RADIOACTIVE TYPE A LIQUIDS AND SOLIDS PACKAGING TESTS

AMMUNITION CONTAINER WITH 1 x 10mL GLASS VIAL OR 1 x 7mL PLASTIC VIAL (W-12 ROUND DESIGN) RADIOACTIVE PKG.

TEST REPORT #: 04-2075

TESTING PERFORMED FOR:

AMERSHAM HEALTH
1053 West Grand Avenue
Chicago, IL 60622

ATTN: Shane Cobb

VULCAN LEAD INC.
1400 West Pierce Street
Milwaukee, WI 53204

ATTN: Matt Macur

TESTING PERFORMED BY:

TEN-E Packaging Services, Inc.
1666 County Road 74
Newport, MN 55055
Phone: (651) 459-0671
Fax: (651) 459-1430

March 22, 2004

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REPORT & SAMPLE INFORMATION

DATE LAST SAMPLES RECEIVED: February 25, 2004

TEST COMPLETED ON: March 12, 2004

SAMPLES:

- The samples tested arrived in good condition at TEN-E Packaging Services, Inc.
- The following results are based solely on the product samples provided by the manufacturer.

OBJECTIVE

To certify the **Amersham Health ammunition container with 1 x 10mL glass vial for liquid radioactive materials, or 1 x 7mL plastic vial for solid radioactive material (W-12 Round Design),** to the Radioactive Type A Performance Tests outlined in the following Regulatory Codes:

- 2003 edition of the Department of Transportation Title 49 Code of Federal Regulations:
  - 173.410 General Design Requirements
  - 173.412 Additional Design Requirements for Type A Packages
  - 173.415 Authorized Type A Packages
  - 173.465 Type A Packaging Tests
- 2003-04 edition of the ICAO Technical Instructions for the Safe Transport of Dangerous Goods by Air
- 45th edition of the IATA Dangerous Goods Regulations

This package is also certified for shipment under the International Regulatory Codes referenced in Appendix I. However, it is the responsibility of the shipper (end user) to determine package authorization for use under these hazardous materials regulations. Appendix I also references Industry Standards used in conducting this certification.

TEST SAMPLE DESCRIPTION:

Ammunition Container with an Inner Primary Container (W-12 Round Design)

PRIMARY RECEPTACLE, OPTION #1

VIAL

DESCRIPTION:
10mL Glass Vial with 20mm Stopper and Seal

MATERIAL:
Flint Glass Vial with Gray Rubber Stopper and Aluminum Seal

DIMENSIONS: Not Provided

SUPPLIER / MANUFACTURER:
Not Provided

PRIMARY RECEPTACLE, OPTION #2

VIAL

DESCRIPTION:
Plastic Vial with 15mm Friction Fit Plug

MATERIAL:
Natural/Clear Vial with Blue Low Density Polyethylene Plug

DIMENSIONS: Not Provided

SUPPLIER / MANUFACTURER:
Not Provided

SECONDARY RECEPTACLE

CONTAINER (W-12 ROUND)

DESCRIPTION:
2-Piece Threaded Container with Top Handle

MATERIAL: Stainless Steel, Lead

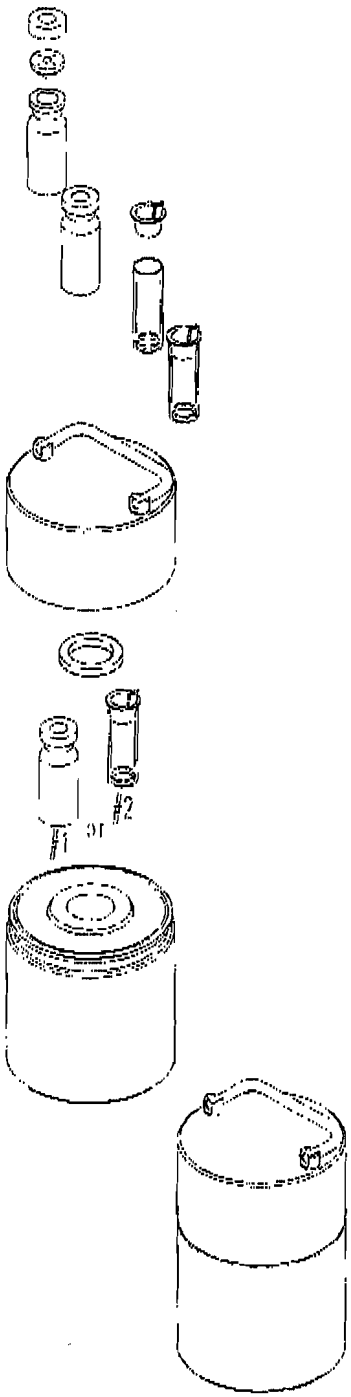
TARE WEIGHT: 22.2 Lbs.

DIMENSIONS:
3.75" OD x 5.10" Shoulder Ht. x 5.41" Overall Ht.

O-RING:
Glued-In (PL-400 Construction Adhesive) Black Buna-N
Rubber O-Ring, 0.210" Thick x 1.037" ID
(Parker 2-319-NO674-70)

SUPPLIER / MANUFACTURER:
Raphael Industries, Drawing No. FA14099

- **Body:** 14047-13, 300 Series STS
- **Cap:** W14047-01
- **Lead Body:** 14047-03
- **Lead Cap:** 14047-05
- **O-Ring:** 14047-11



Contact packaging manufacturer for specifications.

TEST SAMPLE DESCRIPTION

Ammunition Container with an Inner Primary Container (W-12 Round Design)

CUSHIONING

DESCRIPTION:
Laminated Top and Bottom Foam Pads, cut to fit inside dimensions of the steel ammunition box

MATERIAL:
Black Polyethylene Foam

DENSITY:
Not Provided

TARE WEIGHT:
Not Provided

DIMENSIONS:
Not Provided

SUPPLIER / MANUFACTURER:
Not Provided

SHIELD

DESCRIPTION/MATERIAL:
Lead Shield, placed in center portion of bottom pad

TARE WEIGHT:
Not Provided

DIMENSIONS:
Not Provided

SUPPLIER / MANUFACTURER:
Not Specified

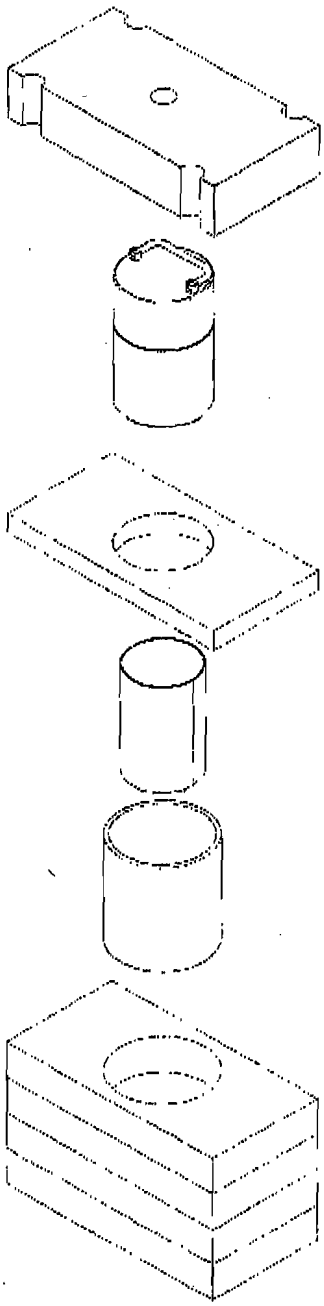
STRIP

DESCRIPTION/MATERIAL:
Stainless Steel Strip, Rolled and placed in center of lead shield

TARE WEIGHT:
Not Provided

DIMENSIONS:
Not Provided

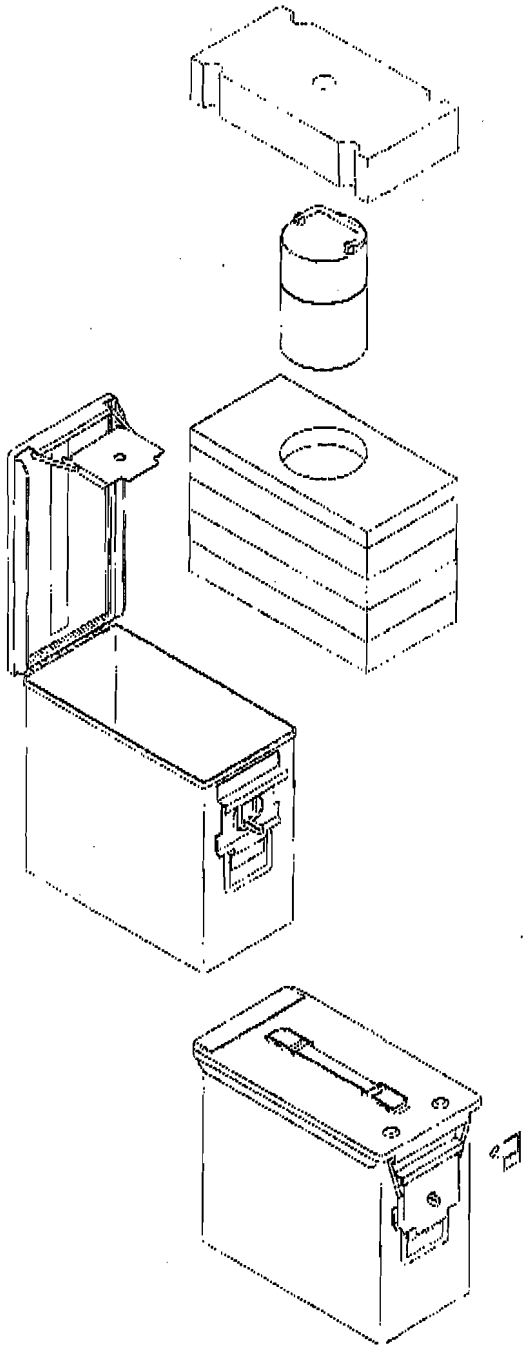
SUPPLIER / MANUFACTURER:
Not Specified



Contact packaging manufacturer for specifications.

TEST SAMPLE DESCRIPTION

Ammunition Container with an Inner Primary Container (W-8 Round Design)



CONTAINER

DESCRIPTION:
Steel Ammunition Box with Hinged Cover, Rubber Seal and Latch

MATERIAL:
Steel

THICKNESS:
Not Provided

TARE WEIGHT:
Not Provided

OVERALL DIMENSIONS:
- **Length:** Not Provided
- **Width:** Not Provided
- **Height:** Not Provided

GASKET: Not Provided

SECUREMENT METHOD:
Gray Plastic Clip Seal

SUPPLIER / MANUFACTURER:
Not Provided

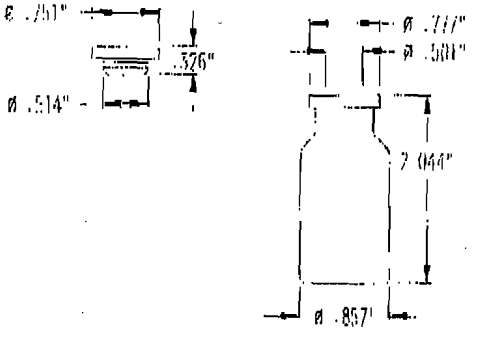
Contact packaging manufacturer for specifications.

QUALITY CONTROL AUDIT RESULTS

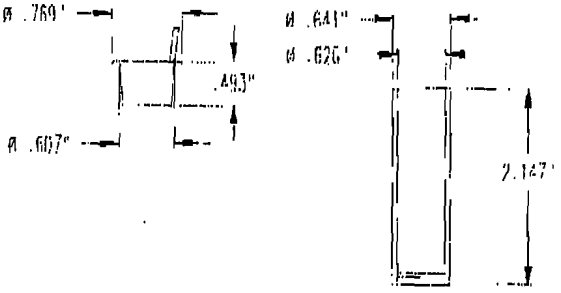
The following audits were performed by TEN-E Packaging Services to document the packaging design.

PRIMARY RECEPTACLE OPTION #1		
CRIMP		
• **Description:**	20mm Aluminum Crimp	
• **Tare Weight:**	0.38 Grams	• **Thickness:** 0.008"
CLOSURE		
• **Description:**	20mm Friction Fit Stopper	
• **Material:**	Rubber; Gray	• **Tare Weight:** 1.58 Grams
VIAL		
• **Description/Material:**	10ml Round Flint Glass Vial	• **Tare Weight:** 10.24 Grams
• **Overflow Capacity:**	13.27mL (0.449 Ounces)	
• **98% Overflow:**	13.01mL (0.440 Ounces)	
• **Min. Wall Thickness:**	0.034", Bottom Head	• **Markings:** None
PRIMARY RECEPTACLE OPTION #2		
CRIMP		
• **Description:**	15mm Friction Fit Plug	
• **Material/Pigment:**	Low Density Polyethylene, Blue	• **Density:** 0.917 g/cc
• **Tare Weight:**	0.62 Grams	• **Markings:** PMI Erie PA 17 6
VIAL		
• **Description Material:**	Round Natural/Clear Plastic Vial	• **Density:** 1.191 g/cc
• **Tare Weight:**	1.65 Grams	
• **Overflow Capacity:**	7.73mL (0.261 Ounces)	
• **98% Overflow:**	7.57mL (0.256 Ounces)	
• **Min. Wall Thickness:**	0.016", Sidewall	• **Markings:** None

Overall Dimensions



Option #1

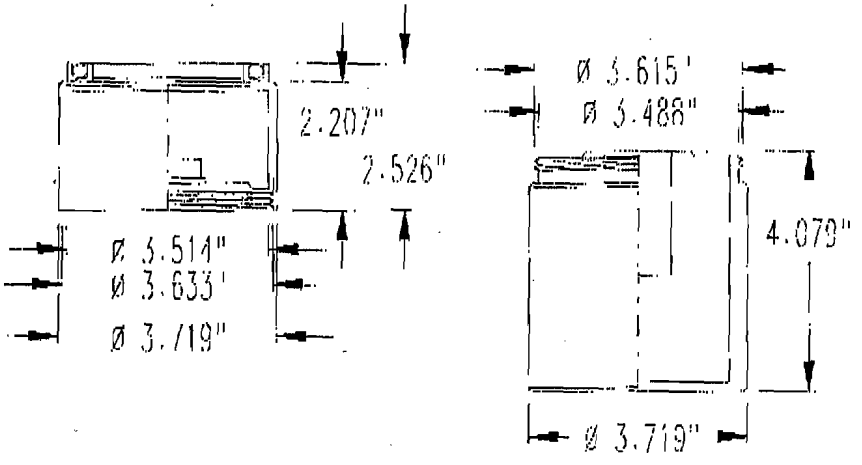


Option #2

QUALITY CONTROL AUDIT RESULTS

SECONDARY RECEPTACLE	
• **Description:**	2-Piece Threaded Container with Top Handle
• **Material/Pigment:**	Stainless Steel Outer Shell with Inner Lead Body
• **Tare Weight:**	**Top:** 2,733 Grams **Bottom:** 6,490 Grams
• **O-Ring:**	Black Rubber O-Ring Glued-In, 2.89 Grams x 0.210" Diameter
• **Markings:**	None

Overall Dimensions



QUALITY CONTROL AUDIT RESULTS

INTERIOR COMPONENTS	
• **Description:**	Top Pad with Finger Holes
• **Material:**	Black Polyethylene Foam
• **Tare Weight:6**	2 Grams
• **Dimensions:**	5-1/2" x 10-3/4" x 2-1/4"
• **Description:**	Laminated Bottom Foam Pad with Inner Lead Shield and SST Sleeve (lead shield and SST sleeve are placed on bottom diameters and the top piece of the bottom pad is glued on top)
• **Material:**	Black Polyethylene Foam
• **Tare Weight:2**	18 Grams (foam only)
• **Dimensions:**	5-1/2" x 10-3/4" x 7-1/4" with 4-3/8" Diameter Bottom Holes with 3-3/4" Diameter Hole on the Top Piece of the Bottom Pad
• **Description/Material:**	Lead Shield
• **Tare Weight:2**	,195 Grams
• **Dimensions:**	4-3/8" OD x 4-13/16" Height x 0.183" Thick
• **Description/Material:**	Stainless Steel Sleeve, Rolled and placed in center of lead shield
• **Tare Weight:1**	20 Grams
• **Dimensions:**	12-3/8" Long x 4-3/4" Height x 0.046" Thick

CONTAINER ASSEMBLY						
• **Description:**	Ammunition Box with Hinged Top Cover with Handle and Crimped-In Black Rubber Gasket, Front Latch with Handle					
• **Material:**	Steel					
• **Finish:**	**Exterior:** Gray **Interior:** Gray					
• **Tare Weight:**	2,748 Grams (with Bottom Foam Insert)					
• **Wall Thickness:**	**Cover:**	1.) 0.0466"	2.) 0.0465"	3.) 0.0465"		
	Sidewall:	1.) 0.0307"	2.) 0.0303"	3.) 0.0301"		
	Bottom:	1.) 0.0300"	2.) 0.0304"	3.) 0.0304"		
• **Dimensions:**	**Cover:** 6-1/8"x 11-3/4" x 1-1/4" **Box:** 5-3/4"x 12"x 9-13/16" **Overall Height:** 10-3/8"					
• **Markings:**	CONT PA 19 S.C.F.					
• **Securement Method:**	Gray Polypropylene Plastic Locking Seal, Tare Weight: 1.46 Grams Markings: SPI "5" PP Pat 4506921 Seal 0160269 EJ Brooks Co					

SAMPLE PREPARATION

Ammunition Container with 1 x Inner Primary Containers (W-12 Round Design)

PACKAGE WEIGHT & SAMPLE PREPARATION INFORMATION – FOR THE 10mL GLASS VIAL PKG.	
TEST CONTENTS:	• Water • Anti-freeze used for the Thermal Shock Test
NET FILL WEIGHT:	• 12.7 Grams
PACKAGE TEST WEIGHT:	• 14.6 Kg (32.2 Lbs.)
RECEPTACLE CLOSURE METHODS: **-10mLGLASS VIAL:**	• Crimped Closure
CLOSURE METHOD (SHIPPER):	• Latched and Plastic Security Device
It is the responsibility of the manufacturer or other person certifying compliance to provide closing instructions in accordance with Title 49 CFR 178.2	
SAMPLE SIZE:	• 5 Complete Package Assemblies Used to Complete the Test Program

TEST	SAMPLE ID:	TEST CONTENTS:	CONDITIONING:
Vibration (Repetitive Shock)	1	Water	Ambient
Vibration (Sweep)	1	Water	Ambient
Thermal Shock	2	Anti-Freeze	-40°C (-40°F) for Four (4) Hours and 70°C (158°F) for Four (4) Hours
Pressure Differential	1	Water	Ambient
Internal Pressure	1	Water	Ambient
Water Spray & 1.2 Meter Drop	2	Water	Ambient
Water Spray & Stacking	3	Water	Ambient
Water Spray & Penetration	1	Water	Ambient
Water Spray & 9.0 Meter Drop	4	Water	Ambient
Water Spray & Penetration	5	Water	Ambient

EQUIPMENT

All inspection, measuring and test equipment that can affect product quality is calibrated and adjusted at prescribed intervals, or prior to use, and is traceable to NIST, using ANSI Z540 as an overall guide for calibration certification.

SAMPLE PREPARATION

Ammunition Container with 1 x Inner Primary Containers (W-12 Round Design)

PACKAGE WEIGHT & SAMPLE PREPARATION INFORMATION – FOR THE 7mL PLASTIC VIAL PKG.	
TEST CONTENTS:	▪ 3 x Capsules • Water used for the Pressure Differential Test
NET FILL WEIGHT:	▪ 1.4 Grams (3 x Capsules per Vial)
PACKAGE TEST WEIGHT:	▪ 14.6 Kg (32.2 Lbs.)
RECEPTACLE CLOSURE METHODS: **-7mL PLASTIC VIAL:**	▪ Friction-Fit Plug
CLOSURE METHOD (SHIPPER):	• Latched and Plastic Security Device
It is the responsibility of the manufacturer or other person certifying compliance to provide closing instructions in accordance with Title 49 CFR 178.2	
SAMPLE SIZE:	• 3 Complete Package Assemblies Used to Complete the Test Program

TEST	SAMPLE ID:	TEST CONTENTS:	CONDITIONING:
Vibration (Repetitive Shock)	1	Capsules	Ambient
Vibration (Sweep)	1	Capsules	Ambient
Thermal Shock	2	Capsules	-40°C (-40°F) for Four (4) Hours and 70°C (158°F) for Four (4) Hours
Pressure Differential	1	Water	Ambient
Water Spray & 1.2 Meter Drop	2	Capsules	Ambient
Water Spray & Stacking	3	Capsules	Ambient
Water Spray & Penetration	1	Capsules	Ambient

EQUIPMENT

All inspection, measuring and test equipment that can affect product quality is calibrated and adjusted at prescribed intervals, or prior to use, and is traceable to NIST, using ANSI Z540 as an overall guide for calibration certification.

GENERAL REQUIREMENTS - REPETITIVE SHOCK VIBRATION TEST

SAMPLE PREPARATION/CONDITIONING:
- Refer to Sample Preparation Page

FREQUENCY:
- 4.3 Hz

TABLE DISPLACEMENT:
- 1"

TEST DURATION:
- 1 Hour

VIBRATION TEST EQUIPMENT:
- LAB Model 6000 Transportation simulator

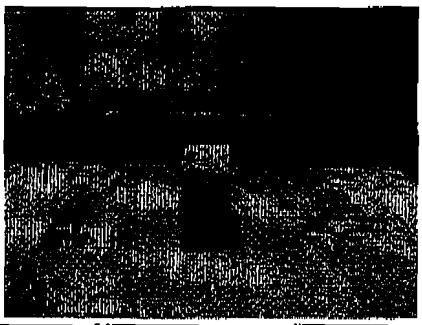
TEST ORIENTATION:
- Base

REGULATORY REFERENCES:
- Refer to Appendix I

INDUSTRY STANDARD REFERENCE:
- Refer to Appendix I

VIBRATION (SHOCK) TEST SET-UP & RESULTS

CRITERIA FOR PASSING



Sample #	No Loss/Dispersal of Contents	No deterioration of the effectiveness of the closing device(s)
1 (Liquids)	Pass	Pass
1 (Solids)	Pass	Pass

COMMENTS / OBSERVATIONS

No visible damage evident to the interior or exterior of the sample.

CRITERIA FOR PASSING THE VIBRATION TEST

The package must be capable of withstanding the effects of any acceleration, vibration or vibration resonance which may arise under conditions likely to be encountered in routine transport without any deterioration in the effectiveness of the closing devices on the various receptacles or in the integrity of the package as a whole.

GENERAL REQUIREMENTS - FREQUENCY SWEEP VIBRATION TEST

SAMPLE PREPARATION/CONDITIONING:
- Refer to Sample Preparation Page

FREQUENCY SWEEP RANGE & RATE:
- 3.0 Hz – 200.0 Hz – 3.0 Hz / 0.5 Octave/Minute

INPUT ACCELERATION:
- 0.5 g

TEST DURATION:
- 1 Hour

VIBRATION TEST EQUIPMENT:
- L.A.B. PTV 48 Vibration Test System

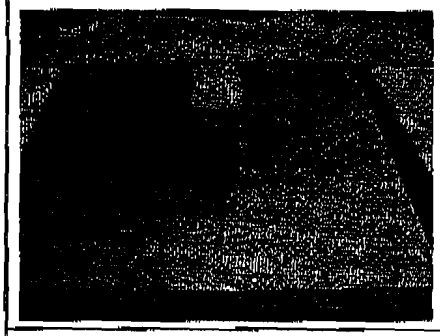
TEST ORIENTATION:
- Base

REGULATORY REFERENCES:
- Refer to Appendix I

INDUSTRY STANDARD REFERENCE:
- Refer to Appendix I

VIBRATION (FREQUENCY SWEEP) TEST SET-UP & RESULTS

CRITERIA FOR PASSING



Sample #	No Loss/Dispersal of Contents	No deterioration of the effectiveness of the closing device(s)
1 (Liquids)	Pass	Pass
1 (Solids)	Pass	Pass

COMMENTS / OBSERVATIONS

No visible damage evident to the interior or exterior of the sample.

CRITERIA FOR PASSING THE VIBRATION TEST

The package must be capable of withstanding the effects of any acceleration, vibration or vibration resonance which may arise under conditions likely to be encountered in routine transport without any deterioration in the effectiveness of the closing devices on the various receptacles or in the integrity of the package as a whole.

GENERAL REQUIREMENTS - THERMAL SHOCK TEST

SAMPLE PREPARATION/CONDITIONING:
- Refer to Sample Preparation Page

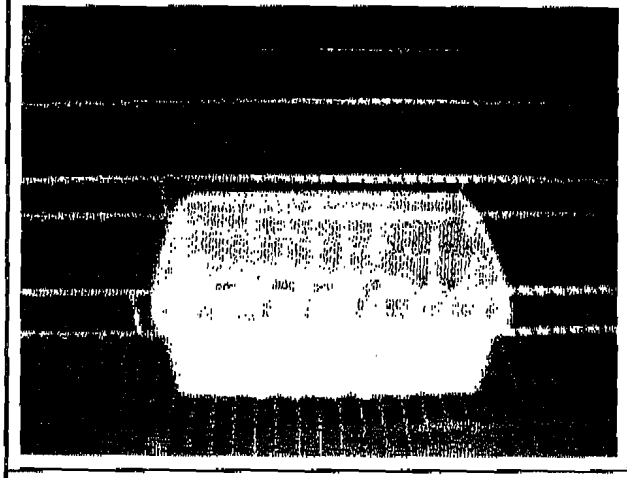
TEST DURATION:
- Eight (8) Hours Total

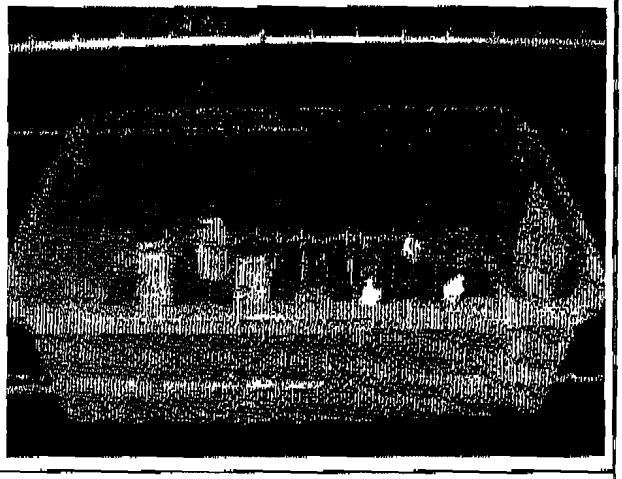
TEST EQUIPMENT:
- Thermotron Chamber (#242)
- Cincinnati Chamber (#241)

REGULATORY REFERENCES:
- Refer to Appendix I

INDUSTRY STANDARD REFERENCE:
- Refer to Appendix I

THERMAL SHOCK TEST SET-UP & RESULTS





COMMENTS / OBSERVATIONS

Sample #	-40°C	70°C
2 (10mL Glass Liquids Primary Receptacle)	No visual degradation of the packaging components following four (4) hour test at -40°C. No leakage of contents evident.	No visual degradation of the packaging components following four (4) hour test at +70°C. No leakage of contents evident.
2 (7mL Plastic Solids Primary Receptacle)	No visual degradation of the packaging components following four (4) hour test at -40°C. No leakage of contents evident.	No visual degradation of the packaging components following four (4) hour test at +70°C. No leakage of contents evident.

CRITERIA FOR PASSING THE THERMAL SHOCK TEST

The component(s) of the package must be able to withstand temperatures ranging from -40°C to 70°C without degradation of materials within these given temperature ranges.

GENERAL REQUIREMENTS - PRESSURE DIFFERENTIAL TEST

SAMPLE PREPARATION/CONDITIONING:
- Refer to Sample Preparation Page

TEST PRESSURE:
- 18 In.-Hg (60 kPa / 8.7 psi)

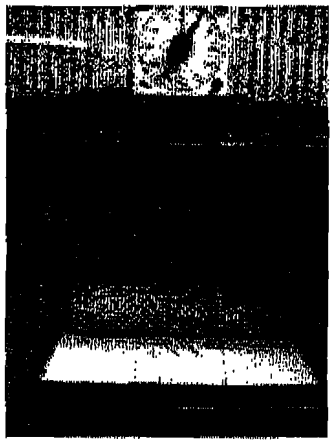
TEST DURATION:
- 5 Minutes

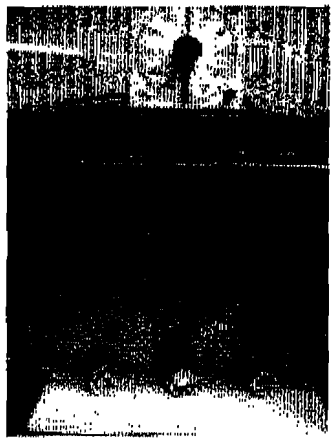
TEST EQUIPMENT:
- Tenney 6S Vacuum Chamber (#618)
- McDanial Dial Pressure Gauge (#612)

REGULATORY REFERENCES:
- Refer to Appendix I

INDUSTRY STANDARD REFERENCE:
- Refer to Appendix I

PRESSURE DIFFERENTIAL TEST SET-UP & RESULTS





Sample #	Result	COMMENTS / OBSERVATIONS
1 (10mL Glass Liquids Primary Receptacle)	Pass	The sample maintained the 60 kPa test pressure for 5 minutes without leakage. There was no leakage evident from the vial (primary receptacle)..
1 (7mL Plastic Solids Primary Receptacle & Secondary Receptacle)	Pass	The sample maintained the 60 kPa test pressure for 5 minutes without leakage. There was no leakage evident from the vial (primary receptacle)..

CRITERIA FOR PASSING THE PRESSURE DIFFERENTIAL TEST

The containment system must retain its radioactive contents under a pressure differential test at 60 kPa.

AIR TRANSPORTATION REQUIREMENTS - INTERNAL PRESSURE TEST

SAMPLE PREPARATION/CONDITIONING:
- Refer to Sample Preparation Page

TEST PRESSURE:
- 28 In.-Hg (95 kPa / 13.8 psi)

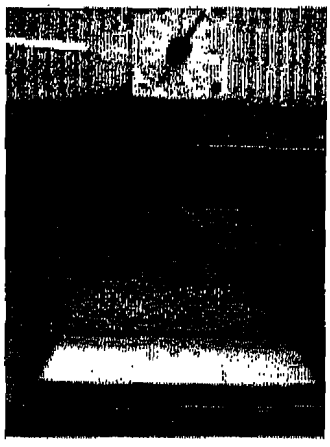
TEST DURATION:
- 5 Minutes

TEST EQUIPMENT:
- Tenney 6S Vacuum Chamber (#618)
- McDanial Dial Pressure Gauge (#612)

REGULATORY REFERENCES:
- Refer to Appendix I

INDUSTRY STANDARD REFERENCE:
- Refer to Appendix I

INTERNAL PRESSURE TEST SET-UP & RESULTS



Sample #	Result	COMMENTS / OBSERVATIONS
1 (10mL Glass Liquids Primary Receptacle)	Pass	The sample maintained the 95 kPa test pressure for 5 minutes without leakage. There was no leakage evident from the vial (primary receptacle).

CRITERIA FOR PASSING THE PRESSURE DIFFERENTIAL TEST

The containment system must retain its radioactive contents under a pressure differential test at 95 kPa.

TESTS FOR DEMONSTRATING ABILITY TO WITHSTAND NORMAL CONDITIONS OF TRANSPORT -- WATER SPRAY & 1.2-METER FREE DROP TEST 10mL GLASS VIAL PACKAGING (FOR LIQUIDS)

WATER SPRAY TEST (SAMPLE PKG: #2)

SAMPLE PREPARATION/CONDITIONING:
- Refer to Sample Preparation Page

TEST DURATION:
- 1 Hour

RAINFALL EXPOSURE:
- Required Rainfall Exposure: 50mm (2.0")/hour (approximately)
- Actual Rainfall Exposure: 50mm (2.0")/hour

REGULATORY REFERENCES:
- Refer to Appendix I

INDUSTRY STANDARD REFERENCE:
- Refer to Appendix I

1.2 METER FREE DROP TEST (SAMPLE PKG: #2)

SAMPLE PREPARATION/CONDITIONING:
- Refer to Sample Preparation Page

PRECONDITIONING:
- Within 15 minutes of the Water Spray Test, the test sample was subjected to the Free Drop Test

DROP ORIENTATION:
- Top Corner

DROP HEIGHT:
- 1.2 m (47.3")

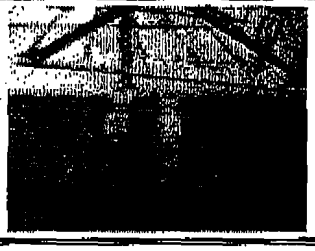
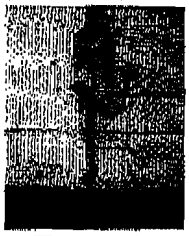
DROP TEST EQUIPMENT:
- L.A.B. ACCU-Drop 160

REGULATORY REFERENCES:
- Refer to Appendix I

INDUSTRY STANDARD REFERENCE:
- Refer to Appendix I

WATER SPRAY AND 1.2-METER FREE DROP TEST SET UP & RESULTS

DROP ORIENTATION	OVERALL CONTAINER HEIGHT			CRITERIA FOR PASSING	
	Prior to Drop	Following Drop	Total Change	No Loss/Dispersal of Contents	<20% Increase in Radiation level at any external surface
TOP CORNER	10.00"	10.00"	0.00"	PASS	*Not Determined

WATER SPRAY SET-UP	DROP SET-UP	COMMENTS / OBSERVATIONS:
		No evidence of loss or dispersal of the contents. No damage evident to the inner components. Minimal deformation evident at the impact corner.

CRITERIA FOR PASSING THE TYPE A RADIOACTIVE PACKAGE PERFORMANCE TESTS

1) *No loss of shielding integrity which would result in more than a 20 % increase in the radiation level at any external surface of the package ***(*This criteria for passing must be determined by the person shipping the radioactive material, based on the comments and the observations noted above).***
2) No loss or dispersal of the radioactive contents.

TESTS FOR DEMONSTRATING ABILITY TO WITHSTAND NORMAL CONDITIONS OF TRANSPORT – WATER SPRAY & 1.2-METER FREE DROP TEST 7mL PLASTIC VIAL PACKAGING (FOR SOLIDS)

WATER SPRAY TEST (SAMPLE PKG: #2)

SAMPLE PREPARATION/CONDITIONING:
- Refer to Sample Preparation Page

TEST DURATION:
- 1 Hour

RAINFALL EXPOSURE:
- Required Rainfall Exposure: 50mm (2.0")/hour (approximately)
- Actual Rainfall Exposure: 50mm (2.0")/hour

REGULATORY REFERENCES:
- Refer to Appendix I

INDUSTRY STANDARD REFERENCE:
- Refer to Appendix I

1.2 METER FREE DROP TEST (SAMPLE PKG: #2)

SAMPLE PREPARATION/CONDITIONING:
- Refer to Sample Preparation Page

PRECONDITIONING:
- Within 15 minutes of the Water Spray Test, the test sample was subjected to the Free Drop Test

DROP ORIENTATION:
- Top Corner

DROP HEIGHT:
- 1.2 m (47.3")

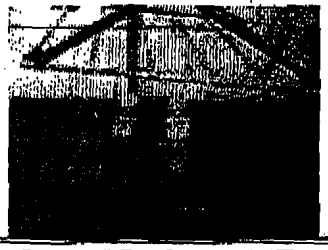
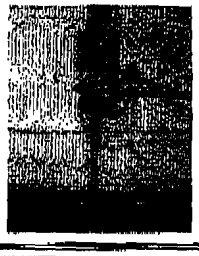
DROP TEST EQUIPMENT:
- L.A.B. ACCU-Drop 160

REGULATORY REFERENCES:
- Refer to Appendix I

INDUSTRY STANDARD REFERENCE:
- Refer to Appendix I

WATER SPRAY AND 1.2-METER FREE DROP TEST SET UP & RESULTS

DROP ORIENTATION	OVERALL CONTAINER HEIGHT			CRITERIA FOR PASSING	
	Prior to Drop	Following Drop	Total Change	No Loss/Dispersal of Contents	<20% Increase in Radiation level at any external surface
TOP CORNER	10.00"	10.00"	0.00"	PASS	*Not Determined

WATER SPRAY SET-UP	DROP SET-UP	COMMENTS / OBSERVATIONS:
		No evidence of loss or dispersal of the contents. No damage evident to the inner components. Minimal deformation evident at the impact corner.

CRITERIA FOR PASSING THE TYPE A RADIOACTIVE PACKAGE PERFORMANCE TESTS

1) *No loss of shielding integrity which would result in more than a 20 % increase in the radiation level at any external surface of the package ***(*This criteria for passing must be determined by the person shipping the radioactive material, based on the comments and the observations noted above).***
2) No loss or dispersal of the radioactive contents.

TESTS FOR DEMONSTRATING ABILITY TO WITHSTAND NORMAL CONDITIONS OF TRANSPORT – WATER SPRAY & STACKING TEST CONDUCTED FOR BOTH THE LIQUIDS & SOLIDS PACKAGING

WATER SPRAY TEST (SAMPLE PKG: #3)

SAMPLE PREPARATION/CONDITIONING:
- Refer to Sample Preparation Page

TEST DURATION:
- 1 Hour

RAINFALL EXPOSURE:
- Required Rainfall Exposure: 50mm (2.0")/hour (approximately)
- Actual Rainfall Exposure: 50mm (2.0")/hour

REGULATORY REFERENCES:
- Refer to Appendix I

INDUSTRY STANDARD REFERENCE:
- Refer to Appendix I

STACKING (SAMPLE PKG: #3)

SAMPLE PREPARATION/CONDITIONING:
- Refer to Sample Preparation Page

PRECONDITIONING:
- Within 15 minutes of the Water Spray Test, the test sample was subjected to the 24-Hour Stacking Test

ACTUAL TOP LOAD APPLIED:
- 200.0 Lbs. (90.7 Kg)

MINIMUM REQUIRED TOP LOAD APPLICATION:
- The Equivalent of five (5) times the mass of the actual package
- 5 x 32.2 Lbs. (14.6 Kg) = 161.0 Lbs. (73.0 Kg)

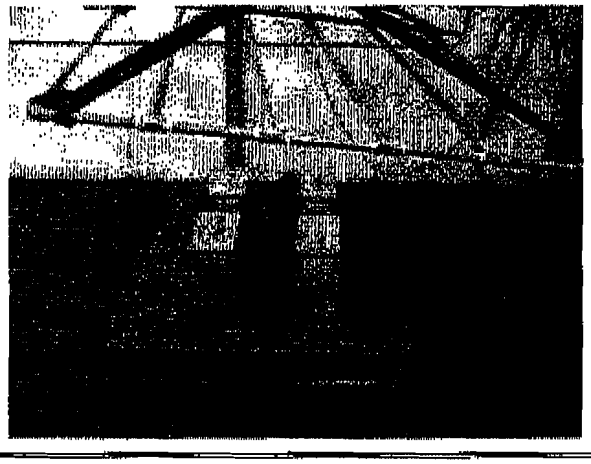
TEST DURATION:
- 24 Hours

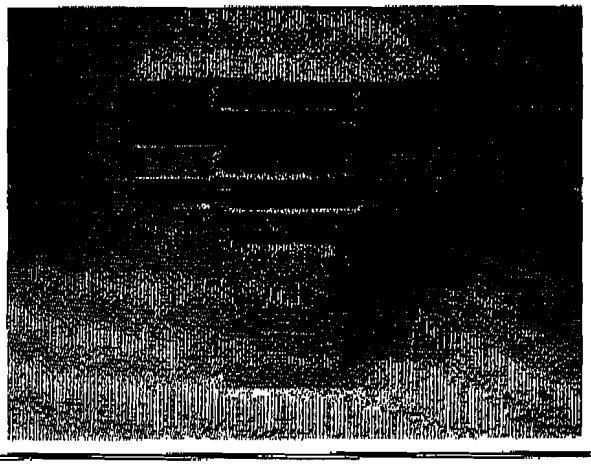
DROP TEST EQUIPMENT:
- Dead Load Steel Weights

REGULATORY REFERENCES:
- Refer to Appendix I

INDUSTRY STANDARD REFERENCE:
- Refer to Appendix I

WATER SPRAY & STACKING TEST SET-UP & RESULTS





Refer to the following page for the Water Spray & Stacking Test Results

TESTS FOR DEMONSTRATING ABILITY TO WITHSTAND NORMAL CONDITIONS OF TRANSPORT – WATER SPRAY & STACKING TEST (CONTINUED)

WATER SPRAY AND STACKING TEST RESULTS				
TOP-TO-BOTTOM DEFLECTION MEASUREMENTS			CRITERIA FOR PASSING	
Prior to Stacking	Following Stacking	Total Change	No Loss/Dispersal of Contents	<20% Increase in radiation level at any external surface
(1)* 10.00"	(1) 10.00"	(1) 0.00"	PASS	**Not Determined
(2)* 10.00"	(2) 10.00"	(2) 0.00"		
(3)* 10.00"	(3) 10.00"	(3) 0.00"		
(4)* 10.00"	(4) 10.00"	(4) 0.00"		
COMMENTS:		* (1) Measurements taken at the right front corner of the shipping carton * (2) Measurements taken at the left front corner of the shipping carton * (3) Measurements taken at the right back corner of the shipping carton * (4) Measurements taken at the left back corner of the shipping carton No damage noted to any components. No leakage of contents.		

CRITERIA FOR PASSING THE TYPE A RADIOACTIVE PACKAGE PERFORMANCE TESTS

1) **No loss of shielding integrity which would result in more than a 20 % increase in the radiation level at any external surface of the package ***(*This criteria for passing must be determined by the person shipping the radioactive material, based on the comments and the observations noted above).***

2) No loss or dispersal of the radioactive contents.

TESTS FOR DEMONSTRATING ABILITY TO WITHSTAND NORMAL CONDITIONS OF TRANSPORT – WATER SPRAY & PENETRATION TEST CONDUCTED FOR BOTH THE LIQUIDS & SOLIDS PACKAGING

WATER SPRAY TEST (SAMPLE PKG: #1)

SAMPLE PREPARATION/CONDITIONING:
- Refer to Sample Preparation Page

TEST DURATION:
- 1 Hour

RAINFALL EXPOSURE:
- Required Rainfall Exposure: 50mm (2.0")/hour (approximately)
- Actual Rainfall Exposure: 50mm (2.0")/hour

REGULATORY REFERENCES:
- Refer to Appendix I

INDUSTRY STANDARD REFERENCE:
- Refer to Appendix I

PENETRATION TEST (SAMPLE PKG: #1)

SAMPLE PREPARATION/CONDITIONING:
- Refer to Sample Preparation Page

PRECONDITIONING:
- Within 15 minutes of the Water Spray Test, the test sample was subjected to the Penetration Test

BAR DROP HEIGHT:
- 1.0m (40.0")

BAR SPECIFICATIONS:
- Cylindrical Steel rod with a 32mm (1.25") Diameter with a hemispherical end, Rod Gross Mass: 6.0 Kg (13.2 Lbs.)

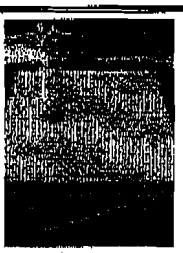
REQUIRED AREA OF IMPACT:
- Center of weakest part of the specimen.
- Center of a sidewall panel surface.

REGULATORY REFERENCES:
- Refer to Appendix I

INDUSTRY STANDARD REFERENCE:
- Refer to Appendix I

WATER SPRAY AND PENETRATION TEST

DART PENETRATION		CRITERIA FOR PASSING	
DEPTH	PENETRATION THROUGH SIDEWALL	No Loss/Dispersal of Contents	<20% Increase in Radiation level at any external surface
N/A	No	PASS	*Not Determined

WATER SPRAY SETUP	PENETRATTION SETUP	COMMENTS / OBSERVATIONS:
		No damage to the inner packaging. No leakage of contents.

CRITERIA FOR PASSING THE TYPE A RADIOACTIVE PACKAGE PERFORMANCE TESTS

1) *No loss of shielding integrity which would result in more than a 20 % increase in the radiation level at any external surface of the package ***(*This criteria for passing must be determined by the person shipping the radioactive material, based on the comments and the observations noted above).***
2) No loss or dispersal of the radioactive contents.

ADDITIONAL TESTS FOR TYPE A PACKAGES DESIGNED FOR LIQUIDS OR GASES – WATER SPRAY & 9.0-METER FREE DROP TEST (10mL GLASS VIAL PKG.)

WATER SPRAY TEST (SAMPLE PKG: #4)

SAMPLE PREPARATION/CONDITIONING:
- Refer to Sample Preparation Page

TEST DURATION:
- 1 Hour

RAINFALL EXPOSURE:
- Required Rainfall Exposure: 50mm (2.0")/hour (approximately)
- Actual Rainfall Exposure: 50mm (2.0")/hour

REGULATORY REFERENCES:
- Refer to Appendix I

INDUSTRY STANDARD REFERENCE:
- Refer to Appendix I

9.0 METER FREE DROP TEST (SAMPLE PKG: #4)

SAMPLE PREPARATION/CONDITIONING:
- Refer to Sample Preparation Page

PRECONDITIONING:
- Within 15 minutes of the Water Spray Test, the test sample was subjected to the Free Drop Test

DROP ORIENTATION:
- Top Corner

DROP HEIGHT:
- 9.0 m (30.0")

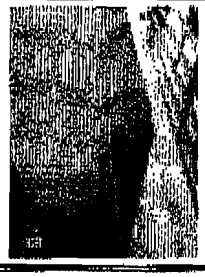
DROP TEST EQUIPMENT:
- Dropped Manually

REGULATORY REFERENCES:
- Refer to Appendix I

INDUSTRY STANDARD REFERENCE:
- Refer to Appendix I

WATER SPRAY AND 9.0-METER FREE DROP TEST-SET UP & RESULTS

DROP ORIENTATION	OVERALL CONTAINER HEIGHT			CRITERIA FOR PASSING	
	Prior to Drop	Following Drop	Total Change	No Loss/Dispersal of Contents	<20% Increase in Radiation level at any external surface
TOP CORNER	10.00"	10.00"	0.00"	PASS	*Not Determined

WATER SPRAY SET-UP	DROP SET-UP	COMMENTS / OBSERVATIONS:
		No evidence of loss or dispersal of the contents. No damage evident to the inner components. Minimal deformation evident at the impact corner.

CRITERIA FOR PASSING THE TYPE A RADIOACTIVE PACKAGE PERFORMANCE TESTS

1) *No loss of shielding integrity which would result in more than a 20 % increase in the radiation level at any external surface of the package ***(*This criteria for passing must be determined by the person shipping the radioactive material, based on the comments and the observations noted above).***
2) No loss or dispersal of the radioactive contents.

ADDITIONAL TESTS FOR TYPE A PACKAGINGS DESIGNED FOR LIQUIDS AND GASES -- WATER SPRAY & PENETRATION TEST (10mL GLASS VIAL PKG.)

WATER SPRAY TEST (SAMPLE PKG: #5)

SAMPLE PREPARATION/CONDITIONING:
- Refer to Sample Preparation Page

TEST DURATION:
- 1 Hour

RAINFALL EXPOSURE:
- Required Rainfall Exposure: 50mm (2.0")/hour (approximately)
- Actual Rainfall Exposure: 50mm (2.0")/hour

REGULATORY REFERENCES:
- Refer to Appendix I

INDUSTRY STANDARD REFERENCE:
- Refer to Appendix I

PENETRATION TEST (SAMPLE PKG: #5)

SAMPLE PREPARATION/CONDITIONING:
- Refer to Sample Preparation Page

PRECONDITIONING:
- Within 15 minutes of the Water Spray Test, the test sample was subjected to the Penetration Test

BAR DROP HEIGHT:
- 1.7m (5.5')

BAR SPECIFICATIONS:
- Cylindrical Steel rod with a 32mm (1.25") Diameter with a hemispherical end, Rod Gross Mass: 6.0 Kg (13.2 Lbs.)

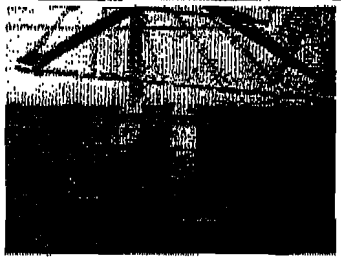
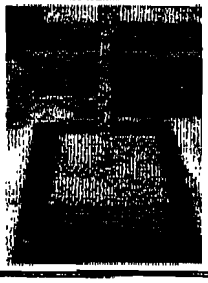
REQUIRED AREA OF IMPACT:
- Center of weakest part of the specimen.
- Center of a sidewall panel surface.

REGULATORY REFERENCES:
- Refer to Appendix I

INDUSTRY STANDARD REFERENCE:
- Refer to Appendix I

WATER SPRAY AND PENETRATION TEST

DART PENETRATION		CRITERIA FOR PASSING	
DEPTH	PENETRATION THROUGH SIDEWALL	No Loss/Dispersal of Contents	<20% Increase in Radiation level at any external surface
N/A	No	PASS	*Not Determined

WATER SPRAY SET-UP	PENETRATTION SET-UP	COMMENTS / OBSERVATIONS:
		No damage to the inner packaging. No leakage of contents.

CRITERIA FOR PASSING THE TYPE A RADIOACTIVE PACKAGE PERFORMANCE TESTS

1) *No loss of shielding integrity which would result in more than a 20 % increase in the radiation level at any external surface of the package ***(*This criteria for passing must be determined by the person shipping the radioactive material, based on the comments and the observations noted above).***
2) No loss or dispersal of the radioactive contents.

DISCLAIMER OF WARRANTIES

Package Description: **Ammunition Container with 1 x 10mL Glass Vial for Liquid Radioactive Materials, or 1 x 7mL Plastic Vials for Solid Radioactive Material (W-12 Round Design)**

TEN-E PACKAGING SERVICES, INC. certifies that the **Amersham Health Type A Radioactive Packaging for Liquids** shown above has met the performance requirements for Type A Radioactive Packages as specified in Parts 173.410, 173.412, 173.415 & 173.465 of the Department of Transportation's Title 49 Code of Federal Regulations (2003 edition). In addition the package complies with the requirements set forth in the 2003-2004 edition of the ICAO Technical Instructions for the Safe Transport of Dangerous Goods by Air, and the 45th edition of the IATA Dangerous Goods Regulations.

ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY THAT THE PACKAGING TESTED IS MERCHANTABLE OR FIT FOR A PARTICULAR PURPOSE, ARE DISCLAIMED. In no event shall TEN-E Packaging Services, Inc. liability exceed the total amount paid by **Amersham Health** for services rendered. In the event of future changes to the above referenced test standard, it is the responsibility **Amersham Health** to determine whether additional testing or updating of past testing is necessary to verify that the packaging we have tested remains in compliance with those standards.

Jim Loth
Project Manager
TEN-E Packaging Services, Inc.

APPENDIX I: REGULATORY STANDARD REFERENCES

REGULATORY REFERENCES			
TEST	**49 CFR① 2003 Edition**	**ICAO② 03-04 Edition**	**IATA③ 45th Edition**
Vibration (Repetitive Shock):	173.24a(a)(5) & 178.608	6; 7.1.7	10.5.3.7
Vibration (Sweep):	173.410(f)	6; 7.1.7	10.5.3.7
Thermal Shock:	173.410(i)(2) & 173.412(c)	6; 7.2.2 & 6; 7.6.5	10.5.3.11 & 10.6.2.1.1.4
Pressure Differential:	173.412(f)	6; 7.6.11	10.6.2.1.2.5
Internal Pressure:	173.410(i)(3)	6; 7.2.3	10.5.3.12
Water Spray / 1.2 m Drop:	173.465(b) & 173.465(c)	6; 7.14.3, 6; 7.13 & 6; 7.14.4	10.6.3.4.2, 10.6.3.3 & 10.6.3.4.3
Water Spray / Stacking	173.465(b) & 173.465(d)	6; 7.14.3 & 6; 7.14.5	10.6.3.4.2 & 10.6.3.4.4
Water Spray & 1 m Penetration	173.465(b) & 173.465(e)	6; 7.14.3 & 6; 7.14.6	10.6.3.4.2 & 10.6.3.4.5
Water Spray / 9 m Drop:	173.465(b), 173.465(c)(5) & 173.466(a)(1)	6; 7.14.3, 6; 7.13 & 6; 7.15(a)	10.6.3.4.2, 10.6.3.3 & 10.6.3.5.1
Water Spray & 1.7 m Penetration	173.465(b) & 173.466(a)(2)	6; 7.14.3 & 6; 7.15(b)	10.6.3.4.2 & 10.6.3.5.2

① United States Departm ent of Transportation Code of Federal Regulations (CFR) Title 49, Transportation, Parts 100-199
② Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO)
③International Air Transport Association (IATA) Dangerous Goods Regulations