

71-5805



CHEM-NUCLEAR SYSTEMS, LLC

140 Stoneridge Drive • Columbia, South Carolina 29210 • (803) 256-0450

January 23, 2001
E&L-017-01

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

**REFERENCE: (1) DECEMBER 05, 2000 LETTER (579-229-00) TO E. WILLIAM BRACH, USNRC,
FROM PATRICK L. PAQUIN, CHEM-NUCLEAR SYSTEMS
(2) JANUARY 22, 2001 TELEPHONE CONVERSATION BETWEEN STEPHEN O'CONNER,
USNRC AND SHAYNE MERRITT, CHEM-NUCLEAR SYSTEMS**

Dear Mr. Brach:

**SUBJECT: SUPPLEMENTAL SUBMITTAL FOR CHEM-NUCLEAR SYSTEMS' PROPOSED REVISION 1
TO THE MODEL NO. 3-55 SAFETY ANALYSIS REPORT (USA/5805/B)**

Chem-Nuclear Systems respectfully submits the enclosed attachments for Revision 1 (Reference 1) to the Safety Analysis Report (SAR) for the CNS 3-55 Certificate of Compliance No. 5805.

Chapters 7 and 8 have been revised as requested per conversation with Mr. O'Conner (Reference 2).

Please replace Chapters 7, 8, and the Table of Contents in Reference 1 with the corresponding documents attached to this letter.

No change to packaging contents is being requested.

If you or members of your staff have any questions about this revision, or wish to arrange a meeting to discuss the changes we have requested, please feel free to contact me at (803) 758-1824.

Sincerely,

J. Shayne Merritt for Patrick L. Paquin

Patrick L. Paquin
General Manager
Engineering and Licensing

Attachments: 1 - Revision 1 of Chapter 7 of the CNS 3-55 Safety Analysis Report
2 - Revision 1 of Chapter 8 of the CNS 3-55 Safety Analysis Report
3 - Revision 1 Table of Contents

NMSSO1public

ATTACHMENT 1

**Revision 1 of Chapter 7 of the CNS 3-55 Safety
Analysis Report**

7.0 OPERATING PROCEDURES

This chapter describes the general procedure for loading and unloading of the CNS 3-55 cask.

7.1 Procedure for Loading the Package

NOTE: WHEN DEPLETED NEUTRON SOURCES ARE TO BE LOADED IN THE CASK, ACTIVATION ANALYSIS MUST BE PERFORMED TO ENSURE SECTION 4 LIMITS ARE NOT EXCEEDED.

7.1.1 Remove the sunshade/personnel barrier, if used, from the cask by removing the twelve (12) bolts that attach the frame to the trailer and lifting it off using the crane.

7.1.2 Prepare to remove the hold-down straps.

NOTE: THE HOLD-DOWN STRAPS MUST BE MATCH-MARKED TO THE CRADLE BEFORE REMOVAL.

7.1.2.1 Remove the sixteen (16) 1¼-inch by 5-inch bolts that secure the two straps to the cradle. Retain the bolts for re-installation.

7.1.2.2 Match mark the hold-down straps as to left and right.

7.1.2.3 Attach a lifting sling to the lifting lug on one of the hold-down straps.

7.1.2.4 Attach the crane hook to the sling, if necessary.

7.1.2.5 Remove the hold-down strap and detach the lifting sling.

7.1.2.6 Repeat Steps 7.1.2.3 – 7.1.2.5 to remove the other hold-down strap.

7.1.3 Attach the 4-inch removable trunnions to the cask. Tighten the bolts until snug, then tighten an additional ¼ turn.

7.1.4 Remove the impact absorbers from the cask lifting trunnions by removing the four bolts from each impact absorber. Retain these bolts for re-installation.

NOTE: THE “WOOD PLANK” METHOD AND “TURNING CRADLE” METHOD ARE BOTH ACCEPTABLE METHODS FOR UP ENDING AND DOWN ENDING THE CASK. THE STEPS FOR THE “WOOD PLANK” METHOD ARE DESIGNATED WITH THE LETTER “A”, WHILE “B” DESIGNATES THE “TURNING CRADLE” METHOD.

7.1.5A Transfer of cask from trailer cradle and lift the cask in a horizontal position using the “wood plank” method.

NOTE: AT LEAST SIXTEEN (16) INCHES OF WOOD MUST BE PLACED BETWEEN THE CASK AND THE LOADING SURFACE.

- 7.1.5.1A Place the two (2) slings around the cask and attach them to the large crane hook.

NOTE: ONE SLING MUST BE POSITIONED AHEAD (TOWARD THE CASK BELL END) OF THE LIFTING TRUNNIONS, AND THE OTHER SLING MUST BE POSITIONED BEHIND (TOWARD THE CASK CLOSURE END) THE REMOVABLE TRUNNIONS. USE THE SLINGS PROVIDED.

- 7.1.5.2A Lift the cask in a horizontal position, lower it onto the wood blocks, and chock it so that it will not roll.

- 7.1.5.3A Remove the slings from the crane hook and lay back out of the way.

- 7.1.5B Transfer of cask from trailer cradle and lift the cask in a horizontal position using the "turning cradle" method.

- 7.1.5.1B Place the two slings around the cask and attach them to the crane hook.

NOTE: ONE SLING MUST BE POSITIONED AHEAD (TOWARD THE CASK BELL END) OF THE LIFTING TRUNNIONS, AND THE OTHER SLING MUST BE POSITIONED BEHIND (TOWARD THE CASK CLOSURE END) THE REMOVABLE TRUNNIONS. USE THE SLINGS PROVIDED.

- 7.1.5.2B Lift the cask in a horizontal position and lower it onto the turning cradle.

- 7.1.5.3B Remove the slings from the crane hook and lay back out of the way.

- 7.1.6 Prepare to remove the impact limiters from the end of the cask.

- 7.1.6.1 Remove the six (6) ¾-inch bolts that secure the impact limiters to the bell section end of the cask.

- 7.1.6.2 Attach a lifting sling to the eyebolts on the impact limiter.

- 7.1.6.3 Attach a lifting sling to the crane hook.

- 7.1.6.4 Slide off the impact limiter and detach the lifting sling.

- 7.1.6.5 Remove the six (6) nuts from the six (6) installation bolts on the base plate end of the cask. Slide the bolts out and retain them for re-installation.

- 7.1.6.6 Attach a lifting sling to the eyebolts on the impact limiter.

- 7.1.6.7 CAREFULLY remove the impact limiter by sliding it off.

7.1.6.8 Remove the six (6) reinforcing blocks and retain them for re-installation.

NOTE: THE "WOOD PLANK" METHOD AND "TURNING CRADLE" METHOD ARE BOTH ACCEPTABLE METHODS FOR UP ENDING AND DOWN ENDING THE CASK. THE STEPS FOR THE "WOOD PLANK" METHOD ARE DESIGNATED WITH THE LETTER "A", WHILE "B" DESIGNATES THE "TURNING CRADLE" METHOD.

7.1.7A Upright the cask using the "wood plank" method.

7.1.7.1A Attach the lifting slings (two) to the appropriate crane hook.

7.1.7.2A Transfer the cask in horizontal position from staging pallets to wood staging pallet. Assure cask will not roll by using chocks.

7.1.7.3A Remove the slings and lay back out of the way.

7.1.7.4A Attach the large crane hook to the lifting yoke.

7.1.7.5A Attach the lifting yoke to the cask lifting trunnions.

7.1.7.6A With the yoke on the large crane hook, start uprighting the cask. Periodically, as the cask is being uprighted, the crane will have to trolley in the direction of cask lift for a smooth transition.

7.1.7.7A Rotate the cask upward until the cask is vertical.

7.1.7.8A With the cask in vertical position and stabilized, move the cask to a predesignated staging area.

7.1.7B Upright the cask using the "turning cradle" method.

7.1.7.1B Place the slings on the large crane hook.

7.1.7.2B Attach the 3-55 primary lifting yoke to the slings.

7.1.7.3B Attach the 3-55 primary lift yoke to the lift trunnions with the open side of the hook toward the outboard end of bell section.

NOTE: THE 3-55 CASK TURNING TRUNNIONS SHOULD NOT SUPPORT THE FULL WEIGHT OF THE LOADED CASK. USE CAUTION WHEN ROTATING CASK THAT THE FULL LOADED WEIGHT OF THE CASK IS NOT BROUGHT TO BEAR ON THE TURNING TRUNNIONS.

NOTE: ENSURE CRANE CABLES, CRANE HOOK, AND PRIMARY YOKE AT 0 DEGREES FROM VERTICAL AT THE BEGINNING OF CASK ROTATION. DURING LIFT TROLLEY CRANE AS NECESSARY TO ASSURE A SMOOTH TRANSITION OF CASK TO A VERTICAL

POSITION (AT NO TIME ALLOW THE CABLE AND YOKE TO BE MORE THAN 20 DEGREES OFF OF VERTICAL POSITION).

- 7.1.7.4B With the primary yoke in place, slowly rotate cask to upright position.
- 7.1.7.5B Raise cask slowly to just clear cask turning trunnions above turning cradle bearings (approximately 6") then traverse crane horizontal to clear cradle uprights and cask base plates prior to any further lift on cask.
- 7.1.7.6B With cask clear of turning cradle, move the cask to pre-designated staging area.
- 7.1.8 Remove the cask drain plug relief valve and prepare to collect contaminated water, if necessary. Remove the cask vent plug at the top of the cask by removing the four (4) ½-inch bolts that hold it in place.
- 7.1.9 Remove the removable trunnions from the cask and retain them for re-installation.
- 7.1.10 Prepare to remove the cask base plate.

NOTE: COUNT THE NUMBER OF TURNS IT TAKES TO REMOVE THE (4) TAPERED LEAD-IN BOLTS AND RECORD THIS NUMBER FOR FUTURE REFERENCE.

- 7.1.10.1 Remove the eight (8) 1½-inch bolts on the cask base plate and the four (4) tapered lead-in bolts from the flange.
- 7.1.10.2 Visually inspect the bolts for any structural defects such as cracks or unusual signs of distress. Replace bolt if threads or bolt head is damaged.
- 7.1.10.3 With the lifting yoke attached to the crane and the upper trunnions, raise the cask bell section clear of the base plate and set it aside on wood blocks. While the bell is being removed, check the cask interior for radiation fields (check that shield ring is in place on base closure plate).

NOTE: RADIOACTIVELY CONTAMINATED LIQUIDS MAY BE 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 (HP) PERSONNEL WITH THE NECESSARY HP MONITORING AND RADIOLOGICAL HEALTH SAFETY PRECAUTIONS AND SAFEGUARDS.

- 7.1.10.4 Inspect the O-Ring seals and the guide pins on base plate, and the o-ring and gasket on vent plug for damage. The seals must be replaced with new seals if inspection shows any defects or at least every six (6) months, as required by Section 8.2.4.

NOTE: WHEN O-RINGS ARE REPLACED, LEAK TESTING IS REQUIRED AS SPECIFIED IN SECTION 8.2.2.1.

7.1.10.5 Place the cask bell section back on the base plate and fasten the bell section to the base plate with four tapered lead-in bolts on the flange. Tighten the bolts firmly but do not torque them down.

7.1.11 Attachment of the Redundant Lifting Device (if required)

7.1.11.1 Remove the cask lifting yoke.

7.1.11.2 Thread one nut onto each end of each threaded rod, such that the nuts are approximately twelve (12) inches from the ends of the rods.

7.1.11.3 Install the threaded rods downward through the holes in the cask bell flange.

7.1.11.4 Lift the threaded washer in place under lower flange of cask bell flange, and turn threaded rod into threaded washer until two (2) full threads are exposed

7.1.11.5 Turn the nut on the lower end of the threaded rod downward until the threaded washer is in firm contact with lower flange of cask bell flange and nut is in firm contact with upper flange of cask bell flange.

7.1.11.6 Rotate the stabilizing band with the small crane or a jib crane so that the cut-out areas are directly above the cask lifting trunnions.

7.1.11.7 Place the stabilizing band over the threaded rod ends.

7.1.11.8 Position the stabilizing band at the top end of the cask so that the flat part of the band (the top) is at the same level as the top of the cask.

7.1.11.9 Place the spreader bar over the threaded rod ends which penetrate the stabilizing band.

7.1.11.10 Thread a 1-1/2-inch nut onto the top of each threaded rod.

7.1.11.11 If cask-lifting device has been removed, re-attach the cask lifting yoke and redundant slings to the overhead crane.

7.1.11.12 Lower the yoke over the cask and raise the yoke until contact is made between the hooks of the yoke, and the cask lifting trunnions. DO NOT lift the cask.

- 7.1.11.13 **Connect the redundant slings to the spreader bar and tighten the turnbuckles.**
- 7.1.12 **Prepare to place the cask into the pool.**
 - 7.1.12.1 **SLOWLY lower the cask into the pool, allowing time for the cask to fill with water. Allow approximately 30 minutes for the cask to fill.**
 - 7.1.12.2 **Locate the position of the yoke in two directions 90° apart. Mark these points on the side of the pool for repositioning of the crane.**
 - 7.1.12.3 **Confirm that the markings for alignment of the cask base plate and the flange on the bell section are visible.**
 - 7.1.12.4 **Using the remote tool, unbolt the four (4) 1½-inch tapered lead-in bolts from the flange on the cask bell section.**
 - 7.1.12.5 **Lift the cask bell section out of the pool and place it on cribbing in the laydown area, if necessary.**
- 7.1.13 **Load the liner or basket onto the cask base plate.**
- 7.1.14 **Prepare to lift the cask out of the pool.**
 - 7.1.14.1 **Position the cask bell section in the exact location as when it was removed from the pool.**
 - 7.1.14.2 **Lower the cask bell section into the pool, aligning the base plate with the bell section by using the guide pins and alignment marks.**
 - 7.1.14.3 **To ensure exact alignment, watch with binoculars as the flange on the bell section makes contact with the base plate. If the bell and base plate are properly aligned, the four tapered lead-in bolts that are dangling from the flange will rise about one inch on contact. After alignment has been confirmed, rest the bell section on the base plate.**
 - 7.1.14.4 **Secure the base plate to the cask by tightening the four (4) tapered lead-in bolts with the special tool. The bolts are in painted locations.**
 - 7.1.14.5 **Lift the cask out of the pool so that the drain clears the pool surface and allow water to drain into the pool. This will require that the cask remains suspended over the pool for about 45 minutes.**
- 7.1.15 **Prepare to decontaminate the cask.**
 - 7.1.15.1 **While the cask is suspended over the pool, hose it and the lifting device with demineralized water.**
 - 7.1.15.2 **Move the cask to a laydown area and set it down in the vertical position.**

- 7.1.15.3 Re-inspect vent plug gasket and O-ring, then install the cask vent plug. Torque bolts to 50 ft-lbs. (\pm 5 ft-lbs.). Attach anti-tamper seals to the vent plug bolts.
- 7.1.15.4 Apply pipe thread sealant to the drain plug relief valve and install and torque to 12 ft-lbs. (\pm 1 ft-LB).
- 7.1.15.5 Scrub the cask with soapy water to decontaminate.
- 7.1.16 Removal of the Redundant Lifting Device
 - 7.1.16.1 Confirm that the cask is resting securely on the floor.
 - 7.1.16.2 Remove the redundant slings.
 - 7.1.16.3 Remove the cask yoke from the lifting trunnions.
 - 7.1.16.4 Remove the cask yoke from the overhead crane, if necessary
 - 7.1.16.5 Remove upper nuts from threaded rods and remove spreader bar.
 - 7.1.16.6 Lift stabilizing band straight up off the cask.
 - 7.1.16.7 Loosen nut above cask bell flange, unscrew threaded rods from threaded washers and remove.
- 7.1.17 Replace the eight (8) 1½-inch base plate bolts. Torque all 12 base plate bolts to a lubricated value of 75 ft-lbs. (\pm 7 ft-lbs.).
 - 7.1.17.1 Prior to delivery of the package to a carrier for transport, the package containment cavity shall be leak tested. The sensitivity of the test shall be at least 1×10^{-1} ATM cm³/sec (STP) per Section 8.2.2.1.
- 7.1.18 Re-Install the removable trunnions.

NOTE: THE "WOOD PLANK" METHOD AND "TURNING CRADLE" METHOD ARE BOTH ACCEPTABLE METHODS FOR UP ENDING AND DOWN ENDING THE CASK. THE STEPS FOR THE "WOOD PLANK" METHOD ARE DESIGNATED WITH THE LETTER "A", WHILE "B" DESIGNATES THE "TURNING CRADLE" METHOD.

- 7.1.19A Prepare to return the cask to a horizontal position using the "wood plank" method.
 - 7.1.19.1A Attach primary lift yoke to large crane hook.
 - 7.1.19.2A Attach primary yoke to lift trunnions on the cask.
 - 7.1.19.3A Position cribbing appropriately.

NOTE: POSITION THE CASK ON THE WOODEN CRIBBING SO THE DRAIN LINE WILL BE ON THE TOP SIDE OF THE CASK AFTER THE CASK IS LAID IN THE HORIZONTAL POSITION ON THE CRIBBING.

7.1.19.4A **SLOWLY** lower the upper end of the cask onto the cribbing with the yoke until the cask is horizontal. The crane will have to trolley with the cask direction for smooth transition.

7.1.19.5A Lower the entire cask in a horizontal position onto wood blocks and chock it to prevent it from rolling.

7.1.19.6A Re-install the removable trunnions.

7.1.19.7A Place the slings two (2) under the cask and attach to the large crane hook.

7.1.19.8A Lift cask in horizontal position and place on wood cribbing.

7.1.19.9A Unhook the slings from the crane and lay back out of the way.

7.1.19B Prepare to return the cask to a horizontal position using the "turning cradle" method.

7.1.19.1B Reinstall removable trunnion and attach primary lift yoke to crane hook (if removed), then attach lift yoke to cask lift trunnions.

7.1.19.2B Move cask to turning cradle staging area.

7.1.19.3B Slowly lower cask to desired height to assure cask base plate will traverse between upright sections of turning cradle and cask turning trunnions are of sufficient height to clear turning table trunnion bearings.

7.1.19.4B Slowly move cask in a horizontal traverse direction to achieve alignment between cask turning trunnions and cask turning cradle bearings until a firm contact is made between cradle bearing and turning trunnion.

NOTE: THE 3-55 CASK TURNING TRUNNIONS SHOULD NOT SUPPORT THE FULL WEIGHT OF THE LOADED CASK. USE CAUTION WHEN ROTATING CASK THAT THE FULL LOADED WEIGHT OF THE CASK IS NOT BROUGHT TO BEAR ON THE TURNING TRUNNIONS.

7.1.19.5B Begin cask rotation to horizontal position. To assure a smooth transition in this operation, trolley crane in direction of rotation while lowering cask. Continue this operation to completion of cask rotation to horizontal position.

- 7.1.19.6B Remove the primary yoke from lift trunnion and remove yoke from large crane hook.
- 7.1.20 Prepare to replace the impact limiters on the bell section end of the cask.
 - 7.1.20.1 Attach a lifting sling to the eyebolts on the impact limiters.
 - 7.1.20.2 Attach the crane hook to the lifting sling.
 - 7.1.20.3 Position the impact limiter near the end of the cask.
 - 7.1.20.4 Align the six (6) tabs on the impact limiter with the six (6) bolt holes on the sides of the cask.
 - 7.1.20.5 Attach the six (6) $\frac{3}{4}$ -inch bolts that secure the impact limiter to the cask.
- 7.1.21 Prepare to replace the impact limiter on the base plate end of the cask.
 - 7.1.21.1 Attach a lifting sling to the eyebolts on the impact limiter.
 - 7.1.21.2 Attach the crane hook to the lifting sling.
 - 7.1.21.3 Position the impact limiter near the end of the cask.
 - 7.1.21.4 Place the six (6) 1-inch by 16-inch bolts through the sequentially numbered blocks, bolts facing the reverse direction, and attach the impact limiter loosely to the cask. Retain a spare bolt for next step in the procedure.
 - 7.1.21.5 When the six (6) bolts and blocks are aligned, slide the impact limiter CAREFULLY into place, reverse the bolts one by one using the spare bolt, and place nuts on the bolts.
 - 7.1.21.6 Tighten the nuts and attach wire seals to the impact limiter.
- 7.1.22 Prepare to replace the cask on the trailer.
 - 7.1.22.1 Remove the cask lifting yoke from the cask lifting trunnions and the crane hook.
 - 7.1.22.2 Attach the two (2) slings around the cask and attach them to the crane hook.

NOTE: ONE SLING MUST BE POSITIONED AHEAD (TOWARD THE CASK BELL END) OF THE LIFTING TRUNNIONS, AND THE OTHER SLING MUST BE POSITIONED BEHIND (TOWARD THE CASK CLOSURE END) OF THE REMOVABLE TRUNNIONS.

- 7.1.22.3 Raise the cask high enough to get the trailer under it.

- 7.1.22.4 Place the cask in the cradle.
- 7.1.22.5 Remove the slings and place them in the equipment box.
- 7.1.22.6 Remove the removable trunnions and place them in the equipment box.
- 7.1.23 Prepare to replace the hold-down straps.
 - 7.1.23.1 Attach the lifting sling to the lifting lug on the hold-down strap.
 - 7.1.23.2 Attach the crane hook to the lifting sling.
 - 7.1.23.3 Position the match-marked strap on the cradle using the alignment marks.
 - 7.1.23.4 Attach the eight (8) 1¼-inch by 5-inch bolts that secure the strap to the cradle.
 - 7.1.23.5 Detach the lifting sling from the hold-down strap.
 - 7.1.23.6 Repeat Steps 7.1.23.1 - 7.1.23.5 to replace the other hold-down strap.
- 7.1.24 Replace the lifting trunnion impact absorbers with four (4) bolts each.
- 7.1.25 Replace the sunshade/personnel barrier, if used, by attaching the twelve (12) bolts that secure the frame to the trailer.
- 7.1.26 Before the cask leaves the facility, the following shall be confirmed:
 - 7.1.26.1 That external lifting trunnions are properly covered or removed for transport.
 - 7.1.26.2 That trailer placarding and cask labeling meet DOT Specifications 49 CFR 172.500 and NRC Specification 10 CFR 71.85(c).
 - 7.1.26.3 The exterior radiation and contamination levels should meet the specification set forth in D.O.T. 49 CFR 173.441 and NRC 10 CFR 71.47 and 71.87. When depleted neutron sources are contained in the cask, perform measurement for neutrons.
 - 7.1.26.4 That the impact limiters are sealed with anti-tamper seals.
 - 7.1.26.5 That the drain plug relief valve has been installed using a pipe thread sealant and sealed with an anti-tamper seal.
 - 7.1.26.6 That the vent plug assembly is sealed with anti-tamper seals.

7.2 Procedure for Unloading the 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.

NOTE: Keep crane cables vertical at all times to prevent lateral movement of the cask. The cask shall be replaced on the trailer in the exact orientation as it was received.

7.2.1 Remove the sunshade/personnel barrier, if used, from the cask by removing the twelve (12) bolts that attach the frame to the trailer and lift it off using the appropriate crane.

7.2.2 Prepare to remove hold-down straps.

NOTE: THE HOLD-DOWN STRAPS MUST BE MATCH-MARKED TO THE CRADLE BEFORE REMOVAL.

7.2.2.1 Remove the seal wires and the sixteen (16) 1-¼-inch by 5-inch bolts that secure the two straps to the cradle. Retain the bolts for re-installation.

7.2.2.2 Match-mark the hold-down straps as to left and right.

7.2.2.3 Attach a lifting sling to the lifting lug on one of the hold-down straps.

7.2.2.4 Attach the crane hook to the sling, if necessary.

7.2.2.5 Remove the hold-down strap and detach the lifting sling.

7.2.2.6 Repeat Steps 7.2.2.3 – 7.2.2.5 to remove the other hold-down strap.

7.2.3 Attach the 4-inch removable trunnions to the cask, if necessary. Tighten the bolts until snug, then tighten an additional ¼ turn.

7.2.4 Remove the impact absorbers from the cask lifting trunnions by removing the four (4) bolts from each impact absorber. Retain these bolts for re-installation.

7.2.5 Prepare to lift the cask in a horizontal position.

7.2.5.1 Place the two (2) slings around the cask and attach them to the crane hook.

NOTE: ONE SLING MUST BE POSITIONED AHEAD (TOWARD THE CASK BELL END) OF THE LIFTING TRUNNIONS, AND THE OTHER SLING MUST BE POSITIONED BEHIND (TOWARD THE CASK CLOSURE END) OF THE REMOVABLE TRUNNIONS. USE THE SLINGS PROVIDED.

7.2.5.2 Lifting the cask in a horizontal position, lower it onto wood blocks, and chock it so that it will not roll.

- 7.2.6 Prepare to remove the impact limiters from the ends of the cask.
 - 7.2.6.1 Remove the six (6) ¾-inch bolts that secure the impact limiters to the bell section end of the cask.
 - 7.2.6.2 Attach a lifting sling to the eyebolts on the impact limiter.
 - 7.2.6.3 Attach the lifting sling to the crane hook.
 - 7.2.6.4 Slide off the impact limiter and detach the lifting sling.
 - 7.2.6.5 Remove the six (6) nuts from the six (6) installation bolts on the base plate end of the cask. Slide the bolts out and retain them for installation.
 - 7.2.6.6 Attach a lifting sling to the eyebolts on the impact limiter.
 - 7.2.6.7 CAREFULLY remove the impact limiter by sliding it off.
 - 7.2.6.8 Remove the (6) reinforcing blocks and retain them for re-installation.
- 7.2.7 Prepare to remove the cask base plate.
 - 7.2.7.1 Attach two (2) shackles to two (2) holes in the base plate where the shackles fit in.
 - 7.2.7.2 Attach the lifting sling to the shackles.
 - 7.2.7.3 Attach the lifting sling to the small crane.
 - 7.2.7.4 Remove the eight (8) 1-1/2-inch bolts and the four (4) tapered lead-in bolts from the cask. Retain them for re-installation.
 - 7.2.7.5 Reposition the cask so that the open end of the cask is over the disposal area of the trench.
 - 7.2.7.6 Attach a cable around the lifting trunnions and to a piece of heavy equipment to prevent movement of the cask.
 - 7.2.7.7 Remove the cask base plate and place it on or wrap it with absorbent material or plastic sheeting.
- 7.2.8 Prepare to remove the contents of the cask.
 - 7.2.8.1 Attach a hook-cable assembly to the basket or liner.
 - 7.2.8.2 Lead the throw-away cable assembly from the cask to a load-pulling winch or crane.

7.2.8.3 **SLOWLY** operate the puller so that the attached cable will pull the liner out of the cask. Continuous movement until the liner clears the cask and is in burial position in the trench.

7.2.9 Reposition the cask onto the wood blocks.

7.2.10 Survey the interior of the cask for radiation/contamination levels. Decontaminate if acceptable levels are exceeded.

CAUTION: TREAT ANY LIQUID IN THE CASK OR USED IN THE DECONTAMINATION PROCESS AS DECONTAMINATED.

7.2.11 Visually inspect the inside of the cask for damage, liquid accumulation, or plugged drains. Remove the liquid and clean any plugged drains or fittings. If the inside surfaces of the cask are damaged, remove the cask from service.

7.2.12 As required, clean the inside of the cask base plate, shield ring, the O-rings, and the seating surfaces. Replace any O-rings if inspection shows any defects or replace in accordance with Section 8.2.4. If O-ring replacement is required, cask must be subjected to leak testing as specified in Section 8.2.2.1.

7.2.13 Prepare to replace the base plate on the cask.

7.2.13.1 Lift the base plate into position using the small crane.

7.2.13.2 Replace the eight (8) 1-1/2-inch bolts and the four (4) tapered lead-in bolts to the base plate. Torque the eight (8) 1-1/2-inch bolts to a lubricated value of 75 ft.-lbs. (\pm 7 ft.-lbs.).

7.2.14 Decontaminate the cask surfaces. Survey to confirm that the cask is free of contamination. (As per Step 7.1.26.3.)

7.2.14.1 If the external surface of the cask is painted, visually inspect the painted surfaces for wear, deep scratches, chipping, etc. Repair as necessary, using CNS Engineering repair procedures. Based on the condition of the coating, the entire surface may be covered with a single coating of epoxy and/or polyurethane paint.

7.2.15 Prepare to replace the impact limiter on the base plate end of the cask.

7.2.15.1 Attach a lifting sling to the eyebolts on the impact limiter.

7.2.15.2 Attach the crane hook to the lifting sling.

7.2.15.3 Position the impact limiter near the end of the cask.

7.2.15.4 Place the six (6) 1-inch by 16-inch bolts through the sequentially numbered blocks, bolts facing in the reverse direction, and attach the impact limiter loosely to the cask. Retain a spare bolt for next step in the procedure.

7.2.15.5 When the six (6) bolts and blocks are aligned, slide the impact limiter CAREFULLY into place, reverse the bolts one by one using the spare bolt, and place nuts on the bolts.

7.2.15.6 Tighten the nuts and attach wire seals to the impact limiter.

7.2.16 Prepare to replace the cask on the trailer.

7.2.16.1 Attach the two (2) slings around the cask and attach them to the crane hook, if necessary.

NOTE: ONE SLING MUST BE POSITIONED FORWARD OF THE LIFTING TRUNNIONS, AND THE OTHER SLING MUST BE POSITIONED AFT OF THE REMOVABLE TRUNNIONS.

7.2.16.2 Raise the cask high enough to get the trailer under it.

7.2.16.3 Place the cask in the cradle.

7.2.16.4 Remove the slings and store them inside the impact limiter on the cask.

7.2.16.5 Remove the removable trunnions and replace them in the equipment box.

7.2.17 Prepare to replace the hold-down straps.

7.2.17.1 Attach a lifting sling to the lifting lug on one hold-down strap.

7.2.17.2 Attach the crane hook to the lifting sling.

7.2.17.3 Position the match-marked strap on the cradle using the alignment marks.

7.2.17.4 Attach the eight (8) 1-1/2-inch by 5-inch bolts that secure the straps to the cradle.

7.2.17.5 Detach the lifting sling from the hold-down straps.

7.2.17.6 Replace the other hold-down strap following the same procedure.

7.2.18 Replace the trunnion impact absorbers with four (4) bolts each.

7.2.19 Replace the sunshade/personnel barrier, if used, by attaching the twelve (12) bolts that secure the frame to the trailer.

7.2.20 Before the cask leaves the facility, perform Step 7.3.

7.3 Preparation of an Empty Package for Transport

- 7.3.1** Verify from previous unloading and Inspection Procedures check-off forms that package interior was decontaminated, clean and free of liquids; that cask interior surfaces were free of damage, shield ring properly in place, and seals and seal surfaces were checked and found acceptable. The requirements of 49 CFR 173.427 with respect to shipment of empty packages will be complied with.
- 7.3.2** Visual inspection of all external surfaces of cask, impact limiters, skid assembly and trailer shall be performed and any defects shall be repaired.
- 7.3.3** Before the cask leaves the facility, the following shall be confirmed:
 - 7.3.3.1** That external lifting trunnions are properly covered or removed for transport.
 - 7.3.3.2** That trailer placarding and cask labeling meet DOT Specifications 49 CFR 172.500 and NRC Specifications 10 CFR 71.85.
 - 7.3.3.3** That exterior radiation levels are per References 1 and 2 in Section 1.3 of this Safety Analysis Report.
 - 7.3.3.4** That the impact limiters are sealed with anti-tamper seals.
 - 7.3.3.5** That the drain plug relief valve is securely installed and sealed with a pipe thread sealant.
 - 7.3.3.6** That the vent plug assembly is securely installed and sealed with an anti-tamper seal.

ATTACHMENT 2

**Revision 1 of Chapter 8 of the CNS 3-55 Safety
Analysis Report**

8.0 ACCEPTANCE TESTS AND MAINTENANCE PROGRAM

8.1 Acceptance Tests

Prior to first use of the package:

8.1.1 Visual Inspection

The entire package, both inside and out, shall be visually inspected to note any significant damage (such as cracks, broken welds, punctures, discontinuities, etc.). Cask finished surfaces shall be checked for finish. Seals and seal surfaces shall be examined for proper condition (as per Step 7.1.10.4). Bolts shall be examined for good condition and then put in place (as per Step 7.1.10.2). Exterior nameplates must be in place and legible.

8.1.2 Structural and Pressure Tests

Vent plug assembly shall be installed on the cask vent, a cask drain outlet valve installed and the cask pressurized to 4 psig with air and bubble testing of all closures in accordance with ANSI Standard N14.5. If seal leakage is detected, the seal will be replaced, the seal surfaces checked and reworked if necessary.

8.1.3 Leak Tests

An alternate hydrostatic test may be performed by placing the vent plug test adapter (LS-6000-4) assembly on the cask vent, attaching a 12 foot or longer length as required of tygon tubing to the vent. Remove the cask drain line plug and install drain valve. Attach water supply to the drain valve. Raise tubing 12 feet above cask. Introduce water into the cask until vent tubing is full. Close drain valve and remove water supply. Check all cask seals for leaks. Replace seals and rework seals surfaces if necessary.

8.1.4 Components Tests

There are no auxiliary components on the package requiring testing.

8.1.5 Tests for Shielding Integrity*

A grid layout shall be overlaid on the outside surfaces of the cask. A radioactive gamma source shall be placed within the cask and the outside surface scanned by suitable radiation detection equipment. An average count rate shall be determined by recording the radiation reading in mR/hr. or counts per minute at the intersection of grid points one foot square over the entire outside surface of the cask. In addition, each one-foot square grid shall be scanned and the highest radiation reading recorded.

Any area or defect which indicates a radiation reading over a square inch of surface area that exceeds twice the average radiation reading for the entire cask shall be repaired. There shall be no more than one defect of this magnitude in any one square foot grid.

8.1.6 Thermal Acceptance Test

No thermal acceptance test is to be performed on the cask package. Section 3.0, Thermal Evaluation, does not indicate any critical temperatures requiring test evaluation.

*Reference: This test procedure is copied from the original contract terms and supplemental agreement between Atcor, Inc. and P.X. Engineering Co., Everett, Mass. (cask fabricator) and certified by Arnold Green Testing Laboratories, Inc., Natick, Mass., dated 4/17/69.

8.2 Maintenance Program

Inspections and tests and the inspections noted in Section 7.0, Operating Procedures, provide for continued monitoring of the condition of the package. Damaged, failed, or even incipient failure will be promptly detected. Repair or replacement shall be made prior to transport (See Appendix 8.3).

8.2.1 Structural and Pressure Tests

Routine visual examinations will be performed to detect damage or defects significant to package condition. Exterior stencils, nameplates, and bolts will be verified in place. Drains, fittings, gaskets, and seals shall be tested to verify that they are not plugged or damaged. Tests for leak tightness of cask in accordance with Section 4.0, Appendix 4.4 shall be accomplished by one of the following methods:

8.2.1.1 Pressuring cask interior to 4 psig and bubble testing all closures.

8.2.1.2 Hydrostatic test (optional).

8.2.1.2.1 Attach a 12 foot or longer length as required of tygon tubing to the vent. Open Vent.

8.2.1.2.2 Remove drain line plug and install drain valve. Attach water supply to drain valve.

8.2.1.2.3 Raise tubing 12 feet above cask.

8.2.1.2.4 Open drain valve. Introduce water into cask until vent tubing is full.

8.2.1.2.5 Close drain valve. Remove water supply.

8.2.1.2.6 Check cask for leaks. All O-rings must be maintained in accordance with Section 8.2.4.

8.2.1.2.7 Drain cask of all water by opening drain valve. (The water in cask may be contaminated and should be drained to contaminated drain.)

8.2.2 Leak Test

8.2.2.1 Prior to delivery of the package to a carrier for transport, the package containment cavity shall be leak tested. The sensitivity of the test shall be at least 1×10^{-1} ATM cm³/SEC (STP).

8.2.2.2 The packaging containment cavity shall be leak tested initially and at least once every twelve (12) months. The sensitivity of the test shall be at least 1×10^{-3} ATM cm³/SEC (STP).

8.2.3 Subsystem Maintenance

The cask does not have any subsystems.

8.2.4 Valves and Gaskets on Containment Vessel

8.2.4.1 All O-rings and gaskets must be replaced at least every six months, even if satisfactory condition is noted during the routine inspections which are made prior to each shipment. After replacement, leak testing is required as specified in 8.2.2.1 above.

8.2.4.2 Relief valve shall be bench tested annually to verify that relief will occur at set pressure of 25 +10% - 0% psig.

8.2.4.3 Pressure gauge shall be tested to verify accuracy within 0.5 psi over range of 0 to 30 psig.

8.2.5 Shielding

No tests are required for shielding performance other than routine loaded surveys.

8.2.6 Thermal

No thermal tests are required.

8.2.7 Painted Cask Surface

If the cask is painted, the painted surface shall be thoroughly examined at periods not to exceed one (1) year and the general condition of the coating noted in the cask documentation. If the overall surface of the cask shows significant cracking, chipping, flaking or discoloration, the cask surface shall be sanded, decontaminated, and re-coated with at least two coats of epoxy and/or polyurethane paint.

(continued on page 8-6)

8.3 Appendix

8.3.1 Documentation

Shipping records shall be maintained as required by 10CFR71.91. All records relating to quality such as maintenance, repair, or rework of the cask shall be maintained according to 10CFR71.135. These shall include but not be limited to material procurement documents, vendor material certification or certificates of compliance, inspections and test results.

8.3.2 Operation

The operation functions of the CNS 3-55 Cask will be examined at periods not to exceed one (1) year to verify the continued satisfactory performance of the cask. However, if the cask has been inactive for a period of greater than one year, these functions will be examined prior to next use. These functions include but shall not be limited to the following features:

- 8.3.2.1 Drain Valve
- 8.3.2.2 Pressure relief valve
- 8.3.2.3 Vent
- 8.3.2.4 Pressure gauge
- 8.3.2.5 Seals

Procedures shall be prepared and followed for each of these operation checks. The results shall be properly recorded and the records will become part of the cask documentation as indicated in Section 8.3.1.

8.3.3 Use

8.3.3.1 Prior to each use of the CNS 3-55 Cask a series of pre-use checks shall be made. The purpose of these checks is to prepare the cask for the ensuing shipment and to assure that there is no apparent damage or deficiency in the cask which occurred during prior use or storage. The pre-use checks as well as the loading operations shall follow prescribed procedures. The pre-use checks shall include but not be limited to:

8.3.3.1.1 Visual Inspection

8.3.3.1.2 Inspection of seals

8.3.3.2 During the cask loading sequence, checks, inspection and measurements shall be made to assure that the cask is properly loaded and sealed.

These checks, inspections, and measurements shall include but not be limited to:

8.3.3.2.1 Health Physics surveys

8.3.3.2.2 Seals and valves checks

8.3.3.2.3 Cover closure checks

8.3.3.2.4 Pressure checks

8.3.3.2.5 Tie-down attachment checks

8.3.3.2.6 Review of decay heat determination

8.3.3.2.7 Dose rate measurements

8.3.4 Maintenance

A maintenance schedule shall be established to keep the cask in a full operable condition. Procedures shall be established which will indicate the routine inspections and maintenance steps which will be taken. The procedures will indicate the frequency of the maintenance operations and inspections and the corrective action which will be taken should damage or an inoperable component be detected.

8.3.5 Repair

Should repair to the CNS 3-55 Cask be required it shall be performed in such a way as to return the cask to an operating condition equal to or better than its original condition. Procedures will be established to assure that the repair to any portion of the cask will not reduce the operability of any other portion or component. The repair program shall include at a minimum the following efforts:

- Design Control and Review
- Materials Selection and Control
- Repair Fabrication Control
- Inspection Control
- Testing Control
- Documentation

8.3.5.1 Design Control and Review

If repair to the cask is indicated, CNS Engineering will determine the manner in which the repair should be performed. Their decisions shall be submitted in writing to Quality Assurance for approval before implementation will be permitted. Approval of CNS Engineering shall be documented and the Transportation Manager shall be responsible for preparing and implementing repair procedures.

8.3.5.2 Materials Selection and Control

All purchased materials and components shall be purchased according to appropriate specifications and requirements. Material certification or certificates of compliance shall be required of all materials and components. Upon receipt of the materials and/or components their compliance with the specifications or requirements shall be checked. They shall then be properly identified as suitable for use in the CNS 3-55 Cask. Any materials or components which will be stored prior to use shall be stored in

such a way that deterioration or damage will not occur during the storage.

8.3.5.3 Repair Control

All repair operations shall be done in accordance with the repair procedures established by CNS Engineering. Where special processes or techniques such as welding or heat treating are specified they shall be performed by qualified technicians or operators and according to established codes and standards. The Quality Assurance Manager will be responsible for implementing the Quality Assurance Program prepared for this work.

8.3.5.4 Inspection Control

The repair work shall be inspected by knowledgeable inspectors at the inspection points indicated in the approved repair procedures. Work shall not proceed at any such inspection point until the inspections and tests have been made and approved by the inspector. The inspector shall be a person who is to perform the inspection and evaluate the results and who did not perform the work or is responsible for the operation.

All instruments used in all inspections shall be calibrated with standards traceable to the National Institute of Standards and Technology or to a certified laboratory. The results of all inspections and tests will be fully documented and become part of the cask records.

Inspectors will be qualified in accordance with appropriate codes and standards.

Nonconforming, inoperative, or malfunctioning materials and equipment will be appropriately marked to prevent inadvertent use or reuse.

Such materials or equipment will be disposed of in a reasonable time after determination of faults for corrective action. (See 3.3.6.)

8.3.5.5 Testing Control

All tests of the repaired cask shall be made as required to show compliance with all requirements of the original cask. Tests such as shielding and pressure tests shall follow the test procedures established for the originally fabricated cask. Where no such test was previously made is deemed desirable on the repaired cask, testing procedures shall be established using current practices for cask testing as a guide. All test procedures and results shall be fully documented and become part of the cask records.

8.3.5.6 Documentation

All of the efforts involved in the cask repair shall be fully documented. This includes but is not limited to:

- 8.3.5.6.1 Repair procedures
- 8.3.5.6.2 Material purchase orders
- 8.3.5.6.3 Material certification
- 8.3.5.6.4 Material receipt inspection reports
- 8.3.5.6.5 Repair inspection reports
- 8.3.5.6.6 Test Procedures and results

All documentation shall become part of the permanent cask records.

8.3.6 Corrective Action Program

The CNS corrective action program shall apply to the operating, use, maintenance and repair procedures for the cask for prompt detection and correction of conditions which might adversely affect the safety of the operation of the cask. In the event of adverse conditions such as deficiencies, deviations, defects, and non-conformance, the cause of such condition will be determined and corrective action will be taken to preclude its repetition. Identification, cause and corrective action for adverse conditions shall be fully documented and become part of the cask records.

ATTACHMENT 3

**Revision 1 of Table of Contents of the CNS 3-55
Safety Analysis Report**

Safety Analysis Report For the CNS 3-55 Shipping Cask

Table of Contents

		<u>Page</u>
1.0	General Information	1-1
1.1	Introduction	1-1
1.2	Package Description	1-1
	1.2.1 Packaging	1-1
	1.2.2 Operational Features	1-6
	1.2.3 Contents of Packaging	1-6
1.3	Appendix	1-7
	1.3.1 References	1-7
	1.3.2 Detailed Package Description	1-8
2.0	Structural Evaluation	2-1
2.1	Structural Design	2-1
	2.1.1 Discussion	2-1
	2.1.2 Design Criteria	2-1
2.2	Weights and Centers of Gravity	2-3
2.3	Mechanical Properties of Materials	2-3
2.4	General Standards for all Packages	2-5
	2.4.1 Chemical and Galvanic Reactions	2-5
	2.4.2 Positive Closure	2-5
	2.4.3 Lifting Devices	2-6
	2.4.4 Tiedown Devices	2-8
2.5	Standards for Type B and Large Quantity Packaging	2-9
	2.5.1 Load Resistance	2-9
	2.5.2 External Pressure	2-10
2.6	Normal Conditions of Transport	2-12
	2.6.1 Heat	2-12
	2.6.2 Cold	2-14
	2.6.3 Pressure	2-18
	2.6.4 Vibration	2-18
	2.6.5 Water Spray	2-18
	2.6.6 Free Drop	2-18
	2.6.7 Corner Drop	2-31
	2.6.8 Penetration	2-31
	2.6.9 Compression	2-31

Table of Contents

2.7	Hypothetical Accident Conditions.....	2-32
2.7.1	Free Drop.....	2-32
2.7.2	Puncture.....	2-72
2.7.3	Thermal.....	2-77
2.7.4	Water Immersion.....	2-79
2.7.5	Summary.....	2-79
2.8	Special Form.....	2-80
2.9	Fuel Rods.....	2-80
2.10	Appendix.....	2-81
2.10.1	Test Report – Scale Model Testing of Short Pipe Sections For Energy Absorption of Impact Loads.....	2-82
2.10.2	Test Data – Scale Model Testing of Cask End Plates for Deflection and Energy Absorption.....	2-107
3.0	Thermal Evaluation.....	3-1
3.1	Discussion.....	3-1
3.2	Summary of Thermal Properties of Materials.....	3-7
3.3	Technical Specifications of Components.....	3-7
3.4	Thermal Evaluation for Normal Conditions of Transport.....	3-8
3.4.1	Thermal Model.....	3-8
3.4.2	Maximum Temperature.....	3-9
3.4.3	Minimum Temperature.....	3-9
3.4.4	Maximum Internal Pressures.....	3-10
3.5	Hypothetical Accident Thermal Evaluation.....	3-11
3.5.1	Thermal Model.....	3-13
3.5.2	Package Conditions and Environment.....	3-17
3.5.3	Package Temperatures.....	3-18
3.5.4	Maximum Internal Pressures.....	3-18
3.5.5	Maximum Thermal Stresses.....	3-21
3.5.6	Evaluation of Package Performance for the Hypothetical Accident Thermal Conditions.....	3-21
3.6	Appendix.....	3-24
4.0	Containment.....	4-1
4.1	Containment Boundary.....	4-1
4.1.1	Containment Vessel.....	4-1
4.1.2	Containment Penetrations.....	4-2
4.1.3	Welds and Seals.....	4-2
4.1.4	Closure.....	4-3

Table of Contents

4.2	Requirements for Normal Conditions of Transport.....	4-3
4.2.1	Release of Radioactive Material.....	4-3
4.2.2	Pressurization of Containment Vessel.....	4-4
4.2.3	Coolant Contamination.....	4-4
4.2.4	Coolant Loss.....	4-4
4.3	Containment Requirements for the Hypothetical Accident Conditions.....	4-4
4.3.1	Fission Gas Products.....	4-5
4.3.2	Releases of Contents.....	4-5
5.0	Shielding Evaluation.....	5-1
5.1	Discussion and Results.....	5-1
5.2	Source Specification.....	5-4
5.2.1	Gamma Source.....	5-4
5.2.2	Neutron Source.....	5-4
5.3	Model Specification.....	5-5
5.3.1	Description of Radial and Axial Shielding Configuration.....	5-5
5.3.2	Description of Lead Slump Configuration.....	5-5
5.3.3	Shield Regional Densities.....	5-9
5.4	Shielding Evaluation.....	5-9
5.5	Appendix.....	5-20
5.6	Appendix.....	5-25
6.0	Criticality Evaluation.....	6-1
7.0	Operating Procedures.....	7-1
7.1	Procedures for Loading the Package.....	7-1
7.2	Procedure for unloading the Package.....	7-11
7.3	Preparation of an Empty Package for Transport.....	7-15
8.0	Acceptance Tests and Maintenance Program.....	8-1
8.1	Acceptance Tests.....	8-1
8.2	Maintenance Program.....	8-3
8.3	Appendix.....	8-6
9.0	Drawings.....	9-1