



FRAMATOME ANP

Mr. Martin Virgilio
Director, Office of Nuclear
Material Safety and Safeguards
Nuclear Regulatory Commission
Washington DC 20555-0001

August 1, 2002
EHSLR:02:029

**SUBJECT: SUBMITTAL OF THE TEST PLAN FOR THE BW-2901 SHIPPING
PACKAGE IN ACCORDANCE WITH CONFIRMATORY ACTION
LETTER No. 02-8-001.**

Dear Mr. Virgilio:

Framatome ANP formerly submits the proposed test plan for the BW-2901 shipping package in accordance with the Confirmatory Action Letter (CAL – 02-8-001). As mentioned in conversation with Mr. David Tiktinsky, Framatome ANP is tentatively planning to perform confirmatory testing at our facility in Lynchburg VA in the early part of September.

As outlined in the initial response to the CAL on July 2, 2002, although the supplemental tests for the BW-2901 package demonstrated the ability of the package to meet the requirements without modification, Framatome ANP intends to test modifications which are intended to increase the level of safety of the package.

Included with this letter is a copy of the test plan to be used during the physical testing.

Sincerely,

Robert S. Freeman
Manager, Environmental
Health, Safety and Licensing
Framatome ANP

NM 5501



ENGINEERING INFORMATION RECORD

Document Identifier 51 - 5019395 - 00

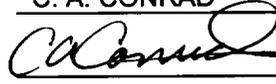
Title BW-2901 FUEL PELLETT SHIPPING CONTAINER TEST

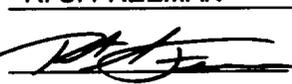
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Signature  Date 8/1/02

Signature  Date 8/1/02

Technical Manager Statement: Initials _____

Reviewer is Independent.

Remarks:

1. TEST PURPOSE

This test is in response to NRC Confirmatory Action Letter No. 02-8-001. The CAL identifies concerns with drum-type (XXX-2901) shipping containers in hypothetical accident conditions. These containers were demonstrated by third party testing to fail (lid separation) when subjected to a shallow angle (17.5°) drop test from 30 feet. Rationale for the angle determination is provided in Section 6.

The purpose of this test is two-fold:

1. Repeat the 30-ft. drop test with a loaded BW-2901 container in the current licensed configuration (with the exception of dunnage for internal payload), followed by a puncture/pin test. Both tests are as specified in 10 CFR71.73. This test will be performed with a more enhanced closure ring.
2. Perform drop and puncture/pin tests on a loaded BW-2901 container fitted with a secondary lid retainer (clamp) mechanism and the non-enhanced closure ring. A description of the lid retainer clamps is provided in Section 2.

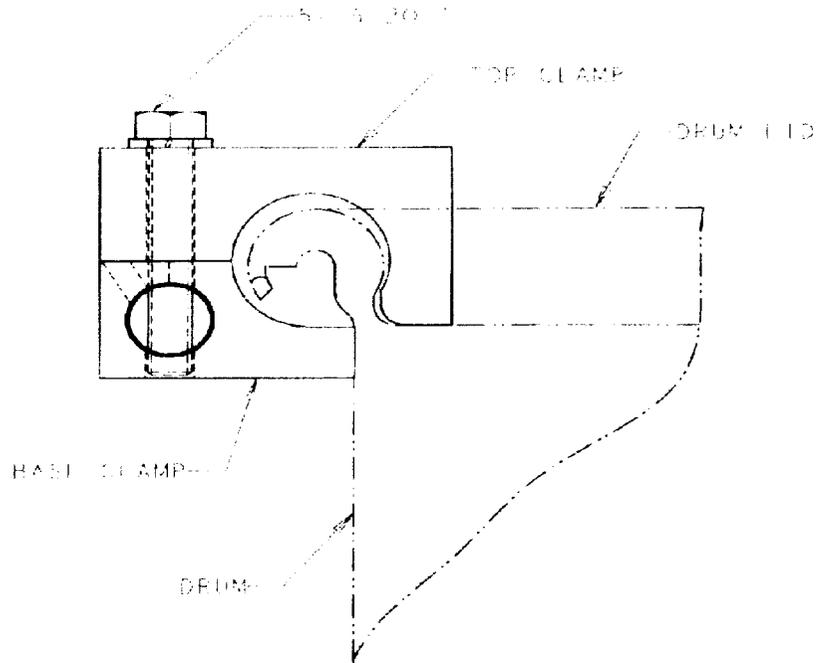
Modification of this testing procedure during the actual tests may become necessary and is considered acceptable provided the designated functions that approved the original document also approve the changes. Deviations from this plan shall be documented.

2. TEST ITEM DESCRIPTION

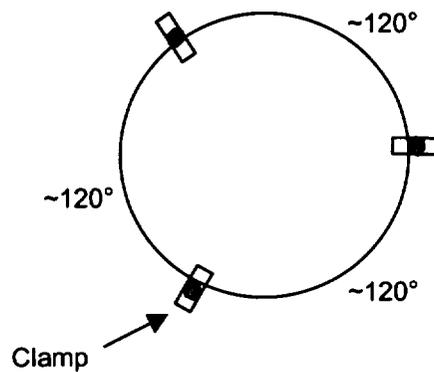
<u>Item</u>	<u>Base Container Design</u>	<u>Applicable Drawing</u>	<u>Modification(s)</u>
1	BW-2901	02-1215599 Rev. 4	Enhanced Closure Ring
2	BW-2901	02-1215599 Rev. 4	3 lid retainer clamps (described below)

2. TEST ITEM DESCRIPTION (cont.)

LID RETAINER CLAMP - The added clamp consists of a two-piece "C" clamp made from 1 in. mild steel. It is installed over the closure ring engaging the ring, lid, and drum lip.



Depending on the results of the first test, between one and three clamps will be used per container, installed at approximately equidistant locations about the lid end circumference (visually 120° apart). The clamps shall be tightened such that the mating halves are "seated". If a single clamp is used, the clamp should be placed at the point of impact since a direct impact on the clamp will determine its ability to withstand the force.



PAYLOAD DESCRIPTION – The inner container shall be loaded with any combination of metallic (e.g. lead, steel, aluminum) or wooden bricks, blocks, or plates to simulate a full fuel pellet payload. The payload shall meet the following criteria:

- Has a combined total weight of 405 ± 10 lbs.
- Visually fills the void space of the inner container to prevent shifting of contents
- Payload weight shall be essentially evenly distributed within the inner container to maintain a center of gravity near the geometric center.

3. TEST ITEM INSPECTION REQUIREMENTS

Test items shall be certified (released) BW 2901 Pellet Shipping Containers per drawing 02-1215599 Rev. 4, and modified only as identified in Section 2.

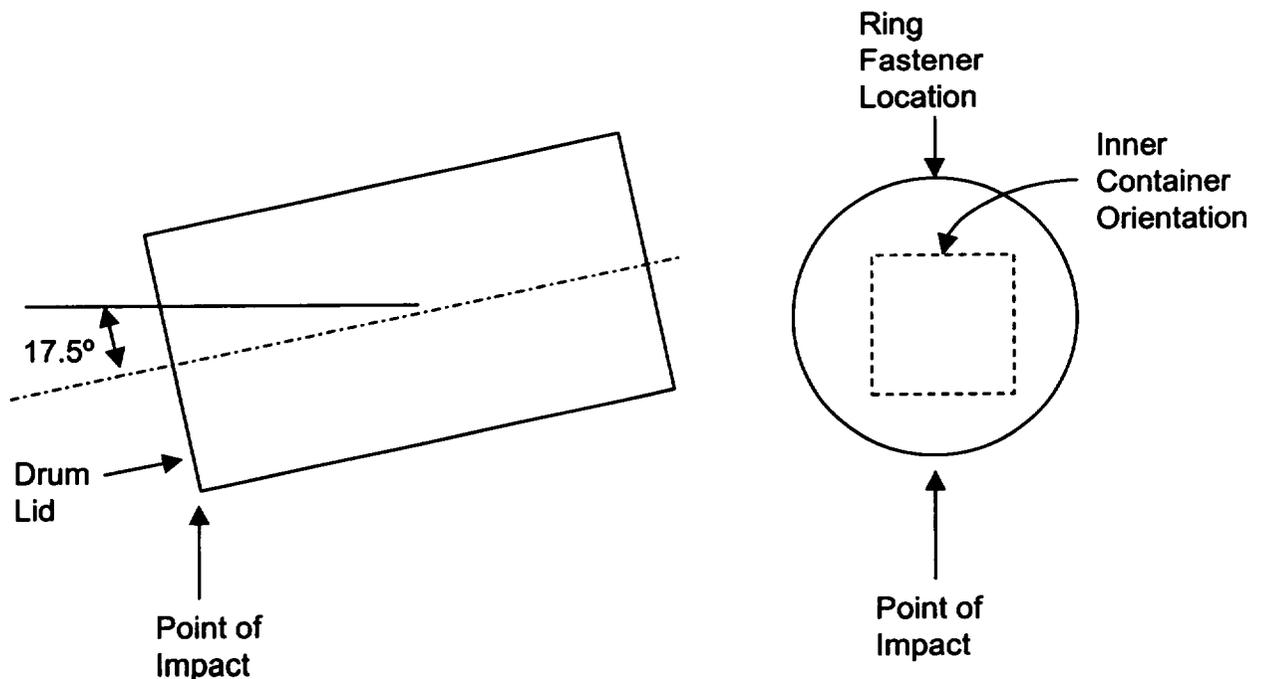
Inspection values shall be recorded for the following:

- Payload description and weight. Drum tare weight. Weigh strapping mechanism separately.
- Final torque on installed drum lid retainer ring closure bolt.
- Remaining gap (across fastener) on installed drum lid retainer ring.
- (Post test) Maximum deformation on drum wall (from cylinder datum).
- (Post test) Maximum deformation of drum ends (from end plane datum).
- (Post test) Description of lid condition (i.e. intact, separated, partially separated, etc.)

4. TEST ACTIVITY

A. DROP TEST

The shipping container shall be loaded as described above and dropped from a height of 30 ft. (minimum height measured from lowest point on container) onto a horizontal steel-reinforced concrete pad. The drum shall be oriented with the lid end $17.5^\circ \pm 2.5^\circ$ (visually measured) downward from a true horizontal position. Further, the retainer ring fastener location shall be rotated $180^\circ \pm 2^\circ$ (visually measured) opposite the point of impact. See sketch.



The drum shall be secured and released such that it maintains this orientation until impact. The strapping mechanism shall be such that it does not interfere with impact or reinforce the container. Weight of the strapping mechanism shall be minimized (and recorded). Temperature of the container shall be stabilized at the ambient condition before dropping and the temperature recorded.

B. PUNCTURE TEST

As directed by the Test Engineer, and subsequent to the Drop Test, the loaded shipping container shall be dropped from a height of 40 in. onto the upper end of a solid, vertical, cylindrical, mild steel bar mounted (i.e., welded) onto the drop test pad. The bar must be 6 in. in diameter and a minimum of 8 in. long with the major axis vertical. The top edge shall not be rounded beyond a radius exceeding 0.25 inches.

The container shall be dropped at an angle of incidence and point of impact that, in the Test Engineer's judgement, will result in the greatest damage. The angle of incidence will be dependent on the most appropriate impact point determined based on the damage caused by the 30 ft drop test. These angular values and the result of each test shall be recorded.

5. TEST DATA/TEST PROCEDURE

A test procedure and/or route card shall be prepared to document the critical aspects of the test process.

Photographs shall be provided to show load configuration, pre-test setup, and post-test container condition, as a minimum. Videotaping of each test is also required.

The test results shall highlight the post-test condition of the container and lid.

PASS/FAIL CRITERIA: A completely detached drum lid, a partially detached drum lid such that the inner package can pass through, or significant breach of the outer container such that the nuclear criticality assumptions are adversely affected will constitute a failed test.

6. 30 FOOT DROP TEST ANGLE OF INCIDENCE

The 30 foot drop attitude is based on the previous drum package test data generated by LLNL (Drop Test Plan for the Combustion Engineering Model No. ABB-2901 Fuel Pellet Shipping Package, Lawrence Livermore National Laboratory Livermore, CA), which established the bases for the Confirmatory Action Letter (02-8-001) and is summarized below. The selection of the $17.5 \pm 2.5^\circ$ impact angle for the 30 foot drop considered the following information:

(1) A $17.5 \pm 2.5^\circ$ free drop produced the latest lid buckling failure of the WSRC-9975 package drum lid.

(2) At an angle of $17.5 \pm 2.5^\circ$, the majority of the impact energy will be devoted to the buckling of the drum lid, and only a small portion of the energy will be used to press the drum lid, closure ring, and drum body closer together. Simplified dynamic analyses using closed-form solutions and the SCANS computer program (USNRC 1990) indicated that the impact force and momentum in the plane of the drum lid, which can cause buckling of the lid, reaches a maximum value at a drop angle of about 30° . However, at this impact angle the impact force and momentum normal to the drum lid, which can push the drum lid, closure bolt and drum body closer together, is also large. This normal impact force vanishes only at a 0° impact.

In the selection of the impact location for the 30 foot drop, the following information was considered:

(1) To detach the drum lid from the closure ring and the drum body, the impact needs to produce a deep indentation into the drum body, so that a large buckling deformation of the drum lid can develop. The large gap and relatively soft plywood located between the drum body and the center of an edge of the square fuel-pellet container will provide the necessary room for developing the required deep indentation and large buckling deformation.

(2) To locate the closure-ring bolt at a location 180° from the impact point serves two purposes:

(a) The bolt location will act as a node (fixed boundary) for the lid buckling deformation. Thus the bolt location will confine the drum-lid buckling to the bottom half of the drum lid, where the impact force is, in relative terms, higher.

(b) The bolt is located sufficiently far from the impact point, so that the damage produced by the 30 foot drop at the impact point will not prevent the removal of the closure ring by the subsequent puncture test.

The impact damage from the 30 foot drop will push the drum lid, closure ring and drum body closer together, and may render the separation of the three components in the damaged area more difficult.