absorber plates provide criticality control.

The gamma shield encloses the confinement vessel and consists of an independent shell and bottom plate of carbon steel and the steel shell of the neutron shield. Gamma shielding is also provided by the confinement lid.

There are four trunnions attached to the cask body. The top trunnions are used for lifting and the bottom trunnions may be used for rotating the unloaded cask.

The radial neutron shield consists of a borated polyester resin compound which surrounds the gamma shield. The resin compound is cast into long, slender aluminum containers which are enclosed in a smooth outer steel shell. The aluminum containers provide a conduction path for heat transfer from the cask body to the outer shell. Axial neutron shielding is provided by a polypropylene disk placed on the cask lid.

The overpressure monitoring system is used to monitor the pressure in the interspace between the inner and outer seals on the lid, vent, and drain port covers. The overpressure monitoring system consists of a tank filled with helium, pressure transducers or switches, and associated tubing, fittings, and valves.

The torispherical weather cover with a Viton o-ring provides weather protection for the closure lid and seal components, the top neutron shield, and the overpressure system.

The auxiliary equipment necessary for ISFSI operation is not included as part of the TN-32 cask system reviewed for a Certificate of Compliance under 10 CFR Part 72, Subpart L. Such equipment may include, but is not limited to, special lifting devices, transfer trailers or equipment, and vacuum drying/helium leak test equipment.

2. OPERATING PROCEDURES

Written operating procedures shall be prepared for cask handling, loading, unloading, movement, surveillance, and maintenance. The user's site-specific written operating procedures shall be consistent with the technical basis described in Chapter 8 of the SAR.

3. ACCEPTANCE TEST AND MAINTENANCE PROGRAM

Written cask acceptance tests and a maintenance program shall be prepared consistent with the technical basis described in Chapter 9 of the SAR.

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**4. QUALITY ASSURANCE**

Activities in the areas of design, procurement, fabrication, assembly, inspection, testing, operation, maintenance, repair, modification of structures, systems and components, and decommissioning that are important to safety shall be conducted in accordance with a Commission-approved quality assurance program which satisfies the applicable requirements of 10 CFR Part 72, Subpart G, and which is established, maintained, and executed with regard to the cask system.

**5. HEAVY LOADS REQUIREMENTS**

Each licensed facility must ensure that cask lifting is evaluated in accordance with the existing heavy loads requirements and procedures of the licensed facility in which the lift is made. An additional safety review (under 10 CFR 50.59 or 10 CFR 72.48, if applicable) is required to show operational compliance with existing facility/site-specific heavy loads requirements. The TN-32B lifting attachments have been designed as single failure proof, and are acceptable for use at sites that require single failure proof.

**6. APPROVED CONTENTS**

Contents of the TN-32 system must meet the specifications given in Appendix A to this certificate.

**7. DESIGN FEATURES**

Features or characteristics for the site, cask, or ancillary equipment must be in accordance with Appendix A to this certificate.

**8. PRE-OPERATIONAL TESTING AND TRAINING EXERCISE**

A dry run training exercise of the loading, closure, handling, unloading and transfer of the TN-32 cask shall be conducted by the cask user prior to the first use of the system to load spent fuel assemblies. The dry run may be performed in an alternate step sequence from the actual procedures. The dry run shall include but is not limited to the following:

Preparation of the TN-32 cask for loading and moving the TN-32 cask into the spent fuel pool.

Selection and verification of specific fuel assemblies to ensure type conformance.

Loading a dummy fuel assembly into the TN-32 and performing appropriate independent verification.

Installation of the TN-32 lid and removal of the TN-32 cask from the spent fuel pool.

Cask draining, vacuum drying, helium backfilling, and leakage testing.

Loading the TN-32 cask onto the cask transporter.

Transferring the cask to the ISFSI.

Placement of the TN-32 cask at the ISFSI.

Unloading operations including refueling.

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**9. SPECIAL REQUIREMENTS FOR CASK THERMAL TESTING**

Each agent and/or subcontractor authorized by the certificate holder to complete final assembly of the TN-32 cask body fabricated under this Certificate of Compliance, shall verify the heat transfer performance of a single cask. This test shall be performed prior to the first loading of any cask assembled by that agent and/or subcontractor with a heat load equal to or greater than 23.7 kilowatts.

A letter report summarizing the test performed, measured temperature data, and the calculated results of the test shall be submitted to the NRC in accordance with 10 CFR 72.4 at least 30 days prior to use of a cask loaded with a heat load equal to or greater than 23.7 kilowatts.

Proposed modifications to the fabrication process shall be evaluated for their potential to impact the heat transfer performance of the cask body. If the modification could result in adverse impact to the heat transfer performance of the cask body, the heat transfer performance of the modified cask shall be verified by an additional thermal test, prior to loading the first modified cask with a heat load equal to or greater than 23.7 kilowatts. The results of additional thermal tests shall be retained in accordance with 10 CFR 72.234(d).

**10. CHANGES TO THE CERTIFICATE OF COMPLIANCE**

The holder of this certificate who desires to make changes to this certificate, which includes Appendix A (Technical Specifications), shall submit an application for amendment of the certificate.

**11. AUTHORIZATION**

The TN-32 system, which is authorized by this certificate, is hereby approved for general use by holders of 10 CFR Part 50 licenses for nuclear reactors at reactor sites under the general license issued pursuant to 10 CFR 72.210, subject to the conditions specified by 10 CFR 72.212, and the attached Appendix A.

FOR THE NUCLEAR REGULATORY COMMISSION

  
E. William Braeh, Director  
Spent Fuel Project Office  
Office of Nuclear Material Safety  
and Safeguards

Attachment:

1. Appendix A

## **TN-32 GENERIC TECHNICAL SPECIFICATION**

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## 1.0 USE AND APPLICATION

### 1.1 Definitions

#### NOTE

The defined terms of this section appear in capitalized type and are applicable throughout these Technical Specifications and Bases.

<u>Term</u>	<u>Definition</u>
<b>ACTIONS</b>	<b>ACTIONS</b> shall be that part of a Specification that prescribes Required Actions to be taken under designated Conditions within specified Completion Times.
<b>CHANNEL OPERATIONAL TEST (COT)</b>	A <b>CHANNEL OPERATIONAL TEST (COT)</b> shall be the injection of a simulated or actual signal into the channel as close to the sensor as practicable to verify the operability of required alarm functions. The <b>COT</b> shall include adjustments, as necessary, of the required alarm setpoint so that the setpoint is within the required range and accuracy.
<b>INTACT FUEL ASSEMBLY</b>	Spent Nuclear Fuel Assemblies without known or suspected cladding defects greater than pinhole leaks or hairline cracks and which can be handled by normal means. Partial fuel assemblies, that is fuel assemblies from which fuel rods are missing, shall not be classified as <b>INTACT FUEL ASSEMBLIES</b> unless dummy fuel rods are used to displace an amount of water equal to or greater than that displaced by the original fuel rod(s).
<b>LOADING OPERATIONS</b>	<b>LOADING OPERATIONS</b> include all licensed activities on a cask while it is being loaded with fuel assemblies. <b>LOADING OPERATIONS</b> begin when the first fuel assembly is placed in the cask and end when the cask is supported by the transporter.
<b>STORAGE OPERATIONS</b>	<b>STORAGE OPERATIONS</b> include all licensed activities that are performed at the Independent Spent Fuel Storage Installation (ISFSI) while a cask containing spent fuel is sitting on a storage pad within the ISFSI.
<b>TRANSPORT OPERATIONS</b>	<b>TRANSPORT OPERATIONS</b> include all licensed activities performed on a cask loaded with one or more fuel assemblies when it is being moved to and from the ISFSI. <b>TRANSPORT OPERATIONS</b> begin when the cask is first suspended from the transporter and end when the cask is at its destination and no longer supported by the transporter.
<b>UNLOADING OPERATIONS</b>	<b>UNLOADING OPERATIONS</b> include all licensed activities on a cask while fuel assemblies are being unloaded. <b>UNLOADING OPERATIONS</b> begin when the cask is no longer supported by the transporter and end when the last fuel assembly is removed from the cask.

## 1.0 USE AND APPLICATION

### 1.2 Logical Connectors

#### PURPOSE

The purpose of this section is to explain the meaning of logical connectors.

Logical connectors are used in Technical Specifications (TS) to discriminate between, and yet connect, discrete Conditions, Required Actions, Completion Times, Surveillances, and Frequencies. The only logical connectors that appear in TS are AND and OR. The physical arrangement of these connectors constitutes logical conventions with specific meanings.

#### BACKGROUND

Several levels of logic may be used to state Required Actions. These levels are identified by the placement (or nesting) of the logical connectors and by the number assigned to each Required Action. The first level of logic is identified by the first digit of the number assigned to a Required Action and the placement of the logical connector in the first level of nesting (i.e., left justified with the number of the Required Action). The successive levels of logic are identified by additional digits of the Required Action number and by successive indentions of the logical connectors.

When logical connectors are used to state a Condition, Completion Time, Surveillance, or Frequency, only the first level of logic is used, and the logical connector is left justified with the statement of the Condition, Completion Time, Surveillance, or Frequency.

#### EXAMPLES

The following examples illustrate the use of logical connectors:

##### EXAMPLE 1.2-1:

##### ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. LCO not met.	A.1 Verify ... <u>AND</u> A.2 Restore ...	

In this example the logical connector AND is used to indicate that when in Condition A, both Required Actions A.1 and A.2 must be completed.



1.2 Logical Connectors

EXAMPLES  
(continued)

EXAMPLE 1.2-2:

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. LCO not met.	<p>A.1 Stop ...</p> <p><u>OR</u></p> <p>A.2.1 Verify ...</p> <p><u>AND</u></p> <p>A.2.2.1 Reduce ...</p> <p><u>OR</u></p> <p>A.2.2.2 Perform ...</p> <p><u>OR</u></p> <p>A.3 Remove ...</p>	

This example represents a more complicated use of logical connectors. Required Actions A.1, A.2, and A.3 are alternative choices, only one of which must be performed as indicated by the use of the logical connector OR and the left justified placement. Any one of these three Actions may be chosen. If A.2 is chosen, then both A.2.1 and A.2.2 must be performed as indicated by the logical connector AND. Required Action A.2.2 is met by performing A.2.2.1 or A.2.2.2. The indented position of the logical connector OR indicates that A.2.2.1 and A.2.2.2 are alternative choices, only one of which must be performed.

## 1.0 USE AND APPLICATION

### 1.3 Completion Times

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<b>PURPOSE</b>	The purpose of this section is to establish the Completion Time convention and to provide guidance for its use.
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<b>BACKGROUND</b>	Limiting Conditions for Operation (LCOs) specify minimum requirements for ensuring safe operation of the cask. The ACTIONS associated with an LCO state Conditions that typically describe the ways in which the requirements of the LCO can fail to be met. Specified with each stated Condition are Required Action(s) and Completion Times(s).
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<b>DESCRIPTION</b>	<p>The Completion Time is the amount of time allowed for completing a Required Action. It is referenced to the time of discovery of a situation (e.g., equipment or variable not within limits) that requires entering an ACTIONS Condition unless otherwise specified, providing the cask is in a specified condition stated in the Applicability of the LCO. Required Actions must be completed prior to the expiration of the specified Completion Time. An ACTIONS Condition remains in effect and the Required Actions apply until the Condition no longer exists or the cask is not within the LCO Applicability.</p>
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Once a Condition has been entered, subsequent subsystems, components, or variables expressed in the Condition, discovered to be not within limits, will not result in separate entry into the Condition unless specifically stated. The Required Actions of the Condition continue to apply to each additional failure, with Completion Times based on initial entry into the Condition.

### 1.3 Completion Times

#### EXAMPLES

The following examples illustrate the use of Completion Times with different types of Conditions and changing Conditions:

#### EXAMPLE 1.3-1:

##### ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
L. Required Action and associated Completion Time not met.	B.1 Perform Action B.1.	12 hours
	<u>AND</u> B.2 Perform Action B.2	36 hours

Condition B has two Required Actions. Each Required Action has its own separate Completion Time. Each Completion Time is referenced to the time that Condition B is entered.

The Required Actions of Condition B are to complete action B.1 within 12 hours AND to complete action B.2 within 36 hours. A total of 12 hours is allowed for completing action B.1 and a total of 36 hours (not 48 hours) is allowed for completing action B.2 from the time that Condition B was entered. If action B.1 is completed within 6 hours, the time allowed for completing action B.2 is the next 30 hours because the total time allowed for completing action B.2 is 36 hours.

### 1.3 Completion Times

#### EXAMPLES (continued)

#### EXAMPLE 1.3-2:

##### ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One system not within limit	A.1 Restore system to within limit.	7 days
B. Required Action and associated Completion Time not met.	B.1 Perform Action B.1.	12 hours
	<u>AND</u> B.2 Perform Action B.2.	36 hours

When a system is determined to not meet the LCO, Condition A is entered. If the system is not restored within 7 days, Condition B is also entered and the Completion Time clocks for Required Actions B.1 and B.2 start. If the system is restored after Condition B is entered, Condition A and B are exited, and therefore, the Required Actions of Condition B may be terminated.

### 1.3 Completion Times

#### EXAMPLES (continued)

#### EXAMPLE 1.3-3:

#### ACTIONS

#### -----NOTE-----

Separate Condition entry is allowed for each component.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. LCO not met.	A.1 Restore compliance with LCO.	4 hours
B. Required Action and associated Completion Time not met.	B.1 Perform Action B.1.	12 hours
	<u>AND</u> B.2 Perform Action B.2.	36 hours

The Note above the ACTIONS Table is a method of modifying how the Completion Time is tracked. If this method of modifying how the Completion Time is tracked was applicable only to a specific Condition, the Note would appear in that Condition rather than at the top of the ACTIONS Table.

The Note allows Condition A to be entered separately for each component, and Completion Times tracked on a per component basis. When a component does not meet the LCO, Condition A is entered and its Completion Time starts. If subsequent components are determined Not to meet the LCO, Condition A is entered for each component and separate Completion Times start and are tracked for each component.

#### IMMEDIATE

When "Immediately" is used as a Completion Time, the COMPLETION TIME Required Action should be pursued without delay and in a controlled manner.

## 1.0 USE AND APPLICATION

### 1.4 Frequency

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#### PURPOSE

The purpose of this section is to define the proper use and application of Frequency requirements.

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#### DESCRIPTION

Each Surveillance Requirement (SR) has a specified Frequency in which the Surveillance must be met in order to meet the associated Limiting Condition for Operation (LCO). An understanding of the correct application of the specified Frequency is necessary for compliance with the SR.

The "specified Frequency" is referred to throughout this section and each of the Specifications of Section 3.0, Surveillance Requirement (SR) Applicability. The "specified Frequency" consists of the requirements of the Frequency column of each SR, as well as certain Notes in the Surveillance column that modify performance requirements.

Situations where a Surveillance could be required (i.e., its Frequency could expire), but where it is not possible or not desired that it be performed until sometime after the associated LCO is within its Applicability, represent potential SR 3.0.4 conflicts. To avoid these conflicts, the SR (i.e., the Surveillance or the Frequency) is stated such that it is only "required" when it can be and should be performed. With an SR satisfied, SR 3.0.4 imposes no restriction.

The use of "met" or "performed" in these instances conveys specific meanings. A Surveillance is "met" only when the acceptance criteria are satisfied. Known failure of the requirements of a Surveillance, even without a Surveillance specifically being "performed," constitutes a Surveillance not "met."

**1.4 Frequency****EXAMPLES**

The following examples illustrate the various ways that Frequencies are specified:

**EXAMPLE 1.4-1:****SURVEILLANCE REQUIREMENTS**

SURVEILLANCE	FREQUENCY
Verify Pressure within limit.	12 hours

Example 1.4-1 contains the type of SR most often encountered in the Technical Specifications (TS). The Frequency specifies an interval (12 hours) during which the associated Surveillance must be performed at least one time. Performance of the Surveillance initiates the subsequent interval. Although the Frequency is stated as 12 hours, an extension of the time interval to 1.25 times the interval specified in the Frequency is allowed by SR 3.0.2 for operational flexibility. The measurement of this interval continues at all times, even when the SR is not required to be met per SR 3.0.1 (such as when the equipment is determined to not meet the LCO, a variable is outside specified limits, or the unit is outside the Applicability of the LCO). If the interval specified by SR 3.0.2 is exceeded while the cask is in a condition specified in the Applicability of the LCO, the LCO is not met in accordance with SR 3.0.1.

If the interval as specified by SR 3.0.2 is exceeded while the unit is not in a condition specified in the Applicability of the LCO for which performance of the SR is required, the Surveillance must be performed within the Frequency requirements of SR 3.0.2 prior to entry into the specified condition. Failure to do so would result in a violation of SR 3.0.4.

## 1.4 Frequency

EXAMPLES  
(continued)EXAMPLE 1.4-2:SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
Verify flow is within limits.	Once within 12 hours prior to starting activity  <u>AND</u>  24 hours thereafter

Example 1.4-2 has two Frequencies. The first is a one time performance Frequency, and the second is of the type shown in Example 1.4-1. The logical connector "AND" indicates that both Frequency requirements must be met. Each time the example activity is to be performed, the Surveillance must be performed prior to starting the activity.

The use of "once" indicates a single performance will satisfy the specified Frequency (assuming no other Frequencies are connected by "AND"). This type of Frequency does not qualify for the 25% extension allowed by SR 3.0.2.

"Thereafter" indicates future performances must be established per SR 3.0.2, but only after a specified condition is first met (i.e., the "once" performance in this example). If the specified activity is canceled or not performed, the measurement of both intervals stops. New intervals start upon preparing to restart the specified activity.



## 2.0 Functional and Operating Limits

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### 2.1 Fuel To Be Stored In The TN-32 Cask

The spent nuclear fuel to be stored in the TN-32 cask shall meet the following requirements:

- a. Fuel shall be unconsolidated INTACT FUEL ASSEMBLIES.
- b. Fuel shall be limited to fuel with zircaloy cladding.
- c. Fuel types shall be limited to the fuel types below with maximum uranium content as follows:

Westinghouse 14x14 Std ZCA and ZCB:	0.4144 MTU/assy.
Westinghouse 15x15:	0.4671 MTU/assy.
Westinghouse 17x17 Std:	0.4671 MTU/assy.
Westinghouse 14x14 OFA:	0.3611 MTU/assy.
Westinghouse 17x17 OFA:	0.4282 MTU/assy.
- d. Fuel may include burnable poison rod assemblies (BPRA's) having the acceptable combination of burnup and cooling time described by Figure 2.1.1-1.
- e. Fuel may include thimble plug assemblies (TPA's) having the acceptable combination of burnup and cooling time described by Figure 2.1.1-2.
- f. Fuel assemblies shall have the following bounding characteristics:
  - i. The maximum initial enrichment shall not exceed 4.05 weight percent.
  - ii. The maximum assembly average burnup shall not exceed 45,000 MWD/MTU
  - iii. The minimum cooling time prior to loading shall be as specified in Table 2.1.1-1.
  - iv. The maximum heat load per assembly shall not exceed 1.02 kW.
  - v. The fuel assembly weight with hardware shall not exceed 1533 lbs.

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### 2.2 Functional and Operating Limits Violations

If any Functional and Operating Limit of 2.1 is violated, the following actions shall be completed:

- 2.2.1 The affected fuel assemblies shall be removed from the cask and placed in a safe condition.
  - 2.2.2 Within 24 hours, notify the NRC Operations Center.
  - 2.2.3 Within 30 days, submit a special report which describes the cause of the violation and the actions taken to restore compliance and prevent recurrence.
-

Table 2.1.1-1  
Minimum Acceptable Cooling Time as a Function of Burnup and Initial Enrichment

Min. Init. Enrichment (% wt)(1)	Maximum Burnup (GWd/MTU)(2)																
	15	20	30	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1.2	7	7															
1.3	7	7															
1.4	7	7															
1.5	7	7	7	8	8	8	8	9									
1.6	7	7	7	7	8	8	8	9	9	9	9						
1.7	7	7	7	7	8	8	8	8	9	9	9	10					
1.8	7	7	7	7	7	8	8	8	9	9	9	10					
1.9	7	7	7	7	7	7	8	8	8	9	9	9	10	10			
2.0	7	7	7	7	7	7	8	8	8	8	9	9	9	10	10		
2.1	7	7	7	7	7	7	7	8	8	8	9	9	9	10	10		
2.2	7	7	7	7	7	7	7	7	8	8	8	9	9	9	10	10	
2.3	7	7	7	7	7	7	7	7	8	8	8	9	9	9	10	10	
2.4	7	7	7	7	7	7	7	7	8	8	8	8	9	9	9	10	10
2.5	7	7	7	7	7	7	7	7	7	8	8	8	8	9	9	9	10
2.6	7	7	7	7	7	7	7	7	7	7	8	8	8	8	9	9	10
2.7	7	7	7	7	7	7	7	7	7	7	7	8	8	8	8	9	9
2.8	7	7	7	7	7	7	7	7	7	7	7	8	8	8	8	9	9
2.9	7	7	7	7	7	7	7	7	7	7	7	7	8	8	8	8	9
3.0	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8	8	9
3.1	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8	8	9
3.2	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8	8
3.3	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8
3.4	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8
3.5	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
3.6	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
3.7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
3.8	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
3.9	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
4.05	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7

■ - not evaluated

- (1) Round actual value down to next lower tenth.  
(2) Round actual value up to next higher GWd/MTU.

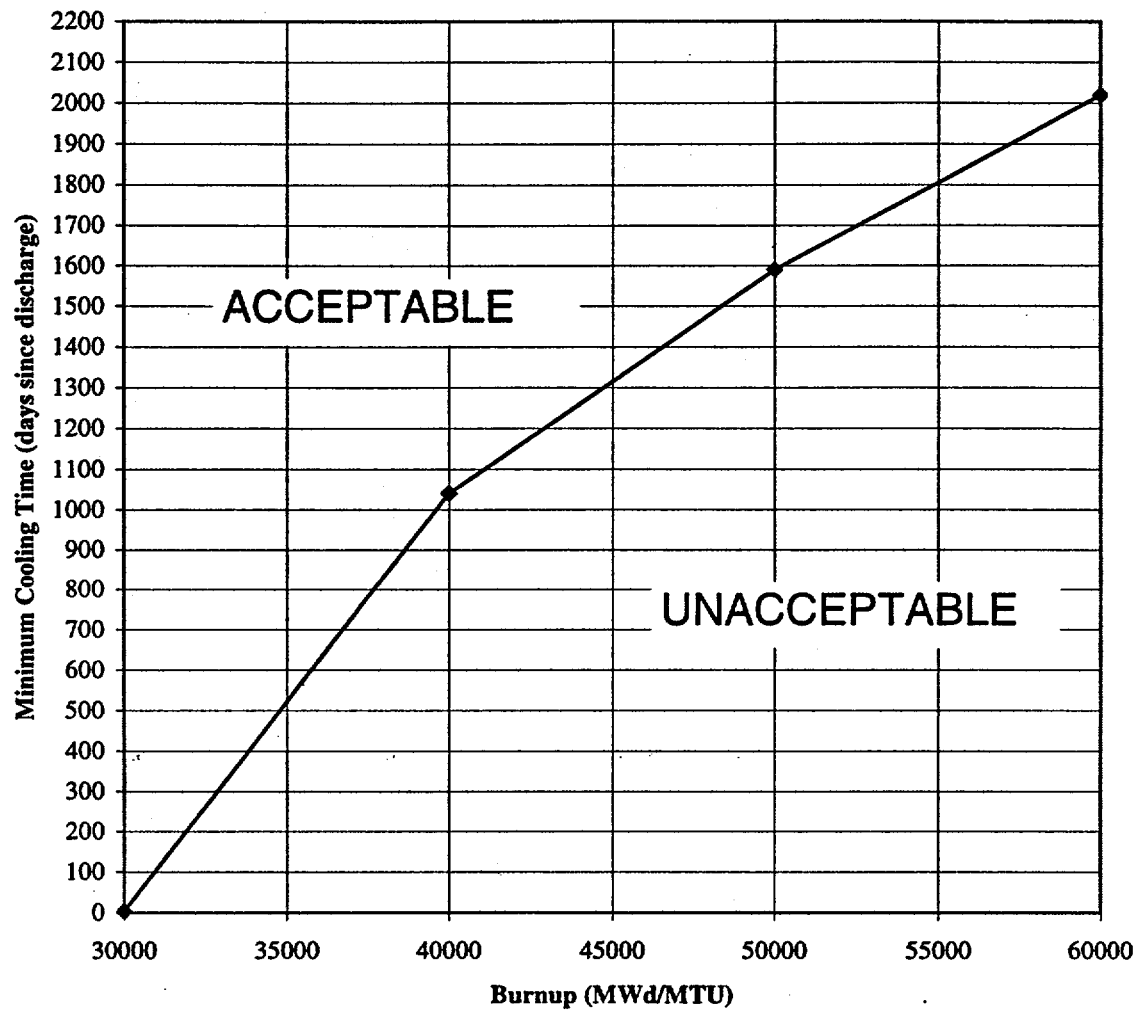


Figure 2.1.1-1  
Burnable Poison Rod Assemblies (BPRAs)  
Minimum Acceptable Cooling Time as a Function of Burnup

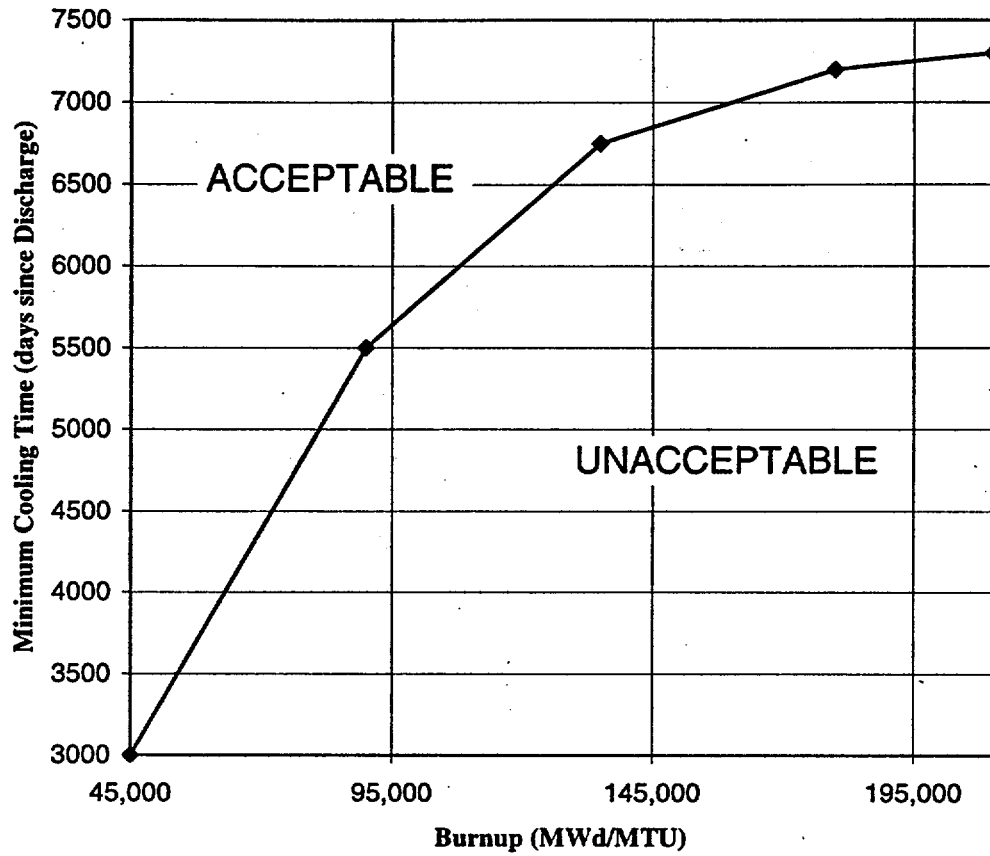


Figure 2.1.1-2  
Thimble Plug Assemblies (TPAs)  
Minimum Acceptable Cooling Time as a Function of Burnup

### 3.0 LIMITING CONDITION FOR OPERATION (LCO) APPLICABILITY

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LCO 3.0.1	LCOs shall be met during specified conditions in the Applicability, except as provided in LCO 3.0.2.
LCO 3.0.2	<p>Upon discovery of a failure to meet an LCO, the Required Actions of the associated Conditions shall be met, except as provided in LCO 3.0.5.</p> <p>If the LCO is met or is no longer applicable prior to expiration of the specified Completion Time(s), completion of the Required Action(s) is not required, unless otherwise stated.</p>
LCO 3.0.3	Not applicable to a cask.
LCO 3.0.4	<p>When an LCO is not met, entry into a specified condition in the Applicability shall not be made except when the associated ACTIONS to be entered permit continued operation in the specified condition in the Applicability for an unlimited period of time. This Specification shall not prevent changes in specified conditions in the Applicability that are required to comply with ACTIONS, or that are related to the unloading of a cask.</p> <p>Exceptions to this Specification are stated in the individual Specifications. These exceptions allow entry into specified conditions in the Applicability when the associated ACTIONS to be entered allow operation in the specified condition in the Applicability only for a limited period of time.</p>
LCO 3.0.5	Equipment removed from service or not in service in compliance with ACTIONS may be returned to service under administrative control solely to perform testing required to demonstrate it meets the LCO or that other equipment meets the LCO. This is an exception to LCO 3.0.2 for the system returned to service under administrative control to perform the testing required to demonstrate that the LCO is met.
LCO 3.0.6	Not applicable to a cask.
LCO 3.0.7	Not applicable to a cask.

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### 3.0 SURVEILLANCE REQUIREMENT (SR) APPLICABILITY

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**SR 3.0.1**                      SRs shall be met during the specified conditions in the Applicability for individual LCOs, unless otherwise stated in the SR. Failure to meet a Surveillance, whether such failure is experienced during the performance of the Surveillance or between performances of the Surveillance, shall be failure to meet the LCO. Failure to perform a Surveillance within the specified Frequency shall be failure to meet the LCO except as provided in SR 3.0.3. Surveillances do not have to be performed on equipment or variables outside specified limits.

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**SR 3.0.2**                      The specified Frequency for each SR is met if the Surveillance is performed within 1.25 times the interval specified in the Frequency, as measured from the previous performance or as measured from the time a specified condition of the Frequency is met.

For Frequencies specified as "once," the above interval extension does not apply. If a Completion Time requires periodic performance on a "once per . . ." basis, the above Frequency extension applies to each performance after the initial performance.

Exceptions to this Specification are stated in the individual Specifications.

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**SR 3.0.3**                      If it is discovered that a Surveillance was not performed within its specified Frequency, then compliance with the requirement to declare the LCO not met may be delayed, from the time of discovery, up to 24 hours or up to the limit of the specified Frequency, whichever is less. This delay period is permitted to allow performance of the Surveillance.

If the Surveillance is not performed within the delay period, the LCO must immediately be declared not met, and the applicable Condition(s) must be entered.

When the Surveillance is performed within the delay period and the Surveillance is not met, the LCO must immediately be declared not met, and the applicable Condition(s) must be entered.

---

**SR 3.0.4**                      Entry into a specified condition in the Applicability of an LCO shall not be made unless the LCO's Surveillances have been met within their specified Frequency. This provision shall not prevent entry into specified conditions in the Applicability that are required to comply with ACTIONS or that are related to the unloading of a cask.

---

### 3.1 CASK INTEGRITY

#### 3.1.1 Cask Cavity Vacuum Drying

**LCO 3.1.1** The cask cavity vacuum drying pressure shall be sustained at or below 4 mbar absolute for a period of at least 30 minutes after isolation from the pumping system.

**APPLICABILITY:** During LOADING OPERATIONS

#### ACTIONS

----- **NOTE** -----  
Separate Condition entry is allowed for each cask.  
-----

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>-----<b>NOTE</b>----- Not applicable until SR 3.1.1.1 is performed.</p> <p>A. Cask cavity vacuum drying pressure limit not met.</p>	<p>-----<b>NOTE</b>----- Action A.1 applies until helium is removed for subsequent operations.</p> <p>A.1 Achieve or maintain a nominal helium environment in the cask</p> <p><u>AND</u></p> <p>A.2 Establish cask cavity drying pressure within limits.</p>	<p>12 hours</p> <p>96 hours</p>
<p>B. Required Action A.1 and associated Completion Time not met.</p>	<p>B.1 Remove all fuel assemblies from the cask.</p>	<p>7 days</p>

C. Required Action A.2 and associated Completion Time not met.	C.1 Remove all fuel assemblies from the cask.	30 days
--	---	---------

#### SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.1.1.1 Verify that the equilibrium cask cavity vacuum drying pressure is brought to $\leq 4$ mbar absolute for at least 30 minutes.	Once, within 24 hours of completion of cask draining.



### 3.1 CASK INTEGRITY

#### 3.1.2 Cask Helium Backfill Pressure

LCO 3.1.2 The cask cavity shall be filled with helium to a pressure of 2230 mbar absolute ( $\pm 100$  mbar).

APPLICABILITY: During LOADING OPERATIONS

#### ACTIONS

----- NOTE -----  
Separate Condition entry is allowed for each cask.  
-----

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>-----NOTE----- Not applicable until SR 3.1.2.1 is performed.</p> <p>A. Cask initial helium backfill pressure limit not met.</p>	<p>-----NOTE----- Action A.1 applies until helium is removed for subsequent operations</p> <p>A.1 Achieve or maintain a nominal helium environment in the cask</p> <p><u>AND</u></p> <p>A.2 Establish cask cavity backfill pressure within limits.</p>	<p>6 hours</p> <p>48 hours</p>
B. Required Action A.1 and associated Completion Time not met.	B.1 Remove all fuel assemblies from the cask.	7 days
C. Required Action A.2 and associated Completion Time not met.	C.1 Remove all fuel assemblies from the cask.	30 days

#### SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.1.2.1 Verify that the cask cavity helium pressure is 2230 mbar absolute ( $\pm 100$ mbar).	Once, within 30 hours of completion of cask draining.

### 3.1 CASK INTEGRITY

#### 3.1.3 Cask Helium Leak Rate

LCO 3.1.3 The combined helium leak rate for all closure seals shall not exceed 1.0 E-5 std cc/sec.

APPLICABILITY: During LOADING OPERATIONS.

ACTIONS

-----NOTE-----  
Separate Condition entry is allowed for each cask.  
-----

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>-----NOTE----- Not applicable until SR 3.1.3.1 is performed.</p> <p>A. Cask helium leak rate not met.</p>	A.1 Establish cask helium leak rate within limit.	48 hours
B. Required Action A.1 and associated Completion Time are not met.	B.1 Remove all fuel assemblies from cask.	30 days

#### SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.1.3.1 Verify the cask helium leak rate is within the limit.	Once, prior to TRANSPORT OPERATIONS.

### 3.1 CASK INTEGRITY

#### 3.1.4 Combined Helium Leak Rate

LCO 3.1.4 The combined helium leak rate for all closure seals and the overpressure system shall not exceed  $1.0 \text{ E-5 std cc/sec}$ .

APPLICABILITY: During STORAGE.  
ACTIONS

-----NOTE-----  
Separate Condition entry is allowed for each cask.  
-----

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>-----NOTE----- Not applicable until SR 3.1.4.1 is performed.</p> <p>A. Combined helium leak rate not met.</p>	A.1 Establish combined helium leak rate within limit.	48 hours
B. Required Action A.1 and associated Completion Time are not met.	B.1 Remove all fuel assemblies from cask.	30 days

#### SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>-----NOTE----- This surveillance may be combined with SR 3.1.3.1.</p> <p>SR 3.1.4.1 Verify the combined helium leak rate is within the limit.</p>	<p>Once prior to TRANSPORT OPERATIONS <u>OR</u> Once within 48 hours of commencing STORAGE OPERATIONS.</p>

### 3.1 CASK INTEGRITY

#### 3.1.5 Cask Interseal Pressure

LCO 3.1.5 Cask interseal pressure shall be maintained at a pressure of at least 3.2 atm abs

APPLICABILITY: During STORAGE OPERATIONS.

#### ACTIONS

-----NOTE-----  
Separate Condition entry is allowed for each cask.  
-----

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Cask interseal pressure below limit.	A.1 Reestablish cask interseal pressure above limit.	7 days
B. Required Action A.1 and associated Completion Time not met.	B.1 Remove all fuel assemblies from cask.	30 days

#### SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.1.5.1 Verify cask interseal helium pressure above limit.	7 days
SR 3.1.5.2 Perform a CHANNEL OPERATIONAL TEST (COT) to verify proper functioning of pressure switch / transducer on cask overpressure system.	Once, within 7 days of commencing STORAGE OPERATIONS and every 36 months thereafter

### 3.1 CASK INTEGRITY

#### 3.1.6 Cask Minimum Lifting Temperature

LCO 3.1.6 The loaded cask shall not be lifted if the outer surface of the cask is below -20°F.

APPLICABILITY: During TRANSPORT OPERATIONS

#### ACTIONS

----- NOTE -----  
Separate Condition entry is allowed for each cask.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Cask surface temperature below limit.	A.1 Lower cask to safe position	Immediately

#### SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.1.6.1 Verify outer surface temperature is above limit.	Once, immediately prior to lifting cask and prior to cask transfer to or from ISFSI.

### 3.2 CASK RADIATION PROTECTION

#### 3.2.1 Cask Surface Contamination

- LCO 3.2.1 Removable contamination on the cask exterior surfaces shall not exceed:
- a. 1000 dpm / 100 cm<sup>2</sup> (0.2 Bq / cm<sup>2</sup>) from beta and gamma sources, and
  - b. 20 dpm / 100 cm<sup>2</sup> (0.003 Bq / cm<sup>2</sup>) from alpha sources.

APPLICABILITY: During LOADING OPERATIONS

#### ACTIONS

-----NOTE-----  
Separate Condition entry is allowed for each cask.  
-----

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Removable contamination on the cask exterior surface exceeds either limit.	A.1 Decontaminate cask surfaces to below required levels.	Prior to TRANSPORT OPERATIONS

#### SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.2.1.1 Verify that the removable contamination on the exterior surface of the cask does not exceed the specified limits.	Once, prior to TRANSPORT OPERATIONS.

### 3.3 CASK CRITICALITY CONTROL

#### 3.3.1 Dissolved Boron Concentration

LCO 3.3.1 The dissolved boron concentration of the water in the spent fuel pool and the water added to the cavity of a loaded cask shall be at least 2300 ppm.

APPLICABILITY: During LOADING and UNLOADING OPERATIONS

#### ACTIONS

----- NOTE -----  
Separate Condition entry is allowed for each cask.  
-----

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Dissolved boron concentration limit not met.	A.1 Suspend loading of fuel assemblies into cask.	Immediately
	<u>AND</u> A.2 Remove all fuel assemblies from cask.	24 hours

**SURVEILLANCE REQUIREMENTS**

SURVEILLANCE	FREQUENCY
<p><b>SR 3.3.1.1</b>    Verify dissolved boron concentration limit in spent fuel pool water and water to be added to the cask cavity is met using two independent measurements.</p>	<p>Within 4 hours prior to commencing <b>LOADING OPERATIONS</b></p> <p><u>AND</u></p> <p>48 hours thereafter while the cask is in the spent fuel pool or while water is in cask.</p>
<p><b>SR 3.3.1.2</b>    Verify dissolved boron concentration limit in spent fuel pool water and water to be added to the cask cavity is met using two independent measurements.</p>	<p>Once, within 4 hours prior to flooding cask during <b>UNLOADING OPERATIONS</b></p> <p><u>AND</u></p> <p>48 hours thereafter while the cask is in the spent fuel pool or while water is in cask.</p>



## 4.0 DESIGN FEATURES

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The specifications in this section include the design characteristics of special importance to each of the physical barriers and to maintenance of safety margins in the cask design. The principal objective of this category is to describe the design envelope which might constrain any physical changes to essential equipment. Included in this category are the site environmental parameters which provide the bases for design, but are not inherently suited for description as LCOs.

### 4.1 Storage Cask

#### 4.1.1 Criticality

The design of the storage cask, including spatial constraints on adjacent assemblies (minimum basket cell opening of 8.64 in. sq.) and the boron content of the basket material (minimum areal density equal to 10 mg B<sup>10</sup>/cm<sup>2</sup>) shall ensure that fuel assemblies are maintained in a subcritical condition with a  $k_{eff}$  of less than 0.95 under all conditions of operation.

#### 4.1.2 Structural Performance

The cask has been evaluated for a cask tipover (equivalent to a side drop of 67 g's) and a bottom end drop resulting in an axial gravitational (g) loading of 50 g's.

#### 4.1.3 Codes and Standards

The TN-32 cask confinement boundary is designed and fabricated in accordance with Subsection NB of the ASME Code. Exceptions to the code are listed in Table 4.1-1. The cask gamma shielding has been evaluated in accordance with Subsection NB of the ASME code with the exceptions listed in Table 4.1-1. The basket is designed in accordance with Subsection NF of the ASME Code. The basket is inspected as shown in Table 4.1-1.

Proposed alternatives to ASME Code Section III, 1992 Edition including exceptions allowed by Table 4.1-1 may be used when authorized by the Director of the Office of Nuclear Material Safety and Safeguards or Designee. The applicant should demonstrate that:

1. The Proposed alternatives would provide an acceptable level of quality and safety, or
2. Compliance with the specified requirements of ASME Code, Section III, 1992 Edition would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Requests for exceptions in accordance with this section should be submitted in accordance with 10 CFR 72.4.

#### 4.1.4 Helium Purity

The cask shall be filled with helium with a purity of at least 99.99%. This level of purity will ensure that the residual impurities in the cask cavity will be less than 1 mole.

## 4.2 Storage Pad

### 4.2.1 Storage Locations for Casks

Casks shall be spaced a minimum of 16 feet apart, center-to-center. This minimum spacing will ensure the proper dissipation of radiant heat energy from an array of casks as assumed in the TN-32 Safety Analysis Report.

### 4.2.2 Pad Properties to Limit Cask Gravitational Loadings Due to Postulated Drops

The TN-32 cask has been evaluated for cask drops onto a reinforced concrete pad. The evaluations are based on the following parameters:

Concrete thickness	36 inches (max)
Nominal concrete compressive strength	6000 psi (max)
Reinforcement Yield Strength	60,000 psi (min)
Soil Effective Modulus of Elasticity	32,600 psi (max)
Maximum drop height	18 inches

This set of limits will ensure that the g loading imposed on the cask is no more than 50 g's (cask bottom end drop).

## 4.3 Site Specific Parameters and Analyses

Site specific parameters and analyses that shall need verification by the system user are, as a minimum, as follows:

1. Tornado maximum wind speeds: 290 mph rotational  
70 mph translational
2. Flood levels up to 57 ft. and drag forces up to 57,160 lbs.
3. Seismic loads of up to 0.26g horizontal and 0.17g vertical.
4. Average daily ambient temperatures:  $\geq -20^{\circ}\text{F}$  minimum  
 $\leq 100^{\circ}\text{F}$  maximum
5. The potential for fires and explosions shall be addressed, based on site-specific considerations. Fires and explosions should be bounded by the cask design bases parameters of 200 gallons of fuel (in the tank of the transporter vehicle) and an external pressure of 25 psig.
6. Supplemental Shielding: In cases where engineered features (i.e. berms, shield walls) are used to ensure that the requirements of 10 CFR 72.104(a) are met, such features are to be considered important to safety and must be evaluated to determine the applicable Quality Assurance Category.

**Table 4.1-1**  
**TN-32 ASME Code Exceptions**

List of ASME Code Exceptions for TN-32 Dry Storage Cask Confinement Boundary/Gamma Shielding/Basket

*The cask confinement boundary is designed in accordance with the ASME Code Subsection NB. The basket was also designed in accordance with ASME Code Subsection NF. The Gamma shielding, which is primarily for shielding, but also provides structural support to the confinement boundary during drop accidents, was not designed in accordance with the code. The analysis of the gamma shielding is in accordance with Subsection NB. Inspections of the gamma shielding are performed in accordance with the ASME Code as detailed in the SAR.*

<b>Component</b>	<b>Reference ASME Code/Section</b>	<b>Code Requirement</b>	<b>Exception, Justification &amp; Compensatory Measures</b>
TN-32 Cask	NB-1100	Stamping and preparation of reports by the Certificate Holder	The TN-32 cask is not N stamped, nor is there a code design specification generated. A design criteria document was generated in accordance with TN's QA Program, and the design and analysis is provided in the SAR.
TN-32 Cask	NCA-3800	Quality Assurance Requirements	The Quality assurance requirements of NQA-1 or 10 CFR 72 Subpart G are imposed in lieu of NCA-3800 requirements.
Lid Bolts	NB-3232.3	Fatigue analysis of bolts	A fatigue analysis of the bolts is not performed for storage, since the bolts are not subject to significant cyclical loads.
Gamma Shielding	NB-1132.2	Non-pressure retaining structural attachments shall conform to Subsection NF	The primary function of the gamma shield is shielding, although credit is taken for the gamma shielding in the structural analysis. The welds are examined in accordance with NF acceptance criteria. A fracture toughness evaluation is presented in Appendix 3E of the SAR.
Pressure test of the confinement boundary	NB-6110	All pressure retaining components shall be pressure tested.	The TN-32 cask is not pressure limited. All confinement welds are fully radiographed. In addition, the gamma shielding supports the confinement boundary under all conditions, so a pressure test of the confinement vessel separately will not simulate actual loading conditions. If the pressure test is performed with the confinement vessel inside the gamma shield, the confinement boundary welds cannot be examined.

**Table 4.1-1 TN-32 ASME Code Exceptions**

<b>Component</b>	<b>Reference ASME Code/Section</b>	<b>Code Requirement</b>	<b>Exception, Justification &amp; Compensatory Measures</b>
Confinement Vessel Material	NB-2120	Requirement materials to be ASME Class 1 material	<p>Standard Review Plan, NUREG-1536 has accepted the use of either Subsection NB (Class 1) or NC (Class 2 or 3) of the Code for the confinement. SA-203 Gr. D is similar to SA-203 Gr. E which is a Class 1 material. The chemical content of the two grades are identical, except that Gr. E restricts the carbon to 0.20 max., while Gr. D further restricts the carbon content to 0.17 max. Gr. D is acceptable as a Class 2 material up to 500° F.</p> <p>Gr. D was selected because of its ductility, since the higher strength is not required. SA-203 Gr. D has better elongation than Grade E and due to its lower strength is more likely to have the good fracture toughness at low temperatures.</p> <p>In selecting materials for storage and transport casks, one of the major selection criteria is fracture toughness at low temperatures. Grade D was selected on this basis. There is no similar requirement for pressure vessels, as they are used at much higher temperatures.</p> <p>For the SA-203 Grade D material, the allowable stress was based on S, the allowable stress for Class 2 components. This is conservative, since NB is based on S<sub>m</sub>, which is 1/3 the tensile strength, while S is 1/4 the tensile strength. Thus there is additional margin over and above the margin required by the code for Class I materials.</p>
Weld of Lid Shield Plate to Lid	NB-4335	Impact testing of weld and heat affected zone of lid to shield plate	<p>If two different materials are joined, the fracture toughness requirements of either may be used for the weld metal. There are no fracture toughness requirements on the shield plate, and therefore none are performed on the base metal or the heat affected zones. This weld is not subject to low temperatures, as it is inside the cask cavity. An evaluation of this weld at low temperatures is presented in Appendix 3E of the SAR.</p>

**Table 4.1-1 TN-32 ASME Code Exceptions**

<b>Component</b>	<b>Reference ASME Code/Section</b>	<b>Code Requirement</b>	<b>Exception, Justification &amp; Compensatory Measures</b>
Gamma Shielding	NB-2190	Material in the component support load path and not performing a pressure retaining function welded to pressure retaining material shall meet the requirements of NF-2000	The gamma shielding materials were procured to ASTM or ASME material specifications. Materials testing is performed in accordance with the applicable specification. Impact testing is not performed on the gamma shielding materials (including welding materials). An evaluation of the gamma shielding due to impact at low temperatures is provided in Appendix 3E of the SAR.
Confinement Vessel	NB-7000	Vessels are required to have overpressure protection	No overpressure protection is provided. Function of confinement vessel is to contain radioactive contents under normal, off normal, and accident conditions of storage. Confinement vessel is designed to withstand maximum internal pressure considering 100% fuel rod failure and maximum accident temperatures.
Confinement Vessel	NB-8000	States requirements for nameplates, stamping and reports per NCA-8000	TN-32 cask to be marked and identified in accordance with 10CFR72 requirements. Code stamping is not required. QA data package to be in accordance with Transnuclear approved QA program.
Confinement Vessel material	NB-2000	Requires materials to be supplied by ASME approved material supplier; Quality assurance to meet NCA requirements	Material will be supplied by Transnuclear approved suppliers with Certified Material Test reports (CMTR) in accordance with NB-2000 requirements. The cask is not code stamped. The quality assurance requirements of NQA-1 or 10 CFR 72 Subpart G are imposed in lieu of the requirements of NCA-3800.

**Table 4.1-1 TN-32 ASME Code Exceptions**

<b>Component</b>	<b>Reference ASME Code/Section</b>	<b>Code Requirement</b>	<b>Exception, Justification &amp; Compensatory Measures</b>
Corner weld between bottom inner plate to inner shell	NB-5231	Full penetration corner welded joints require the fusion zone and the parent metal beneath the attachment surface to be UT after welding	In lieu of the UT inspection, the joint will be examined by RT and either PT or MT methods in accordance with ASME Subsection NB requirements.
Boundary of Jurisdiction	NB-1131	The design specification shall define the boundary of a component to which another component is attached.	A code design specification was not prepared for the TN-32 cask. A TN design criteria was prepared in accordance with TN's QA program. The containment boundary is specified in Chapter 1 of the SAR.
Aluminum basket plate and rail, neutron absorber plates	NF-2120	Materials to be ASME Class 1 material	The aluminum plate strength is not used for structural analysis under normal operating loads nor the 50g accident end drop load. The aluminum plate strength is only assumed to be effective for the short duration dynamic loading from a tipover accident and for secondary thermal stress calculations. 6061-T6 is ASME code material (Class 2 or 3). The strength of the neutron absorber plates are not considered in any analysis.

**Table 4.1-1 TN-32 ASME Code Exceptions**

<b>Component</b>	<b>Reference ASME Code/Section</b>	<b>Code Requirement</b>	<b>Exception, Justification &amp; Compensatory Measures</b>
Basket	NF-4000/NF-5000	Welding/NDE Inspections	Basket welding procedures are qualified in accordance with ASME Section IX. Due to the unique nature of these welds, special inspections and tests were developed for these welds. These are described in Section 9.1.2 of the SAR
Components other than the containment boundary and basket	Subsection NB		The code does not apply to components other than the containment boundary and basket. The gamma shielding has been analyzed and inspected in accordance with Subsection NB as defined at the beginning of this table
Basket	NF-3000	Allowable Stresses	The ASME Code gives stress values up to 400°F. Stress values above 400°F are taken from "Aluminum Standards and Data", 1990. The allowable stresses used for the aluminum basket plate and rail are based on S, the allowable stress for a Class 2 or 3 component. This is conservative, since the analyses of the basket and rail are performed in accordance with the rules of Subsection NF. Subsection NF allowables are based on $S_m$ which is 1/3 the ultimate strength, while S is 1/4 the ultimate strength. Thus there is additional margin built into the analysis of the basket and rail over and above the margin required by Subsection NF for class 1 materials

## 5.0 ADMINISTRATIVE CONTROLS

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### 5.1 Training Module

Training modules shall be developed under the general licensee's training program as required by 10 CFR 72.212(b)(6). Training modules shall require a comprehensive program for the operation and maintenance of the TN-32 spent fuel storage cask and the independent spent fuel storage installation (ISFSI). The training modules shall include the following elements, at a minimum:

- TN-32 cask design (overview)
- ISFSI Facility design (overview)
- Systems, Structures, and Components Important to Safety (overview)
- TN-32 Dry Storage Cask Safety Analysis Report (overview)
- NRC Safety Evaluation Report (overview)
- Certificate of Compliance conditions
- TN-32 Technical Specifications
- Applicable Regulatory Requirements (e.g., 10 CFR72, Subpart K, 10 CFR 20, 10 CFR Part 73)
- Required Instrumentation and Use
- Operating Experience Reviews
- TN-32 Cask Operating and Maintenance procedures, including:
  - Fuel qualification and loading
  - Rigging and handling
  - Loading Operations as described in Chapter 8 of the SAR
  - Unloading Operations including reflooding as described in Chapter 8 of the SAR
  - Auxiliary equipment operations and maintenance (i.e. vacuum drying, helium backfilling and leak testing, reflooding)
  - Transfer operations including loading and unloading of the Transport Vehicle
  - ISFSI Surveillance operations
  - Radiation Protection
  - Maintenance
  - Security
  - Off-normal and accident conditions, responses and corrective actions.

### 5.2 Programs

The following programs shall be established, implemented, and maintained:



### 5.2.1 Cask Sliding Evaluation

The TN-32 cask has been evaluated for sliding in the unlikely events of a seismic event. A static coefficient of friction of 0.35 is used in these analyses. This program provides a means for evaluating the coefficient of friction to ensure that the cask will not slide during the seismic event.

- a. Pursuant to 10 CFR 72.212, this program shall evaluate the site-specific ISFSI pad configurations/conditions to ensure that the cask would not slide during the postulated design basis earthquake. The program shall conclude that the surface static friction coefficient of friction is greater than or equal to 0.35.
- b. Alternatively, for site-specific ISFSI pad configurations/conditions with a lower coefficient of friction than 0.35, the program shall evaluate the site specific conditions to ensure that the TN-32 cask will not slide during the postulated design basis earthquake. The program shall also evaluate storm winds, missile impacts and flood forces to ensure that the cask will not slide such that it could result in impact with other casks or structures at the ISFSI. The program shall ensure that these alternative analyses are documented and controlled.

### 5.2.2 Cask Transport Evaluation Program

This program provides a means for evaluating various transport configurations and transport route conditions to ensure that the design basis drop limits are met.

- a. Pursuant to 10 CFR 72.212, this program shall evaluate the site-specific transport conditions. To demonstrate compliance with Technical Specification 4.2.2, the program shall conclude that the expected lift height above the transport surface shall be less than or equal to that described by Technical Specification 4.2.2. Also, the program shall conclude that the transport route conditions (e.g., surface hardness and pad thickness) are equivalent to or less limiting than those prescribed for the typical pad surface which forms the basis for Technical Specification 4.2.2.
- b. Alternatively, for site-specific transport conditions which are not encompassed by those of Technical Specification 4.2.2, the program shall evaluate the site-specific conditions to ensure that the end-drop loading does not exceed 50 g. This alternative analysis shall be commensurate with the analysis which forms the basis of Technical Specification 4.2.2 (Reference TN-32 SAR Appendix 3A). The program shall ensure that these alternative analyses are documented and controlled.
- c. This program shall establish administrative controls and procedures to ensure that cask TRANSPORT OPERATIONS are conducted within the limits imposed by the Technical Specifications or the alternative analysis described above.

### 5.2.3 Cask Surface Dose Rate Evaluation Program

This program provides a means for ensuring that ISFSI's using TN-32 casks do not violate the requirements of 10 CFR 72 and Part 20 regarding radiation doses and dose rates.

1. As part of its evaluation pursuant to 10 CFR 72.212, the licensee shall perform an analysis to confirm that the limits of 10 CFR Part 20 and 10 CFR Part 72.104 will be satisfied under the actual site conditions and configurations considering the planned number of casks to be used and the planned fuel loading conditions.

**5.2.3 Continued**

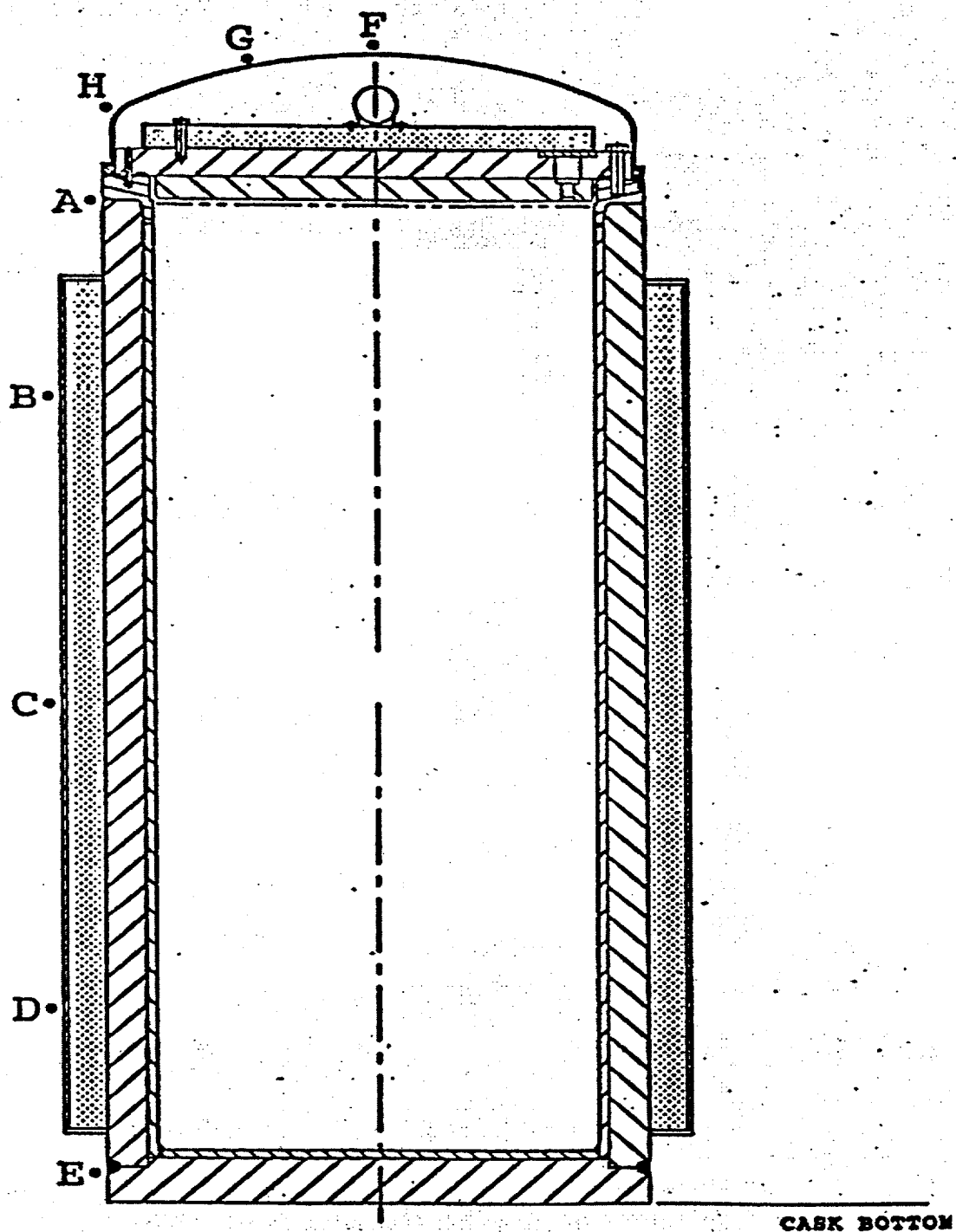
2. On the basis of the analysis in TS 5.2.3.1, the licensee shall establish a set of cask surface dose rate limits which are to be applied to TN-32 casks used at the site. Limits shall establish average gamma-ray and neutron dose rates for:
  - A. The top of the TN-32 cask (protective cover)
  - B. The sides of the radial neutron shield,
  - C. The side of the cask above the radial neutron shield, and
  - D. The side of the cask below the radial neutron shield.
3. Notwithstanding the limits established in TS 5.2.3.2, the dose rate limits may not exceed the values calculated in the SAR for a content of design basis fuel as follows:
  - A. 60 mr/hr gamma and 10 mr/hr neutron on the top (protective cover)
  - B. 170 mr/hr gamma and 20 mr/hr neutron on the sides of the radial neutron shield
  - C. 280 mr/hr gamma and 140 mr/hr neutron on the side surfaces of the cask above the radial neutron shield region.
  - D. 110 mr/hr gamma and 200 mr/hr neutron on the side surfaces of the cask below the radial neutron shield region.
4. Prior to transport of a TN-32 containing spent fuel to the ISFSI, the licensee shall measure the cask surface dose rates and calculate average values as described in 5.2.3.7 and 5.2.3.8.

The measured average dose rates shall be compared to the limits established in TS 5.2.3.2 or the limits in TS 5.2.3.3, whichever are lower.
5. If the measured average surface dose rates do not meet the limits of TS 5.2.3.2 or TS 5.2.3.3, whichever are lower, the licensee shall take the following actions:
  - A. Notify the U.S. Nuclear Regulatory Commission (Director of the Office of Nuclear Material Safety and Safeguards) within 30 days.
  - B. Administratively verify that the correct fuel was loaded, and
  - C. Perform an analysis to determine that placement of the as-loaded cask at the ISFSI will not cause the ISFSI to exceed the radiation exposure limits of 10 CFR Parts 20 and 72.
6. If the analysis in 5.2.3.5.C shows that placement of the as-loaded cask at the ISFSI will cause the ISFSI to exceed the radiation exposure limits of 10 CFR Parts 20 and 72, the licensee shall remove all fuel assemblies from the cask within 30 days of the time of cask loading.
7. The surface dose rates shall be measured at approximately the following points (see also Figure 5.2.3-1).
  - A. Above the Radial Neutron Shield (A): Midway between the top of the cask body flange and the top of the radial neutron shield. At least six measurements equally spaced circumferentially.

**5.2.3 Continued**

- B. Sides of Radial Neutron Shield (B, C and D): one sixth, one half and five sixths of the distance from the top of the radial neutron shield. At least six measurements equally spaced circumferentially at each elevation, two of which shall be at the circumferential location of the cask trunnions. However, no measurement shall be taken directly over the trunnion.
  - C. Below Radial Neutron Shield (E): Midway between the bottom of the radial neutron shield and the bottom of the cask. At least six measurements equally spaced circumferentially.
  - D. Top of Cask (F, G and H): At the center of the protective cover, one measurement (F). Half way between the center and the knuckle at least four measurements equally spaced circumferentially (G). At the knuckle at least four measurements equally spaced circumferentially (H).
8. The average dose rates shall be determined as follows.

In each of the four measurement zones in TS 5.2.3.7, the sum of the dose rate measurements is divided by the number of measurements to determine the average for that zone. The neutron and gamma-ray dose rates are averaged separately. Uniformly spaced dose rate measurement locations are chosen such that each point in a given zone represents approximately the same surface area.



\* NOTE: DOSE MEASUREMENTS ARE AT  
CONTACT

FIGURE 5.2.3-1  
CONTACT DOSE RATE  
MEASUREMENTS LOCATIONS

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