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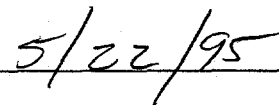
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7. Abstract The 49 CFR 173.465 Type A packaging tests will verify that SPM-1 will provide adequate protection and pass as a Type A package. Test will determine that the handle of the Pig will not penetrate through the plywood spacer and rupture the shipping container. Test plan/procedure provides planning, pre-test, setup, testing, and post-testing guidelines and procedures for conducting the "Free Drop Test" procedure for the SPM-1 package.		
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TEST PLAN/PROCEDURE FOR THE SPM-1 SHIPPING CONTAINER SYSTEM

1.0 INTRODUCTION

The SPM-1 shipping container system is to be used for the transportation of radioactive test samples for both onsite and offsite. The container is a 12-gal steel drum that satisfies the requirements of both U.S. Department of Transportation 7A Type A containers (WHC 1992) and MS-27684-18 military specification. The drum is 20.88 in. high (without lid and ring) and 13.88 in. in diameter. Contained within the drum are plywood spacers, the Sample Pig, and payload.

The SPM-1 shipping container system is currently in use. A question was addressed regarding the handle of the Sample Pig puncturing or otherwise degrading the container. An actual drop is the only way to verify the integrity of the SPM-1 shipping container system.

2.0 PURPOSE/SCOPE

2.1 PURPOSE

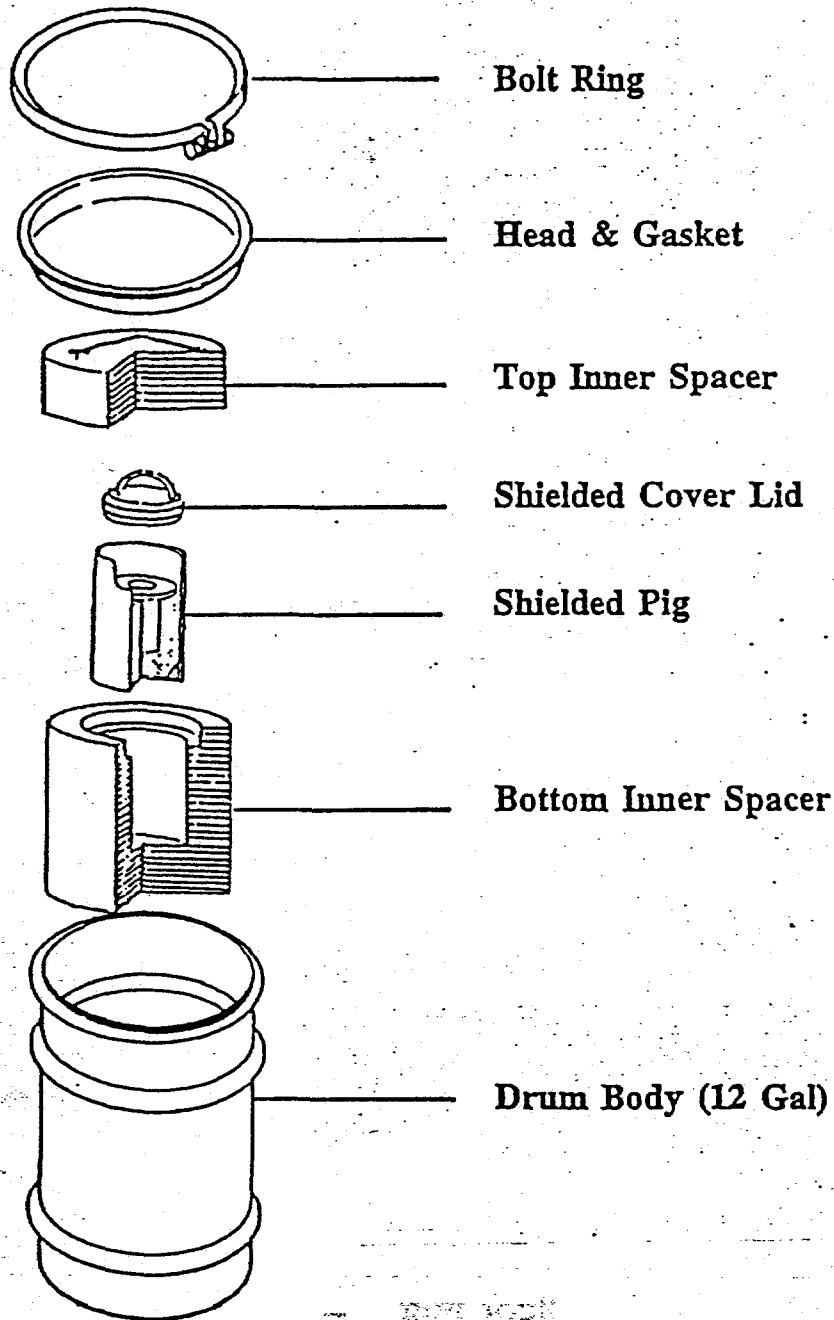
The purpose of this test is to demonstrate that the SPM-1 system will provide adequate protection and keep the handle of the Sample Pig from rupturing the drum. The test procedure consists of a drop onto the target in a manner that will cause maximum damage to the safety features being tested.

The test will follow the guidelines of 49 CFR 173.465 "Type A Packaging Tests." Only one flat drop on the lid of the container will be performed because the SPM-1 system already passes as a Type A package. This drop is only to confirm that the Sample Pig handle will not rupture the container.

2.2 SCOPE

This test plan/procedure provides planning, pre-test, setup, testing, and post-testing guidelines and procedures for conducting the "Free Drop Test" procedure for the SPM-1 package.

**Figure 1. SPM-1 Shipping Container System
Steel Drum - Military Spec MS-27684-18
12 Gallon - DOT 7A Type A**



3.0 GENERAL REQUIREMENTS

3.1 TEST ARTICLE

The test article consists of the SPM-1 shipping container system. The shipping container system includes a steel drum, lid, ring, plywood spacers, and Sample Pig. To simulate the payload of the Sample Pig spilling, a fluorescein mixture will be used to determine if there are any leaks in the container.

3.2 TEST OBJECTIVE

The objective of this test is to determine whether the Sample Pig handle can critically affect the performance of the SPM-1 shipping container system for Type A package criteria. This will be accomplished by dropping the test article once, in the configuration described in Table 1, and evaluating any damage to the container and contents.

Table 1. Required Drop Configuration.

Required Drop Configuration
<p>Drop No. 1, Top Flat Drop</p> <p>The SPM-1 shipping container system shall be raised 48 in. above the floor (measured from the lowest point) with the top (lid) of the container facing down. The SPM-1 container should be oriented such that the line of impact through the center of gravity (cg) is perpendicular to the floor when released (flat drop).</p>

3.3 ACCEPTANCE CRITERIA

The acceptance criteria for the drop is that the seal at the lid is not broken, no puncture occurs from the handle, and there is no change in shielding or radiation levels at the outside of the container. To ensure that the seal is not broken or container punctured, a fluorescein test will be conducted. The test will include 4 basic steps:

1. Place the fluorescein mixture inside the drum near the top of the lid (not inside the Sample Pig).
2. Seal the container and check the outside of the container for any traces with a ultraviolet light.
3. Check the drop test area with the ultraviolet light.
4. Inspect the container and drop test area after the drop for any leakage.

A visual inspection will be made of the Sample Pig and any deflection of the drum, crush of the plywood, or any overall change of position of the Sample Pig will be measured. These measurements will determine if there was loss of shielding or change in radiation levels due to changes in position of the load and damage to the packaging.

3.4 PHOTOGRAPHY

The container is to be photographed when set up for the drop and after the drop to document any damage to the test article. Photographs should be concentrated around lid, upper plywood spacer, and Sample Pig. Additional photographs will be taken during testing at the discretion of the cognizant engineer or a quality assurance (QA) representative.

The photography equipment will be supplied by the cognizant engineer.

3.5 SAFETY

The test engineer shall coordinate with the Westinghouse Hanford Company (WHC) safety engineer to review and establish safety requirements for the tests. The test engineer shall ensure that all lifting equipment is operational and certified for use.

4.0 TEST REQUIREMENTS

4.1 TEST FACILITY

The test facility must be well lit and be able to accommodate the drop test. The test pad shall be composed of a hard unyielding surface such that all energy from the drop is applied to the container.

A suitable test pad is located in the 300 Area of the Hanford Site, Building 305.

4.2 REQUIRED TEST EQUIPMENT

Table 2 shows a partial list of equipment required for the 48-in. drop test. Equipment may be added or deleted from this list by the test engineer, as required and documented.

Table 2. Required Equipment.

Item	Responsibility
Crane with a quick-release hook and a 500-lb lifting capacity	
Lifting fixture for use with crane and quick-release hook and any special rigging required	
Scale capable of measuring up to 300 lb	
Fluorescein and flour mixture (1:20 ratio) 1/8 cup fluorescein and 2 1/4 cups flour	
Ultraviolet light and any extension cords needed	
Black marking pen	
Still camera	
Water spray bottle (for fluorescein test)	
Sample Pig--provided by Compliance and Support Sampling Operations	
Safety glasses and hard hats for spectators	

4.3 TOOLS

Table 3 shows a partial list of the tools needed at the test facility to conduct the transit drop procedure. Other items may be added to this list by the test engineer, as required and documented.

Table 3. Required Tools.

Two 1-in. adjustable open-end wrenches
Torque wrench capable of 50 ft-lb
3/8-in. ratchet and 9/16-in. socket
Standard screwdriver
9/16-in. open-end wrench
Mixing bucket and utensils for fluorescein and flour
Level
Rubber mallet

4.4 TEST PERSONNEL

The following personnel listed in Table 4 will be required for this test. Personnel involved in the testing are required to print their names, then initial and date next to their printed names.

Table 4. Required Test Personnel.

Personnel	Names (Print)	Initial	Date
Test engineer P. V. Meeuwsen			
Alternate			
Cognizant engineer B. D. Flanagan			
Alternate			
Technician			
Alternate			
QA rep. C. R. Hoover/G. E. Mata			
Alternate			

QA = Quality assurance.

The test engineer is required to witness all testing described in this procedure.

5.0 PRE-TEST REQUIREMENTS

5.1 SAFETY

All test operations shall be conducted in a safe manner. The test engineer shall be responsible for the safety of personnel and equipment at the test site, for ensuring all witness and test support personnel are at assigned safe locations before lifting or dropping the test article, and for ensuring all personnel have required safety equipment (e.g., hard hats, eye protection).

5.2 TEST PERSONNEL

All test support personnel shall have received any required training prior to participating in the tests. All test operations shall be conducted by authorized personnel.

5.3 FACILITIES, EQUIPMENT, AND MATERIALS

Landlord concurrence for the use of the test facility shall be obtained by the test engineer prior to any test activities.

The test engineer and cognizant engineer shall schedule and arrange for the arrival of all lifting equipment, the SPM-1 shipping container system, additional lighting equipment, and other items, as needed. The Pig will be brought in and removed on the same day with a drum available in case the Pig becomes damaged.

The test engineer shall verify that all key personnel are cognizant of their responsibilities and commitments for a timely and successful test.

5.4 TEST CHECKLISTS

All checklists shall be witnessed and signed off by the test engineer and the responsible QA representative after the completion of each test.

5.5 HOISTING AND RIGGING EQUIPMENT

All hoisting and rigging equipment shall have current load test tags and shall be operated by qualified personnel of the facility.

The test operations shall be supported by the appropriate number of qualified personnel. The test engineer shall verify that test personnel are cognizant of their responsibilities and commitment for a timely completion and successful test.

Special rigging necessary to hold the test article in the predetermined orientation for the drop is the responsibility of the test engineer.

6.0 TEST PROCEDURE

6.1 DROP TEST PROCEDURE

6.1.1 Pre-Drop Test Activities

The test engineer shall complete a pre-test checklist (see Figure 1).

Figure 2. Pre-Test Checklist for Starting Test Article Drop Tests.

Pre-Test Checklist for Starting Test Article Drop Tests	
<ol style="list-style-type: none">1. Confirm arrival of Sample Pig from Compliance and Support Sampling Operations.2. Hold a pre-test meeting with all personnel involved with this test. The Test Engineer shall review the test procedures and discuss potential hazards involved with this test.3. Identify safety zones to test personnel and observers.4. Remove dirt and debris from Test Pad.5. Set up photographic equipment and verify operation.6. Inspect and verify all lifting equipment is currently certified.7. Prepare fluorescein and flour mixture. Mixture ratio is 1 part fluorescein and 20 parts flour.8. Test fluorescein mixture with ultraviolet light. Response? Yes _____ No _____ Response must be yes before proceeding to drop test. Comments: _____ _____ _____9. Visually inspect Sample Pig for any damage. Note any marks which could mistakenly be listed as damage after drop. _____ _____ _____ _____	
Test Engineer _____	Date: _____
QA Representative _____	Date: _____

6.1.2 Drop Test

Drop No. 1 is the top-face drop. The SPM-1 container shall be raised 48 in. above the floor. The SPM-1 container should be oriented so that the line of impact through the cg is perpendicular to the floor when released (flat drop).

6.1.2.1. Perform pre-drop procedure and complete checklist for Drop No. 1 (see Figure 2).

6.1.2.2. Direct all personnel to go to their assigned, WHC safety-approved, observation and test locations.

6.1.2.3. Authorize the rigging crew to lift the test article to an elevation of 48 in., and verify that the test article is in the correct orientation and is stable.

6.1.2.4. Verify test article elevation using chain marker taped to package.

Elevation = _____ Initial _____

Remove chain marker before drop.

6.1.2.5. Verify cameras are operating.

6.1.2.6. Authorize the rigging crew to drop the test article on the test engineers signal.

6.1.2.7. Verify the test article is in a stable position on the test pad before proceeding to the next step.

6.1.2.8. The test engineer, cognizant engineer, and QA representative shall complete the post-drop checklist (see Figure 3).

7.0 POST-TEST ACTIVITIES

The cognizant engineer shall have the Pig returned to Compliance and Support Sampling Operations as soon as possible after the testing has been completed. The SPM-1 container will be returned to Packaging Engineering at MO-916 in the 1100 area after the container is checked for traces of contamination and all testing is completed.

Figure 3. Pre-Drop Checklist for Drop No. 1.

Pre-Drop Checklist for Drop No. 1	
1. Place the bottom inner spacer in the drum. Place the Sample Pig inside bottom inner spacer then cover with the top inner spacer.	
2. Add fluorescein mixture to inside of container.	
3. Verify gasket is in place and seal container. Clean outside of container to remove any trace of fluorescein before test.	
4. Verify ring is in closed position by tightening bolt to 40 ± 4 ft-lb torque with tapping of ring with rubber mallet during tightening. Torque: _____	
5. Examine outside of container and test pad for any traces of fluorescein with ultraviolet light and water mist. Response? Yes _____ No _____ If yes, clean until no response. Comments: _____ _____	
6. Weigh test article on scale. Weight: _____ lb Scale Inspection Date _____	
7. Move test article onto test pad.	
8. Install rigging setup for drop, as specified in Table 1.	
9. Attach crane hook to rigging and carefully lift the test article until it is just clear of the test pad.	
10. Verify all test preparations for the drop are complete.	
<p>Pre-Drop Checklist for Drop No. 1 has been completed.</p> <p>Test Engineer: _____ Date: _____</p> <p>QA Representative: _____ Date: _____</p>	

Figure 4. Post-Drop Checklist for Drop No. 1.

Post-Drop Checklist for Drop No. 1	
<p>1. Examine the exterior of the container and drop pad with ultraviolet light for evidence of fluorescein.</p> <p>Response? Yes ___ No ___</p> <p>Comments/Measurements: _____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	
<p>2. Record damaged areas with the camera.</p>	
<p>3. Evaluate the condition of the contents.</p> <p>Comments/Measurements: _____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	
<p>4. Record any damage to the contents with the camera.</p>	
<p>5. Clean any fluorescein residue from the inside of the container and any which may have spilled.</p>	
<p>6. Visually inspect Sample Pig for any damage. Enter comments:</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	
<p>7. Return Sample Pig to Compliance and Support Sampling Operations.</p>	
<p>Post-Drop Checklist for Drop No. 1 has been completed.</p> <p>Test Engineer: _____ Date: _____</p> <p>QA Representative: _____ Date: _____</p>	

8.0 REFERENCES

49 CFR 173.465, "Type A Packaging Tests," *Code of Federal Regulations*, as amended.

Procurement Specification, MIL-D-6054, *Drums, Metal-Shipping and Storage 3 to 12 Gallons*, Military Standard MS27684.

WHC-CM-6-1, *Standard Engineering Practices*, Westinghouse Hanford Company, Richland, Washington.

WHC, 1992, *Test and Evaluation Document for DOT Specification 7A Type A Packaging*, WHC-EP-0558, Westinghouse Hanford Company, Richland, Washington.