Section 5 Post Test Assessment

Only 1 package needed to undergo radiation profile inspection because only it and one other test specimen showed the same slight variation in the source location dimension after testing. This test specimen successfully passed the radiation profile inspection. The minor damage to the welded body structure indicates there is no need for radiographs to be taken for further examination.

The test results indicate the SENTRY transport package complies with the normal transport test requirements of 10 CFR part 71 and IAEA TS-R-1 1996. There was no loss or dispersal of radioactive contents, no significant increase in external surface radiation levels and no substantial reduction in the effectiveness of the packaging. There was no loss of shielding integrity resulting in more than a 20% increase in the radiation level at any external surface of the package.

However, the 1.2 meter free drop revealed a weakness in the lock cover assembly and potentially the #10-32 screws of the rear plate Posilock mechanism. The lock cover and rear plate Posilock will need to be modified to enable the SENTRY transport package to pass the hypothetical accident condition tests.

Appendix

1. ~~Test Specimen Manufacturing Documentation~~
   - ~~See network file location: K:\2 Released Files (PDF)\Test Plans & Reports (TP)\TP180 SENTRY Transport Testing\Test Specimen Build\Route Cards & TMIs~~

2. ~~Measurement and Test Equipment Calibration Records~~
   - ~~See network file location: K:\2 Released Files (PDF)\Test Plans & Reports (TP)\TP180 SENTRY Transport Testing\Test Specimen Build\Equip Cal & Insp Records~~

3. Test Worksheets (Equipment list, checklist and data sheets)

Note: Appendices 1 and 2 are for internal reference by QSA Global, Inc. and are not included as part of the Appendix submitted to the USNRC in support of the Type B(U) application for these packages.

Test Specimen & Equipment List

Test Specimen & Equipment Documentation

Test Specimen

Configuration	Drawing Number	Serial Number	Attach IIR	Attach NCR	Attach Route Cards
Basic	TP86015-330	TP180A	See TMI 189	NA	Yes
Basic	TP86015-330	TP180B	See TMI 189	NA	Yes
Basic	TP86015-330	TP180C	See TMI 189	NA	Yes
Basic	TP86015-330	TP180D	See TMI 189	NA	Yes
Basic	TP86015-330	TP180E	See TMI 189	NA	Yes

Tools & Equipment

Tool Description	Enter the Model and Serial Number Mark NA when not used.	Attach Inspection Report or Calibration Certificate
Drop Surface, Drawing No. T10740	S/N 001	Yes
Penetration Bar, Drawing No. T10129	S/N 01	Yes

Record any additional tools used to facilitate the test and attach the appropriate inspection report or calibration certificates.

TEMPERATURE GAGE	ENG-20	YES
WEIGHT SCALE	F16383	YES

Signature	Print Name	Date
Engineering: S. Grenier	S. GRENIER	13 OCT 2009
Regulatory:	C. Pidot	13 Jan 10
Quality Assurance: C. Reighan	C Raghan	13 Jan 2010

Penetration Test Checklist

Test: PENETRATION TEST		
Test Location: QSA ENGINEERING TEST AREA - BURLINGTON MA		
Step	**Data**	
1. Record test specimen serial number:	TP180A	
2. Record the test specimen weight:	655 LBS.	
3. Record the ambient temperature (°C): 18.9°C	66.1°F	Instrument S/N: ENG-20
4. Identify target location on test specimen.	PLUNGER LOCK ON DUST COVER	
5. Photograph set-up with penetration bar touching target location on test specimen.	DONE	
6. Lift penetration bar 40 inches from target location on test specimen to lowest point on penetration bar.	DONE	
7. Release the penetration bar.	DONE	
8. Photograph target location after impact.	DONE	
9. Record the damage to the test specimen. Use a separate sheet and attach, if needed. SMALL DENT ON PLASTIC DUST COVER AND BRASS PLUNGER LOCK		
10. Engineering, Regulatory Affairs and Quality Assurance make a preliminary assessment relative to 10 CFR 71. Record the assessment on a separate sheet and attach.		

Test witnessed by (Signature)	**Print Name**	**Date**
Engineering: S Grenier	S. GRENIER	9 OCT 2009
Regulatory Affairs: L. Pollard	L. Pollard	13 Oct 09
Quality Assurance: C Rayhan	C Rayhan	13 Oct 2009

Penetration Test Data Sheet

Test Unit Model/Serial No.: TP180 A	Test: PENETRATION TEST
Test Date: 9 OCT 2009	Test Time: 3:15 PM

Describe the test orientation:

PROJECTOR/PACKAGE ON SIDE WITH REAR PLATE FACING UP.

Describe on-site inspection (damage, broken parts, etc.):

* IMPACT DENT ON PLUNGER LOCK FACE AND ON BLACK TREFOIL PLASTIC DUST COVER.

* COULD NOT INSERT KEY INTO LOCK AFTER TEST.

* NO LOSS OF CONTENTS.

WITNESSED BY MIKE FULLER (REGULATORY)

On-site test assessment:

- Was the test performed in accordance with 10 CFR 71, IAEA TS-R-1 1996, and this test plan? (Yes) or No.
- Does the test specimen meet the requirements of 10 CFR 71 and IAEA TS-R-1 1996 for this test? (Yes) or No.
- Should testing continue with this test specimen? (Yes) or No. If yes, next test: _____

Engineering: S. Gr 9 OCT 09 **Regulatory:** 13 Oct 09 **QA:** C. Hayden 13 Oct 2009

Completed by: STEVE GRENIER	Date: 9 OCT 2009

Test Inspection Data Sheet

Test Specimen Serial No.: TP180A	Last Test Performed: PENETRATION TEST

Describe and measure (if appropriate) any damage or broken parts, etc.:

PLUNGER LOCK FACE AND PLASTIC TREFOIL DUST COVER SHOWS DENT AT POINT OF IMPACT.

Describe and measure (if appropriate) any signs of permanent strain or deformation:

DENT ON DUST COVER AND LOCK

Describe the condition of the simulated source wire assembly.

COULD NOT UNLOCK PLUNGER LOCK TO EXAMINE SOURCE WIRE BUT ASSUME NO AFFECT ON SOURCE WIRE.

Reassemble the package using a representative active source, making sure that the source position and the package configuration is the same as they were immediately after the last test.

Measure and record a radiation profile of each test specimen in accordance with QSA Global Work Instruction WI-Q-1806.

Compare the pre-test dose levels with post-test dose levels at the surface of the package and at 1 meter from the surface of the package.

THIS WILL BE PERFORMED AFTER 4 FOOT DROP OR 40-INCH PUNCTURE TEST.

Is a radiograph required to inspect for hidden component damage or failure? If radiography is performed, describe any damage or failures found.

NO RADIOGRAPH IS NECESSARY

Completed by: S. GREEN	Date: 9 OCT 2009

Free Drop & Puncture Test Checklist

Test: 4-FOOT DROP TEST		
Test Location: QSA GLOBAL BURLINGTON MA		
Step	**Data**	
1. Record test specimen serial number:	TP180A	
2. Record the test specimen weight:	655 LBS.	
3. Record the ambient temperature (°C):	51°F	Instrument S/N: ENG-20
4. Identify set-up orientation figure:	#1	
5. Record drop height.	4.8 FEET (57 INCHES)	
6. Photograph set-up in at least two perpendicular planes.	✓	
7. Begin video recording of the test so that impact is recorded.	✓	
8. Release the test specimen.	✓	
9. Stop the video recorder. Ensure the point of impact and orientation specified in the plan has been achieved.	✓	
10. Record the damage to the test specimen. Use a separate sheet and attach, if needed.	✓	
11. Engineering, Regulatory Affairs and Quality Assurance make a preliminary assessment relative to 10 CFR 71. Record the assessment on a separate sheet and attach.		

Test witnessed by (Signature)	**Print Name**	**Date**
Engineering: S. Grenier	S. GRENIER	13 OCT 2009
Regulatory Affairs: L. Pickles	C. Pickles	13 Jan 10
Quality Assurance: C. Rayhon	C. Rayhon	13 Jan 10

Free Drop & Puncture Test Data Sheet

Test Unit Model/Serial No.: TP180A	Test: 4-FOOT DROP TEST
Test Date: 13 OCT 2009	Test Time: 3:00 PM

Describe drop orientation and drop height:

ORIENTATION #1 PER PLAN AT 57 INCHES

Describe impact (location, rotation, etc.):

IMPACT LOCATION ON REAR PORT TUBE FACE.
SPECIMEN ROTATED 180° AFTER IMPACT.

Describe on-site inspection (damage, broken parts, etc.):

BOTTOM PORTION OF TUBE BENT INWARD ABOUT 1/16 INCH.
BRASS PLUNGER LOCK COMPRESSED INTO PLASTIC DUST COVER.
ONE BROKEN PIN ON DUST COVER - NEEDED TO KEEP COVER ON.

On-site test assessment:

- Was the test performed in accordance with 10 CFR 71, IAEA TS-R-1 1996, and this test plan? (Yes) or No.
- Does the test specimen meet the requirements of 10 CFR 71 and IAEA TS-R-1 1996 for this test? (Yes) or No.
- Any changes to subsequent drop orientations needed to achieve maximum damage? Especially for the SENTRY 330 Standard, SENTRY 330 Special, and SENTRY Source Changer configurations. Yes or (No) If yes, then identify and justify.
- Did sufficient damage occur at or on the rear-plate attachment area to warrant further drop testing the SENTRY 110 Projector – Basic configuration because of its thinner rear-plate? Yes or (No).
- Should testing continue with this test specimen? Yes or (No)* If yes, next test: _____
- Will the test specimen pass the thermal test based on the accumulated damage assessment? ~~Yes or No~~ NA.

Engineering (SD) 13OCT09 **Regulatory:** 13Oct10 **QA:** C. Coughlin 14 Jan 2010

Describe any post-test disassembly and inspection:

* REAR PLATE AND DUST COVER ASSEMBLIES REMOVED AND TAKEN APART. REAR PLATE PARTS INTACT AND FUNCTIONAL.
DUST COVER PIN BROKEN INDICATES POSSIBLE FAILURE FOR 30-FOOT DROP.

Describe any change in source position (if possible):

NO CHANGE IN SOURCE POSITION

Describe results of radiography (if performed):

NOT PERFORMED

Completed by: S. Glenn	Date: 13 OCT 2009

Test Inspection Data Sheet

Test Specimen Serial No.: TP180A	Last Test Performed: 4-FOOT DROP

Describe and measure (if appropriate) any damage or broken parts, etc.:

ONE BROKEN PIN ON DUST COVER ASSEMBLY.

* BOTTOM END OF REAR PLATE PORT TUBE BENT IN ABOUT $\frac{1}{16}$ IN.

Describe and measure (if appropriate) any signs of permanent strain or deformation:

* SEE ABOVE.

Describe the condition of the simulated source wire assembly.

NO AFFECT ON SIMULATED SOURCE ASSEMBLY CONDITION OR LOCATION.

Reassemble the package using a representative active source, making sure that the source position and the package configuration is the same as they were immediately after the last test.

Measure and record a radiation profile of each test specimen in accordance with QSA Global Work Instruction WI-Q-1806.

Compare the pre-test dose levels with post-test dose levels at the surface of the package and at 1 meter from the surface of the package.

THIS WILL BE DONE AT A LATER DATE OR AFTER PUNCTURE TEST.

Is a radiograph required to inspect for hidden component damage or failure? If radiography is performed, describe any damage or failures found.

NOT REQUIRED.

Completed by: S. Gremia	Date: 13 OCT 2009

Free Drop & Puncture Test Checklist

Test: 4-FOOT DROP TEST		
Test Location: QSA-GLOBAL BURLINGTON MA		
Step	**Data**	
1. Record test specimen serial number:	TP180B	
2. Record the test specimen weight:	656 LBS.	
3. Record the ambient temperature (°C):	51°F	Instrument S/N: ENG-20
4. Identify set-up orientation figure:	#2	
5. Record drop height.	4.8 FEET (57 INCHES)	
6. Photograph set-up in at least two perpendicular planes.	✓	
7. Begin video recording of the test so that impact is recorded.	✓	
8. Release the test specimen.	✓	
9. Stop the video recorder. Ensure the point of impact and orientation specified in the plan has been achieved.	✓	
10. Record the damage to the test specimen. Use a separate sheet and attach, if needed.	✓	
11. Engineering, Regulatory Affairs and Quality Assurance make a preliminary assessment relative to 10 CFR 71. Record the assessment on a separate sheet and attach.		

Test witnessed by (Signature)	**Print Name**	**Date**
Engineering: S. Greniger	S. GRENIGER	13 OCT 2009
Regulatory Affairs: L. Pedro	L. Pedro	13 Jan 10
Quality Assurance: C. Raymon	C. Raymon	13 Jan 10

Free Drop & Puncture Test Data Sheet

Test Unit Model/Serial No.: TP180B	Test: 4-FOOT DROP TEST
Test Date: 13 OCT 2009	Test Time: 3:15 PM

Describe drop orientation and drop height:

DROP ORIENTATION # 2 PER PLAN AT 57 INCHES.

Describe impact (location, rotation, etc.):

IMPACT LOCATION ON PROTRUDING REAR PLATE PORT TUBE EDGE.

SPECIMEN ROTATED 90° AFTER IMPACT.

Describe on-site inspection (damage, broken parts, etc.):

NO OBVIOUS BROKEN PARTS.

REAR PLATE PORT TUBE CRUSHED IN TOWARD DUST COVER.

On-site test assessment:

- Was the test performed in accordance with 10 CFR 71, IAEA TS-R-1 1996, and this test plan? (Yes) or No.
- Does the test specimen meet the requirements of 10 CFR 71 and IAEA TS-R-1 1996 for this test? (Yes) or No.
- Any changes to subsequent drop orientations needed to achieve maximum damage? Especially for the SENTRY 330 Standard, SENTRY 330 Special, and SENTRY Source Changer configurations. Yes or (No.) If yes, then identify and justify.
- Did sufficient damage occur at or on the rear-plate attachment area to warrant further drop testing the SENTRY 110 Projector – Basic configuration because of its thinner rear-plate? Yes or (No)
- Should testing continue with this test specimen? (Yes) or No. If yes, next test: 30-FOOT DROP
- Will the test specimen pass the thermal test based on the accumulated damage assessment? ~~Yes or No~~ NA.

Engineering: S. Green 13 OCT 09 **Regulatory:** 13 Oct 09 **QA:** C. Langston 14 Oct 2009

Describe any post-test disassembly and inspection:

NO DISASSEMBLY PERFORMED.

Describe any change in source position (if possible):

(SO) 13 OCT 2009 Slight ~~NO~~ CHANGE IN SOURCE POSITION ABOUT 1/8 INCH TOWARDS FRONT END.

Describe results of radiography (if performed):

NOT PERFORMED.

Completed by: S. GREEN	Date: 13 OCT 2009

Test Inspection Data Sheet

Test Specimen Serial No.: TP180B	Last Test Performed: 4-FOOT DROP TEST

Describe and measure (if appropriate) any damage or broken parts, etc.:

LIP OF THE WELDED PORT TUBE BENT IN TOWARDS THE DUST COVER BY ABOUT 1 INCH. CAN NOT REMOVE DUST COVER WITHOUT REMOVING DENT OR CUTTING COVER.

Describe and measure (if appropriate) any signs of permanent strain or deformation:

SEE ABOVE.

Describe the condition of the simulated source wire assembly.

UNABLE TO REMOVE DUST COVER TO ACCESS SOURCE WIRE, EXPECT NO DAMAGE TO SOURCE WIRE. SLIGHT CHANGE IN LOCATION.

Reassemble the package using a representative active source, making sure that the source position and the package configuration is the same as they were immediately after the last test.

Measure and record a radiation profile of each test specimen in accordance with QSA Global Work Instruction WI-Q-1806.

Compare the pre-test dose levels with post-test dose levels at the surface of the package and at 1 meter from the surface of the package.

THIS WILL BE DONE AT A LATER DATE OR AFTER PUNCTURE TEST.

Is a radiograph required to inspect for hidden component damage or failure? If radiography is performed, describe any damage or failures found.

NOT REQUIRED.

Completed by: S. Graves	Date: 13 OCT 2009

Free Drop & Puncture Test Checklist

Test: 4-FOOT DROP TEST		
Test Location: QSA-GLOBAL BURLINGTON MA		
Step	**Data**	
1. Record test specimen serial number:	TP180C	
2. Record the test specimen weight:	652 LBS.	
3. Record the ambient temperature (°C):	52°F	Instrument S/N: ENG-20
4. Identify set-up orientation figure:	#3	
5. Record drop height.	4.8 FEET (57 INCHES)	
6. Photograph set-up in at least two perpendicular planes. ✓		
7. Begin video recording of the test so that impact is recorded. ✓		
8. Release the test specimen. ✓		
9. Stop the video recorder. Ensure the point of impact and orientation specified in the plan has been achieved. ✓		
10. Record the damage to the test specimen. Use a separate sheet and attach, if needed. ✓		
11. Engineering, Regulatory Affairs and Quality Assurance make a preliminary assessment relative to 10 CFR 71. Record the assessment on a separate sheet and attach.		
Test witnessed by (Signature)	**Print Name**	**Date**
Engineering: S. Greniger	S. GRENIGR	13 OCT 2009
Regulatory Affairs: L. Pidra	L. Pidra	13 Jan 10
Quality Assurance: C. Rayfman	C Rayfman	13 Jan 10

Free Drop & Puncture Test Data Sheet

Test Unit Model/Serial No.: TP180C	Test: 4-FOOT DROP TEST
Test Date: 13 OCT 2009	Test Time: 3:26 PM

Describe drop orientation and drop height:

DROP ORIENTATION #3 PER PLAN AT 57 INCHES.

Describe impact (location, rotation, etc.):

IMPACT LOCATION ON BODY WELD SEAM (LONGITUDINAL).
SPECIMEN ROTATED 90° ONTO ITS TOP AFTER IMPACT.

Describe on-site inspection (damage, broken parts, etc.):

MINOR DENT OF BODY AT THE WELD SEAM LOCATION.

On-site test assessment:

- Was the test performed in accordance with 10 CFR 71, IAEA TS-R-1 1996, and this test plan? (Yes) or No.
- Does the test specimen meet the requirements of 10 CFR 71 and IAEA TS-R-1 1996 for this test? (Yes) or No.
- Any changes to subsequent drop orientations needed to achieve maximum damage? Especially for the SENTRY 330 Standard, SENTRY 330 Special, and SENTRY Source Changer configurations. Yes or (No) If yes, then identify and justify.
- Did sufficient damage occur at or on the rear-plate attachment area to warrant further drop testing the SENTRY 110 Projector – Basic configuration because of its thinner rear-plate? Yes or (No)
- Should testing continue with this test specimen? (Yes) or No. If yes, next test: 30-FOOT DROP
- Will the test specimen pass the thermal test based on the accumulated damage assessment? ~~Yes or No~~ NA

Engineering: S Gromi 13OCT09 **Regulatory:** 13 Oct 09 **QA:** C. Langston 14 Dec 09

Describe any post-test disassembly and inspection:

NO DISASSEMBLY PERFORMED.

Describe any change in source position (if possible):

NO CHANGE IN SOURCE POSITION.

Describe results of radiography (if performed):

NOT PERFORMED.

Completed by: S. Gromi	Date: 13 OCT 2009

Test Inspection Data Sheet

Test Specimen Serial No.: TP180C	Last Test Performed: 4-FOOT DROP TEST

Describe and measure (if appropriate) any damage or broken parts, etc.:

DENT AT ONE END OF TUBE WELD SEAM NEAR END PLATE. DENT IS ABOUT 2 INCHES LONG.

Describe and measure (if appropriate) any signs of permanent strain or deformation:

SEE ABOVE.

Describe the condition of the simulated source wire assembly.

NO AFFECT ON SIMULATED SOURCE ASSEMBLY GUIDE LINE OR LOCATION.

Reassemble the package using a representative active source, making sure that the source position and the package configuration is the same as they were immediately after the last test.

Measure and record a radiation profile of each test specimen in accordance with QSA Global Work Instruction WI-Q-1806.

Compare the pre-test dose levels with post-test dose levels at the surface of the package and at 1 meter from the surface of the package.

THIS WILL BE DONE AT A LATER DATE OR AFTER THE PUNCTURE TEST.

Is a radiograph required to inspect for hidden component damage or failure? If radiography is performed, describe any damage or failures found.

NOT REQUIRED

Completed by: S. Gram	Date: 13 OCT 2009

Free Drop & Puncture Test Checklist

Test: 4 - FOOT DROP		
Test Location: QSA - GLOBAL, BURLINGTON, MA		
Step	**Data**	
1. Record test specimen serial number:	TP180 D	
2. Record the test specimen weight:	657 LBS.	
3. Record the ambient temperature (°C):	51°F	Instrument S/N: ENG-20
4. Identify set-up orientation figure:	#4	
5. Record drop height.	4.7 FEET (57 INCHES)	
6. Photograph set-up in at least two perpendicular planes.	✓	
7. Begin video recording of the test so that impact is recorded.	✓	
8. Release the test specimen.	✓	
9. Stop the video recorder. Ensure the point of impact and orientation specified in the plan has been achieved.	✓	
10. Record the damage to the test specimen. Use a separate sheet and attach, if needed.	✓	
11. Engineering, Regulatory Affairs and Quality Assurance make a preliminary assessment relative to 10 CFR 71. Record the assessment on a separate sheet and attach.		

Test witnessed by (Signature)	**Print Name**	**Date**
Engineering: S. Grenier	S. GRENIER	13 OCT 2009
Regulatory Affairs: L. Parker	L. Parker	13 Oct 09
Quality Assurance: C. Royston	C. Royston	13 Oct 09

Free Drop & Puncture Test Data Sheet

Test Unit Model/Serial No.: TP180D	Test: 4-FOOT DROP TEST
Test Date: 13 OCT 2009	Test Time: 3:36 PM

Describe drop orientation and drop height:

DROP ORIENTATION #4 PER PLAN AT 57 INCHES.

Describe impact (location, rotation, etc.):

IMPACT LOCATION ON CYLINDER EDGE OF BODY.
SPECIMEN ROTATED ONTO ITS SIDE (WELD SEAM) AFTER IMPACT.

Describe on-site inspection (damage, broken parts, etc.):

MINOR DENT AT IMPACT LOCATION.

On-site test assessment:

- Was the test performed in accordance with 10 CFR 71, IAEA TS-R-1 1996, and this test plan? (Yes) or No.
- Does the test specimen meet the requirements of 10 CFR 71 and IAEA TS-R-1 1996 for this test? (Yes) or No.
- Any changes to subsequent drop orientations needed to achieve maximum damage? Especially for the SENTRY 330 Standard, SENTRY 330 Special, and SENTRY Source Changer configurations. Yes or (No.) If yes, then identify and justify.
- Did sufficient damage occur at or on the rear-plate attachment area to warrant further drop testing the SENTRY 110 Projector – Basic configuration because of its thinner rear-plate? Yes or (No)
- Should testing continue with this test specimen? (Yes) or No. If yes, next test: 30-FOOT DROP
- Will the test specimen pass the thermal test based on the accumulated damage assessment? ~~Yes or No~~ N/A

Engineering: S. Gumi 13 OCT 09 **Regulatory:** [signature] 13 Oct 09 **QA:** C. Kopman 14 Oct 2009

Describe any post-test disassembly and inspection:

NO DISASSEMBLY PERFORMED.

Describe any change in source position (if possible):

NO CHANGE IN SOURCE LOCATION.

Describe results of radiography (if performed):

NOT PERFORMED.

Completed by: S. Gumi	Date: 13 OCT 2009

Test Inspection Data Sheet

Test Specimen Serial No.: TP180D	Last Test Performed: 4-FOOT DROP TEST

Describe and measure (if appropriate) any damage or broken parts, etc.:

WELDED EDGE OF CYLINDER BODY DENTED SLIGHTLY ABOUT 1/4 INCH IN AND ABOUT 3 INCHES LONG.

Describe and measure (if appropriate) any signs of permanent strain or deformation:

SEE ABOVE.

Describe the condition of the simulated source wire assembly.

NO AFFECT ON SIMULATED SOURCE ASSEMBLY CONDITION.
NO CHANGE IN SOURCE POSITION.

Reassemble the package using a representative active source, making sure that the source position and the package configuration is the same as they were immediately after the last test.

Measure and record a radiation profile of each test specimen in accordance with QSA Global Work Instruction WI-Q-1806.

Compare the pre-test dose levels with post-test dose levels at the surface of the package and at 1 meter from the surface of the package.

THIS WILL BE DONE AT A LATER DATE OR AFTER THE PUNCTURE TEST.

Is a radiograph required to inspect for hidden component damage or failure? If radiography is performed, describe any damage or failures found.

NOT REQUIRED.

Completed by: S. Glenn	Date: 13 OCT 2009

Free Drop & Puncture Test Checklist

Test: 4-FOOT DROP TEST		
Test Location: QSA-GLOBAL BURLINGTON MA		
Step	**Data**	
1. Record test specimen serial number:	TP180E	
2. Record the test specimen weight:	659 LBS.	
3. Record the ambient temperature (°C):	51°F	Instrument S/N: ENG-20
4. Identify set-up orientation figure:	#5	
5. Record drop height.	4.7 FEET (57 INCHES)	
6. Photograph set-up in at least two perpendicular planes.	✓	
7. Begin video recording of the test so that impact is recorded.	✓	
8. Release the test specimen.	✓	
9. Stop the video recorder. Ensure the point of impact and orientation specified in the plan has been achieved.	✓	
10. Record the damage to the test specimen. Use a separate sheet and attach, if needed.	✓	
11. Engineering, Regulatory Affairs and Quality Assurance make a preliminary assessment relative to 10 CFR 71. Record the assessment on a separate sheet and attach.		

Test witnessed by (Signature)	**Print Name**	**Date**
Engineering: S. Grenier	S. GRENIER	13 OCT 2009
Regulatory Affairs:	C. Pidut	13 Oct 09
Quality Assurance: C. Raughan	C. Raughan	13 Oct 09

Free Drop & Puncture Test Data Sheet

Test Unit Model/Serial No.: TP180 E	Test: 4-FOOT DROP TEST
Test Date: 13 OCT 2009	Test Time: 3:46 PM

Describe drop orientation and drop height:

ORIENTATION #5 PER PLAN AT 57 INCHES.

Describe impact (location, rotation, etc.):

IMPACT LOCATION ON TOP SURFACE. SPECIMEN BOUNCED ABOUT 2 INCHES VERTICALLY AND LANDED BACK ON TOP SURFACE.

Describe on-site inspection (damage, broken parts, etc.):

- TWO BROKEN PINS ON LOCK COVER (DUST COVER).
- DIFFICULTY ACTUATION POSILOCK

On-site test assessment:

- Was the test performed in accordance with 10 CFR 71, IAEA TS-R-1 1996, and this test plan? **(Yes) or No.**
- Does the test specimen meet the requirements of 10 CFR 71 and IAEA TS-R-1 1996 for this test? **(Yes) or No.**
- Any changes to subsequent drop orientations needed to achieve maximum damage? Especially for the SENTRY 330 Standard, SENTRY 330 Special, and SENTRY Source Changer configurations. **Yes or (No)** If yes, then identify and justify.
- Did sufficient damage occur at or on the rear-plate attachment area to warrant further drop testing the SENTRY 110 Projector – Basic configuration because of its thinner rear-plate? **Yes or (No)**
- Should testing continue with this test specimen? **Yes or (No)** If yes, next test: _____
- Will the test specimen pass the thermal test based on the accumulated damage assessment? ~~**Yes or No**~~ NA

Engineering: S. Gem 13oct09 **Regulatory:** [signature] 13 Oct 09 **QA:** C. Kenyon 14 Oct 09

Describe any post-test disassembly and inspection:

REAR PLATE AND DUST COVER REMOVED AND TAKEN APART. THE FOUR SCREWS HOLDING THE SELECTOR RING RETAINER APPEAR TWISTED SLIGHTLY CAUSING THE ANTI-ROTATION LUGS TO BIND.

Describe any change in source position (if possible):

SLIGHT CHANGE IN SOURCE LOCATION – ABOUT ½ INCH TOWARDS FRONT.

Describe results of radiography (if performed):

NOT PERFORMED.

Completed by: S. Gem	Date: 13 OCT 2009

Test Inspection Data Sheet

Test Specimen Serial No.: TP180 E	Last Test Performed: 4-FOOT DROP TEST

Describe and measure (if appropriate) any damage or broken parts, etc.:

TWO BROKEN PINS ON LOCK COVER ASSEMBLY. BROKEN PINS ALLOW THE DUST COVER (WITH LOCK COVER) TO FALL AWAY FROM REAR PLATE.

Describe and measure (if appropriate) any signs of permanent strain or deformation:

SEE ABOVE

Describe the condition of the simulated source wire assembly.

NO DAMAGE TO SIMULATED SOURCE WIRE.
POST TEST MEASUREMENT INDICATES SLIGHT MOVEMENT (1/8 INCH) TOWARDS FRONT END.

Reassemble the package using a representative active source, making sure that the source position and the package configuration is the same as they were immediately after the last test.

Measure and record a radiation profile of each test specimen in accordance with QSA Global Work Instruction WI-Q-1806.

Compare the pre-test dose levels with post-test dose levels at the surface of the package and at 1 meter from the surface of the package.

THIS WILL BE DONE AT A LATER DATE.

Is a radiograph required to inspect for hidden component damage or failure? If radiography is performed, describe any damage or failures found.

NOT REQUIRED.

Completed by: S. Gram	Date: 13 OCT 2009

Test Specimen & Equipment List

Test Specimen & Equipment Documentation

Test Specimen

Configuration	Drawing Number	Serial Number	Attach IIR	Attach NCR	Attach Route Cards
Basic	TP86015-330	TP180A	See TMI 189	NA	Yes
Basic	TP86015-330	TP180B	See TMI 189	NA	Yes
Basic	TP86015-330	TP180C	See TMI 189	NA	Yes
Basic	TP86015-330	TP180D	See TMI 189	NA	Yes
Basic	TP86015-330	TP180E	See TMI 189	NA	Yes

Tools & Equipment

Tool Description	Enter the Model and Serial Number Mark NA when not used.	Attach Inspection Report or Calibration Certificate
Drop Surface, Drawing No. T10740	S/N 001	Yes
Penetration Bar, Drawing No. T10129	S/N 01	Yes

Record any additional tools used to facilitate the test and attach the appropriate inspection report or calibration certificates.

TEMPERTURE GAGE	ENG-20	YES
WEIGHT SCALE	F16383	YES.

Signature	Print Name	Date
Engineering: S. Greniser	S. GRENISER	13 OCT 2009
Regulatory: D. Richardson	L. Riddick	13 Jan 10
Quality Assurance: C. Reighard	C Reighard	13 Jan 2010

Penetration Test Checklist

Test: PENETRATION TEST		
Test Location: QSA ENGINEERING TEST AREA - BURLINGTON MA		
Step	**Data**	
1. Record test specimen serial number:	TP180A	
2. Record the test specimen weight:	655 LBS.	
3. Record the ambient temperature (°C): 18.9°C	66.1°F	Instrument S/N: ENG-20
4. Identify target location on test specimen.	PLUNGER LOCK ON DUST COVER	
5. Photograph set-up with penetration bar touching target location on test specimen.	DONE	
6. Lift penetration bar 40 inches from target location on test specimen to lowest point on penetration bar.	DONE	
7. Release the penetration bar.	DONE	
8. Photograph target location after impact.	DONE	
9. Record the damage to the test specimen. Use a separate sheet and attach, if needed. SMALL DENT ON PLASTIC DUST COVER AND BRASS PLUNGER LOCK		
10. Engineering, Regulatory Affairs and Quality Assurance make a preliminary assessment relative to 10 CFR 71. Record the assessment on a separate sheet and attach.		

Test witnessed by (Signature)	Print Name	Date
Engineering: S Grenier	S. GRENIER	9 OCT 2009
Regulatory Affairs: L Polito	L. POLITO	13 Oct 09
Quality Assurance: C Raghan	C Raghan	13 Oct 2009

Penetration Test Data Sheet

Test Unit Model/Serial No.: TP180 A	Test: PENETRATION TEST
Test Date: 9 OCT 2009	Test Time: 3:15 PM

Describe the test orientation:

PROJECTOR/PACKAGE ON SIDE WITH REAR PLATE FACING UP.

Describe on-site inspection (damage, broken parts, etc.):

* IMPACT DENT ON PLUNGER LOCK FACE AND ON BLACK TREFOIL PLASTIC DUST COVER.
* COULD NOT INSERT KEY INTO LOCK AFTER TEST.
* NO LOSS OF CONTENTS.

WITNESSED BY MIKE FULLER (REGULATORY)

On-site test assessment:

- Was the test performed in accordance with 10 CFR 71, IAEA TS-R-1 1996, and this test plan? (Yes) or No.
- Does the test specimen meet the requirements of 10 CFR 71 and IAEA TS-R-1 1996 for this test? (Yes) or No.
- Should testing continue with this test specimen? (Yes) or No. If yes, next test: _____

Engineering: S. Gr 9 OCT 09 Regulatory: [signature] 13 Apr 10 QA: C. Hayden 13 Apr 2010

Completed by: STEVE GRENIER	Date: 9 OCT 2009

Test Inspection Data Sheet

Test Specimen Serial No.: TP180A	Last Test Performed: PENETRATION TEST

Describe and measure (if appropriate) any damage or broken parts, etc.:

PLUNGER LOCK FACE AND PLASTIC TREFOIL DUST COVER SHOWS DENT AT POINT OF IMPACT.

Describe and measure (if appropriate) any signs of permanent strain or deformation:

DENT ON DUST COVER AND LOCK

Describe the condition of the simulated source wire assembly.

COULD NOT UNLOCK PLUNGER LOCK TO EXAMINE SOURCE WIRE BUT ASSUME NO AFFECT ON SOURCE WIRE.

Reassemble the package using a representative active source, making sure that the source position and the package configuration is the same as they were immediately after the last test.

Measure and record a radiation profile of each test specimen in accordance with QSA Global Work Instruction WI-Q-1806.

Compare the pre-test dose levels with post-test dose levels at the surface of the package and at 1 meter from the surface of the package.

THIS WILL BE PERFORMED AFTER 4 FOOT DROP OR 40-INCH PUNCTURE TEST.

Is a radiograph required to inspect for hidden component damage or failure? If radiography is performed, describe any damage or failures found.

NO RADIOGRAPH IS NECESSARY

Completed by: S. GRENIER	Date: 9 OCT 2009

Free Drop & Puncture Test Checklist

Test:	4-FOOT DROP TEST	
Test Location:	QSA GLOBAL BURLINGTON MA	
Step	**Data**	
1. Record test specimen serial number:	TP180A	
2. Record the test specimen weight:	655 LBS.	
3. Record the ambient temperature (°C):	51°F	Instrument S/N: ENG-20
4. Identify set-up orientation figure:	#1	
5. Record drop height.	4.8 FEET (57 INCHES)	
6. Photograph set-up in at least two perpendicular planes.	✓	
7. Begin video recording of the test so that impact is recorded.	✓	
8. Release the test specimen.	✓	
9. Stop the video recorder. Ensure the point of impact and orientation specified in the plan has been achieved.	✓	
10. Record the damage to the test specimen. Use a separate sheet and attach, if needed.	✓	
11. Engineering, Regulatory Affairs and Quality Assurance make a preliminary assessment relative to 10 CFR 71. Record the assessment on a separate sheet and attach.		

Test witnessed by (Signature)	Print Name	Date
Engineering: S. Greiner	S. GREINER	15 OCT 2009
Regulatory Affairs: L. Gilchrist	C. Pollard	13 Jan 10
Quality Assurance: C. Rayhon	C. Rayhon	13 Jan 10

Free Drop & Puncture Test Data Sheet

Test Unit Model/Serial No.: TP180A	Test: 4-FOOT DROP TEST
Test Date: 13 OCT 2009	Test Time: 3:00 PM

Describe drop orientation and drop height:

ORIENTATION #1 PER PLAN AT 57 INCHES

Describe impact (location, rotation, etc.):

IMPACT LOCATION ON REAR PORT TUBE FACE,
SPECIMEN ROTATED 180° AFTER IMPACT.

Describe on-site inspection (damage, broken parts, etc.):

BOTTOM PORTION OF TUBE BENT INWARD ABOUT 1/16 INCH.
BRASS PLUNGER LOCK COMPRESSED INTO PLASTIC DUST COVER.
ONE BROKEN PIN ON DUST COVER - NEEDED TO KEEP COVER ON.

On-site test assessment:

- Was the test performed in accordance with 10 CFR 71, IAEA TS-R-1 1996, and this test plan? (Yes) or No.
- Does the test specimen meet the requirements of 10 CFR 71 and IAEA TS-R-1 1996 for this test? (Yes) or No.
- Any changes to subsequent drop orientations needed to achieve maximum damage? Especially for the SENTRY 330 Standard, SENTRY 330 Special, and SENTRY Source Changer configurations. Yes or (No) If yes, then identify and justify.
- Did sufficient damage occur at or on the rear-plate attachment area to warrant further drop testing the SENTRY 110 Projector – Basic configuration because of its thinner rear-plate? Yes or (No.)
- Should testing continue with this test specimen? Yes or (No) If yes, next test: _____ *
- Will the test specimen pass the thermal test based on the accumulated damage assessment? ~~Yes or No~~ NA.

Engineering: (SD) 13OCT09 Regulatory: 130ct10 QA: C. Coughlin 19 Oct 2010

Describe any post-test disassembly and inspection:

* REAR PLATE AND DUST COVER ASSEMBLIES REMOVED AND TAKEN APART. REAR PLATE PARTS INTACT AND FUNCTIONAL.
DUST COVER PIN BROKEN INDICATES POSSIBLE FAILURE FOR 30-FOOT DROP.

Describe any change in source position (if possible):

NO CHANGE IN SOURCE POSITION

Describe results of radiography (if performed):

NOT PERFORMED

Completed by: S. Glenn	Date: 13 OCT 2009

Test Inspection Data Sheet

Test Specimen Serial No.: TP180A	Last Test Performed: 4-FOOT DROP

Describe and measure (if appropriate) any damage or broken parts, etc.:

ONE BROKEN PIN ON DUST COVER ASSEMBLY.

* BOTTOM END OF REAR PLATE PORT TUBE BENT IN ABOUT $\frac{1}{16}$ IN.

Describe and measure (if appropriate) any signs of permanent strain or deformation:

* SEE ABOVE.

Describe the condition of the simulated source wire assembly.

NO AFFECT ON SIMULATED SOURCE ASSEMBLY CONDITION OR LOCATION.

Reassemble the package using a representative active source, making sure that the source position and the package configuration is the same as they were immediately after the last test.

Measure and record a radiation profile of each test specimen in accordance with QSA Global Work Instruction WI-Q-1806.

Compare the pre-test dose levels with post-test dose levels at the surface of the package and at 1 meter from the surface of the package.

THIS WILL BE DONE AT A LATER DATE OR AFTER PUNCTURE TEST.

Is a radiograph required to inspect for hidden component damage or failure? If radiography is performed, describe any damage or failures found.

NOT REQUIRED.

Completed by: S. Gremia	Date: 13 OCT 2009

Free Drop & Puncture Test Checklist

Test:	4-FOOT DROP TEST	
Test Location:	QSA-GLOBAL BURLINGTON MA	
Step	**Data**	
1. Record test specimen serial number:	TP180B	
2. Record the test specimen weight:	656 LBS.	
3. Record the ambient temperature (°C):	51°F	Instrument S/N: 5-6-20
4. Identify set-up orientation figure:	#2	
5. Record drop height.	4.8 FEET (57 INCHES)	
6. Photograph set-up in at least two perpendicular planes.	✓	
7. Begin video recording of the test so that impact is recorded.	✓	
8. Release the test specimen.	✓	
9. Stop the video recorder. Ensure the point of impact and orientation specified in the plan has been achieved.	✓	
10. Record the damage to the test specimen. Use a separate sheet and attach, if needed.	✓	
11. Engineering, Regulatory Affairs and Quality Assurance make a preliminary assessment relative to 10 CFR 71. Record the assessment on a separate sheet and attach.		

Test witnessed by (Signature)	Print Name	Date
Engineering: S. Grenier	S. GRENIER	13 OCT 2009
Regulatory Affairs: L. Pinder	L. Pinder	13 Jan 10
Quality Assurance: C. Rayman	C. Rayman	13 Jan 10

Free Drop & Puncture Test Data Sheet

Test Unit Model/Serial No.: TP180B	Test: 4-FOOT DROP TEST
Test Date: 13 OCT 2009	Test Time: 3:15 PM

Describe drop orientation and drop height:

DROP ORIENTATION #2 PER PLAN AT 57 INCHES.

Describe impact (location, rotation, etc.):

IMPACT LOCATION ON PROTRUDING REAR PLATE PORT TUBE EDGE.
SPECIMEN ROTATED 90° AFTER IMPACT.

Describe on-site inspection (damage, broken parts, etc.):

NO OBVIOUS BROKEN PARTS.
REAR PLATE PORT TUBE CRUSHED IN TOWARD DUST COVER.

On-site test assessment:

- Was the test performed in accordance with 10 CFR 71, IAEA TS-R-1 1996, and this test plan? (Yes) or No.
- Does the test specimen meet the requirements of 10 CFR 71 and IAEA TS-R-1 1996 for this test? (Yes) or No.
- Any changes to subsequent drop orientations needed to achieve maximum damage? Especially for the SENTRY 330 Standard, SENTRY 330 Special, and SENTRY Source Changer configurations. Yes or (No.) If yes, then identify and justify.
- Did sufficient damage occur at or on the rear-plate attachment area to warrant further drop testing the SENTRY 110 Projector – Basic configuration because of its thinner rear-plate? Yes or (No)
- Should testing continue with this test specimen? (Yes) or No. If yes, next test: 30-FOOT DROP
- Will the test specimen pass the thermal test based on the accumulated damage assessment? ~~Yes or No~~ NA.

Engineering: S. Green (SECTOR) Regulatory: [signature] 13 Oct 2009 QA: C. [signature] 14 Oct 2009

Describe any post-test disassembly and inspection:

NO DISASSEMBLY PERFORMED.

Describe any change in source position (if possible):

SLIGHT CHANGE IN SOURCE POSITION ABOUT 1/8 INCH TOWARDS FRONT END.

(SG) 13 OCT 2009

Describe results of radiography (if performed):

NOT PERFORMED.

Completed by: S. GREEN	Date: 13 OCT 2009

Test Inspection Data Sheet

Test Specimen Serial No.: TP180B	Last Test Performed: 4-FOOT DROP TEST

Describe and measure (if appropriate) any damage or broken parts, etc.:

LIP OF THE WELDED PORT TUBE BENT IN TOWARDS THE DUST COVER BY ABOUT 1 INCH. CAN NOT REMOVE DUST COVER WITHOUT REMOVING DENT OR CUTTING COVER.

Describe and measure (if appropriate) any signs of permanent strain or deformation:

SEE ABOVE.

Describe the condition of the simulated source wire assembly.

UNABLE TO REMOVE DUST COVER TO ACCESS SOURCE WIRE. EXPECT NO DAMAGE TO SOURCE WIRE. SLIGHT CHANGE IN LOCATION.

Reassemble the package using a representative active source, making sure that the source position and the package configuration is the same as they were immediately after the last test.

Measure and record a radiation profile of each test specimen in accordance with QSA Global Work Instruction WI-Q-1806.

Compare the pre-test dose levels with post-test dose levels at the surface of the package and at 1 meter from the surface of the package.

THIS WILL BE DONE AT A LATER DATE OR AFTER PUNCTURE TEST.

Is a radiograph required to inspect for hidden component damage or failure? If radiography is performed, describe any damage or failures found.

NOT REQUIRED.

Completed by: S. Gronow	Date: 13 OCT 2009

Free Drop & Puncture Test Checklist

Test:	4-FOOT DROP TEST	
Test Location:	QSA-GLOBAL BURLINGTON MA	
Step	**Data**	
1. Record test specimen serial number:	TP180C	
2. Record the test specimen weight:	652 LBS.	
3. Record the ambient temperature (°C):	52°F	Instrument S/N: ENG-20
4. Identify set-up orientation figure:	#3	
5. Record drop height.	4.8 FEET (57 INCHES)	
6. Photograph set-up in at least two perpendicular planes.	✓	
7. Begin video recording of the test so that impact is recorded.	✓	
8. Release the test specimen.	✓	
9. Stop the video recorder. Ensure the point of impact and orientation specified in the plan has been achieved.	✓	
10. Record the damage to the test specimen. Use a separate sheet and attach, if needed.	✓	
11. Engineering, Regulatory Affairs and Quality Assurance make a preliminary assessment relative to 10 CFR 71. Record the assessment on a separate sheet and attach.		

Test witnessed by (Signature)	Print Name	Date
Engineering: S. Grenier	S. GRENIER	13 OCT 2009
Regulatory Affairs: L. Pidz	L. Pidz	13 Jan 10
Quality Assurance: C. Rayfman	C Rayfman	13 Jan 10

Free Drop & Puncture Test Data Sheet

Test Unit Model/Serial No.: TP180C	Test: 4-FOOT DROP TEST
Test Date: 13 OCT 2009	Test Time: 3:26 PM

Describe drop orientation and drop height:

DROP ORIENTATION #3 PER PLAN AT 57 INCHES.

Describe impact (location, rotation, etc.):

IMPACT LOCATION ON BODY WELD SEAM (LONGITUDINAL).
SPECIMEN ROTATED 90° ONTO ITS TOP AFTER IMPACT.

Describe on-site inspection (damage, broken parts, etc.):

MINOR DENT OF BODY AT THE WELD SEAM LOCATION.

On-site test assessment:

- Was the test performed in accordance with 10 CFR 71, IAEA TS-R-1 1996, and this test plan? (Yes) or No.
- Does the test specimen meet the requirements of 10 CFR 71 and IAEA TS-R-1 1996 for this test? (Yes) or No.
- Any changes to subsequent drop orientations needed to achieve maximum damage? Especially for the SENTRY 330 Standard, SENTRY 330 Special, and SENTRY Source Changer configurations. Yes or (No) If yes, then identify and justify.
- Did sufficient damage occur at or on the rear-plate attachment area to warrant further drop testing the SENTRY 110 Projector – Basic configuration because of its thinner rear-plate? Yes or (No)
- Should testing continue with this test specimen? (Yes) or No. If yes, next test: 30-FOOT DROP
- Will the test specimen pass the thermal test based on the accumulated damage assessment? ~~Yes or No~~ NA

Engineering: S Gromi 13oct09 Regulatory: 13/oct/09 QA: C. Hamilton 14 Oct 2009

Describe any post-test disassembly and inspection:

NO DISASSEMBLY PERFORMED.

Describe any change in source position (if possible):

NO CHANGE IN SOURCE POSITION.

Describe results of radiography (if performed):

NOT PERFORMED.

Completed by: S. Gromi	Date: 13 OCT 2009

Test Inspection Data Sheet

Test Specimen Serial No.: TP180C	Last Test Performed: 4-FOOT DROP TEST

Describe and measure (if appropriate) any damage or broken parts, etc.:

DENT AT ONE END OF TUBE WELD SEAM NEAR END PLATE. DENT IS ABOUT 2 INCHES LONG.

Describe and measure (if appropriate) any signs of permanent strain or deformation:

SEE ABOVE.

Describe the condition of the simulated source wire assembly.

NO AFFECT ON SIMULATED SOURCE ASSEMBLY GAP, LINE OR LOCATION.

Reassemble the package using a representative active source, making sure that the source position and the package configuration is the same as they were immediately after the last test.

Measure and record a radiation profile of each test specimen in accordance with QSA Global Work Instruction WI-Q-1806.

Compare the pre-test dose levels with post-test dose levels at the surface of the package and at 1 meter from the surface of the package.

THIS WILL BE DONE AT A LATER DATE OR AFTER THE PUNCTURE TEST.

Is a radiograph required to inspect for hidden component damage or failure? If radiography is performed, describe any damage or failures found.

NOT REQUIRED

Completed by: S. Gram	Date: 13 OCT 2009

Free Drop & Puncture Test Checklist

Test: 4 - FOOT DROP		
Test Location: QSA - GLOBAL, BURLINGTON, MA		
Step	**Data**	
1. Record test specimen serial number:	TP180 D	
2. Record the test specimen weight:	657 LBS.	
3. Record the ambient temperature (°C):	51°F	Instrument S/N: ENG-20
4. Identify set-up orientation figure:	#4	
5. Record drop height.	4.7 FEET (57 INCHES)	
6. Photograph set-up in at least two perpendicular planes.	✓	
7. Begin video recording of the test so that impact is recorded.	✓	
8. Release the test specimen.	✓	
9. Stop the video recorder. Ensure the point of impact and orientation specified in the plan has been achieved.	✓	
10. Record the damage to the test specimen. Use a separate sheet and attach, if needed.	✓	
11. Engineering, Regulatory Affairs and Quality Assurance make a preliminary assessment relative to 10 CFR 71. Record the assessment on a separate sheet and attach.		

Test witnessed by (Signature)	Print Name	Date
Engineering: S. Grenier	S. GRENIER	13 OCT 2009
Regulatory Affairs: L. Prather	L. Prather	13 Jan 10
Quality Assurance: C. Roughton	C. Roughton	13 Jan 10

Free Drop & Puncture Test Data Sheet

Test Unit Model/Serial No.: TP180D	Test: 4-FOOT DROP TEST
Test Date: 13 OCT 2009	Test Time: 3:36 PM

Describe drop orientation and drop height:

DROP ORIENTATION #4 PER PLAN AT 57 INCHES.

Describe impact (location, rotation, etc.):

IMPACT LOCATION ON CYLINDER EDGE OF BODY.
SPECIMEN ROTATED ONTO ITS SIDE (WELD SEAM) AFTER IMPACT.

Describe on-site inspection (damage, broken parts, etc.):

MINOR DENT AT IMPACT LOCATION.

On-site test assessment:

- Was the test performed in accordance with 10 CFR 71, IAEA TS-R-1 1996, and this test plan? (Yes) or No.
- Does the test specimen meet the requirements of 10 CFR 71 and IAEA TS-R-1 1996 for this test? (Yes) or No.
- Any changes to subsequent drop orientations needed to achieve maximum damage? Especially for the SENTRY 330 Standard, SENTRY 330 Special, and SENTRY Source Changer configurations. Yes or (No) If yes, then identify and justify.
- Did sufficient damage occur at or on the rear-plate attachment area to warrant further drop testing the SENTRY 110 Projector – Basic configuration because of its thinner rear-plate? Yes or (No)
- Should testing continue with this test specimen? (Yes) or No. If yes, next test: 30-FOOT DROP
- Will the test specimen pass the thermal test based on the accumulated damage assessment? ~~Yes or No~~ N/A

Engineering: S. Gurr 13OCT09 Regulatory: [signature] 13 Oct 09 QA: C. Kaplan 19 Oct 2009

Describe any post-test disassembly and inspection:

NO DISASSEMBLY PERFORMED.

Describe any change in source position (if possible):

NO CHANGE IN SOURCE LOCATION.

Describe results of radiography (if performed):

NOT PERFORMED.

Completed by: S. Gurr	Date: 13 OCT 2009

Test Inspection Data Sheet

Test Specimen Serial No.: TP180D	Last Test Performed: 4-FOOT DROP TEST
Describe and measure (if appropriate) any damage or broken parts, etc.: WELDED EDGE OF CYLINDER BODY DENTED SLIGHTLY ABOUT 1/4 INCH IN AND ABOUT 3 INCHES LONG.	
Describe and measure (if appropriate) any signs of permanent strain or deformation: SEE ABOVE.	
Describe the condition of the simulated source wire assembly. NO AFFECT ON SIMULATED SOURCE ASSEMBLY CONDITION. NO CHANGE IN SOURCE POSITION.	
Reassemble the package using a representative active source, making sure that the source position and the package configuration is the same as they were immediately after the last test. Measure and record a radiation profile of each test specimen in accordance with QSA Global Work Instruction WI-Q-1806.	
Compare the pre-test dose levels with post-test dose levels at the surface of the package and at 1 meter from the surface of the package. THIS WILL BE DONE AT A LATER DATE OR AFTER THE PUNCTURE TEST.	
Is a radiograph required to inspect for hidden component damage or failure? If radiography is performed, describe any damage or failures found. NOT REQUIRED.	
Completed by: S. Glenn	Date: 15 OCT 2009

Free Drop & Puncture Test Checklist

Test: 4-FOOT DROP TEST		
Test Location: QSA-GLOBAL BURLINGTON MA		
Step	**Data**	
1. Record test specimen serial number:	TP180E	
2. Record the test specimen weight:	659 LBS.	
3. Record the ambient temperature (°C):	51°F	Instrument S/N: ENG-20
4. Identify set-up orientation figure:	#5	
5. Record drop height.	4.7 FEET (57 INCHES)	
6. Photograph set-up in at least two perpendicular planes.	✓	
7. Begin video recording of the test so that impact is recorded.	✓	
8. Release the test specimen.	✓	
9. Stop the video recorder. Ensure the point of impact and orientation specified in the plan has been achieved.	✓	
10. Record the damage to the test specimen. Use a separate sheet and attach, if needed.	✓	
11. Engineering, Regulatory Affairs and Quality Assurance make a preliminary assessment relative to 10 CFR 71. Record the assessment on a separate sheet and attach.		

Test witnessed by (Signature)	Print Name	Date
Engineering: S. Grenier	S. GRENIER	13 OCT 2009
Regulatory Affairs:	C. Pidut	13 Oct 09
Quality Assurance: C. Rayhan	C. Rayhan	13 Oct 09

Free Drop & Puncture Test Data Sheet

Test Unit Model/Serial No.: TP180 E	Test: 4-FOOT DROP TEST
Test Date: 13 OCT 2009	Test Time: 3:46 PM

Describe drop orientation and drop height:

ORIENTATION #5 PER PLAN AT 57 INCHES.

Describe impact (location, rotation, etc.):

IMPACT LOCATION ON TOP SURFACE. SPECIMEN BOUNCED ABOUT 2 INCHES VERTICALLY AND LANDED BACK ON TOP SURFACE.

Describe on-site inspection (damage, broken parts, etc.):

- TWO BROKEN PINS ON LOCK COVER (DUST COVER).
- DIFFICULTY ACTUATION POSILOCK

On-site test assessment:

- Was the test performed in accordance with 10 CFR 71, IAEA TS-R-1 1996, and this test plan? (Yes) or No.
- Does the test specimen meet the requirements of 10 CFR 71 and IAEA TS-R-1 1996 for this test? (Yes) or No.
- Any changes to subsequent drop orientations needed to achieve maximum damage? Especially for the SENTRY 330 Standard, SENTRY 330 Special, and SENTRY Source Changer configurations. Yes or (No) If yes, then identify and justify.
- Did sufficient damage occur at or on the rear-plate attachment area to warrant further drop testing the SENTRY 110 Projector – Basic configuration because of its thinner rear-plate? Yes or (No)
- Should testing continue with this test specimen? Yes or (No) If yes, next test: _____
- Will the test specimen pass the thermal test based on the accumulated damage assessment? ~~Yes or No~~ N/A

Engineering: S. Gm 13oct09 Regulatory: [signature] 13 Oct 09 QA: C. [signature] 14 Oct 09

Describe any post-test disassembly and inspection:

REAR PLATE AND DUST COVER REMOVED AND TAKEN APART. THE FOUR SCREWS HOLDING THE SELECTOR RING RETAINER APPEAR TWISTED SLIGHTLY CAUSING THE ANTI-ROTATION LUGS TO BIND.

Describe any change in source position (if possible):

SLIGHT CHANGE IN SOURCE LOCATION - ABOUT 1/8 INCH TOWARDS FRONT.

Describe results of radiography (if performed):

NOT PERFORMED.

Completed by: S. Gm	Date: 13 OCT 2009

Test Inspection Data Sheet

Test Specimen Serial No.: TP180 E	Last Test Performed: 4-FOOT DROP TEST

Describe and measure (if appropriate) any damage or broken parts, etc.:

TWO BROKEN PINS ON LOCK COVER ASSEMBLY. BROKEN PINS ALLOW THE DUST COVER (WITH LOCK COVER) TO FALL AWAY FROM REAR PLATE.

Describe and measure (if appropriate) any signs of permanent strain or deformation:

SEE ABOVE

Describe the condition of the simulated source wire assembly.

NO DAMAGE TO SIMULATED SOURCE WIRE.
POST TEST MEASUREMENT INDICATES SLIGHT MOVEMENT (1/8 INCH) TOWARDS FRONT END.

Reassemble the package using a representative active source, making sure that the source position and the package configuration is the same as they were immediately after the last test.

Measure and record a radiation profile of each test specimen in accordance with QSA Global Work Instruction WI-Q-1806.

Compare the pre-test dose levels with post-test dose levels at the surface of the package and at 1 meter from the surface of the package.

THIS WILL BE DONE AT A LATER DATE.

Is a radiograph required to inspect for hidden component damage or failure? If radiography is performed, describe any damage or failures found.

NOT REQUIRED.

Completed by: S. Gramm	Date: 13 OCT 2009

SENTRY Test Plan 180 Source Location Data Sheet				
Test Specimen	Initial (Pre-Test) Dimension (inch)	Post 4-foot Drop Test Dimension (inch)	Post 30-foot Drop Test Dimension (inch)	Post Puncture Drop Test Dimension (inch)
TP180A	6 5/8"	6 5/8"		
TP180B	6 5/8"	6 1/2"		
TP180C	6 5/8"	6 5/8"		
TP180D	6 5/8"	6 5/8"		
TP180E	6 5/8"	6 1/2"		
TP180F	—	—		
TP180G	—	—		
TP180H	6 5/8"	—		
TP180J	—	—		

JU
13OCT2009

JU
14OCT09

SOURCE
LOCATION
MEASUREMENT

QSA GLOBAL

SHIELDING PROFILE AND INSPECTION FORM (SPIF) F-Q-1806-2

Sheet 1 of 1

Shield Data

Model: 86010-330	Serial # TP180A	Radionuclide: Co-60	Max. Capacity 330 Ci
Shield P/N: 86001-330	Shield Heat # C586-A06		Lot # 0914100302

Profile Process Data

Source Model: 424-13	Source Ser. # B351278	Radionuclide: Co-60	Activity: 324-1 Ci
Survey Inst. E600	Serial # 1863	Date Cal. 2/24/09	Date Due: 2/24/10
Inst. Probe: SHP270	Serial # 00542	Capacity Correction Factor: 1.02	

	Measured Dose Rate mR/hr				Adjusted Dose Rate mR/hr		
Location	At Surface	Surface Corr. Factor	At 30 Cm [Note 2]	At one Meter	At Surface	At 30 Cm [Note 2]	At one Meter [Note 1]
Top	15	1.09	NA	.5	17	NA	.5
Right	55	1.06		1.1	60		1.1
Front	35	1.06		1.0	38		1.0
Left	45	1.06		1.2	49		1.2
Rear	30	1.06		1.3	32		1.3
Bottom	25	1.09	↓	1.0	28	↓	1.0
				Acceptance Criteria:	≤200	NA	≤50
				Result: (Check one) Accept	✓	Reject	

Inspector: [signature] Date: 5/22/09 NCR # _____

Comments:

Track welded.

Notes:

1. Refer to F-Q-1806-1, Shield Efficiency Testing Surface Correction Factors for an existing device model, or F-Q-1806-3, Shield Profile Worksheet for One meter acceptance limit.
2. The 30cm readings are only required when specifically requested.
3. Additional sheets may be used to describe results or indicate reading locations using sketches. Number all sheets and indicate total number of sheets. Make sure shield identification is included on each sheet.
4. Consult instrument calibration records for instrument uncertainty.

QSA GLOBAL

SHIELDING PROFILE AND INSPECTION FORM
(SPIF)
F-Q-1806-2

Sheet 1 of 1

Shield Data			
Model: Sentry 330	Serial # TP1808	Radionuclide: Co-60	Max. Capacity 330 Ci
Shield P/N: 86001-330	Shield Heat # C613-A06		Lot # 09205 01008

Profile Process Data			
Source Model: 424-13	Source Ser. # 27747B	Radionuclide: Co-60	Activity: 312.1 Ci
Survey Inst. E600	Serial # 1863	Date Cal. 2/24/09	Date Due: 2/24/10
Inst. Probe: HP.270	Serial # 00542	Capacity Correction Factor: 1.06	

	Measured Dose Rate mR/hr				Adjusted Dose Rate mR/hr		
Location	At Surface	Surface Corr. Factor	At 30 Cm [Note 2]	At one Meter	At Surface	At 30 Cm [Note 2]	At one Meter [Note 1]
Top	19	1.09	NA	.4	22	NA	.4
Right	50	1.06		.9	56		1.0
Front	25	1.06		.8	28		.9
Left	40	1.06		.9	45		1.0
Rear	50	1.06		1.2	56		1.3
Bottom	25	1.09	↓	.4	29	↓	.4
				Acceptance Criteria:	≤200	NA	≤ 50 ≤ 40
				Result: (Check one) Accept	✓	Reject	

8/27/09

Inspector: _____ Date: 8/8/09 NCR # _____

Comments: Meter Reading was less background of .2 mR/hr

Notes:
1. Refer to F-Q-1806-1, Shield Efficiency Testing Surface Correction Factors for an existing device model, or F-Q-1806-3, Shield Profile Worksheet for One meter acceptance limit
2. The 30cm readings are only required when specifically requested.
3. Additional sheets may be used to describe results or indicate reading locations using sketches. Number all sheets and indicate total number of sheets. Make sure shield identification is included on each sheet.
4. Consult instrument calibration records for instrument uncertainty.

QSA GLOBAL

SHIELDING PROFILE AND INSPECTION FORM (SPIF)
F-Q-1806-2

Sheet 1 of 1

Shield Data

Model: Sentry 330	Serial # T180B	Radionuclide: Co 60	Max. Capacity 330 Ci
Shield P/N: 96001-330	Shield Item # C615-A06	Lot # 092030100B	

Profile Process Data

Source Model: 424-13	Source Ser. # 27746B	Radionuclide: Co 60	Activity: 195.6 Ci
Survey Inst. 1 E600	Serial # 1863	Date Cal. 3/24/10	Date Due: 3/24/11
Survey Inst. 2 NA	Serial # NA	Date Cal. NA	Date Due: NA
Inst. Probe: 1 #6270	Serial # 00542	Inst. Probe: 2 NA	Serial # NA
Capacity Correction Factor: 1.69			

	Measured Dose Rate mR/hr				Adjusted Dose Rate mR/hr		
Location	At Surface	Surface Corr. Factor	At 30 Cm [Note 2]	At One Meter	At Surface	At 30 Cm [Note 2]	At One Meter [Note 1]
Top	14	1.09	NA	.32	26	NA	.54
Right	18	1.06		.50	32		.85
Front	34	1.06		.62	61		1.1
Left	33	1.06		.63	59		1.1
Rear	13	1.06		.51	23		.90
Bottom	19	1.09	↓	.20	35	↓	.34
				Acceptance Criteria:	≤200	NA	≤ 5.0
				Result: (Check one) Accept	✓	Reject	

Inspector: _____ Date: 3/29/10 NCR # _____

Comments: All but bottom 1 meter readings are less background. 06
Bottom 1 meter reading is below background. 3

Notes:
1. Refer to F-Q-1806-1, Shield Efficiency Testing Surface Correction Factors for an existing device model, or F-Q-1806-3, Shield Profile Worksheet for One meter acceptance limit.
2. The 30cm readings are only required when specifically requested.
3. Additional sheets may be used to describe results or indicate reading locations using sketches. Number all sheets and indicate total number of sheets. Make sure shield identification is included on each sheet.
4. Attach auto profiler print out to this sheet if used.

QSA GLOBAL

SHIELDING PROFILE AND INSPECTION FORM (SPIF)
F-Q-1806-2

"Engineering Task Sample" Sheet 1 of 1

Shield Data

Model: Sentry 330	Serial # TP180C	Radionuclide: Co-60	Max. Capacity 330 Ci
Shield P/N: B6001-330	Shield Heat # C601-A06		Lot # 09163012I0

Profile Process Data

Source Model: 424-13	Source Ser. # 277470	Radionuclide: Co-60	Activity: 312.8 Ci
Survey Inst. E600	Serial # 1863	Date Cal. 2/24/09	Date Due: 2/24/10
Inst. Probe: HP-270	Serial # 00542	Capacity Correction Factor: 1.06	

	Measured Dose Rate mR/hr				Adjusted Dose Rate mR/hr		
Location	At Surface	Surface Corr. Factor	At 30 Cm [Note 2]	At one Meter	At Surface	At 30 Cm [Note 2]	At one Meter [Note 1]
Top	17	1.09	NA	.56	20	NA	.59
Right	55	1.06		.96	62		1.02
Front	27	1.06		1.30	30		1.38
Left	55	1.06		1.43	62		1.52
Rear	30	1.06		1.45	34		1.54
Bottom	32	1.09	↓	.74	37	↓	.78
				Acceptance Criteria:	≤200	NA	≤ 1050
				Result: (Check one) Accept	✓	Reject	8/19/10

Inspector: [signature] Date: 8/5/09 NCR # _____

Comments:
All Readings are Less Background of .04 mR/h
(1 meter readings taken with E600, SN 2750, cal 2 APR 09, due 2 APR 10
due to its 30 sec scaler cycle.)

Notes:
1. Refer to F-Q-1806-1, Shield Efficiency Testing Surface Correction Factors for an existing device model, or F-Q-1806-3, Shield Profile Worksheet for One meter acceptance limit
2. The 30cm readings are only required when specifically requested.
3. Additional sheets may be used to describe results or indicate reading locations using sketches. Number all sheets and indicate total number of sheets. Make sure shield identification is included on each sheet.
4. Consult instrument calibration records for instrument uncertainty.

QSA GLOBAL

SHIELDING PROFILE AND INSPECTION FORM (SPIF)
F-Q-1806-2

Sheet 1 of 1

Shield Data

Model: 86010-330	Serial # TP120D	Radionuclide: Co-60	Max. Capacity 330 Ci
Shield P/N: 8600I-330	Shield Heat # C608-A06		Lot # 091910y408

Profile Process Data

Source Model: 60011	Source Ser. # 27747B	Radionuclide: Co-60	Activity: 311.0 Ci
Survey Inst. E600	Serial # 1863	Date Cal. 2/24/08	Date Due: 2/24/10
Inst. Probe: HP-270	Serial # 00542	Capacity Correction Factor: 1.06	

	Measured Dose Rate mR/hr				Adjusted Dose Rate mR/hr		
Location	At Surface	Surface Corr. Factor	At 30 Cm [Note 2]	At one Meter	At Surface	At 30 Cm [Note 2]	At one Meter [Note 1]
Top	20	1.09	NA	.35	23	NA	.37
Right	50	1.06		.95	56		1.00
Front	35	1.06		.85	39		.90
Left	40	1.06		1.35	844		1.43
Rear	36	1.06		1.35	40		1.43
Bottom	27	1.09		.4	31		.42
				Acceptance Criteria:	≤200	NA	≤105.0
				Result: (Check one) Accept	✓	Reject	

Inspector: _____ Date: 8/20/08 NCR # _____

Comments:
1 meter Readings are less background of .05 mR/hr

Notes:
1. Refer to F-Q-1806-1, Shield Efficiency Testing Surface Correction Factors for an existing device model, or F-Q-1806-3, Shield Profile Worksheet forOne meter acceptance limit
2. The 30cm readings are only required when specifically requeted.
3. Additional sheets may be used to describe results or indicate reading locations using sketches. Number all sheets and indicate total number of sheets. Make sure shield Identification is included on each sheet.
4. Consult instrument calibrationrecords for instrument uncertainty.

QSA GLOBAL

SHIELDING PROFILE AND INSPECTION FORM (SPIF) F-Q-1806-2

Sheet 1 of 1

Shield Data

Model: 88010-330	Serial # TP1808	Radionuclide: Co 60	Max. Capacity 330 Ci
Shield P/N: 86001-330	Shield Heat # C611-A06		Lot # 091970090?

Profile Process Data

Source Model: 424-13	Source Ser. # 277478	Radionuclide: Co-60	Activity: 310.1 Ci
Survey Inst. E600	Serial # 1853	Date Cal. 2/24/09	Date Due: 2/24/10
Inst. Probe: HP270	Serial # 00642	Capacity Correction Factor: 1.06	

Location	Measured Dose Rate mR/hr: At Surface	Surface Corr. Factor	At 30 Cm [Note 2]	At one Meter	Adjusted Dose Rate mR/hr: At Surface	At 30 Cm [Note 2]	At one Meter [Note 1]
Top	20	1.09	NA	.40	23	NA	.43
Right	45	1.06		.81	51		.86
Front	31	1.06		.36	35		.38
Left	35	1.06		.88	39		.93
Rear	34	1.06		1.65	38		1.7
Bottom	25	1.09	↓	.50	29	↓	.53
			Acceptance Criteria:		≤200	NA	≤ 1.0 5.0 9/30/09
			Result: (Check one)	Accept	✓	Reject	

Inspector: _____ Date: 8/28/09 NCR # _____

Comments:
* all one (1) meter Readings are less background of .05

Notes:
1. Refer to F-Q-1806-1, Shield Efficiency Testing Surface Correction Factors for an existing device model, or F-Q-1806-3, Shield Profile Worksheet for One meter acceptance limit
2. The 30cm readings are only required when specifically requested.
3. Additional sheets may be used to describe results or indicate reading locations using sketches. Number all sheets and indicate total number of sheets. Make sure shield identification is included on each sheet.
4. Consult instrument calibration records for instrument uncertainty.

QSA GLOBAL

SHIELDING PROFILE AND INSPECTION FORM (SPIF) F-Q-1806-2

Sheet 1 of 1

Shield Data

Model: 86610-330	Serial # TP1806	Radionuclide: Co 60	Max. Capacity 330 Ci
Shield P/N: 86001-330	Shield Heat # C615-A06	Lot # 092220081	

Profile Process Data

Source Model: 424-13	Source Ser. # 277478	Radionuclide: Co-60	Activity: 309.4 Ci
Survey Inst. E600	Serial # 1863	Date Cal. 2/24/09	Date Due: 2/24/10
Inst. Probe: HP270	Serial # 00542	Capacity Correction Factor: 1.07	

	Measured Dose Rate mR/hr				Adjusted Dose Rate mR/hr		
Location	At Surface	Surface Corr. Factor	At 30 Cm [Note 2]	At one Meter	At Surface	At 30 Cm [Note 2]	At one Meter [Note 1]
Top	20	1.09	NA	.4	23	NA	.4
Right	45	1.06		.9	51		1.0
Front	41	1.06		.9	47		1.0
Left	42	1.06		1.0	48		1.1
Rear	47	1.06		1.6	53		1.7
Bottom	25	1.09	↓	.3	29	↓	.3
			Acceptance Criteria:		≤ 200	NA	≤ 5.0
			Result: (Check one)	Accept	✓	Reject	

Inspector: [signature] Date: 9/5/09 NCR # _____

Comments:

All 1 meter readings are less background of 0.1

Notes:

1. Refer to F-Q-1806-1, Shield Efficiency Testing Surface Correction Factors for an existing device model, or F-Q-1806-3, Shield Profile Worksheet forOne meter acceptance limit
2. The 30cm readings are only required when specifically requested.
3. Additional sheets may be used to describe results or indicate reading locations using sketches. Number all sheets and indicate total number of sheets. Make sure shield identification is included on each sheet.
4. Consult instrument calibrationrecords for instrument uncertainty.

2.12.4 Test Plan 180 Report #2 dated 7 April 2010