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Project Title/Work Order PIG SHIPPING CONTAINER TEST SEQUENCE (WHC-SD-TP-TP-005)		EDT No. 604911			
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1,2	1,2	Cog. Mgr.: JG Field	<i>[Signature]</i>	1/13/95	G2-02	PV Meeuwse	<i>[Signature]</i>	1/13/95	B6-13
1,2	1,2	QA: SB Dutta	<i>[Signature]</i>	1/13/95	L6-35	OSTI (2 copies) 48-07			
1,2	1	Safety: DW McNally	<i>[Signature]</i>	1/13/95	G2-03				
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RELEASE AUTHORIZATION

Document Number: WHC-SD-TP-TP-005, Rev. 0

Document Title: Sample Pig Shipping Container Transport System Drop Test

Release Date: 1/13/95

This document was reviewed following the procedures described in WHC-CM-3-4 and is:

APPROVED FOR PUBLIC RELEASE

WHC Information Release Administration Specialist:

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7. Abstract This test plan outlines testing of the integrity of the pig shipping container.		
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LIST OF TERMS

ANSI	American National Standards Institute
CFR	Code of Federal Regulations
CSSO	computer systems security officer
DOT	U.S. Department of Transportation
MSLD	mass spectrometer leak detector
QC	quality control
SARP	Safety Analysis Report for Packaging
WHC	Westinghouse Hanford Company

PIG SHIPPING CONTAINER TEST SEQUENCE

1.0 DROP TEST REQUIREMENTS

1.1 HELIUM LEAK TEST

After the fabrication package has been completed, perform a helium leak test using a mass spectrometer leak detector (MSLD). The maximum allowable leak is 1.96×10^{-7} atm-cc/sec (air) per American National Standards Institute (ANSI) N14.5 using Westinghouse Hanford Company (WHC) procedure NDT-LT-6000, Rev 3 (WHC 1994a). The pig shipping container is designed and fitted with dual O-rings and Cajon¹ "O-seal" fittings which are used to inject helium and to connect to the MSLD. The O-ring to be leak tested is the inner O-ring.

Enter leak rate observed: _____

Leak Test Examiner: _____ Date: _____

1.2 TEST CONFIGURATION

Assemble the pig shipping container and the N-55 Overpack for the free drop required by 10 CFR 71.73c(1). The free-fall distance shall be a minimum of 9 m (29.53 ft) from the lowest part of the transport packaging assembly to the surface of the test pad.

Ensure the test unit configuration includes the N-55 Overpack, a U.S. Department of Transportation (DOT) 17H 55-gal drum, inner spacers (drawing H-2-824691, Rev. 0), a pig shipping container (drawing H-2-824299, Rev. 1), and a shielded sample pig (drawing H-2-37076, Rev. 3), plus the sample bottle.

1.3 TEST SEQUENCE AND DESCRIPTION

Perform three consecutive drops, in series:

1. 9 m side drop -- Drop so that the axial centerline of the overpack is in the horizontal plane, and the impact is on the outside diameter of the overpack
2. 9 m bottom drop -- Drop so that the axial centerline of the overpack is vertical, and the impact is on the bottom of the overpack
3. 9 m corner drop -- Drop so that the axial centerline of the overpack is at a 45° angle and the impact will be on the bottom chime.

¹Cajon is a trademark of Cajon Company.

2.0 TEST PREPARATION

2.1 SYNTHESIZE PAYLOAD

2.1.1 Simulated Test Solution

Packaging Engineering will furnish a 125 Ml (nominal) glass bottle. Fill the glass bottle with a mixture of fluorescein and water to simulate the payload. Ensure the bottle is filled to the neck with a mixture of 20 vol% (minimum) fluorescein and 80 vol% water. Wrap the bottle in a poly bag and place it inside the sample pig during the test sequence.

QC verification: _____ Date: _____

2.1.2 Test the Fluorescein Solution with Ultraviolet Light

Response? YES ☐ NO ☐

QC verification: _____ Date: _____

2.2 ASSEMBLE TRANSPORT PACKAGING ASSEMBLY FOR TEST

Assemble the entire transport packaging assembly in accordance with the Safety Analysis Report for Packaging (SARP) (WHC 1992) requirements. Exceptions are the O-ring hardness and formulation, and pig shipping container bolt torque. The torque level is given in Section 2.3.2, item 6. The drawings for the pig shipping container and the inner spacers have been changed, but the test parameters, test sequence and test preparations are not changed, except as required for the MSLD leak test because of the dual O-rings and O-seal test fittings.

2.3 DROP TEST CHECKLIST

Use the following checklist for verifying test preparation, transport packaging assembly, drop sequence, and post drop test evaluation and testing.

2.3.1 Preliminary and Preparatory Test Activities

The test activities are as follows.

1. Weigh each major component of the transport packaging assembly. Note each weight in the space provided.

- N-55 Overpack plus DOT 17H drum: _____ pounds
- Inner spacer (upper and lower): _____ pounds

- Pig shipping container: _____ pounds
- Shielded pig: _____ pounds
- Glass bottle plus payload: _____ pounds

Total Weight: _____ pounds

Scale calibration due date: _____

QC verification: _____ Date: _____

2. Establish safe locations for all observers during the drop test. This is the responsibility of the safety engineer or other person designated by the facility manager.
3. Engage a photographer to photograph equipment and drop test activities for the SARP (WHC 1992), if needed.
4. Prepare and verify rigging and measuring equipment for drop testing, by using the following steps. A 9 m length of wire or other suitable measuring device will be provided to attach to the bottom of the transport packaging assembly to verify drop height for each drop.
 - a. Prepare the lifting sling.
 - b. Verify the lifting hook is rated for the load, and the hook examination and inspection is current.
 - c. Verify the trigger device for the sling operates properly.

QC verification: _____ Date: _____

5. Use the appropriate laboratory ware. Prepare the fluorescein powder and water in the proportions specified in Section 2.1.

QC verification: _____ Date: _____

6. Expose a sample of the fluorescein solution to verify performance of the ultraviolet light.

QC verification: _____ Date: _____

2.3.2 Test Article Preparation

The test article preparation is as follows.

1. Place the fluorescein powder water mixture in the screw-cap bottle furnished by Packaging Engineering. Wipe the bottle exterior and threads to remove any spilled liquid or residue. Tighten the cap hand tight.

QC verification: _____ Date: _____

2. Shake the bottle vigorously, and examine for leakage.

QC verification: _____ Date: _____

3. Place the bottle, with its contents, in a poly bag per Waste Tank Sampling Engineering Procedures TO-080-403 (WHC 1994b) or TO-080-410 (WHC 1995).

CSSO signature: _____ Date: _____

QC verification: _____ Date: _____

4. Place the bagged bottle in the shielded pig, install pig lid, and latch pin.

QC verification: _____ Date: _____

5. Prepare the pig shipping container O-rings and install in O-ring grooves in the pig shipping container.

CSSO signature: _____ Date: _____

QC verification: _____ Date: _____

6. Install the shielded pig in the pig shipping container. Install flange bolts and torque to a wrench reading of 240 in.-lb $\pm$ 5.

Calibration due date: _____

CSSO signature: _____ Date: _____

QC verification: _____ Date: _____

7. Verify the lower inner spacer is inside the drum. Install the loaded pig shipping container in the cavity of the lower inner spacer.

QC verification: _____ Date: _____

8. Install the upper inner spacer.

QC verification: _____ Date: _____

9. Verify the drum head seal (gasket) is in place.

QC verification: _____ Date: _____

10. Install the drum head. Torque to 480 in.-lb $\pm$ 5.

Calibration due date: _____

CSSO signature: _____ Date: _____

QC verification: _____ Date: _____

11. Install the N-55 Overpack cover. Clamp cover with four latches per SARP requirements (WHC 1992).

CSSO signature: _____ Date: _____

QC verification: _____ Date: _____

12. Attach the lifting sling for the transport packaging assembly drop test.

QC verification: _____ Date: _____

13. Attach the 9 m measuring device to the lowest point on the package.

QC verification: _____ Date: _____

14. Specific Tests - Controls and Approvals:

- A Safety Engineer or other person designated by the Facility Manager shall reinforce safe locations for observers during the drop test.
- The Cognizant Engineer shall verify the correct orientation of the transport packaging assembly for each drop test in the sequence.
- Raise the transport packaging assembly to the required drop height (9 m). The Crane Operator shall indicate to the Cognizant Engineer when the test is ready for drop.
- Quality Control shall indicate to the Cognizant Engineer that the test preparation is in compliance with pre-test requirements.
- The Cognizant Engineer shall give the signal to the Crane Operator to release the packaging and execute the drop.

3.0 PERFORM DROP TESTS

3.1 SIDE DROP TEST

Perform the side drop test as follows.

1. Verify the transport packaging assembly is in the side impact orientation.

Cognizant Engineer signature: _____ Date: _____

2. Complete side drop test.

Cognizant Engineer signature: _____ Date: _____

3.2 BOTTOM DROP TEST

Perform the bottom drop test as follows.

1. Verify the transport packaging assembly is in the bottom impact orientation.

Cognizant Engineer signature: _____ Date: _____

2. Complete bottom drop test.

Cognizant Engineer signature: _____ Date: _____

3.3 CORNER DROP TEST

Perform the corner drop test as follows.

1. Verify the transport packaging assembly is in the bottom corner (bottom chime) impact orientation.

Cognizant Engineer signature: _____ Date: _____

2. Complete corner drop test.

Cognizant Engineer signature: _____ Date: _____

4.0 POST-TEST EXAMINATION

4.1 TEST ARTICLE DISASSEMBLY

4.1.1 N-55 Overpack

Dismantle the N-55 Overpack.

4.1.2 Upper Spacer

Remove the upper Inner Spacer.

4.1.3 Pig Shipping Container

Remove the pig shipping container.

4.2 PIG SHIPPING CONTAINER AND INNER SPACER EXAMINATION

4.2.1 Fluorescein Test Verification

Expose a sample of the fluorescein solution to verify performance of the ultraviolet light.

Response?

YES ☐

NO ☐

QC verification: _____ Date: _____

4.2.2 Pig Shipping Container Examination

Examine the exterior of the pig shipping container with ultraviolet light for evidence of fluorescein.

Response?

YES ☐

NO ☐

QC verification: _____ Date: _____

4.2.3 Inner Spacer Cavity Examination

Examine the inner cavity surfaces of the upper and lower Inner Spacers with ultraviolet light for evidence of fluorescein.

Response? YES ☐ NO ☐

Comment _____

QC verification: _____ Date: _____

4.2.4 Payload Examination

Examine the payload as follows.

1. Disassemble the pig shipping container.
2. Evaluate the condition of the bagged glass bottle. Enter comments: _____

3. Clean any fluorescein solution residue from the inside of the pig shipping container using ethyl alcohol, and dry the pig shipping container. Clean the O-rings only sufficiently to remove any trace of fluorescein solution (rinse with ethyl alcohol, dry without wiping so as not to disturb Apiezon film²).
4. Reassemble the pig shipping container.
5. Perform a helium leak test using an MSLD. The maximum allowable leak is 1.6×10^{-7} atm-cc/sec (air) per ANSI N14.5 using WHC procedure number NDT-LT-6000, Rev 3. The O-ring to be leak tested is the inner O-ring.

Enter leak rate observed: _____

Leak Test Examiner: _____ Date: _____

²Apiezon film is a trademark of the Apiezon Company.

5.0 REFERENCES

5.1 DOCUMENTS

- ANSI, 1987, *Leak Tests on Packages for Shipment of Radioactive Materials*, ANSI N14.5, American National Standards Institute, New York, New York.
- 10 CFR 71.73, "Hypothetical Accident Conditions," *Code of Federal Regulations*, as amended.
- WHC, 1992, *Sample Pig Transport System Safety Analysis Report for Packaging (Onsite)*, WHC-SD-TP-SARP-001, Rev. 0, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1994a, *General Leak Test Procedure*, NDT-LT-6000, Rev. 3, Westinghouse Hanford Company Richland, Washington.
- WHC, 1994b, *Supernatant or Sludge Sampling of Hydrogen, Organic, Hydrogen Organic, or Organic Ferrocyanide Watchlist Tanks*, Waste Tank Sampling Engineering Procedure No. TO-080-403, Westinghouse Hanford Company, Richland, Washington, August 4, 1994.
- WHC, 1995, *Supernatant or Sludge Sampling of Aging, Waste Storage Tanks*, Waste Tank Sampling Engineering Procedure No. TO-080-410, Westinghouse Hanford Company, Richland, Washington, January 9, 1995.

5.2 DRAWINGS

- H-2-824691, Rev. 0, *Inner Spacer Assembly*.
- H-2-824299, Rev. 1, *Pig Shipping Container Double O-Ring Seal*.