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NUCLEAR ENERGY BUSINESS OPERATIONS
GENERAL ELECTRIC COMPANY • VALLECITOS NUCLEAR CENTER • PLEASANTON, CALIFORNIA 94566

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May 30, 1985

Mr. C. E. MacDonald, Chief
Transportation Certification Branch
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

References: 1) Certificate of Compliance No. 5971, Docket 71-5971.
2) Docket 71-5980.

Dear Mr. MacDonald:

General Electric hereby requests that Certificate of Compliance No. 5971 for the General Electric Model 200 shipping container be renewed. Enclosed in support of this request is an updated version of our consolidated application for the previous renewal (February 20, 1980). This version has been reviewed to assure agreement between the text of the application and the certification drawings and to assure inclusion of applicable supplements to the application.

In addition, two of the certification drawings (129D4756 and 129D4758) have been revised to show an alternative silicone gasket for the cask. This gasket had been included in some previous certificates for the Model 200 and is essentially the same as the one authorized for the GE Model 600 (Docket 71-5980).

Maintenance procedures for most GE shielded shipping containers are generic and have been previously submitted and reviewed under Docket 71-5980. The only procedure unique to the Model 200 is included with this application. No quality assurance procedures for the manufacture or receipt of new containers are included as GE does not currently plan to obtain new containers. All procedures are for demonstration only and are subject to change.

GE also requests that Item 5.(a)(1) of the certificate be modified to read "Model No: 200".

A check for $150.00 is enclosed.

Sincerely,

G. E. Cunningham
G. E. Cunningham
Senior Licensing Engineer

/ca

Encl.

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GENERAL ELECTRIC SHIELDED CONTAINER - MODEL 200

1.0 PACKAGE DESCRIPTION - PACKAGING

(a) General

All dimensions referenced in the descriptive section are nominal dimensions. Actual dimensional tolerances are contained in the simplified certification drawings. All lifting and/or tiedown devices for additional containers of this model if different from the lifting and/or tiedown devices described in this application will satisfy the requirements of 10CFR71.45. This container is detailed in G.E. Drawings 129D4756 Rev. 1, 129D4757 Rev. 0, 129D4758 Rev. 1, and 129D4759 Rev. 0, attached.

Shape:

An upright circular cylinder shielded cask and an upright circular cylinder protective jacket with attached square base.

Size:

The shielded cask is 20.25 inches in diameter by 53.88 inches high. The protective jacket is 65.38 inches high by 37.62 inches across the box section. The base is 47.50 inches square.

Construction:

The cask is a lead-filled carbon and stainless steel weldment. The protective jacket is a double walled structure of 0.38 inch carbon steel plate and surrounds the cask during transport. The square base is 0.50 inch carbon steel with four I-beams attached.

Weight: The cask weighs 6300 pounds. The protective jacket and base weigh 2500 pounds. The cask liners weigh 525 and 650 pounds. The maximum packaging weight is approximately 10,000 pounds.

(b) Cask Body

Outer Shell: 0.38 inch thick steel plate, 53 inches high by 20.25 inches in diameter with a 0.38 inch bottom plate and a 1.13 inch top flange.

Cavity: 0.15 inch stainless steel wall and bottom plate, 7.62 inch inner diameter by 37 inches deep.

Shielding Thickness: 5.84 inches of lead on sides, 7.94 inches of lead beneath cavity.

Penetration: One, 0.50 inch outer diameter by 0.125 inch wall stainless steel tube gravity drain line from the side of the cavity bottom to the side of the cask outer shell near the cask bottom closed with a fusible lead cored 1 NPT hex head pipe plug which protrudes 0.50 inch outside of shell surface or equivalent plug. General Electric may, at its discretion, permanently close and seal the drain line for this container model with no interference to other structural properties of the cask.

Filters: None.

Lifting Devices: Two diametrically opposed ears welded to sides of cask, covered by protective jacket during transport.

Primary Coolant: Air.

(c) Cask Lid

Shape:	A cylinder of decreasing diameter attached to flat plates.
Size:	The top plate is 20.25 inches in diameter by 0.75 inch thick. The bottom plate is 10.44 inches in diameter by 0.13 inch thick. The cylinder is 14.88 inches in diameter at the top by 10.44 inches in diameter at the bottom by 7.50 inches high.
Construction:	Lead filled steel clad cylinders welded to circular steel plates.
Closure:	Six, 1-inch 8-UNC-2A steel bolts equally spaced 60° apart on a 17.30 inch diameter bolt circle.
Closure Seal:	Molded silicone rubber seal bonded to an aluminum back-up plate; or 0.25 thick flat silicone rubber gasket.
Penetrations:	None.
Shield Expansion Void:	None.
Lifting Device:	Single steel loop 1.25 inch diameter steel rod located in center of lid top. Covered by protective jacket during transport.

(d) Protective Jacket Body

Shape:	Basically a right circular cylinder with open bottom and with a protruding box section diametrically across top and vertically down sides.

Size:	65.33 inches high by 37.60 inches wide across the box section. The outer cylindrical diameter is 26.75 inches. The inner diameter is 23.25 inches. A 5.68 inch wide by 0.38 inch thick steel flange is welded to the outer wall of the open bottom.
Construction:	Carbon steel throughout. Double walled construction. The walls are 0.38 inch thick. One and one-half inch air gap between cask shell and inner jacket wall and a 1-inch air gap between inner and outer jacket walls throughout. Six, 12-inch high by 0.38 inch thick gussets are welded to the outer cylindrical wall and flange. Including the two box sections, the gussets are spaced 40° apart.
Attachment:	Four, 2-inch bolts connect the protective jacket body, through the flange to the pallet.
Lifting Devices:	Two rectangular, 1.13 inch thick steel loops located on top of the box section at the corners. The steel is 7 inches long by 3 inches high by 3-1/2 inches wide.
Tiedown Devices:	Two diametrically opposed 2-inch thick steel ears welded to sides of box section, each ear has a 1.50 inch hole to accept clevis or cable.
Penetrations:	Slots along periphery of the protective jacket at the bottom, slots in box section under lifting loops, allows natural air circulation for cooling.

(e) Protective Jacket Base

Shape: Hollow cylindrical weldment with square bottom plate. Four I-beams are welded to square bottom of plate.

Size: Bottom plate is 47.50 inches square and 0.50 inch thick. The cylindrical collar is 22 inches in outer diameter by 3 inches high. The bottom plate attached to four 4x1x47.50 bars. Three 4 inch I-beams are attached across the bars.

Construction: The cylindrical collar houses two sets of 1.25 inch by 1.25 inch by 0.25 inch steel energy absorbing angles separated by a 0.38 inch thick carbon steel mid-plate. The cask rests on this assembly. The collar is welded to the 0.50 inch thick carbon steel base plate. Four I-beams are welded in parallel to the base plate.

2.0 PACKAGE DESCRIPTION - CONTENTS

(a) General: Radioactive material as the metal or metal oxide (but specifically not loose powders); or other non-decomposable (at 650°F) solid materials.

(b) Form: Byproduct, source, and special nucler material in the form of fuel rods or plates, fuel assemblies, or meeting the requirements of special form radioactive material; or solid non-fissile irradited metal hardware, reactor control rods (blades), and reactor start-up sources.

(c) Fissile Content — Not to exceed 500 grams of U-235, 300 grams of U-233, 300 grams of Pu, or a prorated quantity of each such that the sum of the ratios does not exceed unity.

(d) Radioactivity — That quantity of any radioactive material which does not generate spontaneously more than 780 thermalwatts by radioactive decay and which meets the requirements of 49CFR173.467.

(e) Heat — Total maximum internally generated heat load not to exceed 780 thermal watts.

An analytical determination, described in Exhibit B to the Application for the GE Model 700 container, of the container temperature profile and heat load resulted in the following:

Cask Surface	-	175^{O}F
Inner Shield	-	119^{O}F
Outer Shield	-	93^{O}F
Ambient	-	80^{O}F
Heat Load	-	780 watts

General Electric will analyze by test or other assessment each container heat loading prior to shipments to verify that the requirements of 10CFR71.71 will be satisfied. Reference is made to the GE-Model 100 Application, Exhibit B, for a method of internal heat load analysis and heat dissipation.

3.0 PACKAGE EVALUATION

(a) General

There are no components of the packaging or its contents which are subject to chemical or galvanic reaction; no coolant is used during transport. The protective jacket is bolted closed during transport. A lock wire and seal of a type that must be broken if the package is opened is affixed to the cask closure. If that portion of the protective jacket which is used in the tiedown system or that portion which constitutes the principal lifting device failed in such a manner to allow the protective jacket to separate from the tiedown and/or lifting devices, the basic protective features of the protective jacket and the enclosed cask would be retained. The package (contents, cask and protective jacket) regarded as a simple beam support at its ends along its major axis, is capable of withstanding a static load, normal to and distributed along its entire length equal to five times its fully loaded weight, without generating stress in any material of the packaging in excess of its yield strength. The packaging is adequate to retain all contents

when subjected to an external pressure of 25 pounds per square inch gauge. Reference is made to the GE - Model 100 Application, Exhibit C, for a method of determining static loads.

The calculative methods employed in the design of the protective jacket are based on strain rate studies and calculations and on a literature search* of the effects on materials under impact conditions. The intent was to design a protective jacket that would not only satisfy the requirements of the U. S. Nuclear Regulatory Commission and the Department of Transportation prescribing the procedures and standards of packaging and shipping and the requirements governing such packaging and shipping but would protect the shielded cask from significant deformation in the event of an accident. In the event that the package was involved in an accident, a new protective jacket could be readily supplied and the shipment continued with minimal time delay.

The effectiveness of the strain rate calculations and engineering intuitiveness in the design and construction of protective jackets was demonstrated with General Electric Shielded Container - Model 100 (Ref.: Model 100 Application, Section 3.0). The protective jacket design for the General Electric Shielded Container, Model 200 will be scaled from the design of the Model 100 in accordance with the cask weight and dimensions, maintaining static load safety factors greater than or equal to unity, and in accordance with the intent to protect the shielded cask from any deformation in the event of an accident.

*TID-7651, SE-RR-65-98

(b) Normal Transport Conditions

Thermal:	Packaging components, i.e., steel shells and lead, uranium and/or tungsten shielding, are unaffected by temperature extremes oi -40°F and 130°F. Package contents, at least singly-encapsulated or contained in inner containers, but not limited to special form, will not be affected by these temperature extremes.
Pressure:	The package will withstand an external pressure of 0.5 times standard atmospheric pressure.
Vibration:	Inspection of the Model 200 casks used since 1958 reveals no evidence of damage of significance to transport safety.
Water Spray and Free Drop:	Since the container is constructed of metal, there is no damage to containment resulting from dropping the container through the standard drop heights after being subjected to water spray.
Penetration:	There is no effect on containment or overall spacing from dropping a thirteen pound by 1-1/4 inch diameter bar from four feet onto the most vulnerable exposed surface of the packaging.
Compression:	The loaded container is capable of withstanding a compressive load equal to five times its weight with no change in spacing.
Summary and Conclusions:	The tests or assessments set forth above provide assurance that the product contents are contained in the Shielded Container - Model 200 during transport and there is no reduction in effectiveness of the package.

(c) Hypothetical Accident Conditions

General: The effectiveness of the strain rate calculations and engineering intuitiveness in the design and construction of protective jackets was demonstrated with the GE Shielded Container - Model 100 (Ref.: Model 100 of Application, Section 3.0). Extrapolations of the Model 100 data were used in the design and construction of the GE Model 200 protective jacket.

Drop Test: The design and construction of the GE Model 200 protective jacket was based on an extrapolation of the proven data generated during the design and construction of the GE Model 100 and on the results of the cask drop experiments by C. B. Clifford(1)(2) and H. G. Clarke, Jr.(3) The laws of similitude were used in an analytical evaluation(3)(4) to determine the protective jacket wall thickness that would withstand the test conditions of 10CFR71.73 without breaching the integrity of the Model 200 cask. The evaluation, described in GE - Model 100 Application, Exhibit A, indicated a protective jacket wall thickness of 3/8 inch. The intent of the design for the GE Model 200 is, during accident conditions, to sustain damage to the packaging not greater than the damage sustained by the GE Model 100 during its accident

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(1) C. B. Clifford, The Design, Fabrication and Testing of a Quarter Scale of the Demonstration Uranium Fuel Element Shipping Cask, KY-56 (June 10, 1968).

(2) C. B. Clifford, Demonstration Fuel Element Shipping Cask from Laminated Uranium Metal-Testing Program, Proceedings of the Second International Symposium on Packaging and Transportation of Radioactive Materials, October 14-18, 1968, pp. 521-556.

(3) H. G. Clarke, Jr., Some Studies of Structural Response of Casks to Impact. Proceedings of the Second International Symposium of Packaging and Transporation of Radioactive Materials, October 14-18, 1968, pp. 373-398.

(4) J. K. Vennard, Elementary Fluid Mechanics, Wiley and Sons, New York, 1962, pp. 256-259.

condition tests (Ref.: Model 100 Application, Section 3.0). It is expected that damage not exceeding that suffered by the GE Model 100 will result if the GE Model 200 is subjected to the 30 foot drop test.

Puncture Test: The intent of the design for the GE Model 200 is to sustain less or equal damage to the packaging during accident conditions than the deformation suffered by the GE Model 100. It is expected that deformation not greater than that sustained by the GE Model 100 will be received by the GE Model 200 in the event that the package is subjected to the puncture test.

Thermal Test: A fire transient using the THTD Code was not run on this container. However, reference is made to the shielded containers Models 100, 700, and 1500 which demonstrate the effectiveness of the double walled steel jacket as a fire as well as crash shield.

General Electric will analyze by test or other assessment each container heat load to verify that the loaded container will withstand the 30 minute 1475°F fire without significant lead melting in the cask.

Water Immersion: Since optimum moderation of product material is assumed in evaluations of criticality safety under accident condition the water immersion test was not necessary.

Summary and Conclusions: The accident tests or assessments described above demonstrated that the package is adequate to retain the product contents and that there

is no change in spacing. Therefore, it is concluded that the General Electric Shielded Container - Model 200 is adequate as packaging for the contents specified in this Application.

4.0 PROCEDURAL CONTROLS

Vallecitos Site Safety Standards have been established and implemented to assure that shipments leaving the Vallecitos Nuclear Center (VNC) comply with the certificates issued for the various shipping container models utilized by the VNC in the normal conduct of its business.

Each cask is inspected and radiographed prior to first use to ascertain that there are no cracks, pinholes, uncontrolled voids or other defects which could significantly reduce the effectiveness of the packaging.

After appropriate U. S. Nuclear Regulatory Commission approval, each package will be identified with a welded on steel plate in accordance with the labeling requirements of 10CFR71 and any other information as required by the Department of Transportation.

5.0 FISSILE CLASS - CLASS II

An analysis has indicated that no greater than the following amount of fissile material may be shipped in any single container:

$$\frac{\text{Grams U-235}}{500} + \frac{\text{Grams-233}}{300} + \frac{\text{Grams Pu (fissile)}}{300} \leq 1.0$$

The density analog method was used to determine the number of containers which may be shipped as Class II. Each container was assumed to hold 500 grams U-235, or 300 grams U-233, or 300 grams of fissile Pu (Pu-239). No credit was taken for Pu-240 content. Critical data used in the calculations was taken from TID-7028 water-metal curves, Figures 8, 27, and 34.

The container was assumed to be filled with water, (1) for the accident condition, and (2) to allow for container wet loading. The fissile material

was assumed to be homogenized with the water. In all cases, this resulted in nearly optimum moderation.

Physically, there is little difference between the accident and non-accident cases except for the addition of water. Both cases were calculated for the Pu loading. The "wet" case was limiting.

The density analog method is described in SNM License Application for VNC, Docket 70-754, Section 5.4.4, dated April 18, 1966. As the shipment will be Class II, the transport index for each loading was calculated, allowing a maximum number of fifty for each shipment.

The full results for the calculations are shown below:

Fissile Content	Safe Number	Transport Index
300 grams Pu (wet)	22	2.3
300 grams U-233 (wet)	120	0.5
300 grams U-235 (wet)	54	1.0

In all cases, regardless of fissile mixtures involved, the loadings will be assumed to be exclusively Pu. The contents will be shipped dry.