Certificate of Compliance
FOR DRY SPENT FUEL STORAGE CASKS

10 CFR 72

AUG 17 1990

1. a. **CERTIFICATE NUMBER:** 1000
   b. **REVISION NUMBER:** 0
   c. **PACKAGE IDENTIFICATION NUMBER:** USA/72-1000'
   d. **PAGE NUMBER:** 1
   e. **TOTAL NUMBER OF PAGES:** 3

2. **Preamble** This certificate is issued to certify that the cask and contents, described in item 5 below, meets the applicable safety standards set forth in Title 10, Code of Federal Regulations, Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste."

3. ***THIS CERTIFICATE*** is issued on the basis of a safety analysis report of the cask design.

a. PREPARED BY (Name and Address)	b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION
General Nuclear Systems, Inc. **220 Stoneridge Drive** **Columbia, SC 29210**	**Topical Safety Analysis Report for the CASTOR V/21 Cask Independent Spent Fuel Storage Installation (Dry Storage) (TSAR)** c. DOCKET NUMBER 72-1000

4. **CONDITIONS** This certificate is conditional upon fulfilling the requirements of 10 CFR 72, as applicable, and the conditions specified below.

5. **Cask**
   a. **Model No:** CASTOR V/21
   b. **Description**
   The CASTOR V/21 cask is designed for the storage and shipment of irradiated spent fuel assemblies. The cask was designed to meet International Atomic Energy Agency's international specifications for Type B(U) packaging corresponding to Nuclear Safety Fissile Class I. However, this certificate addresses spent fuel handling, transfer, and storage on an NRC-licensed nuclear reactor

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site but does not address any use or certification of this cask design for offsite transport of spent fuel.

The CASTOR V/21 cask body consists of a thick-walled nodular iron casting. The overall length is 4,886 mm (192.4 in), and the side wall thickness (without fins) is 379 mm (14.9 in). The cross-sectional diameter of the cask body, which weighs approximately 92.3 tonne (101.8 ton), is 2,400 mm (94.5 in). The cask cavity has a diameter of 1,527 mm (60.1 in) and a length of 4,154 mm (163.5 in). It holds a fuel basket and is designed to accommodate 21 PWR fuel assemblies. The loaded weight of the cask is about 106 tonne (117 ton). Four trunnions are bolted on, two at the head end and two at the bottom end of the body.

Gamma and neutron radiation is shielded by the cast iron wall of the cask body. Also for neutron shielding, two concentric rows of axial holes in the wall of the cask body are filled with polyethylene rods. The bottom and the secondary cover each have a slab of the same material inserted for the same purpose.

The cask is sealed, to maintain a helium atmosphere, with a multiple-cover system consisting of a primary lid and a secondary lid. The primary lid is constructed of stainless steel. The overall thickness is 290 mm (11.4 in). It is fastened to the body with 44 bolts. The primary lid has two penetrations, used for flushing and venting of the cask cavity as well as the performance of the leak test. The flushing and venting connections are sealed with separate lids. The secondary lid is also made of stainless steel. The overall thickness is 90 mm (3.5 in). It is bolted to the body. A combination of multiple elastomer and metal seals for each lid provide leak tightness. However, no credit is claimed in the TSAR (see Section 3.3.2.2) or given by NRC for elastomer seals for the 20-year storage period.

The fuel basket accepts the spent fuel assemblies and ensures that criticality will not occur. In addition, it ensures exact positioning of the individual fuel assemblies. It is of welded construction and is made either of stainless steel or stainless steel and borated stainless steel sections. At the top end of the cask there is a flushing connection for rinsing, cleaning, and drying of the interior during loading and unloading procedures at the nuclear power plant. The flushing channel runs inside the wall of the body; it has one end at the top and the other end at the bottom of the inside of the cask. Gas intake and exhaust are via the valve in the primary lid. The lid system is fitted with a leak-testing device, a pressure gauge, which is also a cask component classified as important to safety in Section 3.4 of the TSAR. The gauge monitors the gas pressure in the interlid space between the primary and secondary lids. This space is used for a gas barrier with an above atmospheric pressure maintained in it.

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The inside of the cask, including the sealing surface, has a nickel coating for corrosion protection. On the outside, the cask is protected by an epoxy resin coating in the fin area and nickel coating elsewhere. The internal heat-transfer medium is an inert gas (helium), which also serves to inhibit corrosion.

Impact limiters are attached at the top and bottom of the loaded CASTOR V/21 cask when it is transferred at a height greater than 15 inches from the reactor to emplacement on the concrete storage pad at the independent spent fuel storage installation. One impact limiter design is used for both the top and bottom cask limiters. It consists of a ring of a dozen 9-inch lengths of 6-inch diameter Schedule 80 stainless steel pipe contained between half-inch thick stainless steel plates. A cask drop would crush the impacted pipe lengths between the steel plates reducing the impact load on the cask.

c. Drawing

The Model No. CASTOR V/21 dry spent fuel storage cask is described by drawings in Appendix 1 of the TSAR.

d. Basic Components

The Basic Components of the Model No. CASTOR V/21 storage cask that are important to safety are listed in Table 3.4-1 of the TSAR.

6. Cask fabrication activities shall be conducted in accordance with the reviewed and approved quality assurance program submitted with the TSAR.

7. Notification of cask fabrication schedules shall be made in accordance with the requirements of §72.232(c), 10 CFR Part 72.

8. Casks of the Model No. CASTOR V/21 authorized by this certificate are 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 §72.210, 10 CFR Part 72, subject to the conditions specified by §72.212 and the attached Conditions for Cask Use.

9. Expiration Date:

August 31, 2010

FOR THE NUCLEAR REGULATORY COMMISSION

Charles J. Haughney
SIGNATURE

Chief, Fuel Cycle Safety Branch
Division of Industrial and
Medical Nuclear Safety
Office of Nuclear Material Safety
and Safeguards

CONDITIONS FOR CASK USE

CERTIFICATE OF COMPLIANCE

72-1000

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1.0 INTRODUCTION

These Conditions for Cask Use govern the safety of the receipt, possession, and storage of irradiated nuclear fuel at an Independent Spent Fuel Storage Installation (ISFSI) and the transfer of such irradiated nuclear fuel to and from a Nuclear Power Station and its ISFSI.

1.1 GENERAL CONDITIONS

1.1.1 Operating Procedures

Written operating procedures shall be prepared for cask handling, movement, emplacement, surveillance, and maintenance.

1.1.2 Quality Assurance

Activities at the ISFSI shall be conducted in accordance with the requirements of Appendix B, 10 CFR Part 50.

1.2 PREOPERATIONAL CONDITIONS

The user shall not allow the initial loading of spent nuclear fuel in the Model No. CASTOR V/21 cask until such time as the following preoperational license conditions are satisfied:

(1) A training module shall be developed for the Station Training Program establishing an ISFSI Training and Certification Program which will cover the following:

a. Cask Design (overview)

b. ISFSI Facility Design (overview)

c. ISFSI Safety Analysis (overview)

d. Fuel loading and cask handling procedures and abnormal procedures

e. Certificate of Compliance (overview).

(2) A training exercise (Dry Run) of cask loading and handling activities shall be held which shall include but not be limited to:

a. Moving cask in and out of spent fuel pool area.

b. Loading a fuel assembly (using dummy assembly).

c. Cask sealing and cover gas backfilling operations.

d. Moving cask to and placing it on the storage pad.

e. Returning the cask to the reactor.

f. Unloading the cask assuming fuel cladding failure.

g. Cask decontamination.

2.0 FUNCTIONAL AND OPERATING LIMITS

2.1 FUEL TO BE STORED AT ISFSI

2.1.1 Specification

The spent nuclear fuel to be received and stored at the ISFSI in CASTOR V/21 casks shall meet the following requirements:

(1) Only irradiated 14 x 14, 15 x 15 and 17 x 17 PWR fuel assemblies with Zircaloy fuel rod cladding may be used. Total assemblies per cask $\leqq$ 21.

(2) Maximum initial enrichment shall not exceed 2.2 weight percent U-235 for fuel stored in the stainless steel basket reviewed and found acceptable. Maximum initial enrichment shall not exceed 3.5 weight percent U-235, for fuel stored in the borated stainless steel basket reviewed and found acceptable.

(3) Maximum assembly average burnup shall not exceed 35,000 megawatt-days per metric ton uranium and specific power shall not exceed 35 kW/kg.

(4) Maximum heat generation rate shall not exceed 1 kilowatt per fuel assembly.

(5) Fuel shall be intact unconsolidated fuel. Partial fuel assemblies, that is, fuel assemblies from which fuel pins are missing must not be stored unless dummy fuel pins are used to displace an amount of water equal to that displaced by the original pins.

(6) Fuel assemblies known or suspected to have structural defects sufficiently severe to adversely affect fuel handling and transfer capability unless canned shall not be loaded into the cask for storage.

(7) A procedure shall be developed for the documentation of the characterizations performed to select spent fuel to be stored in the casks. Such procedure shall include independent verification of fuel assembly selection by an individual other than the original individual making the selection.

(8) Immediately prior to insertion of a spent fuel assembly into a cask, the identity of the assembly shall be independently verified by two individuals.

2.1.2 Basis

The design criteria and subsequent safety analysis assumed certain characteristics and limitations for the fuels that are to be received and stored. Specification 2.1.1 assures that these bases remain valid by defining the type of spent fuel, maximum initial enrichment, irradiation history, and maximum thermal heat generation.

2.2 GNSI CASTOR V/21 DRY STORAGE CASK

2.2.1 Specification

The GNSI CASTOR V/21 Dry Storage Casks used to store spent nuclear fuel at an ISFSI shall have the operating limits shown in Table 2-1.

2.2.2 Basis

The design criteria and subsequent safety analysis of the GNSI CASTOR V/21 assumed certain characteristics and operating limits for the use of the casks. This specification assures that those design criteria are not exceeded.

Table 2-1 GNSI CASTOR V/21 OPERATING LIMITS

	Operating Limit
Max. Lifting Height with a Non-Redundant Lifting Device	
. with impact limiters	5 feet
. without impact limiters	15 inches
Dose Rate	
. 2 m Distance	$\leqq$ 10 mrem/hr
. Surface	$\leqq$ 200 mrem/hr
Cask Tightness	
(Standard He-Leak Rate)	
. Primary Lid Seal	$\leqq 10^{-6}$ mbar l/s
. Secondary lid Seal	$\leqq 10^{-6}$ mbar l/s
Max. Specific Power of One Fuel Assembly	1.0 kW
Helium Pressure limit (Cask Cavity)	800 ± 100 mbar

2.3 LIMITING CONDITION - HANDLING HEIGHT

2.3.1. Specification

This specification applies to handling of a cask being used for spent fuel storage outside of the Fuel Building and Crane Enclosure Building.

(1) The CASTOR V/21 dry storage cask shall not be handled at a height of greater than 15 inches without an impact limiter.

(2) With the impact limiter the CASTOR V/21 dry storage cask shall not be handled at a height greater than 5 feet.

2.3.2 Basis

The drop analyses performed for the CASTOR V/21 dry storage cask requires that an impact limiter be used for postulated cask drop incidents on the ISFSI storage pad for drops greater than 15 inches up to 60 inches without sustaining unacceptable damage to the storage cask and fuel basket. This limiting condition ensures that the handling height limits will not be exceeded at the storage pad or in transit to and from the reactor.

2.4 DRY STORAGE CASK SURFACE CONTAMINATION

2 4.1 Specification

Initial removable contamination on the dry storage cask shall not exceed 2200 dis/min/100 cm^2 from beta-gamma sources, and 220 dis/min/100 cm^2 from alpha sources.

2.4.2 Basis

Compliance with this limit ensures that the decontamination requirements of 49 CFR 173.443 will be met.

2.5 DRY STORAGE CASK INTERNAL COVER GAS

2.5.1 Specification

The dry storage casks shall be backfilled with helium.

2.5.2 Basis

The thermal analysis performed for the dry storage casks assumes the use of helium as a cover gas. In addition, the use of an inert gas (helium) is to ensure long-term maintenance of fuel clad integrity.

2.6 LIMITING CONDITION - PRESSURE SWITCH

2.6.1 Specification

The pressure switch used to monitor the leak tightness of the CASTOR V/21 dry storage cask shall have the performance characteristics shown in Table 3.3-6 of the TSAR.

3.0 SURVEILLANCE REQUIREMENTS

Requirements for surveillance of various radiation levels, cask internal pressure, contamination levels, cask seal leak rates, and fuel related parameters are contained in this section. These requirements are summarized in Table 3-1 from details contained in Section 3.1 through 3.6. Specified time intervals may be adjusted plus or minus 25 percent to accommodate normal test schedules.

Table 3-1 SURVEILLANCE REQUIREMENTS SUMMARY

Section	Quantity or Item	Period
3.1.1	Cask Loading Measurements	P
3.2.1	Cask Seal Testing	L
3.3.1	Cask Contamination	L
3.4.1	Dose Rates (Cask surface or up to 2 meters from cask surface)	L
	Dose Rates (Fence)	Q
3.5.1	Safety Status Surveillance	Q
3.6.1	Pressure Switch Parameters	P & L
3.7.1	Alarm System	A

P - Prior to cask loading
L - During loading operations
Q - Quarterly
A - Annually

3.1 CASK LOADING MEASUREMENTS

3.1.1 Specification

For the first loading of a cask model, cask side-wall surface dose rate shall be measured upon cask draining. Prior to moving the cask to the storage pad, cask surface temperature shall be measured after the cask has been sealed for an appropriate period, which should not be less than that expected for the cask surface temperature to come into approximate equilibrium. These dose rate and temperature measurements shall be made at the cask side-wall mid-line at three locations 120° apart around the cask circumference and shall be recorded to establish a baseline of comparison for all subsequent loadings of this model of cask.

For all subsequent loadings of casks of this model, measure and record cask side-wall surface dose rates and temperatures at the cask side-wall mid-line at three locations 120° apart and compare these to the baseline established during first cask use. Do not transfer the cask to the storage pad if unexplained variations (which can not be resolved through known differences in spent fuel assemblies loaded) are found.

3.1.2 Basis

These measurements are to assure that casks have been properly loaded.

3.2 CASK SEAL TESTING

3.2.1 Specification

Prior to storage, the cask must be properly sealed by testing as specified in Section 10.2.2.1 of the TSAR.

3.2.2 Basis

The safety analysis of leak tightness of the cask as discussed in the topical report is based on the seals being leak tight to 10^{-6} mbar l/s. This check is done to ensure compliance with this design criteria.

3.3 CASK CONTAMINATION

3.3.1 Specification

After cask loading and prior to moving the cask to the storage pad, the cask shall be swiped to ensure that removable surface contamination levels are less than 2200 dis/min/100 cm^2 from beta-gamma emitting sources, and 220 dis/min/100 cm^2 from alpha emitting sources.

3.3.2 Basis

This surveillance requirement will ensure compliance with the decontamination requirements of 49 CFR 173.443 prior to storage in the ISFSI.

3.4 DOSE RATES

3.4.1 Specification

The following dose rate measurements shall be made for the ISFSI:

1. Cask Surface Gamma and Neutron Dose Rates: After completion of cask loading, gamma and neutron measurements shall be taken on the outside surface (or within 2 meters of the cask surface). The combined gamma and neutron dose rates shall be less than the surface dose rate stated in Table 2-1 (or the specified rate at a distance of up to 2 meters from the cask surface).

2. Dry Cask ISFSI Boundary: Doses shall be determined by measurement at the Dry Cask ISFSI site fence and shall be evaluated on a quarterly basis to demonstrate compliance with §20.105(b)(2), 10 CFR Part 20.

3.4.2 Basis

These measurements are necessary to assure compliance with the cask specifications and that the dose rates at the security fence meet Part 20 limits as additional casks are placed in storage.

3.5 SAFETY STATUS SURVEILLANCE

3.5.1 Specification

A visual surveillance shall be performed on a quarterly basis of the ISFSI to determine that no significant damage or deterioration of the exterior of the emplaced casks has occurred. Surveillance shall also include observation to determine that no significant accumulation of debris on cask surfaces has occurred.

3.5.2 Basis

This surveillance requirement shall ensure cask maintenance.

3.6 CASK INTERLID PRESSURE (CASTOR V/21)

3.6.1 Specification

The cask interlid pressure shall be monitored by use of a pressure switch having the characteristics described in Table 3.3-6 of the TSAR. The switching pressure shall be factory set at 4 tar for the interlid space, and a functional test shall be performed during cask preparation.

3.6.2 Basis

This specification requires the interlid space to be maintained to detect any possible leakage of either cask seal.

3.7 ALARM SYSTEM

3.7.1 Specification

An alarm system to which all of the pressure switches are connected shall be installed at the storage site and functionally tested annually to ensure proper operation of the system.

3.7.2 Basis

The alarm system must be capable of alerting surveillance personnel of possible cask seal failure and must permit identification of the specific cask indicating a seal failure.