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TEST REPORT FOR CESIUM POWDER AND PELLETS INNER CONTAINER DECONTAMINATION METHOD DETERMINATION TEST

D. L. Kelly

Waste Management Federal Services, Inc., Northwest Operations
Richland, WA 99352

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Abstract: Three Cesium Powder and Pellets Inner Containers underwent performance testing in July 1998. A total of thirteen tests were conducted. The test plan (HNF-2945) was revised extensively in the field during testing. As a result, this Test Report contains the official test documentation and provides a single document reference. The "Heat/Scrub Test Using Water Dampended Rags (Modification 1)" was successful in that there were three passes.

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LIST OF TERMS

BWHC	B&W Hanford Company
NHC	Numatec Hanford Company
QA	Quality Assurance
WMNW	Waste Management Federal Services, Northwest Operations

TEST REPORT FOR CESIUM POWDER AND PELLETS INNER CONTAINER DECONTAMINATION METHOD DETERMINATION TEST

1.0 INTRODUCTION

This report documents the decontamination method determination testing that was performed on three cesium powder and pellets inner container test specimens. The test specimens were provided by B&W Hanford Company (BWHC). The tests were conducted by the Numatec Hanford Company (NHC), in the 305 Building. Photographic evidence was also provided by NHC. The Test Plan and Test Report were provided by Waste Management Federal Services, Inc., Northwest Operations (WMNW). Witnesses to testing included a WMNW test engineer, a BWHC project engineer, and a BWHC Quality Assurance (QA) representative.

The Test Plan was modified with the mutual decision of the WMNW test engineer, the BWHC project engineer, and the BWHC QA representative. The results of this decision were written in red (permanent type) ink on the "official copy" of the test procedure. Due to the extent of the changes, a summary of the test results are provided in Section 3.0 of this Test Report. In addition, a copy of the "official copy" field documentation obtained during testing is included in Appendix A. The original Test Plan (HNF-2945) will be revised to indicate that extensive changes were required in the field during testing; however, the test documentation will stand as is (i.e., it will not be retyped, text shaded, etc.) due to the inclusion of the test parameters and results into this Test Report.

2.0 PURPOSE AND SCOPE

The Cesium Powder and Pellets Inner Container was performance tested per the criteria specified in Section 4.0 of HNF-2399, *Design, Fabrication, and Assembly Criteria for Cesium Powder and Pellet Inner Container*, and Task Order SW826. The test criteria specified that the Inner Container be water tight during decontamination of the exterior surface. Several different test methods were applied, as documented within the Test Plan and as provided in the Summary (Section 3.0) below. Any in-leakage of fluorescent water to the Inner Container constituted a container seal failure.

3.0 SUMMARY

Thirteen tests were conducted using three test specimens (C-PP10, C-PP11, and C-PP12). Table 3-1 identifies the tests conducted, status, and the section location within this Test Report where information may be found. The Heat/Scrub Test Using Water Dampened Rags (Modification 1), that was conducted as Test #11, #12, and #13, was successful in that there were three passes.

The pretest requirements described in Section 6.1 of the Test Plan, and the preparation of the test specimens described in Section 6.2 of the Test Plan were followed prior to conducting any of the tests described in this report. In addition, the lid and body interface for all test specimens was checked and polished prior to conducting any additional tests with that specimen.

Table 3-1. Tests Conducted.

Test Number	Test Report Section	Test Type	Status
1	3.1.1	Heat/Water Immersion Test	Fail (1)
2	3.1.2	Heat/Water Spray Test (Modification 1)	Fail (1)
3	3.1.3	Scrub Test Using Water Saturated Rags	Pass (1)
4	3.1.4	Heat/Water Spray Test (Modification 2)	Pass (1)
5 & 6	3.1.5	Heat/Water Immersion Test (Modification 1)	Fail (2)
7	3.1.6	Heat/Water Spray Test (Modification 3)	Fail (1)
8, 9, & 10	3.1.7	Heat/Scrub Test Using Water Saturated Rags (Modification 1)	Pass (1) Fail (2)
11, 12, & 13	3.1.8	Heat/Scrub Test Using Water Dampened Rags (Modification 1)	Pass (3)

3.1 TESTING DATA

Due to the extensive changes made during testing, the information in this section has been extracted from the Test Plan "official copy" that was used in the field, and is provided in Tables 3-2 through 3-10 for easy reference. The tables are identified by test number and test

type. A copy of the "official copy" of the Test Plan that was used in the field during testing is provided as Appendix A to this report.

The temperature gauges and timing devices used during testing were not calibrated. All temperatures and times provided in this report are approximate.

The information for the torque wrench used during testing is provided in Table 3-2. The same torque wrench was used for all tests.

Table 3-2. Torque Wrench Information.

Torque Wrench Identification	545-88-01-202, serial number 6064
Next Calibration Due Date	2/27/99
Accuracy	+/- 4%

3.1.1 Heat/Water Immersion Test

The first test conducted was the Heat/Water Immersion Test as described in Section 6.3 of the Test Plan. This test was not modified in the field. The following information represents the data collected during testing:

Table 3-3. Test #1-- Heat/Water Immersion Test.

	Test Specimen: C-PP10	Test Specimen: C-PP11	Test Specimen: C-PP12
Test Contents	Empty	N/A	N/A
Seal Type	Polished	N/A	N/A
Heated Container Temp (Oven)	201.1°C (394°F)	N/A	N/A
Initial Cap Torque	25 ft-lb	N/A	N/A
Cooled Test Specimen Temp.	74.4°C (166°F)	N/A	N/A
Verified Cap Torque	25 ft-lb	N/A	N/A

Table 3-3. Test #1-- Heat/Water Immersion Test.

	Test Specimen: C-PP10	Test Specimen: C-PP11	Test Specimen: C-PP12
Retorque Required	Yes	N/A	N/A
Water Temp.	29.4°C (85°F)	N/A	N/A
Immersion Depth	8 ft, 8 in.	N/A	N/A
Start Time	11:36:16	N/A	N/A
End Time	11:41:28	N/A	N/A
Breakaway Torque	started @ 50, broke @ 28 = 22 ft-lb	N/A	N/A
Fluorescein/Moisture: Seal Gasket Threads Inside	Y Y Y Y	N/A	N/A
Galling: Threads Seal	N N	N/A	N/A
Result of Test	Fail	N/A	N/A
Comments	The gasket shifted over slightly upon the final torque. Upon opening the test specimen, a drop of moisture was observed under the gasket. Approximately 90 mil. of water and fluorescein was removed from the test specimen after the test.		

3.1.2 Heat/Water Spray Test (Modification 1)

The second test conducted consisted of a combination of tests documented in the Test Plan; however, it was not originally a part of the Test Plan. For documentation purposes, this will be termed the Heat/Water Spray Test (Modification 1).

The Heat/Water Spray Test (Modification 1) conducted during Test #2 consisted of heating an empty test specimen to approximately 200°C (392°F), placing the closure cap onto the Container, letting the container be free-air cooled to approximately 100°C (212°F), and the

closure cap torqued to 25 ft-lb. The Container was then sprayed with a mixture of water and fluorescein that was delivered through a 3/8-in. diameter tube from a container that was elevated 4 ft above the container seal area. The water was sprayed onto the seal area of the Container for two periods of at least 2 minutes each. After the test the closure caps were removed, and the inside of the Container was examined for water. In addition, the threads and seals were inspected for galling. The following information represents the data collected during testing:

Table 3-4. Test #2-- Heat/Water Spray Test (Modification 1).

	Test Specimen: C-PP10	Test Specimen: C-PP11	Test Specimen: C-PP12
Test Contents	N/A	Empty	N/A
Seal Type	N/A	Polished	N/A
Heated Container Temp (Oven)	N/A	200°C (392°F)	N/A
Initial Cap Torque	N/A	N/A	N/A
Cooled Test Specimen Temp.	N/A	104.4°C (220°F)	N/A
Verified Cap Torque	N/A	25 ft-lb	N/A
Retorque Required	N/A	N/A	N/A
Water Container Height	N/A	4 ft	N/A
Period 1 Start Time	N/A	2:46:18	N/A
Period 1 End Time	N/A	2:48:18	N/A
Period 2 Start Time	N/A	2:48:26	N/A
Period 2 End Time	N/A	2:50:26	N/A
Breakaway Torque	N/A	started @ 50, broke @ 30 = 20 ft-lb	N/A
Fluorescein/Moisture: Seal Gasket Threads Inside	N/A	Y Y Y Y	N/A

Table 3-4. Test #2-- Heat/Water Spray Test (Modification 1).

	Test Specimen: C-PP10	Test Specimen: C-PP11	Test Specimen: C-PP12
Galling: Threads Seal	N/A	N N	N/A
Result of Test	N/A	Fail	N/A
Comments	Approximately ½ teaspoon of water and fluorescein mixture was observed inside the Container upon opening		

3.1.3 Scrub Test Using Water Saturated Rags

The third test was the Scrub Test Using Water Saturated Rags as described in Appendix B, Section B.3 of the Test Plan. This test was not modified in the field. The following information represents the data collected during testing:

Table 3-5. Test #3-- Scrub Test Using Water Saturated Rags.

	Test Specimen: C-PP10	Test Specimen: C-PP11	Test Specimen: C-PP12
Test Contents	N/A	N/A	Flour & Fluorescein
Seal Type	N/A	N/A	Polished*
Closure Cap Torque	N/A	N/A	25 ft-lb
Start Time	N/A	N/A	10:11:33
End Time	N/A	N/A	10:16:34
Breakaway Torque	N/A	N/A	started @ 50, broke @ 25 = 25 ft-lb
Fluorescein/Moisture: Seal Gasket Threads Inside	N/A	N/A	Y Y Y N

Table 3-5. Test #3-- Scrub Test Using Water Saturated Rags.

	Test Specimen: C-PP10	Test Specimen: C-PP11	Test Specimen: C-PP12
Galling: Threads Seal	N/A	N/A	N N
Result of Test	N/A	N/A	Pass
Comments	<p>*A fabricated seal was to be used for this test; however, the fabricated seal would not fit over the threads of the cap so a polished seal was used instead.</p> <p>Moisture, flour, and fluorescein were found on the upper portion of the cap threads, about half-way down onto the cap. Test results were considered acceptable to establish a minimum decontamination requirement.</p>		

3.1.4 Heat/Water Spray Test (Modification 2)

Upon completion of Test #3, it was determined that the Heat/Water Spray Test (Modification 1) that was conducted as Test #2 would be conducted next (as Test #4) with the following additional criteria:

- (1) The cap and body interface would be cleaned and polished for all test specimens
- (2) No gasket would be used
- (3) The test specimen will be filled 75-80% full with heated quartz crystals.

This test will be identified as Heat/Water Spray Test (Modification 2). The following information represents the data collected during testing:

Table 3-6. Test #4 -- Heat/Water Spray Test (Modification 2).

	Test Specimen: C-PP10	Test Specimen: C-PP11	Test Specimen: C-PP12
Test Contents	Heated quartz crystals	N/A	N/A
Seal Type	None	N/A	N/A

Table 3-6. Test #4 -- Heat/Water Spray Test (Modification 2).

	Test Specimen: C-PP10	Test Specimen: C-PP11	Test Specimen: C-PP12
Heated Container Temp (Oven)	200.8°C (393.4°F)	N/A	N/A
Initial Cap Torque	N/A	N/A	N/A
Cooled Test Specimen Temp.	83.3°C (182°F)	N/A	N/A
Verified Cap Torque	25 ft-lb	N/A	N/A
Retorque Required	No	N/A	N/A
Water Container Height	4 to 5 ft range	N/A	N/A
Period 1 Start Time	2:58:21	N/A	N/A
Period 1 End Time	3:01:22	N/A	N/A
Period 2 Start Time	3:01:27	N/A	N/A
Period 2 End Time	3:03:28	N/A	N/A
Breakaway Torque	started @ 50, broke @ 29 = 21 ft-lb	N/A	N/A
Fluorescein/Moisture: Seal Gasket Threads Inside	Y N/A Y N	N/A	N/A
Galling: Threads Seal	N N	N/A	N/A
Result of Test	Pass	N/A	N/A
Comments	There was an indication of one drop of water/fluorescein mixture at the lid/body interface. Moisture followed the threads of the cap. No moisture or leakage was indicated inside the container body.		

3.1.5 Heat/Water Immersion Test (Modification 1)

Test #5 and #6 were conducted as a modified Heat/Water Immersion Test (Modification 1) from that described in Section 6.3 of the Test Plan. Modifications were made during this test as follows:

- (1) No gasket would be used
- (2) The test specimens will be filled 75-80% full with coarse salt crystals
- (3) Test specimen C-PP11 will be topped with approximately 1 tablespoon of baking flour.

The following information represents the data collected during testing:

Table 3-7. Test #5 and #6-- Heat/Water Immersion Test (Modification 1).

	Test Specimen: C-PP10	Test Specimen: C-PP11	Test Specimen: C-PP12
Test Sequence	N/A	Test #6	Test #5
Test Contents	N/A	Coarse salt crystals and flour	Coarse salt crystals
Seal Type	N/A	None	None
Heated Container Temp (Oven)	N/A	201.5°C (394.7°F)	201.4°C (394.5°F)
Initial Cap Torque	N/A	25 ft-lb	25 ft-lb
Cooled Test Specimen Temp.	N/A	98.9° (210°F)	100°C (212°F)
Verified Cap Torque	N/A	25 ft-lb	25 ft-lb
Retorque Required	N/A	Yes	Yes
Water Temp.	N/A	Not requested	Not requested
Immersion Depth	N/A	8 ft, 8 in.	8 ft, 8 in.
Start Time	N/A	2:12:30	1:18:54
End Time	N/A	2:17:31	1:23:55

Table 3-7. Test #5 and #6-- Heat/Water Immersion Test (Modification 1).

	Test Specimen: C-PP10	Test Specimen: C-PP11	Test Specimen: C-PP12
Breakaway Torque	N/A	started @ 95, broke @ 30 = 35 ft-lb	started @ 90, broke @ 0 = 90 ft-lb
Fluorescein/Moisture: Seal Gasket Threads Inside	N/A	Y N/A Y Y	Y N/A Y N ¹
Galling: Threads Seal	N/A	N N	Y ² Y ²
Result of Test	N/A	Fail	Fail

Table 3-7. Test #5 and #6-- Heat/Water Immersion Test (Modification 1).

	Test Specimen: C-PP10	Test Specimen: C-PP11	Test Specimen: C-PP12
Comments	<p><u>Test #5 (C-PP12)</u>: Moisture was indicated on the underside of cap and about 3/4 of the way down on the cap threads. Inside was questionable because under black light inspection some of the crystals looked illuminant and tinted a very light greenish color. It could not be determined if the light green color was caused by a change in the crystals due to the extreme heat, or if fluorescein had actually come in contact with the crystals. Therefore, the following comparisons were performed:</p> <ol style="list-style-type: none"> 1) Checked the salt crystals (under a black light) from the test unit and could not determine if the change in the color of the salt crystals was due to heat or possible fluorescein. 2) Checked only heated salt crystals (under a black light) and they looked similar to the salt crystals noted in Item 1 above. 3) Checked "clean" unheated salt crystals (under a black light) and they were a pinkish color. 4) Checked tested salt crystals from Item #1 above and added approximately 5-6 drops of water/fluorescein mixture to these crystals. Under black light inspection the fluorescein was easily detected. <p>¹It was believed that Test #5 (C-PP12) did not have any in-leakage of water and fluorescein and that it passed.</p> <p>²However, after this test unit was transferred to the 306 Facility for polishing, the BWHC Project Engineer noted that galling of the lid and body interface did occur. However, there was no galling of the threads. This was a fail.</p> <p><u>Test #6 (C-PP11)</u>: Approximately 1/4 teaspoon of moisture was present inside the Container body and sides. Moisture was also detected on the flour that was added to top of salt crystals.</p>		

3.1.6 Heat/Water Spray Test (Modification 3)

Test #7 was conducted as the Heat/Water Spray Test (Modification 3) to verify the results found and documented under Test #4. Test #7 was conducted the same as Test #4, and included the following modifications:

- (1) The cap and body interface would be cleaned and polished for all test specimens
- (2) No gasket would be used
- (3) The test specimen will be filled 75-80% full with coarse crystal salt.

The following information represents the data collected during testing:

Table 3-8. Test #7 -- Heat/Water Spray Test (Modification 3).

	Test Specimen: C-PP10	Test Specimen: C-PP11	Test Specimen: C-PP12
Test Contents	Coarse crystal salt	N/A	N/A
Seal Type	None	N/A	N/A
Heated Container Temp (Oven)	201.4°C (394.5°F)	N/A	N/A
Initial Cap Torque	Hand tight	N/A	N/A
Cooled Test Specimen Temp.	104.4°C (220°F)	N/A	N/A
Verified Cap Torque	25 ft-lb	N/A	N/A
Retorque Required	N/A	N/A	N/A
Water Container Height	4 ft	N/A	N/A
Water Temperature	31.1°C (88°F)	N/A	N/A
Period 1 Start Time	10:18:15	N/A	N/A
Period 1 End Time	10:20:30	N/A	N/A
Period 2 Start Time	10:20:34	N/A	N/A
Period 2 End Time	10:22:35	N/A	N/A

Table 3-8. Test #7 -- Heat/Water Spray Test (Modification 3).

	Test Specimen: C-PP10	Test Specimen: C-PP11	Test Specimen: C-PP12
Breakaway Torque	started @ 90, broke @ 69 = 21 ft-lb	N/A	N/A
Fluorescein/Moisture: Seal Gasket Threads Inside	Y N/A Y Y	N/A	N/A
Galling: Threads Seal	N Y	N/A	N/A
Result of Test	Fail	N/A	N/A
Comments	Moisture was detected approximately 1-1/4 in. deep within the capsule, beginning 1/2 in. beyond the threads. Approximately 5 drops were noted below the threads. The threads of the capsule and lid had moisture throughout. Moisture was detected on the interface surface of the lid and capsule. There was a slight detection of fluorescein on the top portion of the salt. Galling was noted on the mating surface of the lid and container.		

3.1.7 Heat/Scrub Test Using Water Saturated Rags (Modification 1)

Test #8, #9, and #10 were conducted and are titled as the Heat/Scrub Test Using Water Saturated Rags (Modification 1). This test is modified from the Scrub Test Using Water Saturated Rags that was used to perform Test #3 (conducted per Appendix B, Section B.3). This test includes a combination of steps performed under Section 6.3 and Section B.3, and includes the following steps:

- (1) The test specimens will be cleaned, have a cleaned body and cap interface, and be polished
- (2) Any galling noted during previous testing shall be determined to not affect the results of additional testing
- (3) The test specimens will not include a gasket
- (4) The test specimens will be filled with coarse salt until approximately 75-80% full

- (5) The test specimens will be heated to approximately 200°C (392°F)
- (6) The closure cap will be hand-tightened onto the container body
- (7) The test specimen will be free-air cooled to approximately 100°C (212°F)
- (8) Test specimen lids will be torqued to 20 ft-lbs instead of 25 ft-lbs
- (9) Test specimens will have a water and fluorescein mixture washed over them at the seal area using a saturated rag for a period of 5 minutes.

**Table 3-9. Test #8, #9, and #10 --
Heat/Scrub Test Using Water Saturated Rags (Modification 1).**

	Test Specimen: C-PP10	Test Specimen: C-PP11	Test Specimen: C-PP12
Test Sequence	Test #10	Test #9	Test #8
Test Contents	Coarse salt crystals	Coarse salt crystals	Coarse salt crystals
Seal Type	None	None	None
Heated Container Temp (Oven)	196°C (384.8°F)	201.5°C (394.7°F)	201.8°C (395.2°F)
Initial Cap Torque	Hand tight	Hand tight	Hand tight
Cooled Test Specimen Temp.	109.4°C (229°F)	100°C (212°F)	103.9°C (219°F)
Verified Cap Torque	20 ft-lb	20 ft-lb	20 ft-lb
Retorque Required	N/A	N/A	N/A
Start Time	2:39:15	2:01:15	1:24:44
End Time	2:44:17	2:06:30	1:29:46
Breakaway Torque	started @ 90, broke @ 70 = 20 ft-lb	started @ 90, broke @ 70 = 20 ft-lb	started @ 90, broke @ 65 = 25 ft-lb
Fluorescein/Moisture:			
Seal	Y	Y	Y
Gasket	N/A	N/A	N/A
Threads	Y	Y	Y
Inside	Y	Y	N

**Table 3-9. Test #8, #9, and #10 --
Heat/Scrub Test Using Water Saturated Rags (Modification 1).**

	Test Specimen: C-PP10	Test Specimen: C-PP11	Test Specimen: C-PP12
Galling: Threads Seal	N N	N N	N N
Result of Test	Fail	Fail	Pass
Comments	<p><u>Test #8 (C-PP12)</u>: Moisture was noted at the lid/body interface and on the threads. No moisture was detected inside the container upon black light inspection.</p> <p><u>Test #9 (C-PP11)</u>: Air suction (i.e., vacuum) was heard when the Container was opened. One drop of moisture was detected approximately 1/4 in. down into the container. One drop of moisture was noted inside the container wall; however the lid was pulled off quickly and there is a possibility that the drop fell from the lid/thread area into the container. No fluorescein was detected in the salt crystals.</p> <p><u>Test #10 (C-PP10)</u>: Moisture was detected at the lid/body interface, threads, and inside the container wall. Fluorescein was detected on approximately 10 salt crystals.</p>		

3.1.8 Heat/Scrub Test Using Water Dampened Rags (Modification 1)

Test #11, #12, and #13 were conducted and are titled as the Heat/Scrub Test Using Water Dampened Rags (Modification 1). This test is modified from the Scrub Test Using Water Dampened Rags identified as Appendix B, Section B.4. This test includes a combination of steps performed under Section 6.3 and Section B.4, and includes the following steps:

- (1) The test specimens will be cleaned, have a cleaned body and cap interface, and be polished
- (2) Any galling noted during previous testing shall be determined to not affect the results of additional testing
- (3) The test specimens will not include a gasket
- (4) The test specimens will be filled with coarse salt until approximately 75-80% full

- (5) The test specimens will be heated to approximately 200°C (392°F)
- (6) The closure cap will be hand-tightened onto the container body
- (7) The test specimen will be free-air cooled to approximately 100°C (212°F)
- (8) Test specimen lids will be torqued to 20 ft-lbs instead of 25 ft-lbs
- (9) A rag will be saturated with a water and fluorescein mixture and wrung-out until damp. The dampened rag will be scrubbed over the test specimen at the seal area for a period of 5 minutes.

**Table 3-10. Test #11, #12, and #13 --
Heat/Scrub Test Using Water Dampened Rags (Modification 1).**

	Test Specimen: C-PP10	Test Specimen: C-PP11	Test Specimen: C-PP12
Test Sequence	Test #11	Test #12	Test #13
Test Contents	Coarse salt crystals	Coarse salt crystals	Coarse salt crystals
Seal Type	None	None	None
Heated Container Temp (Oven)	199°C (390.2°F)	200.5°C (392.9°F)	200.5°C (392.9°F)
Initial Cap Torque	Hand tight	Hand tight	Hand tight
Cooled Test Specimen Temp.	100°C (212°F)	100°C (212°F)	100°C (212°F)
Verified Cap Torque	20 ft-lb	20 ft-lb	20 ft-lb
Retorque Required	N/A	N/A	N/A
Start Time	14:38:00	14:48:30	15:05:25
End Time	14:43:05	14:53:35	15:10:30
Breakaway Torque	started @ 90, broke @ 75 = 15 ft-lb	started @ 90, broke @ 74 = 16 ft-lb	started @ 90, broke @ 75 = 15 ft-lb
Fluorescein/Moisture:			
Seal	N	N	N
Gasket	N/A	N/A	N/A
Threads	N	N	N
Inside	N	N	N

**Table 3-10. Test #11, #12, and #13 --
Heat/Scrub Test Using Water Dampened Rags (Modification 1).**

	Test Specimen: C-PP10	Test Specimen: C-PP11	Test Specimen: C-PP12
Galling: Threads Seal	N N	N N	N N
Result of Test	Pass	Pass	Pass
Comments	No moisture detected and no galling indicated.		

4.0 REFERENCES

HNF-2399, *Design, Fabrication, and Assembly Criteria for Cesium Powder and Pellet Inner Containers*, B&W Hanford Company, Richland, Washington, April 6, 1998. (Note: This document was undergoing revision at the time the test report documentation was being approved for release.)

HNF-2945, *Cesium Powder and Pellets Inner Container Decontamination Method Determination Test*, Waste Management Federal Services, Inc., Northwest Operations, Richland, Washington, July 9, 1998.

Task Order Agreement Contract E42800, Task Order SW826, *Preparation of a Performance Test Plan and Performance Test of Cesium Powder and Pellet Inner Container*, BWHC-9854672, May 28, 1998.

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APPENDIX A
TEST PLAN - FIELD COPY DOCUMENTATION

HNF-3099 Rev. 0

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JUL 09 1998 <i>Sta. 37</i>	ENGINEERING DATA TRANSMITTAL	Page 1 of <u>1</u> 1. EDT 622374
--------------------------------------	-------------------------------------	--

2. To: (Receiving Organization) BWHC - 324 Projects	3. From: (Originating Organization) Packaging Engineering (03E00)	4. Related EDT No.: NA
5. Proj./Prog./Dept./Div.: BWHC - 324 Projects (K4C25) (WMNW: 772030/40-054-001)	6. Design Authority/ Design Agent/Cog. Engr.: SD Landsman, Cog. Engr., BWHC	7. Purchase Order No.: NA
8. Originator Remarks:		9. Equip./Component No.: NA
11. Receiver Remarks:		10. System/Bldg./Facility: NA
11A. Design Baseline Document? ☐ Yes ☒ No		12. Major Assm. Dwg. No.: NA
ENGINEERING DATA TRANSMITTAL		13. Permit/Permit Application No.: NA
		14. Required Response Date: <i>7/9/98</i>

15. DATA TRANSMITTED					(F)	(G)	(H)	(I)
(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	Approval Designator	Reason for Transmittal	Originator Disposition	Receiver Disposition
1	HNF-2945		0	Cesium Powder and Pellets Inner Container Decontamination Method Determination Test	Q	1,2		

16. KEY		
Approval Designator (F) E, S, Q, D or N/A (see WHC-CM-3-6, Sec.12.7)	Reason for Transmittal (G) 1. Approval 2. Release 3. Information 4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	Disposition (H) & (I) 1. Approved 2. Approved w/comment 3. Disapproved w/comment 4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION (See Approval Designator for required signatures)											
(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN
		Design Authority	<i>N/A</i>			1	I	SD Landsman	<i>SD Landsman</i>	<i>7/9/98</i>	L5-32
		Design Agent	<i>N/A</i>			1	I	DH Sandoz	<i>DH Sandoz</i>	<i>7-9-98</i>	L1-06
1	I	Cog. Eng.: PC Ferrell	<i>PC Ferrell</i>	<i>7/9/98</i>	H1-15						
1	I	Cog. Mgr.: JC Field	<i>JC Field</i>	<i>7/9/98</i>	H1-15						
1	I	QA: CR Hoover	<i>CR Hoover</i>	<i>7/9/98</i>	H1-15						
		Safety	<i>N/A</i>								
		Env.	<i>N/A</i>								

18. <i>PC Ferrell</i> Signature of EDT Originator <i>7/9/98</i> Date	19. <i>E.J. Bitten</i> Authorized Representative for Receiving Organization <i>7/9/98</i> Date	20. <i>J.C. Field</i> Design Authority/Cognizant Manager <i>7/9/98</i> Date	21. DOE APPROVAL (if required) Ctrl. No. NA ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments
---	---	--	--

HNF-3099 Rev. 0

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HNF-2945, Rev. 0

Cesium Powder and Pellets Inner Container Decontamination Method Determination

P. C. Ferrell

Waste Management Federal Services Inc., Northwest Operations,
Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-96RL13200

EDT/ECN: EDT 622374

UC: 513

Org Code: 03E00

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Total Pages: 30

Key Words: Cesium Powder and Pellets, Inner Container, Decontamination.

Abstract: The Cesium Powder and Pellets Inner Container is to be performance tested per the criteria specified in Section 4.0 of HNF-2399, "Design, Fabrication, and Assembly Criteria for Cesium Powder and Pellet Inner Container." The test criteria specifies that the Inner Container be water tight during decontamination of the exterior surface. Three prototypes will be immersed into a pool of water to simulate a water decontamination process.

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James Aardal 7/9/98
Release Approval Date

Release Stamp

Approved for Public Release

A-4

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LIST OF TERMS

BWHC	B&W Hanford Company
QA	Quality Assurance
QC	Quality Control
WMNW	Waste Management Federal Services, Inc., Northwest Operations

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CESIUM POWDER AND PELLETS INNER CONTAINER DECONTAMINATION METHOD DETERMINATION TEST

1.0 PURPOSE AND SCOPE

The Cesium Powder and Pellets Inner Container is to be performance tested per the criteria specified in Section 4.0 of HNF-2399, *Design, Fabrication, and Assembly Criteria for Cesium Powder and Pellet Inner Container* and Task Order SW826. The test criteria specifies that the Inner Container be water tight during decontamination of the exterior surface.

The decontamination method determination test will consist of heating, cooling, then immersing three prototype Inner Containers in a pool of water to simulate a water decontamination process. Due to the concern of condensate, the pool of water will contain a leak detection agent (fluorescein). Any in-leakage detection of the fluorescent water to the Inner Container will constitute container seal failure. Additional optional tests are identified in Appendices B and C of this test procedure. The tests will be conducted by the Numatec Hanford Company in the 305 Building.

This procedure may be modified at any time by the mutual decision of the Waste Management Federal Services, Inc., Northwest Operations (WMNW) test engineer and the B&W Hanford Company (BWHC) project engineer and Quality Assurance (QA) representative. The results of such a decision shall be written in red (permanent type) ink on the original test procedure and initialed and dated by the aforementioned parties. At the conclusion of the test, any changes will be incorporated into the document with an engineering change notice.

2.0 REFERENCES

HNF-2399, *Design, Fabrication, and Assembly Criteria for Cesium Powder and Pellet Inner Containers*, B&W Hanford, Company, Richland, Washington, March 18, 1998.

Task Order Agreement Contract E42800, Task Order SW826, Preparation of a Performance Test Plan and Performance Test of Cesium Powder and Pellet Inner Container, BWHC-9854672, May 28, 1998.

3.0 GENERAL REQUIREMENTS

3.1 RECORDS

The WMNW test engineer shall mark one copy of this test procedure, for the testing organization, with the words "Official Copy." The official copy shall be used to record the WMNW test engineer's or the designee's signature, signifying completion of the procedure steps. The completed official copy will be given to BWHC for retention. All entries will be signed and dated. All other test data will be placed into the test file, and maintained in accordance with Project Hanford Management Contract records management requirements.

The WMNW test engineer will prepare a test report summarizing the test results. A summary table depicting test data will be included into the test report. The report, after being signed by the WMNW test engineer and the BWHC project engineer and QA representative, will be distributed to all involved personnel and the customer.

3.2 MEASURE OF SUCCESS

The performance test will be successful when all pretest activities, tests, and post-test activities are completed and recorded in an accurate manner.

3.3 SAFETY

The test facility shall be responsible for reviewing and establishing safety requirements for its portion of the tests.

3.4 PRETEST MEETINGS

Prior to testing, the facility test engineer or designee shall conduct a pretest meeting with all test personnel to review the test procedure and schedule for the day. Safety requirements shall be reviewed along with any special instructions.

3.5 PHOTOGRAPHY

The test facility at the 305 Building shall be responsible for providing photographic evidence of each test setup and the test results.

3.6 EXPECTED DATA

The expected data obtained from these tests shall consist of still pictures, written observations from visual examinations, and the completed test procedures, including equipment calibration data and test details.

3.7 MATERIAL TRANSFER FORM

The BWHC Material Transfer Form (included in Appendix A) shall be completed anytime the test units change custody or building locations. In addition, a copy of the form shall be provided to the BWHC project engineer or designee by the individual receiving the test units.

4.0 PREREQUISITES

4.1 SAFETY

All test operations shall be conducted in a safe and approved manner by authorized personnel. The facility test engineer shall be responsible for approving, authorizing, and maintaining the safety of personnel and equipment at the test facility. The facility test engineer shall review procedures with all test personnel at the start of each test series.

4.2 PERSONNEL REQUIREMENTS

All test personnel shall have received any required special training prior to participating in the tests. All test operations shall be conducted by authorized personnel. A copy of the test procedures shall be reviewed by all test personnel at the start of each test.

The Quality Control (QC) representative, whose signature indicates observation and acceptance of satisfactory completion of any or all test conditions identified in this test procedure, shall have current Level II qualification/certification in the Basic and Mechanical Inspection disciplines. Copies of certifications shall be included in the data package for each signatory QC representative witnessing the included testing activities of these tests.

4.3 WITNESSES

All required test procedure signature points will be signed off and witnessed by the WMNW test engineer, the BWHC project engineer (or designee), and the BWHC QC representative for each test. The QC representative shall verify and record the current calibration status and acceptable indicating range for each instrument used for establishing test conditions and recording of data. Test conditions and parameters shall be verified as acceptable and will be implicit in the QC representative signature following the completion of each test.

5.0 TEST EQUIPMENT

The test equipment will be provided by the 305 Building facility or by BWHC. All test equipment shall be currently calibrated, and a copy of the calibration sheets shall be provided to the WMNW test engineer. The test specimens will be provided by BWHC.

6.0 DETAILED TEST PROCEDURE

The Inner Container is designed to hold Cesium parts and pieces and provide a water tight seal during decontamination of its external surface. If changes need to be taken during testing, these steps will be documented within this test plan, and concurrence will be provided by the WMNW test engineer, BWHC project engineer (or designee), and the BWHC QC representative. A decision point has been added after each section to determine how to proceed.

To demonstrate the sealing capabilities of the Inner Container seal, three prototypic Inner Containers will be subjected to a heat/water immersion test. The Container will be heated to an approximate temperature, and the closure cap will be placed onto each Container then torqued to 25 ft-lbs. The test specimen will be cooled to an approximate temperature and placed into a pool of water that contains a leak-detection agent (fluorescein). If no in-leakage of fluorescein water into the Inner Container is observed, additional testing will not be required.

If fluorescein water in-leakage is detected the Inner Containers will be cleaned out, and the Inner Containers will be subjected to an optional water immersion test. The closure cap on each Inner Container will be torqued to 25 ft-lbs. If no leakage of water into the Inner Container is observed, additional testing will not be required.

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If water in-leakage is detected the Inner Containers will be cleaned out, the closure cap on each on each Inner Container will be torqued to 25 ft-lbs, and the Inner Containers will be subjected to an 2-minute water wash from a hose attached to a water container that is 4 feet above the elevation the test is conducted at. If no leakage of water is detected, additional testing will not be required.

If water in-leakage is detected the Inner Containers will be cleaned out, the closure cap on each Inner Container will be torqued to 25 ft-lbs and the containers will be subjected to a vigorous scrub using water saturated rags for a period of 5 minutes. If no leakage of water is detected, additional testing will not be required.

If water in-leakage is detected the Inner Containers will be cleaned out, the closure cap on each Inner Container will be torqued to 25 ft-lbs and the containers will be subjected to a vigorous 5-minute scrub using dampened rags. If no leakage of water is detected, additional testing will not be required.

If water in-leakage is detected, BWHC Cesium Legacy project management will be consulted to determine path forward. Optional test procedures provided in Appendix B. If BWHC Cesium Legacy project management determines that a higher torque value is to be tested, follow the additional water immersion test procedure provided in Appendix C.

A copy of the test results will be forwarded to BWHC Cesium Legacy cognizant engineer upon successful completion of the test procedure.

6.1 PRETEST REQUIREMENTS

The following items will be verified prior to starting the test.

1. The lid and body of each test specimen shall be permanently and uniquely marked to ensure traceability of the test specimen throughout the test. The identification marking of the lid for each test specimen shall match the identification marking of the test specimen body.
2. The BWHC material transfer form (included in Appendix A) shall be completed, and a copy of this form shall be provided to the BWHC project engineer or designee by the recipient of the test specimens.
3. Each test specimen shall be fabricated to drawing H-3-307832.
4. Test apparatus is ready and instruments are calibrated.

All requirements specified in Section 6.1 are completed. Authorization is granted to assemble the test specimens and start the test.

7/13/98
WMNW Test Engineer Date

7/13/98
BWHC Project Engineer Date

7/13/98
BWHC QC Representative Date

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6.2 PREPARATION OF TEST SPECIMENS

1. Ensure that each test specimen is clean and dry.

All test specimen preparation requirements specified in Section 6.2 are completed.
Authorization is granted to start the test.

Lisa L Kelly 7/13/98
WMNW Engineer Date

W. J. J. J. J. 7/13/98
BWNC Project Engineer Date

[Signature] 7/13/98
BWNC QC Representative Date

6.3 HEAT/WATER IMMERSION TEST

TEST NUMBER 1

The heat/water immersion test consists of heating the test specimens to approximately 200°C (392°F), placing the closure cap onto each Container and torquing the cap to 25 ft-lbs. The test specimen will be free-air cooled to approximately 100°C (212°F) and the closure cap torque reverified to 25 ft-lbs. The specimen will then be placed into a pool of water that contains a leak-detection agent (fluorescein). The test specimens will be placed into the water to a depth of 8.1 ft (+0.5/-0 ft) for a period of at least 5 minutes. After the test, the closure cap will be removed and the inside of the test specimen will be examined for in-leakage of fluorescein water. In addition, the threads and seals will be inspected for galling. The detailed procedure follows.

1. Heat the Container to approximately 200°C (392°F) and remove from oven. (The closure cap will not be heated.) Record the temperature in the table below.
2. Install the closure cap and **polished seal** on the test specimen. Using the BWNC provided spanner, torque the closure cap to 25 ft-lbs. Record torque wrench calibration information, test specimen torque values, and type of seal below.

Torque Wrench Identification: 545-88-01-202 s/n 6064
Next Calibration Due Date: 2-27-99
Acceptable Range: +/- 4%

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TEST SPECIMEN NUMBER	TYPE OF SEAL INSTALLED	HEATED CONTAINER TEMP.	INITIAL CLOSURE CAP TORQUE VALUE	COOLED TEST SPEC. TEMP.	VERIFIED CLOSURE CAP TORQUE VALUE	RE-TORQUE REQ'D (Y / N)
C-PP10	Polished	394 in oven 326 out (F)	25 ft-lb	166 (F)	25 ft-lb	yes
C-PP11						
C-PP12						

H₂O temp
85°F

- Free-air cool the test specimen to approximately 100°C (212°F). Record the temperature in the table above.
- Verify that the torque on the closure cap is 25 ft-lbs. Re-torque to 25 ft-lbs if needed. Record the verified closure cap torque value in the table above, and indicate if re-torquing was required.
- Place the test specimen into an appropriate holder and lower the specimen into the pool of fluorescent water to a depth of 8.1 ft (+0.5, - 0 ft) (**use 8 feet, 8 inches**). The immersion depth is measured from the top of the water to the upper most surface of the test specimen. Hold the test specimen at the prescribed depth for at least 5 minutes. Remove the test specimen. This test will be conducted on all three test specimens. Record the following:

#1 Test Specimen: C-PP10
Immersion Depth: 8 ft - 8 in.
Start Time: 11:36:16
End Time: 11:41:28

*tank has approx.
60 gal. of water and
8 grams of fluorescein
added.*

Test Specimen: _____
Immersion Depth: _____
Start Time: _____
End Time: _____

Test Specimen: _____
Immersion Depth: _____
Start Time: _____
End Time: _____

6. After the test is completed, towel dry the test specimen to remove any visible moisture on the external surfaces. Pay particular attention to the seal area to ensure all moisture is removed.
7. Remove the closure cap from each test specimen. Record the breakaway torque value below for each test specimen as appropriate.

#1

TEST SPECIMEN NUMBER	BREAKAWAY TORQUE VALUE
C-PP10	<i>started @ 50 - broke away @ 28 (22 ft lb)</i>
C-PP11	
C-PP12	

8. Visually examine the interior of each test specimen for in-leakage of fluorescent water. If needed, use a black light. Use the table below to note any fluorescein detection to the seal area, gasket, threads, and inside the test specimen. Use the table below to note any galling of the threads or sealing surface. In addition, record any additional information as needed for documentation purposes.

#1

TEST SPECIMEN NUMBER	FLUORESCIN/MOISTURE				GALLING	
	SEAL	GASKET	THREADS	INSIDE	THREADS	SEAL
C-PP10	<i>Y</i>	<i>Y</i>	<i>Y</i>	<i>Y</i>	<i>N</i>	<i>N</i>
C-PP11						
C-PP12						

Test #1 - C-PP10: Gasket shifted over slightly upon final torque. Indicated drop of moisture under gasket. Measured approximately 90 ml. of liquid + fluorescein inside container.

Dana L Kelly 7-13-98
WMNW Test Engineer Date

[Signature] 7/13/98
BWNC Project Engineer Date

[Signature] 7/13/98
BWNC QC Representative Date

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9. If galling is found, determine if it will affect the results of any additional testing.
10. If no in-leakage of fluorescent water is found and additional testing will be performed, proceed to Appendix B.
11. If additional testing will not be performed, clean the test specimens to remove the fluorescein, and notify the BWHC project engineer for disposition of the test specimens.

Test #2 will be conducted and consists of a combination of steps provided in Section 6.3 (Heat/Water Immersion Test) and Section B.2 (Water Spray Test). Per 324 Projects Mgr, BWHC. Go to Section B.2 of procedure.

Dana L. Kelly 7/13/98
~~Dana L. Kelly~~ 9/10/98
WMMW Test Engineer / date

J.W. Rankin 7/13/98
BWHC Project Engineer / date

[Signature] 7/13/98
BWHC QC Rep / date

APPENDIX A
MATERIAL TRANSFER FORM

DRIVER/CARRIER _____ DATE _____

MATERIAL/ITEM NO.

RECEIVED FROM _____ DATE _____

DELIVER TO _____ DATE _____

ACCEPTED BY _____ DATE _____

REMARKS _____

QC VERIFICATION BY _____ DATE _____

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MATERIAL TRANSFER FORM

FILE COPY

DRIVER/CARRIER Gary Lankham DATE 6/24/98

MATERIAL/ITEM NO.

WEST INNER CAPSULES C-PP10, C-PP11, and C-PP12
With Top End Caps + SealsRECEIVED FROM Gary Lankham DATE 6/24/98DELIVER TO Paul Meekusen DATE 6/24/98ACCEPTED BY Paul M DATE 6/24/98REMARKS Delivered to 305 bldg. for water
integrity testing.QC VERIFICATION BY DATE 6/24/98

2/11/98

ATTACHMENT # B3

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MATERIAL TRANSFER FORM

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DRIVER/CARRIER G. Lankhan DATE 7/14/98

MATERIAL/ITEM NO.

WESF inner tubes Sub-Assemblies
C-PP10, C-PP11 and C-PP12

RECEIVED FROM Paul Meemissen DATE 7/14/98

DELIVER TO T.M. Delucchi DATE 7/14/98

ACCEPTED BY T.M. Delucchi DATE 7/14/98

REMARKS for cleanup

QC VERIFICATION BY [Signature] DATE 7/14/98

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MATERIAL TRANSFER FORM

RECEIVED
DATE
TIME
BY
OFFICE

DRIVER/CARRIER

G. Lanham

DATE

7/14/98

MATERIAL/ITEM NO.

WEST inner tube Sub-assembly
C-PP10

RECEIVED FROM

TA Delucchi

DATE

7/14/98

DELIVER TO

Paul Meunissen

DATE

7/14/98

ACCEPTED BY

[Signature]

DATE

7/14/98

REMARKS

for Testing

QC VERIFICATION BY

[Signature]

DATE

7/14/98

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MATERIAL TRANSFER FORM

FILE COPY

DRIVER/CARRIER G Lankham DATE 7/15/98

MATERIAL/ITEM NO.

3ea West inner Capsule Subassemblies
C-PP10, C-PP11, C-PP12

RECEIVED FROM FA Delucchi (206) DATE 7/15/98

DELIVER TO Paul Meenissen (206) DATE 7/15/98

ACCEPTED BY Paul Meenissen DATE 7/15/98

REMARKS for water testing.

QC VERIFICATION BY Q DATE 7/15/98

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MATERIAL TRANSFER FORM

DRIVER/CARRIER Gary Lanham DATE 7/16/98

MATERIAL/ITEM NO.

WEST inner tubes sub-assemblies
C-PP11, C-PP12

RECEIVED FROM Paul Moonwson ^(for) DATE 7/16/98

DELIVER TO T.A. Delucchi ^(for) DATE 7/16/98

ACCEPTED BY L.E. Pettus DATE 7/16/98

REMARKS for Clean up. Surfaces.

QC VERIFICATION BY JD DATE 7/16/98

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MATERIAL TRANSFER FORM

DRIVER/CARRIER Gary Lankam DATE 7/16/98

MATERIAL/ITEM NO.

WESF inner tubes. Subassemblies
C-PP11, C-PP12

RECEIVED FROM TA Delucchi (306) DATE 7/16/98

DELIVER TO Pant Meenwisen (305) DATE 7/16/98

ACCEPTED BY Karl [Signature] DATE 7/16/98

REMARKS for testing

QC VERIFICATION BY [Signature] DATE 7/16/98

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MATERIAL TRANSFER FORM

DRIVER/CARRIER Gary Lanham DATE 7/16/98

MATERIAL/ITEM NO.

WEST Inner tube Subassembly
C-PP10,

RECEIVED FROM Paul Meenissen DATE 7/16/98

DELIVER TO T.A. Delucchi DATE 7/16/98

ACCEPTED BY L.T. Calton DATE 7/16/98

REMARKS for Clean up of Sealing Surfaces.

QC VERIFICATION BY DATE 7/16/98

ORIGINAL

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11.30

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MATERIAL TRANSFER FORM

DRIVER/CARRIER Gary Lanham DATE 7/16/98

MATERIAL/ITEM NO.

WESF laser tube Sub-assembly
C-PP10

RECEIVED FROM TA. Deluschi DATE 7/16/98

DELIVER TO Paul Meeuwsen DATE 7/16/98

ACCEPTED BY Paul M DATE 7/16/98

REMARKS Returns for water testing.

QC VERIFICATION BY DATE 7/14/98

Paul
ORIGINAL

HNF-3099 Rev. 0

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MATERIAL TRANSFER FORM

3:35 pm.

DRIVER/CARRIER Gary Lashan DATE 7/16/98

MATERIAL/ITEM NO.

WEST inner tubes, Sub-assemblies,
C-PP10, C-PP11 and C-PP12

RECEIVED FROM Paul Meenwisen ⁽³⁰⁵⁾ DATE 7/16/98

DELIVER TO TA Delucchi ⁽³⁰⁶⁾ DATE 7/16/98

ACCEPTED BY Myron Lantier DATE 7-17-98

REMARKS for Cleanup of seating Surfaces.

QC VERIFICATION BY

(Signature)

DATE

7/16/98

ORIGINAL

HNF-3099 Rev. 0

OFFICIAL COPY

MATERIAL TRANSFER FORM

DRIVER/CARRIER Gary Lushan DATE 7/17/98

MATERIAL/ITEM NO.

WESF inner tubes, Sub-assemblies
C-PA10, C-PA11 and C-PA12

RECEIVED FROM TA Schuch DATE 7/17/98

DELIVER TO Paul Meenissen DATE 7/17/98

ACCEPTED BY DZ Powell DATE 7/17/98

REMARKS Return for Testing.

QC VERIFICATION BY DATE 7/17/98

APPENDIX B
OPTIONAL TESTS

B.1 OPTIONAL WATER IMMERSION TEST

If optional water immersion tests are desired, proceed with the following steps.

B.1.1 Preparation of Test Specimens

A mixture of flour and fluorescein will be placed in each of the test units and the closure cap and seal will be installed and torqued. The flour and fluorescein mixture will aid in the detection of any water that may leak into the test specimens. The detailed preparation procedures are as follows.

1. Ensure that each test specimen is clean and dry.
2. Determine if any galling found will affect the result of this test.
3. Prepare three mixtures of $\frac{1}{4}$ cup flour and $\frac{1}{4}$ tsp fluorescein. Place one mixture into each test specimen.

NOTE: Caution should be used to ensure that none of the mixture comes in contact with the test specimen outer surface or closure threads.

4. Install the closure cap and seal on each test specimen. Ensure that the identification marking of the lid mates with the identification marking of the body. **On one test specimen use a BWHC fabricated seal; on the other two test specimens use BWHC procured seals.** Using the BWHC provided spanner, torque each closure cap to 25 ft-lbs. Record torque wrench calibration information, test specimen torque values, and type of seal below.

Torque Wrench Identification: _____

Next Calibration Due Date: _____

Acceptable Range: _____

TEST SPECIMEN NUMBER	TYPE OF SEAL INSTALLED	CLOSURE CAP TORQUE VALUE
C-PP10		
C-PP11		
C-PP12		

5. If needed, clean the external surface of the test specimens.

All test specimen preparation requirements specified in Section B.1.1 are completed. Authorization is granted to start the test.

WMNW Test Engineer _____ Date _____

BWHC Project Engineer _____ Date _____

BWHC QC Representative _____ Date _____

B.1.2 Optional Water Immersion Test

TEST NUMBER _____

The optional water immersion test consists of placing the test specimens in a pool of water to a depth of 8.1 feet for two periods of at least 5 minutes each. After the test, the closure caps will be removed and the inside of each test specimen will be examined for water. In addition, the threads and seals will be inspected for galling. The detailed procedure follows.

NOTE: The water temperature of the immersion pool and the test facility air temperature will be verified prior to the start of this test. If additional steps need to be taken during testing to ensure that a vacuum is not created within the inner container, these steps will be documented within this test plan, and concurrence will be provided by the WMNW test engineer, BWHC project engineer (or designee), and the BWHC QC representative.

TEST SPECIMEN NUMBER	TEMPERATURE OF POOL	BLDG AIR TEMPERATURE
C-PP10		
C-PP11		
C-PP12		

- Place the three test specimens in an appropriate holder and lower the specimens into the pool of water to a depth of 8.1 feet (+0.5, -0 ft) (**use 8 feet, 8 inches**). The immersion depth is measured from the top of the water to the upper most surface of the test specimens. Hold the test specimens at the prescribed depth for at least 5 minutes. Remove the test specimens and repeat the immersion test for another period of at least 5 minutes. Record the following:

Period 1

Immersion Depth: _____

Start Time: _____

End Time: _____

Period 2

Immersion Depth: _____

Start Time: _____

End Time: _____

2. After the test is completed, towel dry the test specimens to remove any visible moisture on the external surfaces. Pay particular attention to the seal area to ensure all moisture is removed.
3. Remove the closure cap from each test specimen. Record the breakaway torque value below for each test specimen as appropriate.

TEST SPECIMEN NUMBER	BREAKAWAY TORQUE VALUE
C-PP10	
C-PP11	
C-PP12	

4. Visually examine the interior of each test specimen for water. If needed, use a black light. Use the table below to note any moisture detection to the seal area, gasket, threads, and inside the test specimen. Use the table below to note any galling of the threads or seal. In addition, record any additional information as needed for documentation purposes.

TEST SPECIMEN NUMBER	MOISTURE				GALLING	
	SEAL	GASKET	THREADS	INSIDE	THREADS	SEAL
C-PP10						
C-PP11						
C-PP12						

OFFICIAL COPY

WMNW Test Engineer

Date

BWHC Project Engineer

Date

BWHC QC Representative

Date

5. If galling is found, determine if it will affect the results of any additional testing.
6. If no water is found and additional testing will be performed, proceed to Section B.2 to continue with optional tests, or to Appendix C for additional water immersion testing using a different torque value.
7. If additional testing will not be performed, clean the test specimens to remove the flour and fluorescein mixture, and notify the BWHC project engineer for disposition of the test specimens.

B.2 WATER SPRAY TESTS

Test #2 (revised)

If water spray tests are desired, proceed with the following steps.

The pretest requirements of Section 6.1 (pg 4) will be met prior to this test. The Preparation of test specimens will be as noted in Section 6.2 (pg 5) Refer to attached sheet for revised test procedure.

B.2.1 Preparation of Test Specimens

~~A mixture of flour and fluorescein will be placed in each of the test units and the closure cap and seal will be installed and torqued. The flour and fluorescein mixture will aid in the detection of any water that may leak into the test specimens. The detailed preparation procedures follow.~~

1. Ensure that each test specimen is clean and dry.
2. Determine if any galling found prior to conducting this test will affect the result of this test.
3. ~~The flour and fluorescein mixture used in the previous test may be used if adequate. If not adequate, remove the old flour and fluorescein mixture and prepare three new mixtures of 1/4 cup flour and 1/4 tsp fluorescein. Place one mixture into each test specimen.~~

NOTE: ~~Caution should be used to ensure that none of the mixture comes in contact with the test specimen outer surface or closure threads.~~

4. ~~Install the closure cap and seal on each test specimen. Ensure that the identification marking of the lid mates with the identification marking of the body. On one test specimen use a BWHC fabricated seal; on the other two test specimens use BWHC procured seals. Using the BWHC provided spanner, torque each closure cap to 25 ft-lbs. Record torque wrench calibration information, test specimen torque values, and type of seal below.~~

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Test #2B.2 ^{Heat/} Water Spray Tests

B.2.1 The pretreat requirements of Section 6.1 (page 4) will be met prior to this test.

The flour and fluorescein mixture will not be placed inside the test specimen.

All requirements specified in section B.2.1 (revised) are completed. Authorization is granted to assemble the test specimen and start the test, Per 324 Projects Mgr, BWHC.

Dana L. Kelly 7/13/98
WMNW Test Engineer / date

W. Zambra 7/13/98
BWHC Project Engineer / date

Ⓟ 7/13/98
BWHC QC Rep / date

B.2.2 ^{Heat/} Water Spray Test Test # 2

This test consists of heating the test specimen to approximately 200°C (392°F), placing the Closure Cap onto the Container, letting the container be free-air cooled to approximately 100°C (212°F), and the Closure Cap torqued to 25 ft-lbs.

The test specimen will then be sprayed with fluorescent water. The water spray will consist of a head of 4ft. on the seal area of the container for two periods of at least 2 minutes each. After the test, the Closure caps will be removed and the inside of each test specimen will be examined for water. In addition, the threads and seals will be inspected for galling. The detailed procedure follows:

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Test #2 (Cont)

1. Heat the Container to approximately 200°C (392°F) and remove from oven. (The Closure Cap will not be heated.) Record the temperature in the table below.
2. Install Closure Cap and polished seal on the test specimen. When test unit reaches approximately 100°C (212°F), torque the Closure Cap to 25 ft.-lbs. Record the torque wrench calibration information, test specimen torque values, & type of seal below.

Torque wrench identification: 545-88-01-202 s/n 6064
 Next Calibration due Date: 2-27-99
 Acceptable range: $\pm 4\%$

Test specimen #: C-PP11
 type of seal installed: polished
 Heated container temp: 200° in oven (C)
 Initial Closure Cap torque value: N/A
 Cooled test spec. temp: 220° (F) begin torque - / torque to 25 ft.-lb.
 Verified Closure Cap torque value:
 re-torque req'd (Y/N): N/A

3. Go to Section B.2.2 (original test plan), step #1. Step #1 will now become step #3. ^{data} Proceed with testing.

Torque Wrench Identification: _____

Next Calibration Due Date: _____

Acceptable Range: _____

TEST SPECIMEN NUMBER	TYPE OF SEAL INSTALLED	CLOSURE CAP TORQUE VALUE
C-PP10		
C-PP11		
C-PP12		

5. If needed, clean the external surface of the test specimens.

All test specimen preparation requirements specified in Section B.2.1 are completed.
Authorization is granted to start the test.

WMNW Test Engineer Date

BWHC Project Engineer Date

BWHC QC Representative Date

B.2.2 Water Spray Test

Refer to attached sheet for revised test procedure for Test #2
TEST NUMBER 2

~~The water spray test consists of spraying water with a head of 4 feet on the seal area of the container for two periods of at least 2 minutes each. After the test, the closure caps will be removed and the inside of each test specimen will be examined for water. In addition, the threads and seals will be inspected for galling. The detailed procedure follows.~~

4. ~~1.~~

Place the three test specimens in an appropriate holder. Rig a container filled with water and equipped with a spigot in a position approximately 4 feet higher than the elevation of the top of the test specimens. Attach a 3/8-inch diameter tygon tube to the container spigot. Allow the water to gravity feed down the tube and spray the seal areas of the test specimens for a period of 2 minutes. The water container height is measured from the bottom of the water container to the upper most surface of the test specimens. At the end of the first period, refill the water container and repeat the spray test for another period of at least 2 minutes. Record the following:

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Period 1

Water Container Height:

Start Time:

End Time:

C-PP11
Test #2

4 ft

2:46:18

2:48:18

Period 2

Water Container Height:

Start Time:

End Time:

4 ft

2:48:26

2:50:26

6.2.

After the test is completed, towel dry the test specimens to remove any visible moisture on the external surfaces. Pay particular attention to the seal area to ensure all moisture is removed.

6.3.

Remove the closure cap from each test specimen. Record the breakaway torque value below for each test specimen as appropriate.

TEST SPECIMEN NUMBER	BREAKAWAY TORQUE VALUE
C-PP10	
C-PP11	start @ 50 - breakaway @ 30 = 20 ft lbs.
C-PP12	

Test #2 -

7.4.

Visually examine the interior of each test specimen for water. If needed, use a black light. Use the table below to note any moisture detection to the seal area, gasket, threads, and inside the test specimen. Use the table below to note any galling of the threads or seal. In addition, record any additional information as needed for documentation purposes.

TEST SPECIMEN NUMBER	MOISTURE				GALLING	
	SEAL	GASKET	THREADS	INSIDE	THREADS	SEAL
C-PP10						
C-PP11	Y	Y	Y	Y	N	N
C-PP12						

Test #2

Test #2 - C-PPH: about 1/2 tsp of water indicated inside tube upon opening. Will proceed to Test B.3 below.

Diana L. Kelly
WMNW Test Engineer

7-13-78
Date

[Signature]
BWHC Project Engineer

7/13/68
Date

[Signature]
BWHC QC Representative

7/13/68
Date

4. 6. If galling is found, determine if it will affect the results of any additional testing.
4. 6. If no water is found and additional testing will be performed, proceed to Section B.3 for additional optional tests.
10. 7. If additional testing will not be performed, clean the test specimens to remove the flour and fluorescein mixture, and notify the BWHC project engineer for disposition of the test specimens.

B.3 SCRUB TEST USING WATER SATURATED RAGS

(Test #3)

B.3.1 Preparation of Test Specimens

A mixture of flour and fluorescein will be placed in each of the test units and the closure cap and seal will be installed and torqued. The flour and fluorescein mixture will aid in the detection of any water that may leak into the test specimens. The detailed preparation procedures follow.

1. Ensure that each test specimen is clean and dry.
2. Determine if any galling found prior to conducting this test will affect the result of this test.
3. The flour and fluorescein mixture used in the previous test may be used if adequate. If not adequate, remove the old flour and fluorescein mixture and prepare three new mixtures of 1/4 cup flour and 1/4 tsp fluorescein. Place one mixture into each test specimen.

NOTE: Caution should be used to ensure that none of the mixture comes in contact with the test specimen outer surface or closure threads.

4. Install the closure cap and seal on each test specimen. Ensure that the identification marking of the lid mates with the identification marking of the body. **On one test specimen use a BWHC fabricated seal; on the other two test specimens use BWHC procured seals.** Using the BWHC provided spanner, torque each closure cap to 25 ft-lbs. Record torque wrench calibration information, test specimen torque values, and type of seal below.

Torque Wrench Identification: 545-88-01-202 s/n 6064
Next Calibration Due Date: 2-27-99
Acceptable Range: +/- 4%

TEST SPECIMEN NUMBER	TYPE OF SEAL INSTALLED	CLOSURE CAP TORQUE VALUE
C-PP10		
C-PP11		
C-PP12	Polished *	25 ft/lb

Test #3

* fabricated seal. would not fit over threads so polished seal was used instead.

5. If needed, clean the external surface of the test specimens.

All test specimen preparation requirements specified in Section B.3.1 are completed. Authorization is granted to start the test.

Donna L. Kelly 7-14-98
WMNW Test Engineer Date

[Signature] 7/14/98
BWHC Project Engineer Date

[Signature] 7/14/98
BWHC QC Representative Date

B.3.2 Scrub Test Using Water Saturated Rags

TEST NUMBER #3

This test consists of subjecting each test specimen to a vigorous scrubbing using water saturated rags for a period of at least 5 minutes. After the test, the closure caps will be removed and the inside of each test specimen will be examined for water. The detailed procedure is as follows.

1. Place a test specimen in an appropriate holder. Saturate several rags with water and vigorously scrub the test specimen seal area for at least 5 minutes. Repeat the test for the other two test specimens. Record the following:

Test Specimen Number: C-PP12
Start Time: 10:11:33
End Time: 10:16:34

Test Specimen Number: _____
Start Time: _____
End Time: _____

Test Specimen Number: _____
Start Time: _____
End Time: _____

2. After the test is completed, towel dry the test specimens to remove any visible moisture on the external surfaces. Pay particular attention to the seal area to ensure all moisture is removed.
3. Remove the closure cap from each test specimen. Record the breakaway torque value below for each test specimen as appropriate.

TEST SPECIMEN NUMBER	BREAKAWAY TORQUE VALUE
C-PP10	
C-PP11	
C-PP12	set @ 50 - broke @ 25 = 25 ft lbs

Test # 3

4. Visually examine the interior of each test specimen for water. If needed, use a black light. Use the table below to note any moisture detection to the seal area, gasket, threads, and inside the test specimen. Use the table below to note any galling of the threads or seal. In addition, record any additional information as needed for documentation purposes.

TEST SPECIMEN NUMBER	MOISTURE				GALLING	
	SEAL	GASKET	THREADS	INSIDE	THREADS	SEAL
C-PP10						
C-PP11						
C-PP12	Y	Y	Y	N	N	N

Test # 3

Test #3 - C-PPA - moisture / flour / filler found on upper portion of flange of cap only (about 1/2 way down on cap).
Test results were reviewed, acceptable to retaining a minimum density in concrete. Determined to be acceptable to maintain testing per Section 1.0 of the plan. It was agreed to modify testing to repeat the test (see Test #2) with the following modifications:
① clean / polished cap & body in place
② no grout
③ take test specimen of grout

WMNW Test Engineer
James Kelly
Date 7-14-98

BWHC Project Engineer
Jim Smith
Date 7/14/98

BWHC QC Representative
[Signature]
Date 7/14/98

5. If galling is found, determine if it will affect the results of any additional testing.

6. If no water is found and additional testing will be performed, proceed to Section B.4.

7. If additional testing will not be performed, clean the test specimens to remove the flour and fluorescein mixture, and notify the BWHC project engineer for disposition of the test specimens.

B.4 SCRUB TEST USING WATER DAMPENED RAGS

B.4.1 Preparation of Test Specimens

A mixture of flour and fluorescein will be placed in each of the test units and the closure cap and seal will be installed and torqued. The flour and fluorescein mixture will aid in the detection of any water that may leak into the test specimens. The detailed preparation procedures follow.

1. Ensure that each test specimen is clean and dry.
2. Determine if any galling found prior to conducting this test will affect the result of this test.
3. The flour and fluorescein mixture used in previous testing may be used if adequate. If not adequate, remove the old flour and fluorescein mixture and prepare three new mixtures of 1/4 cup flour and 1/4 tsp fluorescein. Place one mixture into each test specimen.

NOTE: Caution should be used to ensure that none of the mixture comes in contact with the test specimen outer surface or closure threads.

4. Install the closure cap and seal on each test specimen. Ensure that the identification marking of the lid mates with the identification marking of the body. **On one test specimen use a BWHC fabricated seal; on the other two test specimens use BWHC procured seals.** Using the BWHC provided spanner, torque each closure cap to 25 ft-lbs. Record torque wrench calibration information, test specimen torque values, and type of seal below.

Torque Wrench Identification: _____

Next Calibration Due Date: _____

Acceptable Range: _____

TEST SPECIMEN NUMBER	TYPE OF SEAL INSTALLED	CLOSURE CAP TORQUE VALUE
C-PP10		
C-PP11		
C-PP12		

5. If needed, clean the external surface of the test specimens.

All test specimen preparation requirements specified in Section B.4.1 are completed. Authorization is granted to start the test.

WMNW Test Engineer Date

BWHC Project Engineer Date

BWHC QC Representative Date

B.4.2 Water Scrub Test Using Dampened Rag

TEST NUMBER _____

This test consists of subjecting each test specimen to a vigorous scrubbing using water dampened rags for a period of at least 5 minutes. After the test, the closure caps will be removed and the inside of each test specimen will be examined for water. The detailed procedure is as follows.

1. Place a test specimen in an appropriate holder. Dampen several rags with water and vigorously scrub the test specimen seal area for at least 5 minutes. Repeat the test for the other two test specimens. Record the following:

Test Specimen Number: _____

Start Time: _____

End Time: _____

Test Specimen Number: _____

Start Time: _____

End Time: _____

Test Specimen Number: _____

Start Time: _____

End Time: _____

2. After the test is completed, towel dry the test specimens to remove any visible moisture on the external surfaces. Pay particular attention to the seal area to ensure all moisture is removed.
3. Remove the closure cap from each test specimen. Record the breakaway torque value below for each test specimen as appropriate.

TEST SPECIMEN NUMBER	BREAKAWAY TORQUE VALUE
C-PP10	
C-PP11	
C-PP12	

4. Visually examine the interior of each test specimen for water. If needed, use a black light. Use the table below to note any moisture detection to the seal area, gasket, threads, and inside the test specimen. Use the table below to note any galling of the threads and seal. In addition, record any additional information as needed for documentation purposes.

TEST SPECIMEN NUMBER	MOISTURE				GALLING	
	SEAL	GASKET	THREADS	INSIDE	THREADS	SEAL
C-PP10						
C-PP11						
C-PP12						

WMNW Test Engineer

Date

BWHC Project Engineer

Date

BWHC QC Representative

Date

5. If galling is found, determine if it will affect the results of any additional testing.
6. If no water is found and additional testing will be performed, proceed to Appendix C.
7. If additional testing will not be performed, clean the test specimens to remove the flour and fluorescein mixture, and notify the BWHC project engineer for disposition of the test specimens.

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WMNW Test Engineer _____ Date _____

BWHC Project Engineer _____ Date _____

BWHC QC Representative _____ Date _____

5. If galling is found, determine if it will affect the results of any additional testing.
6. If no water is found and additional testing will be performed, proceed to Section B.2 to continue with optional tests, or to Appendix C for additional water immersion testing using a different torque value.
7. If additional testing will not be performed, clean the test specimens to remove the flour and fluorescein mixture, and notify the BWHC project engineer for disposition of the test specimens.

B.2 WATER SPRAY TESTS

If water spray tests are desired, proceed with the following steps.

B.2.1 Preparation of Test Specimens

The pretest requirements of Section 6.1 (pg 4) will be met prior to this test. The preparation of test specimens will be as noted in Section 6.2 (pg 5). Refer to the attached sheet for revised test procedure.

A mixture of flour and fluorescein will be placed in each of the test units and the closure cap and seal will be installed and torqued. The flour and fluorescein mixture will aid in the detection of any water that may leak into the test specimens. The detailed preparation procedures follow.

1. Ensure that each test specimen is clean and dry.
2. Determine if any galling found prior to conducting this test will affect the result of this test.
3. The flour and fluorescein mixture used in the previous test may be used if adequate. If not adequate, remove the old flour and fluorescein mixture and prepare three new mixtures of ¼ cup flour and ¼ tsp fluorescein. Place one mixture into each test specimen.

NOTE: Caution should be used to ensure that none of the mixture comes in contact with the test specimen outer surface or closure threads.

4. Install the closure cap and seal on each test specimen. Ensure that the identification marking of the lid mates with the identification marking of the body. On one test specimen use a BWHC fabricated seal; on the other two test specimens use BWHC procured seals. Using the BWHC provided spanner, torque each closure cap to 25 ft-lbs. Record torque wrench calibration information, test specimen torque values, and type of seal below.

Test #4 (Heat / Water spray Test)

Refer to modified test conducted in Section B.2. (Test #2)
 This will be termed the heat / water spray test. Additional
 modifications will be made as noted on pg B-10 signatures.

The pre-test requirements of Section 6.1 (page 4) will
 be met prior to this test.

The flour + fluorescein mixture will not be placed
 inside the test specimen.

All requirements specified in Section B.2.1 (revised)
 are completed. This test specimen has been cleaned
 and the lid + body, repolished. Authorization
 is granted to assemble the test specimen and
 start the test, per 324 Projects Mgr, BWHC.

Dorcas Z. Kelly 7/14/98
 WMNW Test Eng. / date

W. Z. Zankham 7/14/98
 BWHC Project Eng. / date

[Signature] 7/14/98
 BWHC QC Rep. / date

Heat / Water Spray TestTest #4

This test will be performed with the same parameters
 as noted in modified Section B.2.2.1 ^(Test #2). In addition,
 the test ~~specifications~~ parameters will include
 the following additional modifications:

- ① Test specimen will have cleaned cap & body
 interface.
- ② Test specimen will not include a gasket.
- ③ Test specimen will be filled with heated
 quartz crystals until approx. 75-80% full.

Test #4

1. Fill test specimen 75-80% full with warmed quartz crystals.
2. Heat test container to approximately 200°C (392°F) and remove from oven. (The closure cap will not be heated.) Record temperature in table below.
3. Install closure cap onto test specimen. When first unit reaches approximately 100°C (212°F), torque closure cap to 25 ft-lb. Record the torque wrench calibration information, test specimen torque values, below.

Torque wrench identification : 545-88-01-202 s/n 6064Next calibration due date : 2-27-99Acceptable range : +/- 4%Test specimen # : C-PP10Type of seal installed : noneHeated container temp : 200.8°CInitial closure cap torque value : N/A (hand tight)Cooled test spec. temp : 182°FVerified closure cap torque value : 25 ft lbre-torque req'd (Y/N) : No

4. To H. Section B.2.2 (original test plan), step #1. Step #1 will now become Step #5. Proceed with testing.

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Torque Wrench Identification: _____
Next Calibration Due Date: _____
Acceptable Range: _____

TEST SPECIMEN NUMBER	TYPE OF SEAL INSTALLED	CLOSURE CAP TORQUE VALUE
C-PP10		
C-PP11		
C-PP12		

5. If needed, clean the external surface of the test specimens.

All test specimen preparation requirements specified in Section B.2.1 are completed. Authorization is granted to start the test.

WMNW Test Engineer _____ Date _____

BWHC Project Engineer _____ Date _____

BWHC QC Representative _____ Date _____

B.2.2 Water Spray Test

Refer to attached sheet for revised test procedure for Test #4

TEST NUMBER 4

The water spray test consists of spraying water with a head of 4 feet on the seal area of the container for two periods of at least 2 minutes each. After the test, the closure caps will be removed and the inside of each test specimen will be examined for water. In addition, the threads and seals will be inspected for galling. The detailed procedure follows.

5. *1.*

Place the three test specimens in an appropriate holder. Rig a container filled with water and equipped with a spigot in a position approximately 4 feet higher than the elevation of the top of the test specimens. Attach a 3/8-inch diameter tygon tube to the container spigot. Allow the water to gravity feed down the tube and spray the seal areas of the test specimens for a period of 2 minutes. The water container height is measured from the bottom of the water container to the upper most surface of the test specimens. At the end of the first period, refill the water container and repeat the spray test for another period of at least 2 minutes. Record the following:

Period 1

Water Container Height: 4ft - 5ft range
Start Time: 2:58:21
End Time: 3:01:22

Period 2

Water Container Height: 4ft - 5ft range
Start Time: 3:01:27
End Time: 3:03:28

6. 2. After the test is completed, towel dry the test specimens to remove any visible moisture on the external surfaces. Pay particular attention to the seal area to ensure all moisture is removed.
7. 2. Remove the closure cap from each test specimen. Record the breakaway torque value below for each test specimen as appropriate.

Test #4 -

TEST SPECIMEN NUMBER	BREAKAWAY TORQUE VALUE
C-PP10	<i>start @ 50 - broke @ 27</i>
C-PP11	
C-PP12	

= 21 ft lb

8. A. Visually examine the interior of each test specimen for water. If needed, use a black light. Use the table below to note any moisture detection to the seal area, gasket, threads, and inside the test specimen. Use the table below to note any galling of the threads or seal. In addition, record any additional information as needed for documentation purposes.

Test #4

TEST SPECIMEN NUMBER	MOISTURE				GALLING	
	SEAL	GASKET	THREADS	INSIDE	THREADS	SEAL
C-PP10	<i>Y</i>	<i>NA</i>	<i>Y</i>	<i>N</i>	<i>N</i>	<i>N</i>
C-PP11						
C-PP12						

Test #4 - C-PP10 - indication of 1 drop water/fluoresc. under lid/body interface. Moisture followed threads of cap, however no moisture/leakage indicated inside container body.

Lorisa L Kelly 7-14-98
WMNW Test Engineer Date

L W Rankin 7/14/98
BWHC Project Engineer Date

[Signature] 7/14/98
BWHC QC Representative Date

9. ~~6.~~ If galling is found, determine if it will affect the results of any additional testing.
10. ~~6.~~ If no water is found and additional testing will be performed, proceed to Section B.3 for additional optional tests.
11. ~~7.~~ If additional testing will not be performed, clean the test specimens to remove the flour and fluorescein mixture, and notify the BWHC project engineer for disposition of the test specimens.

B.3 SCRUB TEST USING WATER SATURATED RAGS

B.3.1 Preparation of Test Specimens

A mixture of flour and fluorescein will be placed in each of the test units and the closure cap and seal will be installed and torqued. The flour and fluorescein mixture will aid in the detection of any water that may leak into the test specimens. The detailed preparation procedures follow.

1. Ensure that each test specimen is clean and dry.
2. Determine if any galling found prior to conducting this test will affect the result of this test.
3. The flour and fluorescein mixture used in the previous test may be used if adequate. If not adequate, remove the old flour and fluorescein mixture and prepare three new mixtures of ¼ cup flour and ¼ tsp fluorescein. Place one mixture into each test specimen.

NOTE: Caution should be used to ensure that none of the mixture comes in contact with the test specimen outer surface or closure threads.

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If water in-leakage is detected the Inner Containers will be cleaned out, the closure cap on each on each Inner Container will be torqued to 25 ft-lbs, and the Inner Containers will be subjected to an 2-minute water wash from a hose attached to a water container that is 4 feet above the elevation the test is conducted at. If no leakage of water is detected, additional testing will not be required.

If water in-leakage is detected the Inner Containers will be cleaned out, the closure cap on each Inner Container will be torqued to 25 ft-lbs and the containers will be subjected to a vigorous scrub using water saturated rags for a period of 5 minutes. If no leakage of water is detected, additional testing will not be required.

If water in-leakage is detected the Inner Containers will be cleaned out, the closure cap on each Inner Container will be torqued to 25 ft-lbs and the containers will be subjected to a vigorous 5-minute scrub using dampened rags. If no leakage of water is detected, additional testing will not be required.

If water in-leakage is detected, BWHC Cesium Legacy project management will be consulted to determine path forward. Optional test procedures provided in Appendix B. If BWHC Cesium Legacy project management determines that a higher torque value is to be tested, follow the additional water immersion test procedure provided in Appendix C.

A copy of the test results will be forwarded to BWHC Cesium Legacy cognizant engineer upon successful completion of the test procedure.

6.1 PRETEST REQUIREMENTS

Test #5 and Test #6

The following items will be verified prior to starting the test.

1. The lid and body of each test specimen shall be permanently and uniquely marked to ensure traceability of the test specimen throughout the test. The identification marking of the lid for each test specimen shall match the identification marking of the test specimen body.
2. The BWHC material transfer form (included in Appendix A) shall be completed, and a copy of this form shall be provided to the BWHC project engineer or designee by the recipient of the test specimens.
3. Each test specimen shall be fabricated to drawing H-3-307832.
4. Test apparatus is ready and instruments are calibrated.

All requirements specified in Section 6.1 are completed. Authorization is granted to assemble the test specimens and start the test.

Anna L Kelly *7/15/98*
WMNW Test Engineer Date

L W Zanham *7/15/98*
BWHC Project Engineer Date

[Signature] *7/15/98*
BWHC QC Representative Date

6.2 PREPARATION OF TEST SPECIMENS

1. Ensure that each test specimen is clean and dry.

2. *Lid and body interface were repolished prior to conducting this test (on all 3 test specimens.)*

All test specimen preparation requirements specified in Section 6.2 are completed.

Authorization is granted to start the test.

3. *No gasket will be used.*

Diana Z Kelly 7/15/98
WMNW Engineer Date

J.W. Zamban 7/15/98
BWNC Project Engineer Date

[Signature] 7/15/98
BWNC QC Representative Date

6.3 HEAT/WATER IMMERSION TEST

TEST NUMBER *5 and 6*

The heat/water immersion test consists of heating the test specimens to approximately 200°C (392°F), placing the closure cap onto each Container and torquing the cap to 25 ft-lbs. The test specimen will be free-air cooled to approximately 100°C (212°F) and the closure cap torque reverified to 25 ft-lbs. The specimen will then be placed into a pool of water that contains a leak-detection agent (fluorescein). The test specimens will be placed into the water to a depth of 8.1 ft (+0.5/-0 ft) for a period of at least 5 minutes. After the test, the closure cap will be removed and the inside of the test specimen will be examined for in-leakage of fluorescein water. In addition, the threads and seals will be inspected for galling. The detailed procedure follows.

1. *and Salt*
Heat the Container to approximately 200°C (392°F) and remove from oven. (The closure cap will not be heated.) Record the temperature in the table below.
2. *2.*
Install the closure cap ~~and polished seal~~ on the test specimen. Using the BWNC provided spanner, torque the closure cap to 25 ft-lbs. Record torque wrench calibration information, test specimen torque values, and type of seal below.

Torque Wrench Identification: 545-88-01-202 5/n 6064
Next Calibration Due Date: 2-27-99
Acceptable Range: +/- 4%

1. *Fill test specimens with coarse salt to approximately 75-80% full. Note - no gasket will be used.*
- Note: *Test Specimen C-PP12 will be filled with salt only. Test specimen C-PP11 will be filled with salt & topped with approximately 1 Tablespoon of baking flour.*

TEST SPECIMEN NUMBER	TYPE OF SEAL INSTALLED	HEATED CONTAINER TEMP.	INITIAL CLOSURE CAP TORQUE VALUE	COOLED TEST SPEC. TEMP.	VERIFIED CLOSURE CAP TORQUE VALUE	RE-TORQUE REQ'D (Y / N)
C-PP10						
#6 C-PP11	none	201.5°C	25 ft-lb	210°F	25 ft-lb	Y
#5 C-PP12	none	201.4°C	25 ft-lb	212°F	25 ft-lb	Y

4. ~~3~~ Free-air cool the test specimen to approximately 100°C (212°F). Record the temperature in the table above.
5. ~~A~~ Verify that the torque on the closure cap is 25 ft-lbs. Re-torque to 25 ft-lbs if needed. Record the verified closure cap torque value in the table above, and indicate if re-torquing was required.
6. ~~B~~ Place the test specimen into an appropriate holder and lower the specimen into the pool of fluorescent water to a depth of 8.1 ft (+0.5, - 0 ft) (**use 8 feet, 8 inches**). The immersion depth is measured from the top of the water to the upper most surface of the test specimen. Hold the test specimen at the prescribed depth for at least 5 minutes. Remove the test specimen. This test will be conducted on all three test specimens. Record the following:

Test Specimen: C-PP12
Immersion Depth: 8ft-8in
Start Time: 1:18:54
End Time: 1:23:55

Test Specimen: C-PP11
Immersion Depth: 8ft-8in
Start Time: 2:12:30
End Time: 2:17:31

Test Specimen: _____
Immersion Depth: _____
Start Time: _____
End Time: _____

7. *6.*

After the test is completed, towel dry the test specimen to remove any visible moisture on the external surfaces. Pay particular attention to the seal area to ensure all moisture is removed.

8. *7.*

Remove the closure cap from each test specimen. Record the breakaway torque value below for each test specimen as appropriate.

TEST SPECIMEN NUMBER	BREAKAWAY TORQUE VALUE
C-PP10	
<i>#6</i> C-PP11	<i>set @ 95 - broke @ 60 = 35 ft lb</i>
<i>#5</i> C-PP12	<i>set @ 90 - broke @ 0 = 90 ft lb</i>

9. *8.*

Visually examine the interior of each test specimen for in-leakage of fluorescent water. If needed, use a black light. Use the table below to note any fluorescein detection to the seal area, gasket, threads, and inside the test specimen. Use the table below to note any galling of the threads or sealing surface. In addition, record any additional information as needed for documentation purposes.

TEST SPECIMEN NUMBER	FLUORESCIN/MOISTURE				GALLING	
	SEAL	GASKET	THREADS	INSIDE	THREADS	SEAL
C-PP10						
<i>#6</i> C-PP11	<i>Y</i>	<i>NA</i>	<i>Y</i>	<i>Y</i>	<i>N</i>	<i>N</i>
<i>#5</i> C-PP12	<i>Y</i>	<i>NA</i>	<i>Y</i>	<i>N(?)</i>	<i>N *</i>	<i>N *</i>

Test #5 (C-PP12): moisture underside of cap & about 3/4 down on cap threads. Inside was questionable & some comparisons performed. See notes on backside of this sheet.

Test #6 (C-PP11): moisture indicated as noted in Table above. Approx. 1/4 length of of moisture present inside tube & along sides. Detected on 1dur added to top.

Amara L. Kelly 7-15-98
WMNW Test Engineer Date

[Signature] 7/15/98
BWHC Project Engineer Date

[Signature] 7/15/98
BWHC QC Representative Date

7/15/98

Test #5 (C-PP12) Notes:

1. Checked salt crystals from test unit & could not determine if change in color of salt crystals was due to test or possible fluor.
2. Checked heated salt crystals & looked similar to salt crystals in #1 above.
3. Checked "clean" unheated salt crystals - pinkish color.
4. Checked heated salt crystals from #1 above and added approximately 5-6 drops of water + fluoroc. mixture to these crystals. Under black light detected fluoroc. immediately.

Determined that test unit C-PP12 did not have any in-leakage of water and fluoroc.

7/16/98

- * Test #5 (C-PP12) After test unit was transferred to facility for polishing, Project engineer noted galling of the lid and body did occur.

Donna L. Kelly 7-16-98
WMNW Test Engr.

W. J. Janssen 7/16/98
BWMC Project Engr.

[Signature] 7/16/98
BWMC QC Rep

WMNW Test Engineer _____ Date _____

BWHC Project Engineer _____ Date _____

BWHC QC Representative _____ Date _____

5. If galling is found, determine if it will affect the results of any additional testing.
6. If no water is found and additional testing will be performed, proceed to Section B.2 to continue with optional tests, or to Appendix C for additional water immersion testing using a different torque value.
7. If additional testing will not be performed, clean the test specimens to remove the flour and fluorescein mixture, and notify the BWHC project engineer for disposition of the test specimens.

B.2 WATER SPRAY TESTS

Test #7

If water spray tests are desired, proceed with the following steps.

B.2.1 Preparation of Test Specimens

The pre-test requirements of Section 6.1 (pg 4) will be met prior to this test. The preparation of test specimens will be as noted in Section 6.2 (pg 5). Refer to the attached sheet for revised test procedure.

A mixture of flour and fluorescein will be placed in each of the test units and the closure cap and seal will be installed and torqued. The flour and fluorescein mixture will aid in the detection of any water that may leak into the test specimens. The detailed preparation procedures follow.

1. Ensure that each test specimen is clean and dry.
2. Determine if any galling found prior to conducting this test will affect the result of this test.
3. The flour and fluorescein mixture used in the previous test may be used if adequate. If not adequate, remove the old flour and fluorescein mixture and prepare three new mixtures of ¼ cup flour and ¼ tsp fluorescein. Place one mixture into each test specimen.

NOTE: Caution should be used to ensure that none of the mixture comes in contact with the test specimen outer surface or closure threads.

4. Install the closure cap and seal on each test specimen. Ensure that the identification marking of the lid mates with the identification marking of the body. On one test specimen use a BWHC fabricated seal; on the other two test specimens use BWHC procured seals. Using the BWHC provided spanner, torque each closure cap to 25 ft-lbs. Record torque wrench calibration information, test specimen torque values, and type of seal below.

Test #7Heat/Water Spray Test

The Heat/Water spray test will be conducted to verify the results of Test #4.

The test specimens have been cleaned & polished prior to conducting this test.

The pre-test requirements of Section 6.1 (page 4) have been met prior to this test.

Authorization is granted to assemble the test specimens and start the test, per 324 Projects Mgr, BWHC.

Donna L Kelly 7/16/98

WMNW Test Engineer /date

[Signature] 7/16/98

BWHC Project Engineer /date

[Signature] 7/16/98

BWHC QC Rep /date

Heat/Water Spray TestTest # 7

This test will be performed with the same parameters as noted in Test #4. In addition, the test parameters will include the following modifications:

- ① Test specimens will have cleaned body & Cap interface.
- ② Test specimens will not include a gasket.
- ③ Test specimens will be filled with coarse crystal salt until approx. 75-80% full.

Test # 7

1. Fill test specimens 75-80% full with coarse crystal salt.

8. Heat test specimens to approximately 300°C (570°F) and remove from oven. (The clearance cap will not be heated). Record temperature in table below.

3. Install clearance cap onto test specimen. (After test unit reaches approximately 100°C (212°F) torque clearance cap to 35 ft-lb. Record the torque wrench calibration information, test specimen torque value, below.

Torque wrench identification: 545-88-01-202 s/n 6064
Next calibration due: 8-27-99
Acceptable range: +/- 4%

Test specimen #:
Type of seal installed:
Heated container temp:
Initial clearance cap torque value:
Cold hot spot temp:
Sealed clearance cap torque value:
re-torque cap & (Y/N):

C-PID
NA
244 ddb 301.4°C
Name hgt
330°F
35 ft-lb
NA

4. Go to Section 8.2.2 (seal and fast plan), step #1. Step #1 will now become Step #5. Proceed with testing.

Torque Wrench Identification: _____

Next Calibration Due Date: _____

Acceptable Range: _____

TEST SPECIMEN NUMBER	TYPE OF SEAL INSTALLED	CLOSURE CAP TORQUE VALUE
C-PP10		
C-PP11		
C-PP12		

5. If needed, clean the external surface of the test specimens.

All test specimen preparation requirements specified in Section B.2.1 are completed. Authorization is granted to start the test.

WMNW Test Engineer _____ Date _____

BWHC Project Engineer _____ Date _____

BWHC QC Representative _____ Date _____

B.2.2 Water Spray Test

Refer to attached sheet for revised test procedure for Test #7

TEST NUMBER 7

The water spray test consists of spraying water with a head of 4 feet on the seal area of the container for two periods of at least 2 minutes each. After the test, the closure caps will be removed and the inside of each test specimen will be examined for water. In addition, the threads and seals will be inspected for galling. The detailed procedure follows.

5. 1.

Place the three test specimens in an appropriate holder. Rig a container filled with water and equipped with a spigot in a position approximately 4 feet higher than the elevation of the top of the test specimens. Attach a 3/8-inch diameter tygon tube to the container spigot. Allow the water to gravity feed down the tube and spray the seal areas of the test specimens for a period of 2 minutes. The water container height is measured from the bottom of the water container to the upper most surface of the test specimens. At the end of the first period, refill the water container and repeat the spray test for another period of at least 2 minutes. Record the following:

Period 1

Water Container Height: 4 ft
Start Time: 10:18:15
End Time: 10:20:30

H₂O temp
88°F

Period 2

Water Container Height: 4 ft
Start Time: 10:20:34
End Time: 10:22:35

6. 2.

After the test is completed, towel dry the test specimens to remove any visible moisture on the external surfaces. Pay particular attention to the seal area to ensure all moisture is removed.

7. 3.

Remove the closure cap from each test specimen. Record the breakaway torque value below for each test specimen as appropriate.

Test #7

TEST SPECIMEN NUMBER	BREAKAWAY TORQUE VALUE
C-PP10	<u>set @ 90 broke @ 69</u>
C-PP11	
C-PP12	

= 21 ft lb.

8. A.

Visually examine the interior of each test specimen for water. If needed, use a black light. Use the table below to note any moisture detection to the seal area, gasket, threads, and inside the test specimen. Use the table below to note any galling of the threads or seal. In addition, record any additional information as needed for documentation purposes.

Test #7

TEST SPECIMEN NUMBER	MOISTURE				GALLING	
	SEAL	GASKET	THREADS	INSIDE	THREADS	SEAL
C-PP10	<u>Y</u>	<u>N/A</u>	<u>Y</u>	<u>Y</u>	<u>N</u>	<u>Y</u>
C-PP11						
C-PP12						

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Test #7 C-PP10 - Moisture detected approx 1 1/4" deep within capsule, beginning 1/2" beyond threads. Approx 5 drops noted below threads. The threads of the capsule & lid had moisture throughout. Moisture detected on interface surface of lid & capsule. Moist detection of fluorescence on top portion of salt. Gallings noted on mating surface of lid and container.

Dana L Kelly 7/16/98
WMNW Test Engineer Date

[Signature] 7/16/98
BWHC Project Engineer Date

[Signature] 7/16/98
BWHC QC Representative Date

9. ☒ If galling is found, determine if it will affect the results of any additional testing.
10. ☒ If no water is found and additional testing will be performed, proceed to Section B.3 for additional optional tests.
11. ☒ If additional testing will not be performed, clean the test specimens to remove the flour and fluorescein mixture, and notify the BWHC project engineer for disposition of the test specimens.

B.3 SCRUB TEST USING WATER SATURATED RAGS

Test #8, #9, #10

Note: Refer to attached sheets marked Heat/Stub Test Using Water Saturated Rags.

B.3.1 Preparation of Test Specimens

A mixture of flour and fluorescein will be placed in each of the test units and the closure cap and seal will be installed and torqued. The flour and fluorescein mixture will aid in the detection of any water that may leak into the test specimens. The detailed preparation procedures follow.

1. Ensure that each test specimen is clean and dry.
2. Determine if any galling found prior to conducting this test will affect the result of this test.
3. The flour and fluorescein mixture used in the previous test may be used if adequate. If not adequate, remove the old flour and fluorescein mixture and prepare three new mixtures of 1/4 cup flour and 1/4 tsp fluorescein. Place one mixture into each test specimen.

NOTE: Caution should be used to ensure that none of the mixture comes in contact with the test specimen outer surface or closure threads.

Test #8, #9, #10 Heat / Scrub Test Using Water Saturated Rag

The test specimens have been cleaned & polished prior to conducting this test.

The pre-test requirements of Section 6.1 (page 4) have been met prior to this test.

Authorization is granted to assemble the test specimens and start the test, per 324 Projects Mgr, BWHC.

Lorrie L. Kelly 7-16-98
WMNW Test Eng. / date

L. W. Jambor 7/16/98
BWMC Project Eng. / date

Ⓚ 7/16/98
BWMC QC Rep / date

Heat / Scrub Test Using Water Saturated Rag

Test # 8, #9, #10

- ① The test specimens will have cleaned body & cap interface, and be polished.
- ② Test specimens will not include a gasket
- ③ Test specimens will be filled with coarse salt until approx. 75-80% full.
- ④ Any galling noted during previous testing shall be determined to not affect the results of additional testing.
- ⑤ Test specimens will have a water & fluorescein mixture washed over them ^{at seal area} using a saturated rag.
- ⑥ Test specimens will be torqued to 20 ft.-lbs. instead of 25 ft.-lbs.

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Test #8, #9, #10

1. Fill test specimens 75-80% full with coarse crystal salt.
2. Heat test specimens to approximately 200°C (392°F) and remove from oven. (The closure cap will not be heated.) Record temperature in Table below.
3. Install closure cap onto test specimen. Free-air cool. When test unit reaches approximately 100°C (212°F) torque the closure cap to 20 ft-lbs. Record the torque wrench calibration information, test specimens torque values, below:

Torque wrench identification:

545-88-01-202 S/n 6064

Next calibration due:

2-27-99

Acceptable range:

+/- 4%

Test specimen #:

Type of seal installed:

Heated container temp: (oven)

Initial torque value:

Cooled test spec. temp:

Verified closure cap torque value:

Re-torque req'd (Y/N):

Test #8	Test #9	Test #10
C-PP12	C-PP11	C-PP10
N/A	N/A	N/A
201.8°C	201.5°C	196°C
Hand Tight	Hand Tight	Hand Tight
219°F	212°F	229°F
20 ft lb	20 ft lb	20 ft lb
N/A	N/A	N/A

4. Go to Section B.3.2 (original test Plan). Step #1 will now become Step #5. Proceed with testing.

4. Install the closure cap and seal on each test specimen. Ensure that the identification marking of the lid mates with the identification marking of the body.
~~On one test specimen use a BWHC fabricated seal; on the other two test specimens use BWHC procured seals.~~ Using the BWHC provided spanner, torque each closure cap to 25 ft-lbs. Record torque wrench calibration information, test specimen torque values, and type of seal below.

Torque Wrench Identification: _____

Next Calibration Due Date: _____

Acceptable Range: _____

TEST SPECIMEN NUMBER	TYPE OF SEAL INSTALLED	CLOSURE CAP TORQUE VALUE
C-PP10		
C-PP11		
C-PP12		

5. If needed, clean the external surface of the test specimens.

All test specimen preparation requirements specified in Section B.3.1 are completed. Authorization is granted to start the test.

 WMNW Test Engineer

 Date

 BWHC Project Engineer

 Date

 BWHC QC Representative

 Date

B.3.2 Scrub Test Using Water Saturated Rags

TEST NUMBER #8, #9, #10

Refer to insert sheet for procedure.

This test consists of subjecting each test specimen to a vigorous scrubbing using water saturated rags for a period of at least 5 minutes. After the test, the closure caps will be removed and the inside of each test specimen will be examined for water. The detailed procedure is as follows.

5. 1.

Place a test specimen in an appropriate holder. Saturate several rags with water and vigorously scrub the test specimen seal area for at least 5 minutes. Repeat the test for the other two test specimens. Record the following:

Test #8 Test Specimen Number: C-PP12 *Held upright*
Start Time: 1:24:44 *entire test*
End Time: 1:29:46

Test #9 Test Specimen Number: C-PP11 *Held upright then turned*
Start Time: 2:01:15 *on side. Add'l time*
End Time: 2:06:30 *was added due to scrub*
not always on seal area.

Test #10 Test Specimen Number: C-PP10
Start Time: 2:39:15
End Time: 2:44:17

6. After the test is completed, towel dry the test specimens to remove any visible moisture on the external surfaces. Pay particular attention to the seal area to ensure all moisture is removed.

7. Remove the closure cap from each test specimen. Record the breakaway torque value below for each test specimen as appropriate.

	TEST SPECIMEN NUMBER	BREAKAWAY TORQUE VALUE
#10-	C-PP10	<i>start @ 90 - broke @ 70 = 20ft lb</i>
#9-	C-PP11	<i>start @ 90 - broke @ 70 = 20ft lb</i>
#8-	C-PP12	<i>start @ 90 - broke @ 65 = 25ft lb</i>

8. Visually examine the interior of each test specimen for water. If needed, use a black light. Use the table below to note any moisture detection to the seal area, gasket, threads, and inside the test specimen. Use the table below to note any galling of the threads or seal. In addition, record any additional information as needed for documentation purposes.

	TEST SPECIMEN NUMBER	MOISTURE				GALLING	
		SEAL	GASKET	THREADS	INSIDE	THREADS	SEAL
#10-	C-PP10	<i>Y</i>	<i>N/A</i>	<i>Y</i>	<i>Y</i>	<i>N</i>	<i>N</i>
#9	C-PP11	<i>Y</i>	<i>N/A</i>	<i>Y</i>	<i>Y</i>	<i>N</i>	<i>N</i>
#8	C-PP12	<i>Y</i>	<i>N/A</i>	<i>Y</i>	<i>N</i>	<i>N</i>	<i>N</i>

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Test #8 (C-PP12) - moisture noted at lid/body interface, on
threads. No moisture inside or on salts after black lt. scan.
Test #9 (C-PP11) - Head air sucking in when seal broke.
1 drop moisture detected approx. 1/4" down into container
(over)

Donna L Kelly 7-16-98
WMNW Test Engineer Date

W. Janham 7/16/98
BWNC Project Engineer Date

[Signature] 7/16/98
BWNC QC Representative Date

- 9 ~~g.~~ If galling is found, determine if it will affect the results of any additional testing.
- 10 ~~g.~~ If no water is found and additional testing will be performed, proceed to Section B.4.
- 11 ~~g.~~ If additional testing will not be performed, clean the test specimens to remove the flour and fluorescein mixture, and notify the BWNC project engineer for disposition of the test specimens.

B.4 SCRUB TEST USING WATER DAMPENED RAGS

*See attached sheets for
Test #11, #12, #13.*

B.4.1 Preparation of Test Specimens

This test was modified from original.

A mixture of flour and fluorescein will be placed in each of the test units and the closure cap and seal will be installed and torqued. The flour and fluorescein mixture will aid in the detection of any water that may leak into the test specimens. The detailed preparation procedures follow.

1. Ensure that each test specimen is clean and dry.
2. Determine if any galling found prior to conducting this test will affect the result of this test.
3. The flour and fluorescein mixture used in previous testing may be used if adequate. If not adequate, remove the old flour and fluorescein mixture and prepare three new mixtures of 1/4 cup flour and 1/4 tsp fluorescein. Place one mixture into each test specimen.

NOTE: Caution should be used to ensure that none of the mixture comes in contact with the test specimen outer surface or closure threads.

(7-16-98)

HNF-3099 Rev. 0

Test #9 (C-PP11) Continued

1 drop of moisture inside Container wall; however the lid was pulled off quickly & drop possibly fell from lid/thread area? No fluorescein detected in salt.

Test #10 (C-PP10)

Moisture detected at lid/body interface, threads, & inside container wall. Fluorescein detected on salt crystals - (approx 10).

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Test #11, #12, #13Heat/Scrub Test Using Water Dampened Rags

The test specimens have been cleaned + polished prior to conducting this test.

The pre-test requirements of Section 6.1 (page 4) have been met prior to this test.

Authorization is granted to assemble the test specimens and start the test, per 324 Projects Mgr, BWHC.

~~Barry~~ ^{7/17/98} ~~7/17/98~~ ^{MF}
WMMW Test Engr. / date

SW Zanban 7/17/98
BWHC Project Engr / date

~~D~~ 7/17/98
BWHC QC Rep / date

Heat/Scrub Test Using Water Dampened RagsTest #11, #12, #13

- ① The test specimens will have been cleaned body + cap interface and be polished.
- ② Test specimens will not include a gasket.
- ③ Test specimens will be filled with coarse salt until approx. 75-80% full.
- ④ Any galling noted during previous testing shall be determined to not affect the results of additional testing.
- ⑤ A rag will be saturated with fluorescein and water and wrung out until damp. Damp rag will be washed over seal area of test unit.
- ⑥ Torque will be 20 ft-lb. A-66

Test #11, #12, #13

1. Fill test specimens 75-80% full with coarse Cuytal salt.
2. Heat test units to approx. 200°C (392°F) and remove from oven. (The closure cap will not be heated.) Record temperature in Table below.
3. Install closure cap onto test specimen. Free-air Cool. When test unit reaches approx. 100°C (212°F) torque closure cap to 30 ft-lb. Record the torque wrench calibration information, test specimen torque values, below:

Torque wrench identification:

545-88-01-202

Next Calibration due:

2/27/99

Acceptable range:

~~± 9%~~ ± 4% ^{70°F 1/24/98}

Test specimen #:

Type of seal installed:

Heated Container temp: (oven)

Initial torque value:

Cooled test spec. temp:

Verified closure cap torque value:

Re-torque req'd (Y/N):

test #11	#12	#13
10	11	12
No Seal	No Seal	No Seal
199°C	200.5°C	200.5°C
Hand Tight	Hand Tight	Hand Tight
100°C	100°C	100°C
20 ft-lb @ 100°C	20 ft-lb @ 100°C	20 ft-lb @ 100°C
N	N	N

4. Go to Section B.4.2. (original test plan). Step #1 will now become Step #5. Proceed with testing

4. Install the closure cap and seal on each test specimen. Ensure that the identification marking of the lid mates with the identification marking of the body. **On one test specimen use a BWHC fabricated seal; on the other two test specimens use BWHC procured seals.** Using the BWHC provided spanner, torque each closure cap to 25 ft-lbs. Record torque wrench calibration information, test specimen torque values, and type of seal below.

Torque Wrench Identification: _____

Next Calibration Due Date: _____

Acceptable Range: _____

TEST SPECIMEN NUMBER	TYPE OF SEAL INSTALLED	CLOSURE CAP TORQUE VALUE
C-PP10		
C-PP11		
C-PP12		

5. If needed, clean the external surface of the test specimens.

All test specimen preparation requirements specified in Section B.4.1 are completed. Authorization is granted to start the test.

WMNW Test Engineer Date

BWHC Project Engineer Date

BWHC QC Representative Date

B.4.2 Water Scrub Test Using Dampened Rag

TEST NUMBER #11

Note: Refer to attached sheets marked Heat/Water Scrub ... Dampened Rag. Test #11, #12, #13

This test consists of subjecting each test specimen to a vigorous scrubbing using water dampened rags for a period of at least 5 minutes. After the test, the closure caps will be removed and the inside of each test specimen will be examined for water. The detailed procedure is as follows.

5. a. Place a test specimen in an appropriate holder. Dampen several rags with water and vigorously scrub the test specimen seal area for at least 5 minutes. Repeat the test for the other two test specimens. Record the following:

Test Specimen Number: 10

Start Time: 14:38:00

End Time: 14:43:05

Test Specimen Number: 11

Start Time: 14:48:30

End Time: 14:53:35

Test Specimen Number: 12

Start Time: 15:05:25

End Time: 15:10:30

6. ~~2~~

After the test is completed, towel dry the test specimens to remove any visible moisture on the external surfaces. Pay particular attention to the seal area to ensure all moisture is removed.

7. ~~3~~

Remove the closure cap from each test specimen. Record the breakaway torque value below for each test specimen as appropriate.

TEST SPECIMEN NUMBER	BREAKAWAY TORQUE VALUE
C-PP10	Started 90, broke @ 75 ft-lb
C-PP11	Started 90, broke @ 74 ft-lb
C-PP12	Started 90, broke @ 75 ft-lb

Test #11

Test #12

Test #13

= 15 ft lb
= 16 ft lb
= 15 ft lb
dub
7/20/98

8. A.

Visually examine the interior of each test specimen for water. If needed, use a black light. Use the table below to note any moisture detection to the seal area, gasket, threads, and inside the test specimen. Use the table below to note any galling of the threads and seal. In addition, record any additional information as needed for documentation purposes.

TEST SPECIMEN NUMBER	MOISTURE				GALLING	
	SEAL	GASKET	THREADS	INSIDE	THREADS	SEAL
C-PP10	N	N/A	N	N	N	N/A
C-PP11	N	N/A	N	N	N	N/A
C-PP12	N	N/A	N	N	N	N/A

Test #11

Test #12

Test #13

7/17/98
WMNW Test Engineer Date

7/17/98
BWHC Project Engineer Date

7/17/98
BWHC QC Representative Date

9. 6. If galling is found, determine if it will affect the results of any additional testing.
10. 6. If no water is found and additional testing will be performed, proceed to Appendix C.
11. 7. If additional testing will not be performed, clean the test specimens to remove the flour and fluorescein mixture, and notify the BWHC project engineer for disposition of the test specimens.

APPENDIX C

ADDITIONAL WATER IMMERSION TESTING DUE TO TORQUE VALUE CHANGE

C.1 ADDITIONAL WATER IMMERSION TESTS

If additional water immersion tests are desired by use of a torque value other than that identified in Appendix B, Section B.1 of this procedure, proceed with the steps that follow.

C.1.1 Preparation of Test Specimens

A mixture of flour and fluorescein will be placed in each of the test units and the closure cap and seal will be installed and torqued. The flour and fluorescein mixture will aid in the detection of any water that may leak into the test specimens. The detailed preparation procedures are as follows.

1. Ensure that each test specimen is clean and dry.
2. Determine if any galling found from previous tests will affect the result of this test.
3. The flour and fluorescein mixture used in previous tests may be used if adequate. If not adequate, remove the old flour and fluorescein mixture and prepare three new mixtures of $\frac{1}{4}$ cup flour and $\frac{1}{4}$ tsp fluorescein. Place one mixture into each test specimen.

NOTE: Caution should be used to ensure that none of the mixture comes in contact with the test specimen outer surface or closure threads.

4. Install the closure cap and seal on each test specimen. Ensure that the identification marking of the lid mates with the identification marking of the body. **On one test specimen use a BWHC fabricated seal; on the other two test specimens use BWHC procured seals.** Using the BWHC provided spanner, torque each closure cap to a pre-determined torque value, other than what has been used for previous testing. Record torque wrench calibration information, test specimen torque values, and type of seal below.

Torque Wrench Identification: _____

Next Calibration Due Date: _____

Acceptable Range: _____

TEST SPECIMEN NUMBER	TYPE OF SEAL INSTALLED	CLOSURE CAP TORQUE VALUE
C-PP10		
C-PP11		
C-PP12		

5. If needed, clean the external surface of the test specimens.

All test specimen preparation requirements specified in Section C.1.1 are completed. Authorization is granted to start the test.

 WMNW Test Engineer Date

 BWHC Project Engineer Date

 BWHC QC Representative Date

C.1.2 Water Immersion Test

TEST NUMBER _____

The water immersion test consists of placing the test specimens in a pool of water to a depth of 8.1 feet for two periods of at least 5 minutes each. After the test, the closure caps will be removed and the inside of each test specimen will be examined for water. In addition, the threads and seals will be inspected for galling. The detailed procedure follows.

NOTE: The water temperature of the immersion pool and the test facility air temperature will be verified prior to the start of this test. If additional steps need to be taken during testing to ensure that a vacuum is not created within the inner container, these steps will be documented within this test plan, and concurrence will be provided by the WMNW test engineer, BWHC project engineer (or designee), and the BWHC QC representative.

TEST SPECIMEN NUMBER	TEMPERATURE OF POOL	BLDG AIR TEMPERATURE
C-PP10		
C-PP11		
C-PP12		

1. Place the three test specimens in an appropriate holder and lower the specimens into the pool of water to a depth of 8.1 feet (+0.5, -0 ft) (**use 8 feet, 8 inches**). The immersion depth is measured from the top of the water to the upper most surface of the test specimens. Hold the test specimens at the prescribed depth for at least 5 minutes. Remove the test specimens and repeat the immersion test for another period of at least 5 minutes. Record the following:

Period 1

Immersion Depth: _____

Start Time: _____

End Time: _____

Period 2

Immersion Depth: _____

Start Time: _____

End Time: _____

2. After the test is completed, towel dry the test specimens to remove any visible moisture on the external surfaces. Pay particular attention to the seal area to ensure all moisture is removed.
3. Remove the closure cap from each test specimen. Record the breakaway torque value below for each test specimen as appropriate.

TEST SPECIMEN NUMBER	BREAKAWAY TORQUE VALUE
C-PP10	
C-PP11	
C-PP12	

4. Visually examine the interior of each test specimen for water. If needed, use a black light. Use the table below to note any moisture detection to the seal area, gasket, threads, and inside the test specimen. Use the table below to note any galling of the threads or seal. In addition, record any additional information as needed for documentation purposes.

TEST SPECIMEN NUMBER	MOISTURE				GALLING	
	SEAL	GASKET	THREADS	INSIDE	THREADS	SEAL
C-PP10						
C-PP11						
C-PP12						

WMNW Test Engineer

Date

BWHC Project Engineer

Date

BWHC QC Representative

Date

5. If gualling is found, determine if it will affect the results of any additional testing.
6. If no water is found and additional testing will be performed at a higher torque value, use additional test sheets provided in Appendic C as needed.
7. If additional testing will not be performed, clean the test specimens to remove the flour and fluoresceine mixture, and notify the BWHC project engineer for disposition of the test specimens.

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DISTRIBUTION SHEET

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Distribution	Packaging Engineering	Date 07/23/98
Project Title/Work Order		EDT No. 622929
Test Report for Cesium Powder and Pellets Inner Container Decontamination Method Determination Test (HNF-3099)		ECN No. NA

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