


**CHEM-NUCLEAR SYSTEMS, LLC**

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Mr. E. William Brach, Director  
 Spent Fuel Project Office  
 Office of Nuclear Material Safety and Safeguards  
 U.S. Nuclear Regulatory Commission  
 Washington, DC 20555

August 23, 2000  
 579-058-00

Dear Mr. Brach:

**SUBJ: SAFETY ANALYSIS REPORT FOR MODEL NO. 8-120B, REV. 4**

Chem-Nuclear Systems respectfully submits the enclosed application for the subject revision to the Safety Analysis Report (SAR) for the CNS 8-120B Certificate of Compliance No. 9168.

The primary purpose of this proposed amendment is to request permission to add four tapped holes to the primary lid of the Cask in the vicinity surrounding the cask vent port. These blind holes will be used to facilitate leak testing the Stat-O-Seal that resides in the vent port. Based on their location and depth size, the addition of these holes will have a minimum impact on the cask's shielding effectiveness while enhancing the efficiency of the test process. Drawing No. C-110-E-0007, included herein, has been revised to depict the location of the holes.

Also included in this submittal are some editorial changes to Sections 4.0 (Containment), 7.0 (Operating Procedure) and 8.0 (Acceptance Tests and Maintenance) of the SAR to correct typographical errors and to provide additional information or clarification to the text. These changes are summarized below.

- Section 4.1.2: revised text to more accurately describe the cask's containment boundary penetrations.
- Section 7.1: added steps describing the removal of the secondary lid.
- Section 7.2: moved note specifying the minimum angle of the lifting cables.
- Section 8.1.3: added information pertaining to the annual leak testing of the vent port penetration and the drain line and corrected typographical errors.
- Section 8.2.1: revised to eliminate the phrase, "large quantity LSA".
- Sections 8.2.1.1 and 8.2.1.2: revised to state that "bolt" (8.2.1.1) and "seal" (8.2.1.2) inspections were required upon removal of the component from the cask.
- Section 8.2.2.2: reworded to eliminate the phrase, "large quantity LSA" and revised to include assembly verification leak testing of the vent port and drain port penetrations, if they have been removed during the loading operation.

No change to packaging contents is being requested.

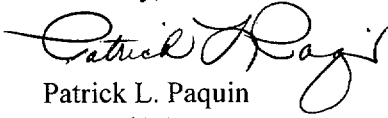
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Mr. Mr. E. William Brach

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If you or members of your staff have any questions about the application, or wish to arrange a meeting to discuss the changes we have requested, please feel free to contact Shayne Merritt at (803) 758-1838.

Sincerely,

A handwritten signature in black ink, appearing to read "Patrick L. Paquin". The signature is fluid and cursive, with a large initial "P" and "L".

Patrick L. Paquin  
General Manager

Attachments:

- (1) Directory of Changes for Incorporating Revision 4 CNS 8-120B Safety Analysis Report
- (2) Revision 4 Change Pages
- (3) Drawing No. C-110-E-0007 Revision 9

**Attachment One**

## INDEX OF REVISIONS FOR CNS 8-120B CASK SAFETY ANALYSIS REPORT

### REMOVE FROM REVISION 3

COVER PAGE

PAGES 4-1 AND 4-2

PAGES 7-1 THROUGH 7-5

PAGES 8-1 THROUGH 8-6

Drawing # C-110-E-0007 Rev. H

### INSERT REVISION 4 REPLACEMENT

COVER PAGE

PAGES 4-1 AND 4-2

PAGES 7-1 THROUGH 7-5

PAGES 8-1 THROUGH 8-5

Drawing # C-110-E-0007 Rev. 9

**Attachment Two**

# SAFETY ANALYSIS REPORT

For

MODEL CNS 8-120B TYPE B SHIPPING PACKAGING

REVISION 4

August, 2000

Submitted by:

Chem-Nuclear Systems, LLC  
140 Stoneridge Dr.  
Columbia, S.C. 29210

## 4.0 Containment

This chapter describes the containment configuration of the Model CNS 8-120B Package for Normal Transport and Hypothetical Accident Conditions.

### 4.1 Containment Boundary

#### 4.1.1 Containment Vessel

The package containment vessel is defined as the inner shell of the shielded transport cask, together with the associated lid, o-ring seals and lid closure bolts. The inner shell of the cask or containment vessel consists of a right circular cylinder of 62 inches inner diameter and 75 inches inside height. The shell is fabricated of  $\frac{3}{4}$ " thick carbon steel plate, ASTM A516-70. At the base, the cylindrical shell is attached to a circular end plate with full penetration welds. The primary lid is attached to the cask body with twenty (20) equally spaced 2-8 UN bolts. A secondary lid covers a 29" opening in the primary lid and is attached to the primary lid using twelve (12) equally spaced 2-8 UN bolts. See Section 4.1.4 for closure details.

#### 4.1.2 Containment Penetration

There are four penetrations of the containment vessel. These are (1) the optional drain line; (2) the primary lid with the containment boundary of the primary lid's inner o-ring; (3) the secondary lid with the containment boundary of the secondary lid's inner o-ring; and (4) the cask vent port located in the primary lid. Located at the cask base, the drain line consists of a 2" diameter steel rod drilled to 0.75 inches diameter penetrating into the second 3-1/4" layer of steel that forms the cask bottom. A 0.63" DIA. hole, drilled at a right angle, opens on the side of the outer shell near the cask bottom. A vent port penetrates the primary lid into the main cask cavity. The vent and drain penetrations are sealed with Parker Stat-O-Seals or equivalent. The primary and secondary lids are sealed with Parker silicone o-rings or equivalent.

#### 4.1.3 Welds and Seals

The containment vessel is fabricated using full penetration groove welds. Seals are described in Sections 4.1.2 and 4.1.4.

#### 4.1.4 Closure

The primary lid closure consists of two 3-1/4" thick laminated plates, stepped to fit over and within the top edge of the cylindrical body. The lid is supported at the perimeter of the cylindrical body by a 3" thick plate (bolt ring) welded to the top of the inner and outer cylindrical body walls. This plate contains a 14-gauge stainless steel ring at a location which corresponds to the sealing surface for the o-rings mounted in the lid. The lid is attached to the cask body by twenty (20) equally spaced 2-8 UN bolts. These bolts are torqued to 500 ft-lbs  $\pm$  10 % (lubricated). Two (2) solid, high temperature silicone o-rings are retained in machined grooves at the lid perimeter. Groove dimensions prevent over-compression of the o-rings by the closure bolt pre-load forces and hypothetical accident impact forces. The cask is fitted with a secondary lid of similar construction attached to the primary lid with twelve (12) equally spaced identical bolts. The secondary lid is also sealed with two (2) solid, high temperature silicone o-rings in machined grooves.

The vent, test ports, and drain penetrations are sealed with Parker Stat-O-Seals, which are used beneath the heads of the hex head cap screws. Table 4.1.4 gives the torque values for the cap screws.



## 7.0 OPERATING PROCEDURE

This chapter describes the general procedure for loading and unloading of the CNS 8-120B Cask.

### 7.1 Procedure for Loading the Package

7.1.1 Loosen and disconnect ratchet binders from upper overpack.

7.1.2 Using suitable lifting equipment, remove upper overpack assembly. Care should be exercised to prevent damage to overpack during handling and storage.

7.1.3 Determine if cask must be removed from trailer for loading purposes. To remove cask from trailer:

7.1.3.1 Disconnect cask to trailer tie-down equipment.

7.1.3.2 Attach cask lifting ears and torque bolts to 200 ft-lbs  $\pm$  20 ft-lbs lubricated.

7.1.3.3 Using suitable lifting equipment, remove cask from trailer and the lower overpack and place cask in level loading position.

NOTE: The cables used for lifting the cask must have a true angle, with respect to the horizontal of not less than 60°.

NOTE: In certain circumstances, loading may be accomplished through the secondary lid; while the primary lid remains on the cask. Alternate "(A)" steps have been included to accommodate this situation.

7.1.4 Loosen and remove the twenty (20) bolts which secure the primary lid to cask body.

7.1.4.A Loosen and remove the twelve (12) bolts which secure the secondary lid to the primary lid.

NOTE: The cables used for lifting either lid must have a true angle, with respect to the horizontal, of not less than 45°.

7.1.5 Remove primary lid from cask body using suitable lifting equipment. Care should be taken during lid handling operations to prevent damage to cask or lid seal surfaces.

7.1.5.A Remove secondary lid from cask body using suitable lifting equipment. Care should be taken during lid handling operations to prevent damage to cask or lid seal surfaces.

7.1.6 Inspect cask interior for damage, loose materials or moisture. Clean and inspect seal surfaces. Replace seals when defects or damage is noted which may preclude proper sealing.

NOTE: In the case of not having package designs with the optional drain line, radioactively contaminated liquids may be pumped out or removed by use of an absorbent material. Removal of any material from inside the cask shall be performed under the supervision of qualified health physics personnel with the necessary H.P. monitoring and radiological health safety precautions and safeguards.

7.1.7 Place disposable liner, drums or other containers into cask and install shoring or bracing, if necessary, to restrict movement of contents during normal transport.

7.1.7.A Process liner as necessary, and cap using standard capping devices.

7.1.8 Clean and inspect lid seal surfaces.

7.1.9 Replace and secure primary lid to cask body using the twenty (20) lid bolts torqued, using a star pattern, to 500 ft-lbs  $\pm$  50 ft-lbs lubricated.

7.1.9.A Replace and secure the secondary lid to the primary lid using the twelve(12) lid bolts torqued, using a star pattern, to 250 ft-lbs  $\pm$  25 ft-lbs lubricated.

NOTE: Leak test the secondary and primary lids' o-ring annuli (even if removal was not performed) in accordance with Section 8.2.2.2, prior to shipment of the package loaded with greater than "Type A" quantities of radioactive material. The vent port shall be leak tested in accordance with Section 8.2.2.2 if it has been removed. For content exemptions of this

test, refer to the current Certificate of Compliance  
No. 9168.

- 7.1.10 If cask has been removed from trailer, proceed as follows to return cask to trailer:
  - 7.1.10.1 Using suitable lifting equipment, lift and position, cask into lower overpack on trailer in the same orientation as removed.
  - 7.1.10.2 Unbolt and remove cask lifting ears.
  - 7.1.10.3 Reconnect cask to trailer using tie-down equipment.
- 7.1.11 Using suitable lifting equipment, lift, inspect for damage, and install upper overpack assembly on cask in the same orientation as removed.
- 7.1.12 Attach and hand tighten ratchet binders between upper and lower overpack assemblies.
- 7.1.13 Cover lift lugs as required.
- 7.1.14 Install anti-tamper seals to the designated ratchet binder.
- 7.1.15 Inspect package for proper placards and labeling.
- 7.1.16 Complete required shipping documentation.
- 7.1.17 Prior to shipment of a loaded package, the following shall be confirmed:
  - (a) That the licensee who expects to receive the package containing materials in excess of Type A quantities specified in 10 CFR 20.205(b) meets and follows the requirements of 10 CFR 20.205. as applicable.
  - (b) That trailer placarding and cask labeling meet DOT specifications (49 CFR 172).
  - (c) That all radiation and surface contamination levels are within the limits of the applicable Federal Regulations.
  - (d) That all anti-tamper seals are properly installed.

## 7.2 Procedure for Unloading Package

In addition to the following sequence of events for unloading a package, packages containing quantities of radioactive material in excess of Type A quantities specified in 10 CFR 20.205(b) shall be received, monitored, and handled by the licensee receiving the package in accordance with the requirements of 10 CFR 20.205 as applicable.

- 7.2.1 Move the unopened package to an appropriate level unloading area.
- 7.2.2 Perform an external examination of the unopened package. Record any significant observations.
- 7.2.3 Remove anti-tamper seals.
- 7.2.4 Loosen and disconnect ratchet binders from the upper overpack assembly.
- 7.2.5 Remove upper overpack assembly using caution not to damage the cask or overpack assembly.
- 7.2.6 If cask must be removed from trailer, refer to Steps 7.1.3.
- 7.2.7 Loosen and remove the twenty (20) primary lid bolts.

NOTE: The cables used for lifting the lid must have a true angle. with respect to the horizontal of not less than 45 degrees.

- 7.2.8 Using suitable lifting equipment, lift lid from cask using care during handling operations to prevent damage to cask and lid seal surfaces.
- 7.2.9 Remove contents to disposal area.

NOTE: In the case of not having package designs with the optional drain line, radioactively contaminated liquids may be pumped out or removed by use of an absorbent material. Removal of any material from inside the cask shall be performed under the supervision of qualified health physics personnel with the necessary H.P. monitoring and radiological health safety precautions and safeguards.

7.2.10 Assemble package in accordance with loading procedure  
(7.1.8 through 7.1.16).

7.3 Preparation of Empty Packages for Transport

The Model CNS 8-120B cask requires no special transport preparation when empty. Loading and unloading procedures outlined in this chapter shall be followed as applicable for empty packages.

NOTE: Each package user will be supplied with a complete detailed operating procedure for use with the package

## 8.0 ACCEPTANCE TESTS AND MAINTENANCE

### 8.1 Acceptance Test

Prior to the first use of the CNS 8-120B package, the following tests and evaluations will be performed.

#### 8.1.1 Visual Examination

The package will be examined visually for any adverse conditions in materials or fabrication. Welds shall be examined for compliance to the drawings. Weld integrity shall be verified by visual examination and magnetic particle or dye penetrant. NDE examinations shall be performed by an ASME Certified inspector. Acceptance criteria for NDE shall be according to ASME Code Section III, Div. 1-Section NB5342 or NB5352 as applicable.

#### 8.1.2 Structural Tests

No structural testing is required.

#### 8.1.3 Leak Tests

This test shall be performed prior to acceptance and operation of a newly fabricated package in accordance with ASTM E-427 using a General Electric Model H-25 Leak Detector or equivalent. The detector sensitivity has a maximum sensitivity of  $1.65 \times 10^{-4} \frac{\text{OZ}}{\text{yr}}$ .

Calibration of the leak detector shall be made in conjunction with a General Electric Model LS-20 or equivalent calibrated leak standard. The setting corresponding to the approved leak test rate will be used.

All four containment boundary penetrations must be tested.

- The volume above the vent port Stat-O-Seal
- The volume between the drain line plug and interior of the cask
- The annulus between the o-ring seals of the primary lid
- The annulus between the o-ring seals of the secondary lid

All four of these volumes must be pressurized to 25 psig with pure dichlorodifluoromethane (R-12) or 1,1,1,2 – tetrafluoroethane (R-134a). Use the detector probe to “sniff” the following areas:

- The vent port penetration on the underside of the primary lid

- Around the head of the cap screw that plugs the drain line
- Interior side of the inner o-ring for the primary lid
- Interior side of the inner o-ring for the secondary lid

Leak detection shall be in accordance with the specifications of ASTM E-427.

Sensitivity at the test conditions is equivalent to the prescribed procedure sensitivity for leak tightness of  $1 \times 10^{-6} \frac{\text{atm} \cdot \text{cm}^3}{\text{s}}$ , based on dry air at standard conditions as defined in ANSI N14.5-1987 (See Sections 4.5 or 4.6 of the SAR for the determination of the test conditions). Any condition, which results in leakage in excess of this value, shall be corrected.

#### 8.1.4 Component Tests

Gaskets and seals will be procured and examined in accordance with the CNS Quality Assurance Program.

#### 8.1.5 Test for Shielding Integrity

Shielding integrity of the package will be verified by gamma scan or gamma probe methods to assure the package is free of significant voids in the poured lead shield annulus. All gamma scanning will be performed on a 4-inch square or less grid system. The acceptance criteria will be that voids resulting in shield loss in excess of 10 % of the normal lead thickness in the direction measured shall not be acceptable.

#### 8.1.6 Thermal Acceptance Tests

No thermal acceptance testing will be performed on the CNS 8-120B package. Refer to the Thermal Evaluation, Section 3.0 of the report.

### 8.2 Maintenance Program

CNSI is committed to an ongoing preventative maintenance program for all shipping packages. The 8-120B package will be subjected to routine and periodic inspections and tests as outlined in this section and CNSI approved procedures.

#### 8.2.1 Routine Maintenance

Unless noted otherwise, for loaded packages containing material greater than "Type A" quantities, each of the following safety related items and functional features shall be visually examined for defects or replacement. Corrective action for defects shall be as noted.

#### 8.2.1.1 Fasteners

The primary and secondary lid bolts shall be visually inspected for defects whenever it is necessary to remove them. Obtain replacement bolts as specified on CNSI Drawing No. C-110-E-0007 (current revision) for any bolts that show cracking or other visual signs of distress.

The cap screws for the vent port, test ports and drain shall be visually inspected for defects whenever it is necessary to remove them. Obtain replacement cap screws as specified on CNSI Drawing No. C-110-E-0007 (current revision) for any cap screws that show cracking or other visual signs of distress.

#### 8.2.1.2 Gaskets and Seals

##### (A) Primary Lid Seals

The primary lid o-ring seals shall be visually inspected (at any time it is necessary to remove the primary lid) for serviceability ensuring that they are in the proper position and free of cracks, tears, cuts, or discontinuities which may prevent them from sealing properly. The seal seating surfaces shall be visually inspected to ensure that they are free of damage, dirt, gravel, or any foreign matter which might damage the seals. If any defects are detected, the seals shall be replaced and/or the seal seating surfaces shall be reworked as necessary to ensure that the lid will seal properly.

##### (B) Secondary Lid Seals

The secondary lid o-ring seals and seating surfaces shall be inspected as specified in Section 8.2.1.2(a) at any time it is necessary to remove the secondary lid. Seal replacement and/or seating surface repair shall be as specified in Section 8.2.1.2(a) if any defects are detected.

##### (C) Test/Vent Ports and Drain Seals



The above seals and seating surfaces shall be inspected as specified in Section 8.2.1.2(a) at any time it is necessary to remove them. Seal replacement and/or seating surface repair shall be as specified in Section 8.2.1.2(a) if any defects are detected.

#### 8.2.1.3 Painted Surfaces, Identification Markings, and Match Marks Used for Closure Orientation.

The above items shall be visually inspected to ensure that painted surfaces are in good condition, identification markings are legible, and that match marks used for closure orientation remain legible and are easy to identify.

### 8.2.2 Periodic Maintenance

The following inspections and/or tests shall be performed as specified.

#### 8.2.2.1 Periodic Leak Tests

The package will be leak tested as described in Section 8.1.3 after its third use. In addition, the containment system, before actual use for shipment, shall have been leak tested according to Section 8.1.3 within the preceding 12-month period.

Also, before actual use for shipment, all seals shall have been replaced within the preceding 12-month period.

#### 8.2.2.2 Assembly Verification Leak Test

This test is required for any shipment of material that is greater than a "Type A" quantity of radioactive material. For content exemptions of these tests, refer to the current Certificate of Compliance No. 9168. The test will verify that the containment system has been assembled properly.

The test will be performed by pressurizing the annulus between the o-ring seals of the primary and secondary lids with air.

In addition, prior to shipment, the vent and drain ports shall be tested by pressurizing the volume above the respective

plug and stat-o-seal, anytime they have been removed during the cask loading operation.

The test shall be performed using a pressure gauge, readable without estimation and calibrated to a maximum error of 1 % of full scale.

The test pressure shall normally be 18 psig (up to 20 psig) and the test shall last for 1 hour. The allowable pressure drop shall be 1 psi. Any condition which results in a pressure drop of more than 1 psi will be corrected.

Sensitivity at the test conditions is equivalent to the prescribed procedure sensitivity of  $5 \times 10^{-4} \frac{\text{atm} \cdot \text{cm}^3}{\text{sec}}$  based on dry air at standard conditions as defined in ANSI N14.5-1987 (see Section 4.4 for the determination of the test conditions).

#### 8.2.3 Subsystem Maintenance

The CNS 8-120B package contains no subsystem assemblies.

#### 8.2.4 Valves, Rupture Discs, and Gaskets on Containment Vessel

As a minimum, all seals will be replaced prior to the annual leak test specified in 8.2.2.1.

#### 8.2.5 Shielding

No shielding tests will be performed after acceptance testing unless damage has required repairs affecting shield integrity. Any shield testing which might be required would be in accordance with the original criteria specified in Section 8.1.5.

**Attachment Three**

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THE RECORD TITLED:  
C-110-E-0007, Rev. 9, SHEET 1 of 3:  
CNSI 8-120B SHIPPING CASK  
WITHIN THIS PACKAGE...OR,  
BY SEARCHING USING THE  
DRAWING NUMBER:  
C-110-E-0007, Rev. 9, SHEET 1 of 3**

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C-110-E-0007, Rev. 9, SHEET 2 of 3**

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