GE Hitachi Nuclear Energy
Anthony E. McFadden
Site Manager

6705 Vallecitos Road
Sunol, California 94586
USA

(925) 862-4344
(815) 953-8211
anthony.mcfadden@ge.com

AEM 13-08

Mark D. Lombard, Director
Document Control Desk
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety and Safeguards
US Nuclear Regulatory Commission
Washington DC

July 1, 2013

Subject: GEH Response to Confirmatory Action Letter NMSS-2012-001 and requests regarding the GE2000 Type B Shipping Cask, Certificate 9228, Docket 71-9228, TAC Nos: LA0129 and L24690

References:
(1) NRC Request for Information, M.D. Lombard to D.R. Krause, 7/23/12
(2) GEH e-mail, Martinez to Saverot, 8/6/12
(3) GEH Letter, D.R. Krause to P. Saverot, 8/21/12
(4) NRC Confirmatory Action Letter, NMSS-2012-001, 9/21/12
(5) GEH Response to Request for Information, A.E. McFadden to M.D. Lombard, 10/10/12
(6) NRC Request for Additional Information, P. Saverot to D.R. Krause, 12/17/12
(7) NRC New Conditions of Certificate of Compliance No. 9228, M. Sampson to D.R. Krause, 1/3/13

Dear Mr. Lombard:

The NRC review of the GE2000, Certificate 9228, Docket 71-9228 began prior to the July 23, 2012 letter and has been continuing through the January 3, 2013 letter. Issues have emerged that caused NRC to issue a Confirmatory Action Letter, Requests for Information and Requests for Additional Information. In all cases GEH has responded accordingly.

References (1) through (6) all deal with the use of the GE2000 with the optional lead liner. In Reference to (2) GEH confirmed its commitment to cease shipments using the lead liner pending resolution of the NRC concerns. In References (1) and (5) GEH provided responses to the questions and in discussion of the answers it was determined that there was a significant difference in understanding between GEH and NRC. The initial response was to design and fabricate a lid for the lead liner that would physically work with the package. As a result of this effort, RAIs in Reference (6) were generated and GEH decided to eliminate the lead liner and lid configuration as an option for the GE2000. GEH is herein requesting removal of this configuration and the associated drawings from the CoC. Given this decision, GEH has determined that it would not be prudent to respond to the RAIs related to the lead liner and lid.

The primary use of the GE2000 is the transport of radioactive cobalt. The Barrel Rack with the Material Basket is the configuration best suited for this transport. In previous RAIs the NRC questioned the adequacy of the accident case demonstration relating to the potential for the source to move into the nominally 2" space above the material basket and outside the barrel. An analysis was performed assuming a source of typical source density protruded into the nominal 2" head space in the GE2000.

While the radiation outside the cask increased some, the transport limits are still met (See Attachment 1 for demonstration). There were several length options shown on the licensing drawings that could not be demonstrated to meet regulatory requirements and those are being removed from the drawing. The revised drawings and a summary listing of changes to each drawing is included as Attachment 2.

With regard to the Confirmatory Action Letter, (Reference 4), only one open issue remains and that was for GEH to notify NRC when it was safe to resume shipments in the GE2000. With the removal of the optional lead liner configuration (drawing 129D4922, Rev. 2). GEH, by this response, has demonstrated the use of the Barrel Rack and Material basket to be safe for transport when using the full length Barrel Rack and Material Basket. Attachment 2 includes updated licensing drawings for 166D8066, Rev. 2 and 183C8356, Rev. 2 that remove the options that are no longer applicable. With the reissue of the CoC that incorporates these modifications, GEH represents the package is safe for transport of Cobalt. GEH is requesting an expedited review of the transport of Cobalt in the Barrel Rack and Material Basket as revised.

In Reference (7) the NRC indicated that with the elimination of the lead liner and lid, the justification provided for the shielding capability for all possible contents and configurations was not adequate. In addition the NRC proposed a reorganization of condition no. 5(b)(1)(ii) of Certificate 9228. As a result of the shielding review without the lead liner and lid, GEH is proposing condition 5(b)(1)(ii) to be revised as shown in Attachment 3. The conditions for isotopes Ir-192 and Zr/Nb-95 could not be shown to be acceptable for transport without further work. Since Zr/Nb-95 is used in the cladding for some of the Cobalt targets these isotopes could not be deleted. General shielding calculations show that 80,000 Ci of Zr/Nb-95 will meet the transport limits. Therefore GEH is requesting Zr/Nb-95 authorization be reduced from 409,000 Ci to 80,000 Ci. Since there is no immediate need for Ir-192, GEH is requesting it be deleted from the authorized contents of section 5(b)(1)(ii).

The NRC requested an outline of the loading and handling procedures for the GE2000 container. GEH-Vallecitos maintains a very detailed engineering document (Specification No. 22A9380) covering all aspects of the use of the GE-2000 package and portions of this document are included as Attachment 4. A revision to this document will be required to reflect the changes submitted within this complete submittal. This excerpt should demonstrate the comprehensive nature of the procedure for the package.

Please contact Don Krause or myself if there are questions regarding this submittal.

Sincerely,

Anthony McFadden
Site Manager

Commitments: None

Attachment(s): 1) HAC Evaluation for Shipments of Cobalt in the Barrel Rack
2) Summary of changes to drawings 166D8066, Rev. 2 and 183C8356, Rev. 2
3) Proposed revision to condition 5(b)(1)(ii)
4) Loading and Handling Procedural Outline

ATTACHMENT 1

HAC Evaluation for Shipments of Cobalt in the Barrel Rack

1.0 NRC RAI RESPONSE

NRC Request for Additional Information Summary:

The NRC requested a shielding evaluation to be performed for the HAC condition for the Model 2000 cask for shipments using the barrel rack. The staff is concerned that in the event of an HAC the source will protrude outside of the barrel rack resulting in significant streaming on the external surface of the package. GEH needs provide justification that during a HAC that the transportation shielding requirements in 10CFR71.51are not exceeded.

GEH Response:

The Hypothetical Accident Condition (HAC) applies the geometry reported in SAR-32318 and the requested modifications per NRC RAI email dated 3/13/13 (Pierre Saverot), which requires the source to protrude outside of the barrel rack. The peak radial dose was calculated using MCNP05P with a barrel rack length of 51.75" and radial thickness of 7". The source extended outward from the barrel rack approximately 2.25" as shown in Figure 1. Significant streaming was identified on the external surface of the overpack at the elevation where the source was not shielded by the barrel rack.

In the event that the Model 2000 shipping cask encounters a HAC, a payload of 130,000 Curies of Co-60 meets the transportation shielding requirements (10CFR71.51) of 1 Rem/hr at 1 meter from the external surface of the package.

Table 1. Model 2000 Cask Accident Dose

Dose Location	Distance	Peak Dose (Rem/hr)
Accident Condition: Outer Radius of Cask Overpack	1 meter	0.930

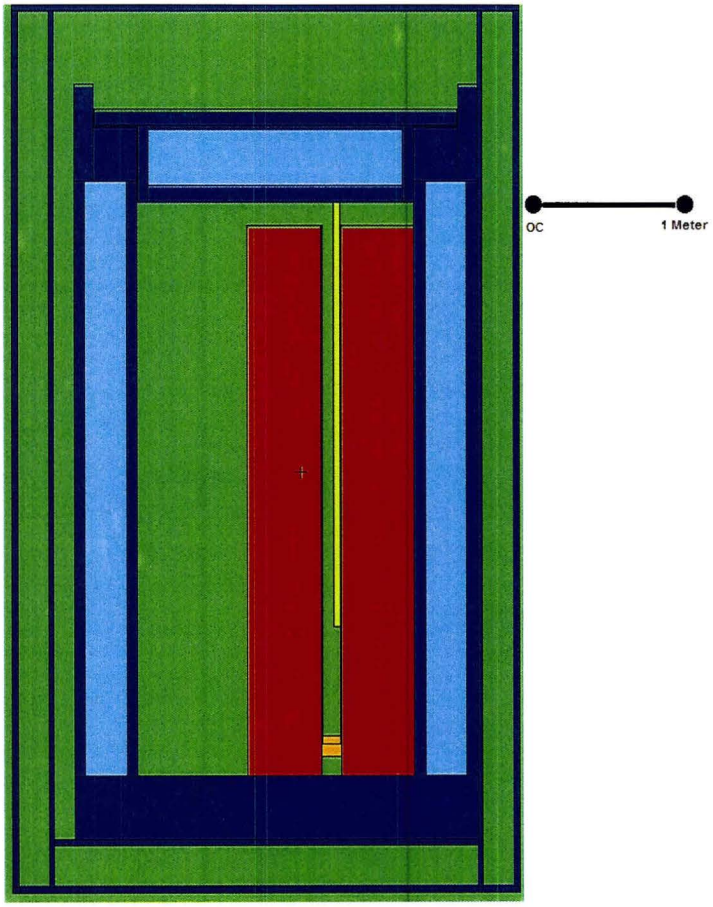


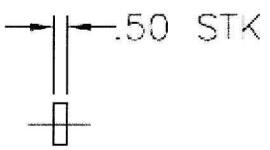
Figure 1. Model 2000 Shipping Package HAC: Co-60 Barrel Rack

ATTACHMENT 2

Summary of changes to drawings 166D8066, Rev. 2 and 183C8356, Rev. 2

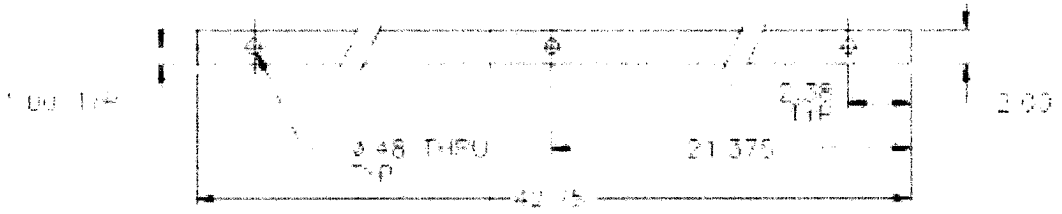
Drawing 166D8066 – Barrel Rack Certification Dwg. Rev. 3

1. GENERAL DOCUMENT UPDATE TO GEH DRAFTING MANUAL STANDARDS FOR LEGAL NAME. OTHER DRAFTING MANUAL REQUIREMENTS NOT INCORPORATED DUE TO NRC LICENSING DRAWING REQUIREMENTS (THESE PRINTS ARE USED FOR COMMUNICATION AND REFERENCE ONLY). TITLE BLOCK AND BORDER UPDATED TO LATEST STANDARDS RESULTING IN BORDER ZONE CHANGES. CHANGED RADIUS CALLOUTS TO STANDARD AND APPLIED QTY'S WHERE TYP. WAS PREVIOUSLY.
2. ZONE B-8 - CHANGED VARIABLE LENGTH TO FIXED LENGTH
   FROM: 44.00 OR 52.00 OPTIONAL
   TO: 51.75+01-.00
   ZONE A-7 - CHANGED VARIABLE DIAMETER TO FIXED DIAMETER
   FROM: DIMENSION E
   TO: 19.00 +/-02
3. TABULAR BILL OF MATERIAL (PARTS LIST) WITH MATERIAL SPECIFICATION AND SAFETY CLASSIFICATION ADDED TO THE FACE OF THE DRAWING PER NRC LICENSING DRAWING REQUIREMENTS.
4. ZONE B-7 – MOVED BOLT CALLOUT TO PARTS LIST ON TOP OF PAGE. ITEM 4
5. ZONE D-8 – (DETAIL G) MADE HOIST RING, SLEEVE AND BOLT REFERENCE, NOT APPLICABLE TO LICENSING REQUIREMENTS.
6. ZONE C-7 - CHANGED VARIABLE ID TO FIXED ID
   FROM: DIMENSION B
   TO: 2.00 +.02-.00
7. REMOVED ALTERNATE CONFIGURATION AND ASSOCIATED VIEW.
8. ZONE B/C-6 - CHANGED SPACER BAR CALLOUT ON ITEM 2. REMOVED "OPTIONAL"
9. ZONE B-6 - CHANGED SPACER RAIL CALLOUT ON ITEM 3. REMOVED "OPTIONAL"
10. ZONE B-6 - CHANGED LINER CALLOUT ON ITEM 1
11. VIEW H-H, CHANGED ITEM NO. 3 TO ITEM NO. 4
12. ZONE C-2 (DETAIL K) – ADDED SPACER RAIL THICKNESS VIEW TO REPLACE MATERIAL THICKNESS CALLOUT UNDER DETAIL K AND MOVED MATERIAL DESCRIPTION UNDER DETAIL K TO PART LIST DESCRIPTION FOR ITEM 3 ADDED

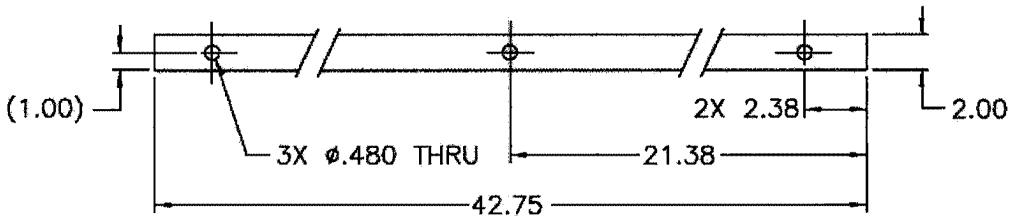


REMOVED: "ALUM. 6061 T6"

13. ZONE C-4 (DETAIL L) CHANGED VARIABLE HEIGHT TO FIXED HEIGHT.
    FROM: DIMENSION A
    TO: 3.12
14. ZONE B-3 (DETAIL L) – MOVED MATERIAL DESCRIPTION TO PARTS LIST
15. ZONE A-4 – REMOVED VARIABLE DIMENSION TABLE.
16. DELETED NOTE 1 AND RENUMBERED NOTES.
17. ZONE B-3 – CHANGED NOTE 3 (UNSPECIFIED TOLERANCES ARE DEFINED IN TITLE BLOCK) AND RENUMBERED TO NOTE 2.
    FROM: ALL OTHER DIMENSIONS ARE +/-0.25 UNLESS SHOWN OTHERWISE
    TO: UNLESS OTHERWISE INDICATED, ALL DIMENSIONS ARE IN INCHES.
18. ZONE B-3 – CHANGED SAFETY RELATED CALLOUT METHOD AND TEXT
    FROM: "* NOT A SAFETY RELATED COMPONENT SHOWN FOR CLARITY ONLY". (THIS REQUIRED ASTERISK ON ALL COMPONENTS THAT WERE **NOT** SAFETY RELATED = ALL PARTS EXCEPT THE LINER)
    TO: "* SAFETY RELATED COMPONENT" (THIS REQUIRES AN ASTERISK ON ALL COMPONENTS THAT ARE SAFETY RELATED = ITEM 1, THE LINER)
19. ADDED NOTE 5, ASSEMBLY WEIGHTS.
20. UPDATED DETAIL K
    a. CHANGED 1.00 WIDTH TO REFERENCE.
    b. CHANGED HOLE SIZE TO .480 FROM .48 AND ADDED QTY.
    c. CHANGE CENTER HOLE LOCATION TO 21.38 FROM 21.375
    d. ADDED QTY NOTE TO 2.38 END HOLE LOCATION
    e. ADDED ITEM 3 BALLOON
    FROM:

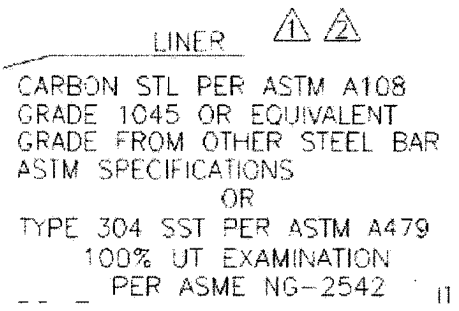


TO:



3 DETAIL K

21. SECTION E-E, ZONE A-6, UPDATED ITEM 1 CALLOUT:
FROM:



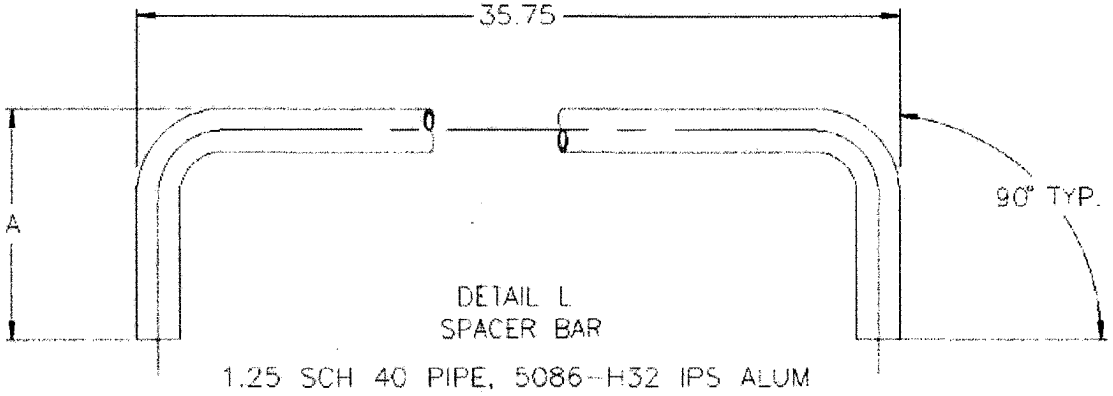
TO:

MATERIAL: CARBON STL PER ASTM A108
GRADE 1045 OR EQUIVALENT GRADE
FROM OTHER STL BAR ASTM SPEC
OR TYPE 304SST PER ASTM A479
100% UT EXAMINATION PER
ASME NG-2542

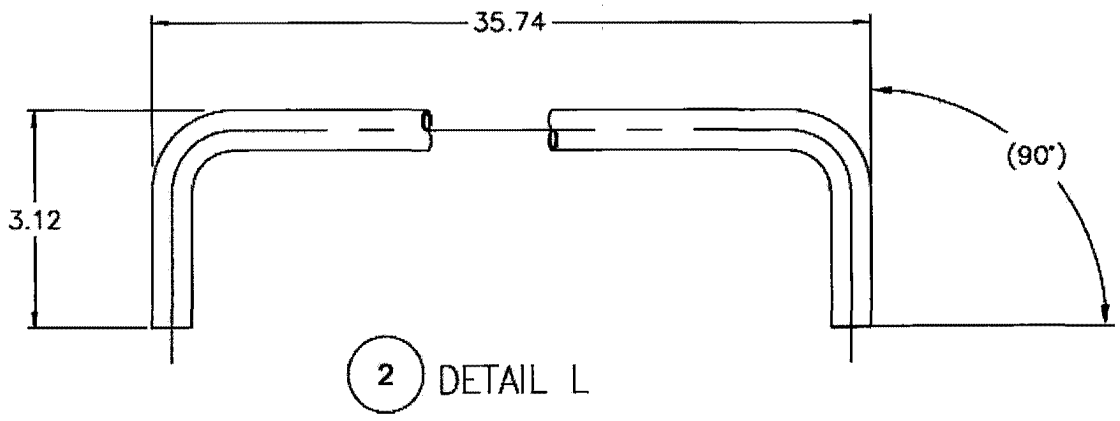
22. CHAMFER IN ZONE C-7 UPDATED FOR TYPOGRAPHICAL ERROR:
FROM 60° X .05
TO 60° X .50

23. DETAIL L, ZONE C-3.
    a. CHANGED WIDTH FROM 35.75 TO 35.74
    b. MADE ANGLE DIMENSION REFERENCE.
    c. ADDED ITEM 2 BALLOON.

FROM:

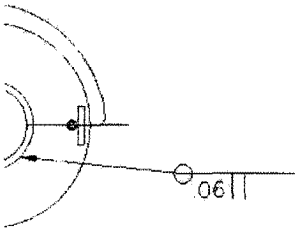


TO:

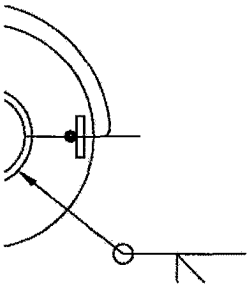


Drawing 183C8356 – Material Basket Certification Dwg. Rev. 3

1. GENERAL DOCUMENT UPDATE TO GEH DRAFTING MANUAL STANDARDS FOR LEGAL NAME. OTHER DRAFTING MANUAL REQUIRMENTS NOT INCORPORATED DUE TO NRC LICENSING DRAWING REQUIRMENTS (THESE PRINTS ARE USED FOR COMMUNICATION AND REFERENCE ONLY). TITLE BLOCK AND BORDER UPDATED TO LATEST STANDARDS RESULTING IN BORDER ZONE CHANGES.
2. TABULAR BILL OF MATERIAL (PARTS LIST) WITH MATERIAL SPECIFICATION AND SAFETY CLASSIFICATION ADDED TO THE TOP FACE OF THE DRAWING PER NRC LICENSING DRAWING REQUIREMENTS.
3. ZONE C-3 - MOVED BAIL TAB POSITION FURTHER IN ON TOP RING TO ALLOW ROOM FOR FILLET WELD THAT IS CALLEDOUT ON TAB . ADDED "2X" TO CALLOUT TO CLARIFY APPLICATION TO BOTH TABS
   FROM: .06
   TO: 2X .09
4. ZONE C-3 – CHANGED WELD CALLOUT ON TOP RING TO TUBE
   FROM:



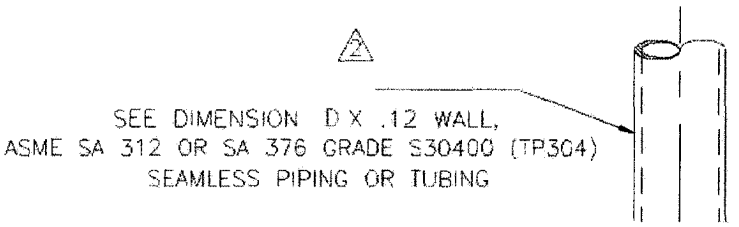
   TO:



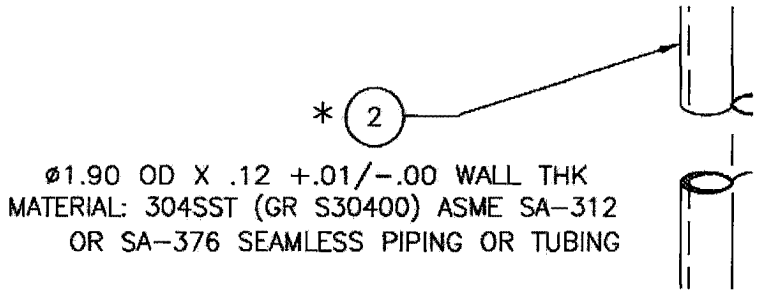
5. ZONE C-4 – MOVED WIRE ROPE DESCRIPTION TO PART LIST AND ADDED ITEM 6 CALLOUT
6. ZONE C-4 – MOVED WIRE TAB DESCRIPTION TO PART LIST AND ADDED ITEM 5 CALLOUT
7. ZONE B-4 – MOVED TOP RING DESCRIPTION TO PART LIST AND ADDED ITEM 1 CALLOUT

8. ZONE B-4 – REMOVED VARIABLE DIMENSION "D" ON TUBE. ADDED TUBE DESCRIPTION TO PART LIST AND ADDED ITEM 2 CALLOUT WITH * INDICATING SAFETY RELATED PER NOTE AT ZONE A-1

FROM:

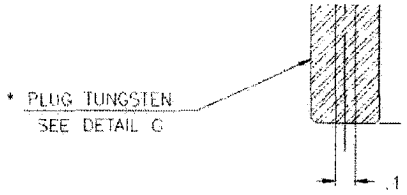


TO:

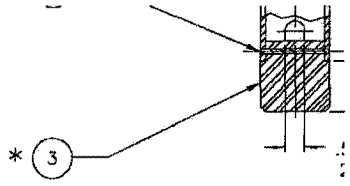


9. ZONE A-4 – MOVED PIN DESCRIPTION TO PART LIST AND ADDED ITEM 4 CALLOUT. CHANGED PIN FROM 1/16" TO 1/8"
10. ZONE A-4 – MOVED PLUG DESCRIPTION TO PART LIST AND ADDED ITEM 3 CALLOUT WITH * INDICATING SAFETY RELATED PER NOTE AT ZONE A-1

FROM:

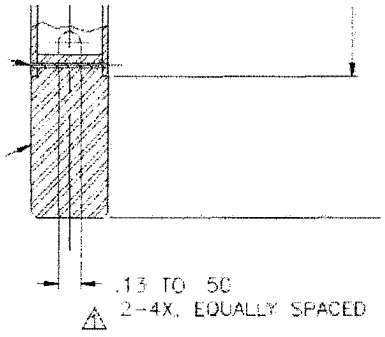


TO:

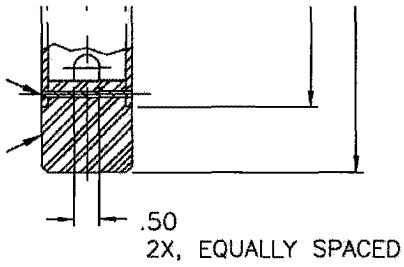


11. ZONE A-3 – REMOVED SLOT OPTIONS AND MADE SLOT DMENSIONS FIXED

FROM:



TO:



12. ZONE B-3 - CHANGED VARIABLE LENGTHS "A" & "B" TO FIXED LEGNTHS

FROM: DIMENSION A

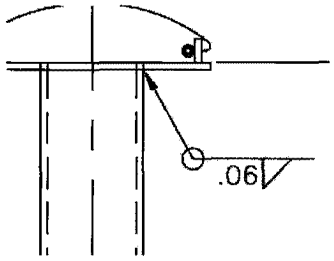
TO: (48.75)

FROM: DIMENSION B

TO: 50.00+.00-.02

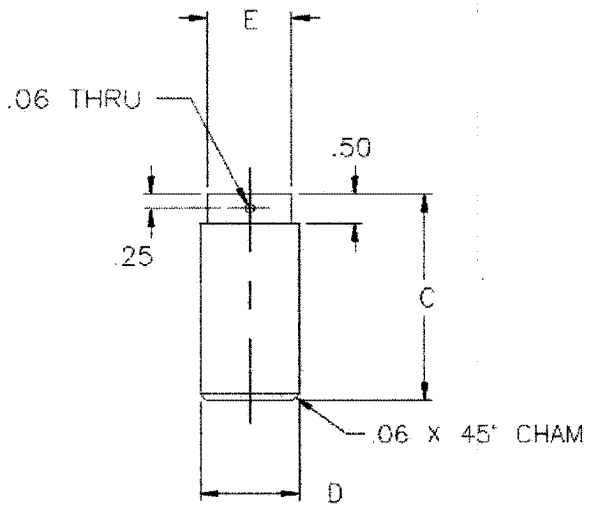
13. ZONE B-3 – ADDED WELD CALLOUT TO UNDERSIDE OF TOP RING

ADDED:



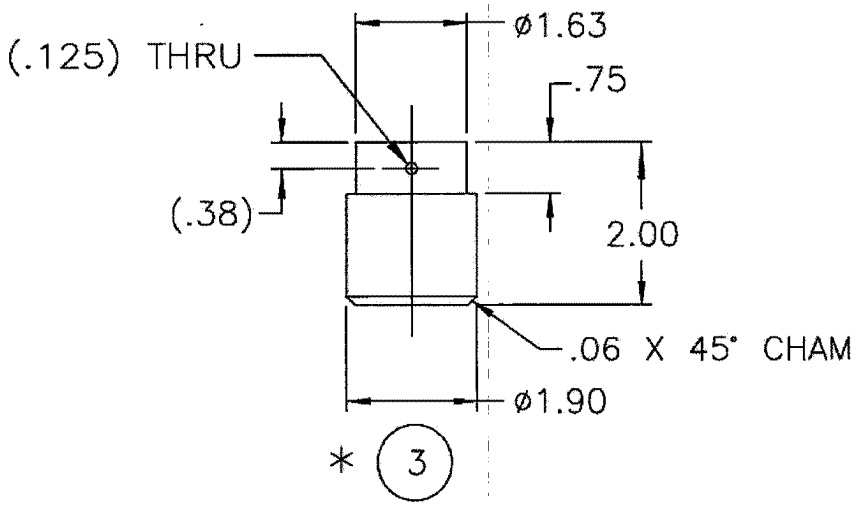
14. REMOVED VARIABLE DIMENSION TABLE FROM BOTTOM OF PRINT

15. ZONE C-2 – PREVIOUSLY DETAIL G CHANGED TO ITEM 3, CHANGED VARIABLE DIMENSIONS "C", "D" AND "E" TO FIXED DIMESIONS. CHANGED PLUG SHOLDER FROM .50 TO .75. CHANGED PIN HOLE DIAMETER AND LOCATION
FROM:



DETAIL G
TUNGSTEN PLUG

TO:



16. ZONE B-2 - CHANGED NOTE 3 (UNSPECIFIED TOLERANCES ARE NOW DEFINED IN TITLE BLOCK)
FROM: ALL OTHER DIMENSIONS ARE +/-0.25 UNLESS SHOWN OTHERWISE
TO: UNLESS OTHERWISE INDICATED, ALL DIMENSIONS AR EIN INCHES.

17. ZONE B-2 – CHANGED SAFETY RELATED CALLOUT METHOD AND TEXT
    FROM: "* NOT A SAFETY RELATED COMPONENT SHOWN FOR CLARITY ONLY". (THIS REQUIRED ASTERISKS ON ALL COMPONETNS THAT WERE NOT SAFETY RELATED = ALL PARTS EXCEPT THE TUBE AND PLUG)
    TO: "* SAFETY RELATED COMPONENT" (THIS REQUIRES AN ASTRISK ON ALL COMPONENTS THAT ARE SAFETY RELATED = ITEM 2 - TUBE AND ITEM 3 - PLUG)

18. DELETED NOTE 1 SINCE IT IS NO LONGER APPLICABLE; MIN/MAX CHART HAS BEEN REMOVED FROM THE DRAWING. RENUMBERED NOTES TO COMPENSATE.

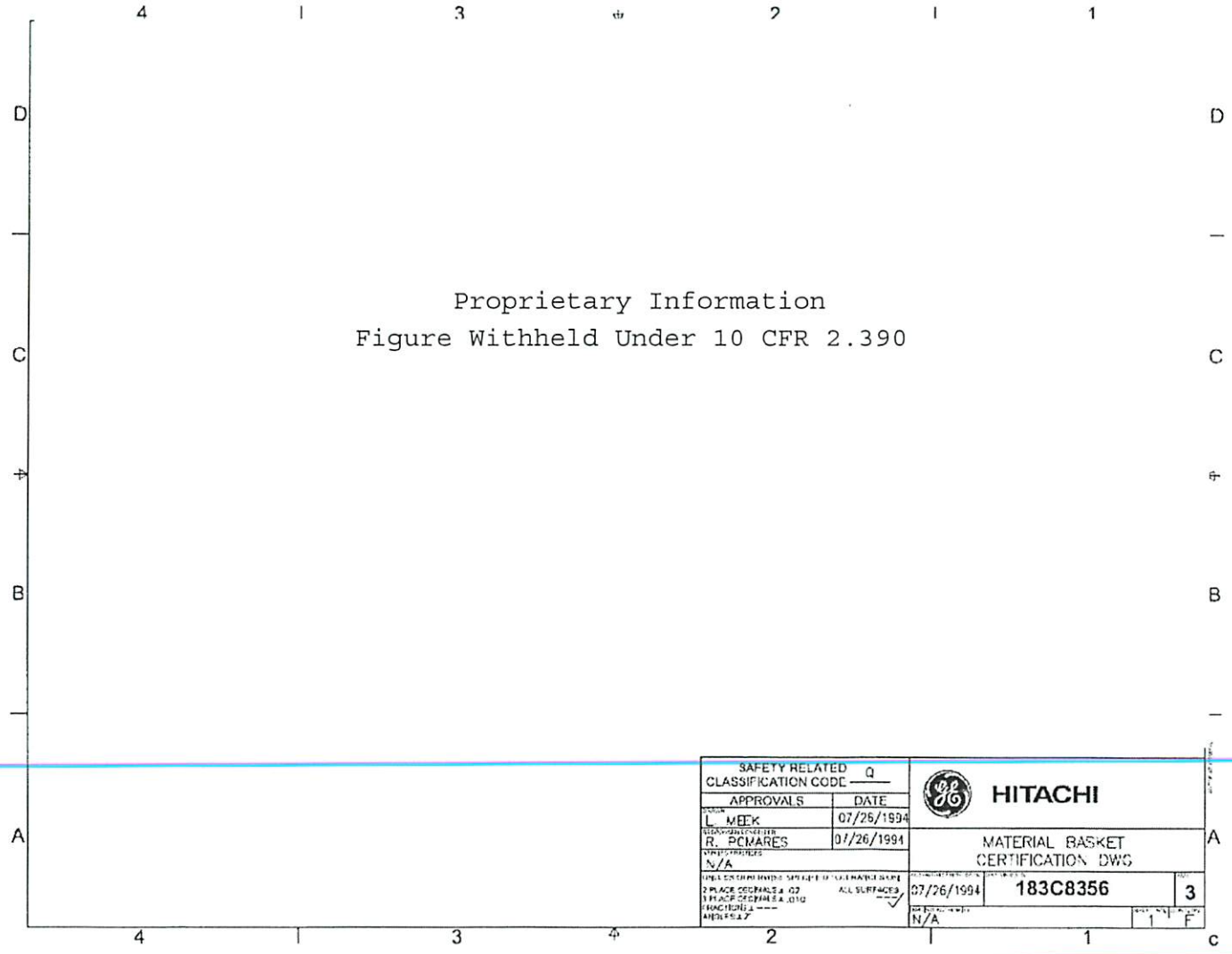
19. ADDED NOTE 5 FOR APPROXIMATE ASSEMBLY WEIGHT.

Revised drawings 166D8066, Rev. 3 and 183C8356, Rev. 3

Proprietary Information
Figure Withheld Under 10 CFR 2.390

SAFETY RELATED		HITACHI	
APPROVALS	DATE		
L. YEEK	07/15/1994	BARREL RACK CERTIFICATION DWG	
R. POMARES	07/15/1994		
N/A		166D8066	3
	7/15/1994	N/A	

Proprietary Information
Figure Withheld Under 10 CFR 2.390



ATTACHMENT 3

Proposed revision to condition 5(b)(1)(ii)

Note: This wording denotes what is proposed to change. All other wording in the COC stays the same.

5. (b) Contents

(1) Type and form of material

(i) *current wording*

(ii) The following isotopes, in solid form Cs-137, Co-60, Hf-181, Sr/Y-90 and Zr/Nb-95; activated, reactor components; and Source or Special Nuclear Material; including any activation products, fission products and actinides.

(iii) current wording

(iv) current wording

(v) current wording

(vi) current wording

5 (b) (2) Maximum quantity of material per package

Current wording

(ii) *For the contents described in 5(b)(1)(ii) 2000 watts decay heat. Fissile contents not to exceed 500 grams U-235 equivalent mass.*

Minimum shielding and shoring requirements for isotopes listed in 5 (b) (1) (ii) are as follows:

Isotope	Minimum required shielding/shoring
Cs-137	Source quantities in either the upper or lower portion of the "two-tier" option of the Multifunctional Rack described in 5(a)(3)(iv) [drawing 105E9555] shall not exceed 211,000 Ci. The top source must be shielded on the bottom by a 1" thick steel end plug and a minimum of 2.375" of steel from the plates in the top and bottom sections of the Multifunctional Rack. The bottom source must also be shielded on the bottom by a 1" end plug and an additional minimum 1.375" of steel from the plates in the bottom section of the Multifunctional Rack.
Co-60	Barrel Rack (drawing 166D8066) as described in 5(a)(3)(v) which includes a minimum 7" radial steel in conjunction with the Material Basket (drawing 183C8356) as described in 5(a)(3)(vi) including a tungsten plug in the bottom of the basket with a minimum length of 1.25".
Hf –181 **OR** Sr/Y–90	Multifunctional Rack (drawing 105E9555) as described in 5(a)(3)(iv).
Zr/Nb-95	Limited to 80,000 Ci in the Multifunctional Rack (drawing 105E9555) as described in 5(b)(3)(iv), or the Barrel Rack and Material Basked (drawings 166D8066 and 183C8356) as described in 5(b)(3)(v & vi).

ATTACHMENT 4

Loading and Handling Procedural Outline

Note: ***Specification No. 22A9380 is provided to demonstrate that GEH has a procedure for handling the GE2000. Sections 6 – 10 are provided in the current version. The specification will be updated to the new information (certificate, drawings and any other changes necessary) when the licensing action is complete.***

TABLE OF CONTENTS

6.0 PACKAGE LOADING

6.1 PACKAGE PREPARATION

6.1.1 Initial Checks

Prior to loading the Model 2000 the following requirements must be verified:

a. Verify operating personnel are trained per Subsection 4.2.

b. Verify shipment plan meets the requirements of Section 4.0.

c. Review maintenance and inspection records to assure that the packaging has been properly maintained and inspected. Refer to Appendix G.

d. Verify that all the required rigging and hoists are available and rated adequately for their intended use as listed in Subsection 5.3. Refer to Appendix G for load test certificates.

e. Verify that all required parts of the packaging operating equipment as listed in Subsection 5.3 are available and ready for use. Refer to Appendix G for equipment calibration certificates.

6.1.2 Packaging Receiving and Inspection

a. Position the Model 2000 transport vehicle for packaging inspection.

b. Inspect the packaging for loose bolts, damage, or deterioration. Examine tie-down components for cracks, wear, or any other damage.

6.1.3 Removal of the Cask from the Transport Vehicle

Refer to Appendix D for package removal instructions.

6.1.4 Preparing to Load the Cask

a. Inspect the cask body. Any damage or unusual conditions should be noted (Figure6.6). If functionality of any part is impaired, refer to Subsection 4.16.

b. Install the cask ears (Figures 6.7 and 6.8). **Torque bolts to 600 ft-lbs (lubricated)** in a crisscross pattern in 200 ft-lb increments. Two sets of ears are available for use 1) the standard lifting ears or 2) the auxiliary ears. If a forklift is to be used to transport the cask, the standard lifting ears must be used. The standard ears are located in the accompanying 7A container in a box labeled Standard Ears. If the cask is to be lifted by overhead crane, then either the standard ears (2) or auxiliary ears (4) may be used. The auxiliary ears are located in the 7A container in a box labeled Auxiliary Ears. See Appendix A for 7A unloading procedure. There is a third approved ear type, the trunnion ears, that is used in overhead crane operations. The trunnion ears are not included within the GE supplied equipment.

   NOTES: (1) Ears must be installed on opposite pads.
   (2) See Appendix A for 7A unloading procedure.
   (3) All ears are accompanied by their attachment bolts.

c. Use properly rated slings if the cask is to be lifted by overhead crane using the standard ears or auxiliary ears or by a forklift truck using the standard ears. The spreader bar and cables provided or equivalent rigging may be used. See Figure 6.9.

d. Position the spreader bar above the cask and attach the spreader bar cables to the ear's or insert forklift truck forks within the standard ears' fork pockets. With the appropriate hoisting devices described in Paragraph 6.1.4 c. above (Figure 6.10) for overhead operations, lift cask from overpack base and transfer cask to a working area. The removal of the cask from the overpack base and its transfer can also be performed using a forklift truck.

CAUTION: CENTER THE CRANE HOOK ON THE SPREADER BAR LOAD PIN. USE RINGS OR SPACERS AS REQUIRED TO ENSURE THE CRANE HOOK IS CENTERED.

6.1.5 Loading Preparation - Dry Remote Operation

For dry remote operation, the following preparations are made prior to loading: Steps and sub-steps within this Paragraph may be performed in parallel or out of sequence as deemed necessary by the site operation.

a. Assure that all remote handling tools to be used have the same or less level of contamination than the contents to be loaded into the cask before removal of cask lid.

b. Remove vent port plug to release any built up pressure that may be present in the cask cavity.

   CAUTION: CASK CAVITY PRESSURE BUILT UP MAY BE RELEASED DURING PLUG REMOVAL. MONITOR CASK VENTING PORT FOR AIRBORNE CONTAMINATION

c. Remove the lid attachment screws. Place the screws in a convenient location so they are not lost, damaged, or contaminated. **ALL THE SCREWS ARE REQUIRED FOR REASSEMBLY.**

d. Remove the cask lid for visual inspection of the cavity with the appropriately rated lifting device and lid handler hook. Perform a visual inspection for damage or foreign materials on cask and lid sealing surfaces, cask seal, and plug cover o-rings. Assure that the proper basket, liner, rack, divider is available and ready for installation. Examine welds and materials for potential defects. Verify all design features are present and in good condition. Use a radiation detector instrument and monitor dose rate during this operation.

e. Install basket or spacers if applicable. Baskets or spacers must be clean, dry, free of oil, etc.

f. Verify that the cask seal is seated properly.

g. Refer to Subsection 6.2 for content loading.

6.1.6 Loading Preparation - Wet Operation

For wet operation, the following preparations are made prior to loading: Steps and sub-steps within this Paragraph may be performed in parallel or out of sequence as deemed necessary by the site operation.

a. Perform a visual inspection of the appropriate basket (basket, liner, rack, divider). Examine welds and materials for potential defects. Verify all design features are present and in good condition.

b. Attach the electric chain hoist with appropriate sling to spreader bar.

c. Attach the lid handler hook to chain hoist and cask lid handle for underwater lid removal (Figure 6.11). Attach guide ropes to lid handler hook.

d. Attach the cask lifting slings to the cask ears. Attach slings to spreader bar. Use an overhead crane for raising and lowering the cask.

e. Assure that the capacity of material handling equipment is not exceeded. **The maximum cask weight is 23,750 lb.** Consider the weight of lifting hardware and that of the water in the cavity in addition to the cask weight when determining handling equipment capacity requirements.

   CAUTION: CENTER THE CRANE HOOK ON THE SPREADER BAR LOAD PIN. USE RINGS OR SPACERS AS REQUIRED TO ENSURE THE CRANE HOOK IS CENTERED.

f. Prepare the cask for lowering into the pool. Remove the plug covers, "O"-ring, and pipe threaded plugs from the vent, drain, and test ports.

g. Verify that contents will not float prior to transfer to pool for cask lid removal.

h. Remove the lid bolts. Place the bolts, plug covers, pipe threaded plugs and o-rings in convenient location so they are not lost, contaminated, or damaged. ALL BOLTS, PLUG COVERS, PIPE THREADED PLUGS, AND O-RINGS ARE REQUIRED FOR REASSEMBLY.

i. Remove the cask lid for visual inspection of the cavity with the appropriately rated lifting device and lid handler hook. Perform a visual inspection for damage or foreign materials on cask and lid sealing surfaces, cask seal, and plug cover o-rings. Assure that the proper basket, liner, rack, divider is available and ready for installation.

j. Verify that the cask seal is seated properly.

k. Attach Spreader Bar slings to the cask ears if need.

l. Move cask over to the pool.

m. Submerge cask in the pool until its top surface is below the water.

n. Raise the cask lid to a height which allows water to enter the cavity and which maintains radiological safety. Lower the cask into the water. This motion should be slow to prevent creation of large air bubbles.

o. Place cask at appropriate depth and slowly raise the cask lid using the electric chain hoist. Monitor dose rate to working personnel. If cask cavity isn't completely full of water, air bubbles may escape when lid is removed. **RESPIRATORY PROTECTION IS RECOMMENDED.**

p. Install basket, rack, or any shoring hardware, as needed. Baskets or spacers must be clean, dry, free of oil, etc.

6.2 CONTENTS INSERTION

Steps and sub-steps within this Paragraph may be performed in parallel or out of sequence as deemed necessary by the site operation.

6.2.1 Loading Irradiated Fuel into the Cask

a. Perform a visual inspection of the appropriate basket (basket, liner, rack, divider). Examine welds and materials for potential defects. Verify all design features are present and in good condition.

b. Obtain the list of irradiated fuel rods, transfer procedure, and cask loading diagram.

c. Move the fuel elements, sections, or rods one at a time to the appropriate cell in the basket or spacing device. Verify fuel element, section, or rod seating. Fuel elements may be loaded into basket, rack, etc, prior loading the device into the cask, except when the fuel divider is used.

d. Verify the identification marking for each fuel element, section, or rod moved, and mark the corresponding records.

e. Use appropriate shoring if needed, to limit movement of the fuel and basket or spacing device.

6.2.2 Loading Irradiated Hardware or Other Contents

a. Perform a visual inspection of the appropriate basket (basket, liner, rack, divider).Examine welds and materials for potential defects. Verify all design features are present and in good condition.

b. Place the basket, rack, or shoring device for the hardware to be transported in the cask.The device must be clean, dry, and free of oil, etc.

c. Load the hardware into the device. The device and/or shoring should limit movement of the hardware. Hardware may be loaded into device prior to loading the device into the cask.

6.3 CLOSURE PLACEMENT, PACKAGE ASSEMBLY, AND LEAK TESTING OF CASK

6.3.1 Installing the Cask Closure Lid - Dry Remote Operation

a. Lower the lid slowly into place. Closely watch this operation to assure that the lid is properly aligned. The lid locating pins should be used as a reference.

b. Install and loosely tighten a minimum of 5 lid attachment screws equally spaced into lid before moving the cask.

6.3.2 Installing the Cask Closure Lid - Wet Operation

a. Lower the lid slowly into place using the electric chain hoist and guide ropes WITHOUT letting the lid sit on the seal. (Keep lid approximately 1 inch off of seal.) Closely watch this operation to assure that the lid is properly aligned. The lid locating pins should be used as reference.

b. Raise the top of the cask approximately 12 inches above the water level to allow the water in the lid cavity to drain into the cask cavity. Set the lid down once the water has drained.

c. Install and hand tighten a minimum of 5 lid attachment screws equally spaced into lid loosely before moving the cask. Lid bolt handling tool may be used for this purpose.

6.3.3 Removing the Cask from the Loading Area

a. Measure radiation levels carefully while removing the cask from the loading area. Radiation levels should meet site-specific requirements.

b. Drain water from cask cavity after underwater loading, by keeping the cask suspended above the pool, or at a convenient location until all the water is drained (approximately 45 minutes).

c. Wipe the cask before placing on the floor. Decontaminate the cask exterior to a level consistent with 49CFR173.443 and 10CFR71.87 and survey for smearable radioactive contamination. For all GE's shipment the cask exterior should be <100 cpm beta/gamma per ft^2 and <200 dpm alpha per ft^2. These limits are GE VNC definition of "clean" or "non-smearable." They are conservative values and well below the regulatory requirements.

6.3.4 Securing the Cask Lid

a. Apply anti-seize compound to screw threads if needed. See Appendix F for approved compounds.

b. Dry operation - Install and hand tighten remaining lid bolts.

c. Wet operation - Remove any water that is present in the unoccupied bolt holes, once dry install and hand tighten bolts. Remove previously installed bolts and dry any water that is present. Make sure to have a minimum of five bolts in place at all times (a wet/dry vacuum is recommended for water removal).

d. Torque the lid attachment screws in a criss-cross pattern (see Figure E.1) using the torque wrench assembly provided by GE or equivalent. **Torque value is 690 ft-lbs (lubricated) in 230 ft-lb increments and** a final pass at the required torque value.

e. Install drain port plug.

f. Dry cask cavity after underwater loading by using a vacuum drying system. See Appendix B, Drying System Operating Procedure.

6.3.5 Assembly Verification Leakage Testing

a. Perform leak testing as described in Appendix C.

b. If leakage is detected in the above test, then repeat the tests after replacing the offending components.

c. Install plug covers to the leak check port, drain, and vent ports.. Assure "O"-rings are properly installed.

6.4 CLOSING AND SEALING OF PACKAGE

Following Leak Testing, prepare the cask for transport of irradiated fuel or other radioactive material as follows:

a. Transport the cask to the overpack base and place it on the base. NOTE: Position cask with its ears in line with the trailer length.

   CAUTION: EAR PADS MAY CONTAIN TRAPPED WATER. CARE SHOULD BE TAKEN TO PREVENT THE SPREAD OF CONTAMINATED WATER OVER THE CASK SURFACE, OVERPACK BASE, AND TRAILER.

b. Remove the cask ears and place them in the appropriate shipping and storage container.

c. Remove slings and turnbuckles from overpack stand.

d. Install slings on spreader bar.

e. NOTE: Different slings with proper ratings may be used to lift overpack.

f. Position the package spreader bar over the overpack, and connect the slings and shackles.

CAUTION: CENTER THE CRANE HOOK ON THE SPREADER BAR LOAD PIN. USE RINGS OR SPACERS AS REQUIRED TO ENSURE THE CRANE HOOK IS CENTERED.

g. Lower the overpack over the cask slowly referencing the locating pins for alignment.

h. Install the overpack bolts to secure the overpack to its base section. Maintain the overpack suspended by the crane during the bolt installation and hand tightening operations.DO NOT FORCE THE BOLTS INTO PLACE, REPOSITION OVERPACK IF NEEDED.

Note: Apply a thread sealant compound, per manufacturer's instructions given on the product label, as required, to the bolt threads prior to installation to prevent vibration loosening of bolts. See Appendix F for approved thread sealant compounds.

i. Torque the overpack bolts sequentially using the torque wrench provided by GE or equivalent. **Torque value is 100 ft-lbs (dry)**. Torque value shall be applied incrementally with a final pass at the required torque value.

6.5 PACKAGE TIE-DOWN

a. Install package to the transport vehicle/ISO flat rack following the instructions given in Appendix D. The Model 2000 does not have any parts or devices that would need to be rendered inoperable pursuant to 10CFR71.87 (h).

6.6 DECONTAMINATION

The exterior surfaces of a shipping package and the transport vehicle should be free of smearable radioactive contamination. Contamination levels should not exceed regulatory limits (refer to Paragraph 6.3.3.C). Decontaminate the surfaces of the package as needed. See Appendix F for approved decontamination solutions.

a. Survey the assembled package for radiation levels and smearable contamination. Decontaminate if necessary.
b. Apply the security seal to the overpack.

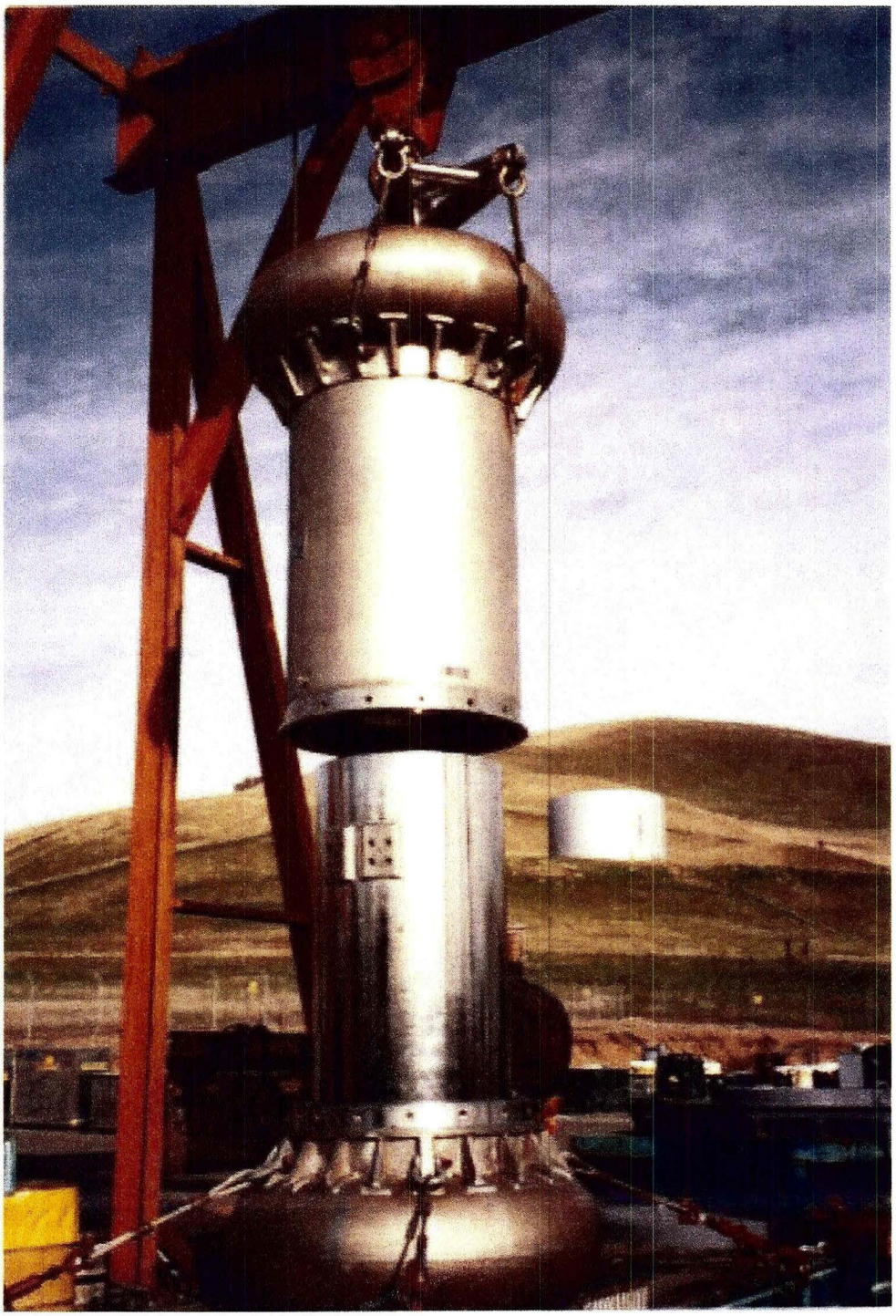


Figure 6.1 Removal of Overpack

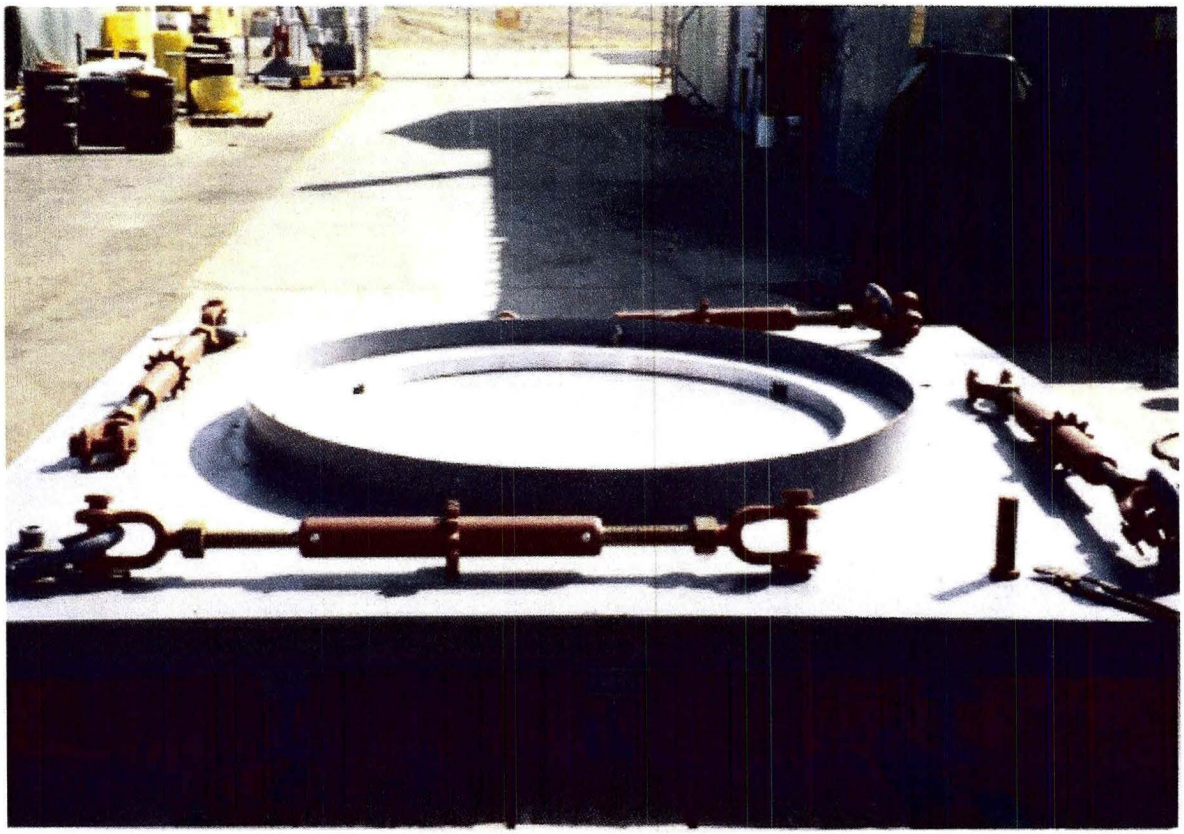


Figure 6.2 Overpack Stand

Figure 6.3 Placement of overpack on overpack stand.

Figure 6.4 Overpack Base

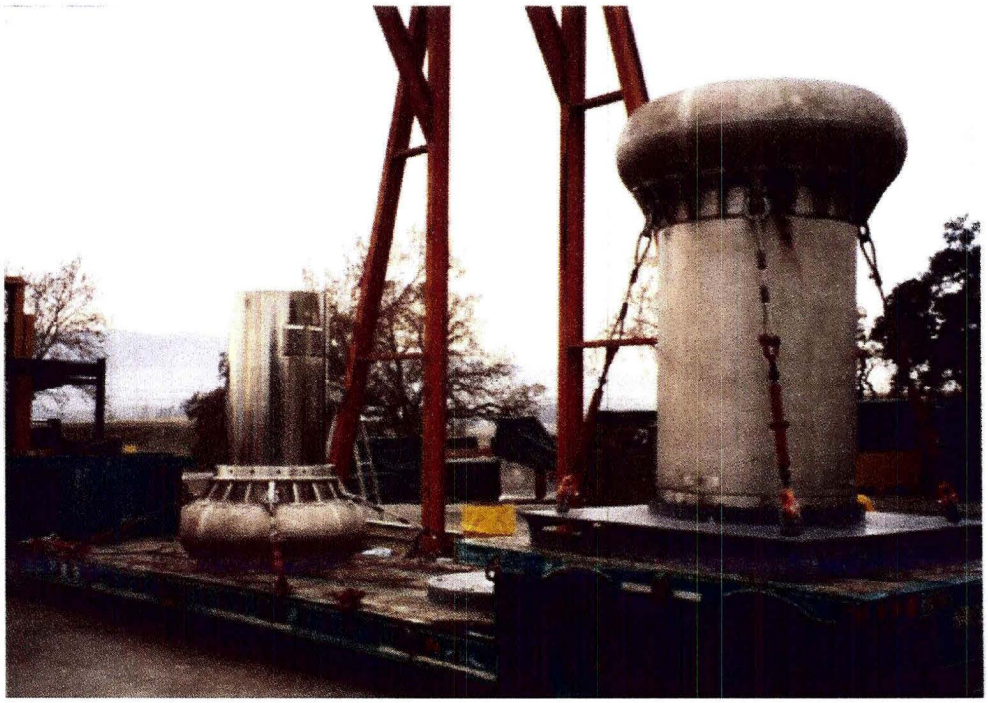


Figure 6.5 Overpack secured to overpack stand

Figure 6.6 Cask on Overpack Base

Figure 6.7 Cask with ears (auxilliary) installed

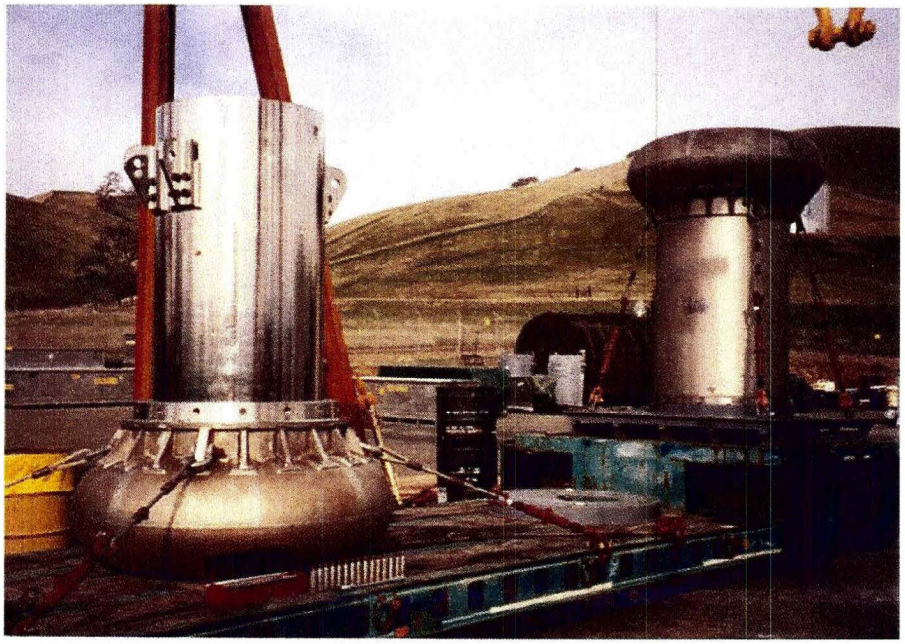


Figure 6.8 Cask with ears (auxilliary) installed and overpack on overpack stand

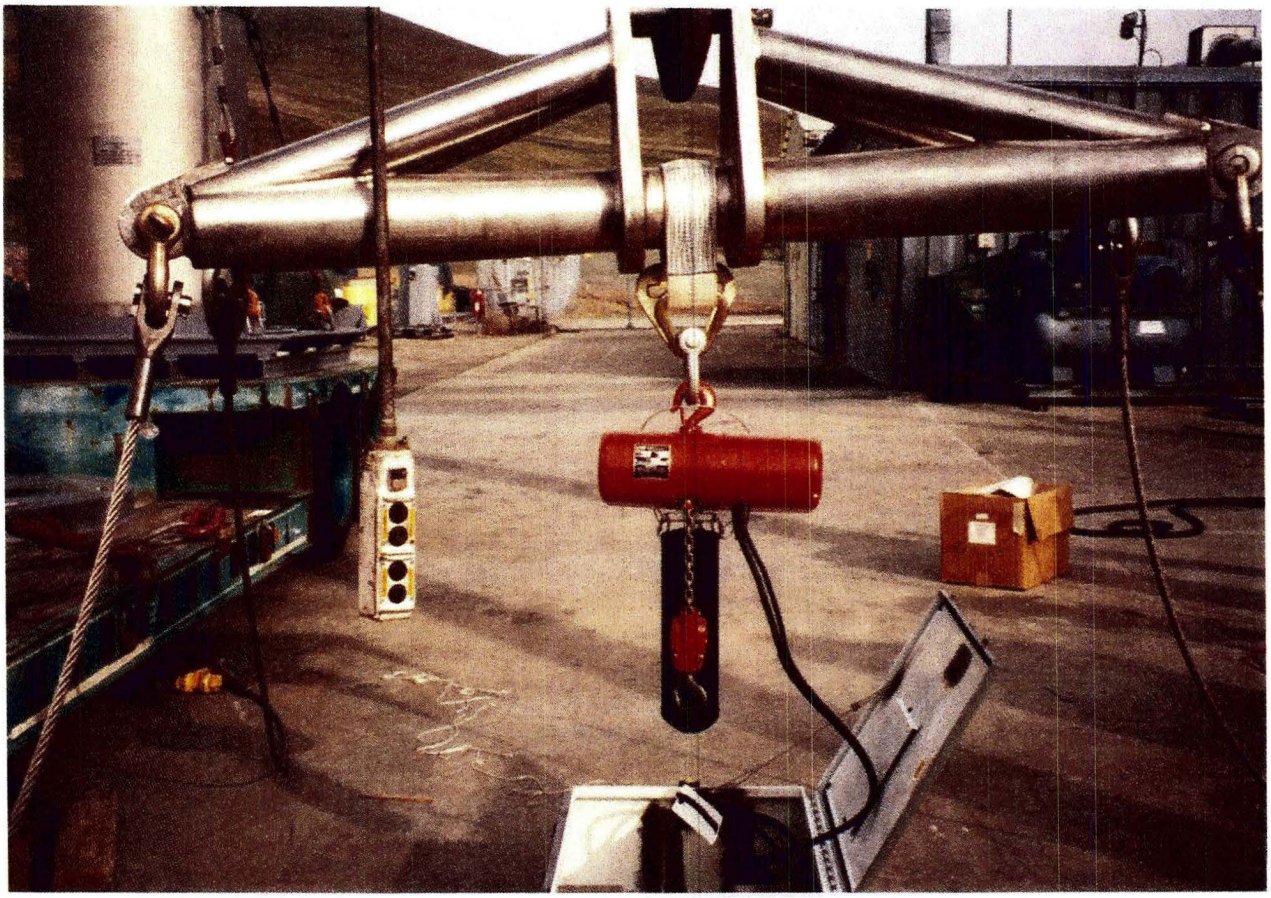


Figure 6.9 Spreader Bar with electric chain hoist installed

Figure 6.10 Spreader bar connected to cask ears

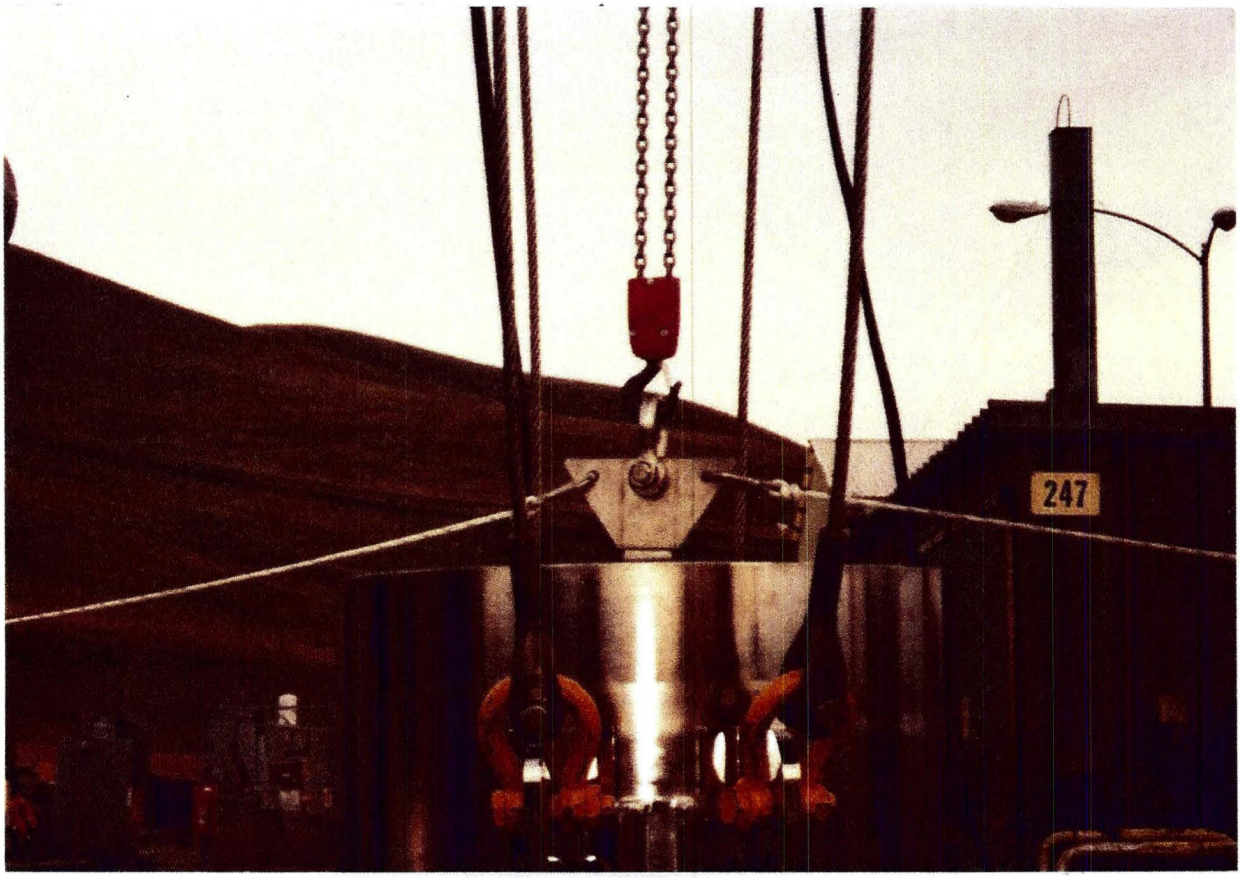


Figure 6.11 Cask lid handler tool

7.0 SHIPMENT PREPARATION

7.1 REQUIREMENT PRIOR TO SHIPPING

To ensure that the requirements of 49CFR173.475 and 10CFR71.87 have been satisfied, the following items must be verified prior to each shipment.

a. Verify that an engineering evaluation per Subsection 4.3 is completed and content is acceptable for shipment.

b. Verify that qualified personnel as per Subsection 4.2 have inspected the package. See Subsections 4.15 and 4.16 if any damage requiring repair is detected.

c. Verify that the Shipper has maintained the packaging as per Section 10.0 of this

d. Specification. Refer to Appendix G.

7.2 SURVEYING

Survey the package and transport vehicle prior to release of the package. This radiological survey must be consistent with 10CFR71.47, 49CFR173.441, and 443.

NOTE: Perform a neutron radiation survey in addition to a gamma radiation survey for irradiated fuel shipment.

Complete a visual survey of the complete package to ensure that it is correctly assembled. Complete the checklist for this survey:

a. Verify correct assembly of package.

b. Verify correct attachment of package anti-tamper seal.

c. Verify proper attachment of overpack screws.

7.3 MARKING AND LABELING

Check the package nameplate. Remove any old labels. Review payload prior to labeling. Label package and transport per 49CFR172.301, 172.310 and 172.403 requirements or EMS Procedure 130P005, "Shipping and Receiving Radioactive Materials" or equivalent site procedure. (DO NOT PLACE ANY LABELS, TAPE, OR MARKINGS DIRECTLY TO THE CASK BODY OR OVERPACK SURFACES. APPLY APPROVED TAPE ON AN AREA FOR LABELING. LABEL, TAPE, OR MARK ON THIS AREA ONLY). See Appendix F for approved markers and tapes.

7.4 SECURING TO VEHICLE

The tie-down system for the Model 2000 is provided with the packaging. The installation instructions for the tie-down system and the cask package are provided in Appendix D, Tie- Down Procedure.

7.5 SHIPPING DOCUMENTS AND NOTIFICATION

7.5.1 Complete the Shipping Manifest to document radiation survey and any other information required by the 49CFR172.202.

7.5.2 Notify consignee before shipment.

7.5.3 Notify any regulatory agencies of the pending shipment, if is required given the type and quantity of the radioactive material to be shipped.

8.0 PACKAGE RECEIPT

8.1 GENERAL

8.1.1 Inform consignee of the radioactive material transfer before shipment and verify those requirements necessary for receiving.

8.1.2 Quarantine and report to the proper Regulatory Compliance and/or Operations organization any packages and/or vehicles received with contamination in excess of facility release limits, or any package received with dose rates in excess of 10CFR71.47, 49CFR173.441, and 443 regulations.

8.2 INSPECTION AND SURVEYS

a. Position the Model 2000 transport vehicle for packaging inspection.

b. Verify package seal is not broken and anti-tamper seal number matches shipping documents if package is full. Notify VNC Shipping or other proper organization if seal has been tampered with or if there is a discrepancy with the documents.

c. Inspect the package for loose bolts, damage, or deterioration. Examine tie-down components for cracks, wear, or any other damage. Record any damage and/or discrepancy on the proper form.

d. Perform a radiological survey (including neutron radiation for irradiated fuel shipments) in accordance with the requirements of 10CFR20.205 or equivalent agreement state regulations.

e. Inspect auxiliary equipment 7A container for evidence of wear and tear. Record any observations.

8.3 REMOVAL FROM VEHICLE

a. Remove 7A container from the vehicle and transfer it to a proper working area, if the container is shipped together with the cask.

b. Open and remove from the 7A container the equipment needed to support the operation to be performed.

   CAUTION: USE PROPER RADIOLOGICAL PROTECTION WHEN OPENING CONTAINER.

c. Remove overpack from its base and place overpack on the overpack stand. Overpack stand may be on the vehicle or may be removed to an appropriate location. See Paragraph 6.1.3 for overpack removal.

d. Remove cask from vehicle during receiving procedure. See Paragraph 6.1.4 cask removal. It is recommended that the overpack base and the overpack stand with the overpack be left on the vehicle, when package is transported vertically. However, loosen the tension on the tie-down cables.

9.0 PACKAGE UNLOADING

9.1 TRANSFER PREPARATIONS

Refer to Paragraphs 6.1.1 through 6.1.4 for step-by-step procedures. Package preparations for unloading are the same as those for loading.

9.2 CLOSURE REMOVAL

Refer to Paragraphs 6.1.5 a. through d. for lid removal in dry remote operations. For wet operation, refer to Paragraphs 6.1.6 a. through o, except steps i and j. All equipment necessary to open and unload package should be available to reduce hazardous radiological exposure.

9.3 CONTENTS REMOVAL

a. Remove the inner container with its content or the content from the cask cavity.

b. Transfer the container or content to a working area. If the loaded container was removed then remove the material or its contents from the container.

c. Re-install the lid and install at least five (5) lid bolts and snug-tighten them.

d. If unloading occurred in water, allow the cask to drain (about 45 minutes) prior to removing it from the pool or basin.

9.4 PREPARATION OF EMPTY PACKAGE FOR TRANSPORT

Perform the following operations:

9.4.1 Cask Cavity Inspection

a. Remove the lid from the empty cask.

b. Verify the cask cavity is empty.

c. Survey the cavity to determine extent of any contamination.

d. Decontaminate the cavity to the limits of 49CFR173.248 if the cask is shipped as an empty packaging. See Appendix F for approved decontamination solutions.

e. Inspect the cavity to assure moisture has been removed.

f. Inspect cask lid seal.

9.4.2 Installation of the Cask Closure Lid

a. Lower the lid slowly onto the cask with proper rigging referencing the guide pins. Watch this operation closely to assure that the lid is properly aligned.

b. Install the lid bolts and snug-tighten them. Torque the lid attachment screws in a criss-cross pattern (see Figure E.1) using the torque wrench assembly provided by GE or equivalent. **Torque value is 690 ft-lbs (lubricated) in 230 ft-lb increments and** a final pass at the required torque value.

c. Inspect the cask to assure that all drain and vent plugs are properly installed.

9.4.3 Assembly Verification Leakage Testing

Leak test is not required on the empty container.

9.4.4 Preparing the Empty Cask for Transport

Decontaminate the external surfaces of the cask and overpack to a level consistent with 49CFR173.428, "Empty Radioactive Materials Packaging". See Appendix F for approved decontamination solutions.

10.0 INSPECTION AND MAINTENANCE

The Model 2000 Packaging must be subjected to the tests and evaluations specified on the Certification Drawing (Section 3) prior to the first use. In addition, shielding integrity, cask containment, and thermal performance must be verified. Furthermore, newly constructed packaging must be leak tested after third use. Refer to Subsection 4.10.

The maintenance program for the packaging requires a series of routine and periodic inspections. The routine inspections are performed at each loading and assembly operation. The periodic inspections are performed at least once, within the 12-month period before use. Testing of the cask sealing capability must be performed after each loading, except for contents meeting "special form", and every twelve months. Appendix G contains all inspection, maintenance, calibration, and load testing records of packaging.

10.1 ROUTINE INSPECTION

a. Determine the smearable and/or fixed contamination level of all surfaces of the overpack, the exterior surfaces of the cask, and removable components.

   CAUTION: SMEARABLE RADIOACTIVE CONTAMINATION MUST BE REMOVED TO DOT/IAEA ACCEPTABLE LEVELS PRIOR TO SHIPMENT. SEE APPENDIX F FOR APPROVED DECONTAMINATION SOLUTIONS.

b. Inspect the metal surfaces for indication of damage.
   1) Signs of excessive heat or fire.
   2) Punctures, holes, or other surface defects.
   3) Dents, scratches, crushed areas indicating a severe impact.
   4) Defects resulting from normal or abnormal wear.

c. Inspect bolts and mating threads for deformed or stripped threads, cracked or deformed hexes on bolt heads, elongated or scored grip length area, and severe rusting or corrosion pitting. Threads shall be sufficiently clean to perform examination.

d. Inspect bottom energy absorbing honeycomb for dents and/or crushed areas.

e. Inspect cask parts, threaded plugs and plug cover for damages. Components shall be sufficiently clean to perform examination.. Reapply required compounds. See Appendix F for approved compounds.

f. Inspect plug cover "O"-ring for resiliency and damage such as cuts, nicks, chips, indentations, or any other defect apparent to the naked eye which could affect sealing integrity.

g. Inspect cask seal for resiliency and complete adhesion to the metal ring. Determine if there are any cuts, nicks, chips, indentations, or any other defect that could affect sealing integrity.

h. Perform cask leak test as described in Appendix C.

i. Verify that the nameplate information is legible, not covered or otherwise obliterated, and securely attached. Cask nameplate must be welded the entire length of each side. Overpack nameplate must be attached by screws on each corner.

j. Replace any damaged bolt, energy absorbing honeycomb, threaded plug, plug cover, "O"-ring and/or seal as required.

k. Record any component replacement activity. GE-VNC shall complete R-9 form, "Type B Packaging Maintenance Checksheet."

l. Document routine inspection. GE-VNC shall complete R-8 form, "Cask Shipping Checksheet."" and R-31, "Model 2000 Overpack Checksheet."

m. Verify the support tools and lifting and tie-down rigging listed in the Equipment Check List, Appendix A.4, is in current calibration and/or has a current load test.

Component	Load Test/ Calibration Value
Lifting Cables & Shackles	26,000 lb for 10 minutes
Spreader Bar Dimensional Test	Against baseline measurements
Chain Hoist	2,750 lb for 10 minutes
Lid Hook and Shackle	2,750 lb for 10 minutes
Cask Lid Handle	5750 lb ± 50 lb for 10 minutes(1)
Lid Sling	2,750 lb for 10 minutes
Preset Torque Wrench	100 ft-lb
0-250 Signal Torque Wrench	Calibrate
0-800 Signal Torque Wrench	Calibrate
4x Torque Multiplier	Calibrate
Permeation Leak	better than 1 x 10^{-5} atm-cc/sec He @ 24.5°C

(1) Apply to those packaging required to comply with NUREG-0612.

10.2 PERIODIC INSPECTION

Periodic inspection is performed after 12 usages or 12 months, whichever comes first. If the cask has not been used for a period exceeding one year, this inspection shall not be required. However, in this event, the inspection shall be performed before returning the cask to service.

a. Perform routine inspection as above with the following additions and exceptions.

1) Perform visual inspection of all welds for cracks or obvious damage. Welds on overpack tie-down ribs shall be examined by the liquid penetrant or magnetic particle method in accordance with ASME Section V, Article 6 or Article 7 and evaluated in accordance with ASME Section III, NF-5340 or NF- 5350, as applicable. Welds on transport trailer tie-down equipment shall be magnetic particle or liquid penetrant examined in accordance with ASME Section V Article 6 or Article 7 and evaluated in accordance with AWS D1.1 (1988 Edition). Welds on cask standard and auxiliary ears, ear mounting plates, and the lid handle shall be examined by the liquid penetrant or magnetic particle method in accordance with ASME Section V, Article 6 or Article 7 and evaluated in accordance with ASME Section III, NB-5340 or NF-5350, as applicable.

2) Test by the magnetic particle or penetrant method all bolts (overpack, cask lid, and ears) per American Society of Mechanical Engineers (ASME) Section III, NB-2580, "Examination of Bolts, Studs, and Nuts". Verify thread dimension by using a Go-No-Go gage.

3) Perform dimension inspections top and bottom energy absorbing honeycombs. Perform visual inspection of top energy absorbing honeycomb capture bolts. Replace them as needed.

4) Either penetrant test or replace the cask port threaded plugs. If penetrant test is selected the test must be performed per American Society of Mechanical Engineers (ASME) Section III, NB-2580, "Examination of Bolts, Studs, and Nuts".

5) Replace plug cover "O"-rings.

6) Replace cask lid seal.

7) Perform cask leak test per the requirement of Appendix E.

b. Perform inspection of vacuum drying readout equipment as follows:

1) Check for signs of physical damage to cable, controller and gauge tube.

2) Verify Convectron Gauge Zero Pressure Simulator output signal by measuring voltage across pins 1 and 3. Insert the prods of a calibrated digital voltmeter through the two holes in the Zero Pressure Simulator gauge shield and contact pins 1 and 3. With the Simulator gauge connected to the operating system depress the switch and observe the voltage reading. Pin 1 should read +.375 volts DC with respect to pin 3. A reading of +.373 VDC to +.377 VDC is acceptable, otherwise replace unit.

3) Verify Gauge Cable continuity by reading the resistance of each wire.

4) Verify Controller Unit calibration by adjusting zero and atmosphere values.Disconnect the gauge tube from the Vacuum Drying system, if connected, and connect the Zero Pressure Simulator in its place. The reading obtained when the Simulator switch is not depressed is of no significance. Depress the momentary pushbutton switch and observe the controller zero indication. Set the readout to zero by adjusting the VAC potentiometer CW until a positive pressure is displayed, then slowly rotate the potentiometer CCW until zero reading is obtained. Continued further rotation will result in the range LED turning off indicating miss adjustment. The optimum setting is when the range LED just lights, or is flashing. Remove the Zero Pressure Simulator from the system and reconnect the gauge tube.

   Calibrate the gauge tube and master gauge to standard atmospheric conditions by allowing the system pressure to rise to atmospheric pressure. Adjust the ATM potentiometer until the pressure indication agrees with the absolute atmospheric pressure as read on the master gauge.

   Failure to be able to adjust either of the potentiometers indicates that the controller unit is malfunctioning. Take a reading of the gauge tube and master gauge.

c. Perform load testing of the cask lid handle. Perform this test only if the packaging must comply with the requirements of NUREG-0612, "Control of Heavy Loads at Nuclear Power Perform load testing of the cask lid handle. Perform this test only if the packaging must comply with the requirements of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plant."

1.0 Establishing Baseline Measurements. See sketch below.

1.1 Place straight edge across the Model 2000 cask top at the corresponding marks. Lid shall be installed and apply a torque of 690 ft-lbs (lubricated) to the lid bolts.

1.2 Measure the distance between the top surface of the lid to the bottom surface of the straight edge using at each marked point on the straight edge.

1.3 Record each value in the table provided below as well as the ID number of the device and its calibration due date.

2.0 Load Test of the Lid Handler.

2.1 Attach lid handler tool to the Lid Handler.

2.2 Attach lid handler tool a dynamometer.

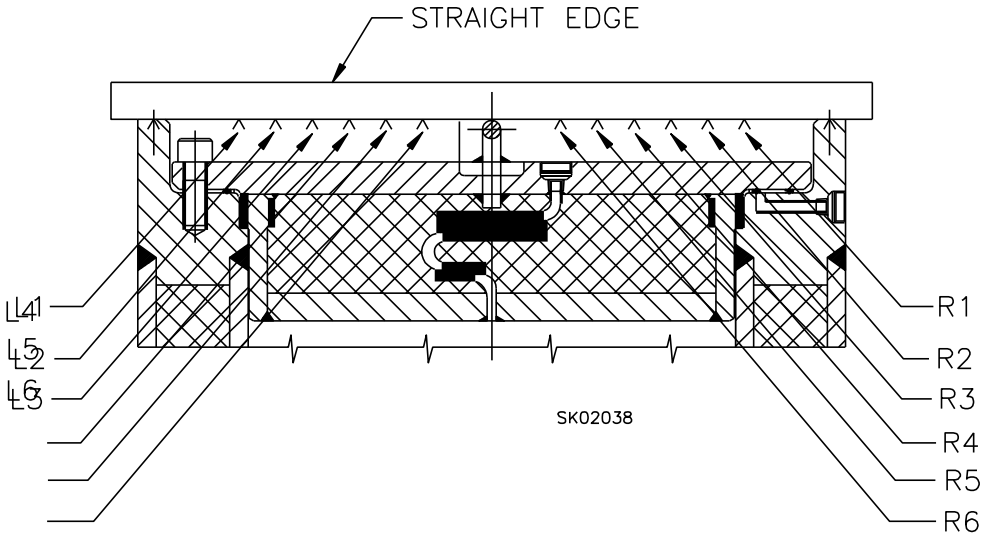
2.3 Apply a load of 5750 lbs □ 50 lbs. Use a manual chain hoist to apply the load.

2.4 Hold load for at least 10 minutes.

2.5 Record applied load, dynamometer ID number and its calibration due date.

3.0 Post Calibration Measurements

3.1 Repeat steps 1.1 through 1.3 above.



DATA SHEET		**Date:**
Point	**Baseline Measurements**	**Post Load Test Measurements**
L1		
L2		
L2		
L4		
L5		
L6		
R1		
R2		
R3		
R4		
R5		
R5		
	Measured By: _____ Witness By: _____	Measured By: _____ Witness By: _____

LOAD TEST	**DATE:**
Dynamometer ID:	Calib. Due Date:
Applied Load of:	At : (hh:mm)
Removed Load At:	(hh:mm)
Performed By: _____ Witness By: _____	