71-9147
rec'd 4/11/88
R-137
PDR

Amersham Corporation
40 North Avenue
Burlington, Massachusetts 01803
Telephone (617) 272-2000

RETURN TO 396-SS

March 30, 1988

Mr. Charles MacDonald, Chief
Transportation Certification Branch
Division of Fuel Cycle and Material Safety, NMSS
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. MacDonald:

I am providing the additional information requested for certificate of compliance number 9147 issued for the model 850 source changer. Enclosed please find revised drawings and pages to be inserted into the original Safety Analysis report submitted in October 1980.

These revised drawings and pages answer most of the concerns noted in your letter dated 24 March 1987. In addition, to assure that the shielding plates are welded securely they undergo a visual inspection performed by Quality Control. Quality Control assures the welds are in accordance with the drawing. Visual inspection of the welds of Type B containers has been used for the past twenty-five years, in that time there has not been a weld failure in either transportation or field use of the containers.

All the structural and shielding concerns have been answered by the satisfactory completion of the thirty foot drop test and the one meter puncture test of the modified 850. A radiation profile performed at the conclusion of these tests indicated no loss of shielding.

I have also included an updated operations manual for the 850, to be incorporated into the safety analysis report.

I trust this provides the information needed to continue processing our request. If I can provide any additional information, please contact me.

Sincerely,

Cathleen M. Roughan

Cathleen M. Roughan
Radiation Safety Officer

jaj/CMR

Supplemental info

29195

Drawing located in transportation

Amersham

1. General Information

Introduction

Amersham Model 850 is designed for use as a source changer and shipping container for Type B quantities of radioactive material in special form. THe Model 850 conforms to the criteria for Type B packaging in accordance with 10CFR71 and satisfies the criteria for Type B (U) packaging in accordance with IAEA Safety Series No. 6, 1973 Revised EDITION.

1.2 Package Description

1.2.1 Packaging

The Model 850 is 10.4 inches (264 mm) high, 8.5 inches (215mm) wide and 8.8 inches (224 mm) deep. The gross weight of the package is 77 pounds (35kg).

The radioactive source assemblies are housed in titanium "U" tubes. The tube has an outside diameter of 0.56 inch (14.3 mm) and a wall thickness of 0.03 inch (0.8 mm). A source stop is installed in one side of the "U" tube to provide positive positioning of the source assembly at the appropriate storage location.

The source tubes are surrounded by depleted uranium metal for shielding . The uranium metal is cast around the titanium source tubes. The weight of the uranium shield is 49 pounds (22 kg).

The uranium shield assembly is encased in a stainless steel housing. The shield assembly is supported on the bottom by a stainless steel support plate which is attached to the package housing. The shield assembly is supported on the top by the lock assemblies. Horizontal movement of the shield assembly is restrained by the studs which mount the support plate to the housing. Rotation of the shield assembly is prevented by engagement of the titanium "U" tubes with the lock assemblies. Copper separators are used to prevent iron-uranium interfaces.

The void space between the uranium shield assembly and the stainless steel housing is filled with a castable rigid polyurethane foam.

Mounted on the top of the package in the lock plate weldments are the lock assemblies. These lock assemblies are used to secure the radioactive source assemblies in the proper shielded position during transport. Shielded shipping plugs must be installed prior to transport over the source tubes. Cover plates, fabricated from stainless steel, are installed on the package to provide protection of locking assemblies.

On certain packages, additional shielding plates are installed to reduce the surface radiation level. These plates are 6.4 mm (0.25 inch) thick and welded to the outside of the package. In addition there may be a 12.8 mm (.50 inch) thick plate welded on the bottom of the source changer. These are described in drawing number 85000 and 85000-5 to 85000-7.

Tamper proof seals are provided during shipment of these packages. Two vent holes in the package provide passageways for the escape of any gas generated from the decomposition of the polyurethane foam in the event that the source changer is involved in a fire accident. The outer packaging is designed to avoid the collection and retention of water. The package has a smooth stainless steel finish to provide for easy decontamination.

The Radioactive material is sealed inside a stainless steel source capsule. The capsule acts as the containment vessel for the radioactive material.

1.2.2 Operational Features

The source assemblies are secured in the proper storage position by means of the locking assemblies. The lock slide engages an undercut in the source assembly preventing movement. The lock slide is secured in position by means of a key operated plunger lock.

1.2.3 Contents of the Package

The Model 850 is designed for the transport of iridium -192 in quantities up to 240 curies as Amersham source assembly Model 90003. This source assembly contains either a Model 90004 or Model 90005 source capsule. These capsules satisfy the criteria for special form radioactive material in accordance with 10CFR71 and IAEA Safety Series No. 6, 1973 Edition (Section 2.8).

1.3 Appendix

Drawing 85090 Sheets 1-5 Descriptive Assembly

Drawing 85011 Shielding Shipping Plugs

Drawing 85093 Label

Drawing 90091 Source Assembly

Drawing 85000 Shielding Plates on Device

2.0 Structural Evaluation

2.1 Structural Design

2.1.1 Discussion

Structurally, the Model 850 consists of four components: A source capsule, shield assembly, outer housing and locking assembly. The source capsule is the primary containment vessel. It satisfies the criteria for special form radioactive material. The shield assembly fulfills two functions. It provides shielding for the radioactive material and , together with the lock assembly, assures proper positioning of the radioactive source.

The outer housing is fabricated from 13 gauge (0.09 inch or 2.3 mm thick) stainless steel. The housing provides the structural strength of the package. The cover plates protect the lock assemblies. The lock assemblies secure the radioactive source assemblies in the proper shielded position in the package and assures positive closure.

2.1.2 Design Criteria

The Model 850 is designed to comply with the requirements of 10CFR71 and IAEA Safety Series No. 6, 1973 Edition. The device is simple in design. There are no design criteria which cannot be evaluated by a straight forward application of the appropriate section of 10CFR71 or IAEA Safety Series No. 6.

2.2 Weights and Centers of Gravity

The Model 850 weighs 77 pounds (35 kg), on certain packages the addition of shielding plates will increase the gross weight to 102 lbs (46 kg). The shield assembly contains 49 lbs (22 kg) of depleted uranium. The center of gravity was located experimentally. It is located along the vertical axis at a distance of 4.3 inches (110 mm) above the bottom surface.

2.3 Mechanical Properties of Materials

The model 850 housing is fabricated from Type 304 stainless steel. This material has a yield strength of 35,000 lbs per square inch (241 MN/m^2). (Ref: Metals Handbook, Vol 1, Eigth Edition).

Drawings of the source capsules used in conjunction with the Model 850 are enclosed in Section 2.10. These source capsules are fabricated from Type 304 or Type 304L stainless steel. The capsules are sealed by tungsten inert gas welding.

2.4 General Standards for All Packages

The shielding or affect the structural integrity of the package.

2.6.6 Free Drop

The drop analysis performed in Section 2.7.1 is sufficient to satisfy the requirements of the normal transport free drop condition. On this basis, we conclude that the Model 850 will withstand the free drop without loss of shielding effectiveness or loss of package integrity.

2.6.7 Corner Drop

Not Applicable

2.6.8 Penetration

A penetration test of the Model 850 was performed. THere was no loss of shielding or loss of structural integrity as a result of this test. A copy of the test report appears in Section 2.10.

2.6.9 Compression

The gross weight of the Model 850 is 77 pounds (35 kg). The maximum cross sectional area of the package is 42 in^2 (0.06 m^2). Thus, five times the weight of the package (385 lbs; 1715 newtons) is greater than two pounds per square inch multiplied by the maximum cross sectional area (184 lbs; 820 newtons).

The Model 850 was subjected to the conditions of the compression test. A load of 459 lbs (2044 newtons) was applied uniformly to the top and bottom of the package for 68 hours. As a result of this test, there was no loss of shielding effectiveness nor loss of structural integrity. A copy of the test report is included in Section 2.10.

2.7 Hypothetical Accident Conditions

2.7.1 Free Drop

The Model 850 and a Model 850 with the additional shielding plates were subjected to a drop test through a distance of 30 feet onto a steel plate. There was no loss of shielding efficiency nor loss of structural integrity as a result of this test. Copies of the test reports are included in Section 2.10.

2.7.2 Puncture

The Model 850 and a Model 850 with the additional shielding plates were subjected to the puncture test of 10 CFR71. As a result of this test, there was no loss of shielding efficiency nor loss of structural integrity. Copies of the test reports are included in Section 2.10.

TEST REPORT

TO: CATHLEEN M. ROUGHAN
FROM: RICHARD E. PERT
DATE: APRIL 1, 1988
SUBJECT: 850 DROP AND PUNCTURE TEST

MODIFIED 850

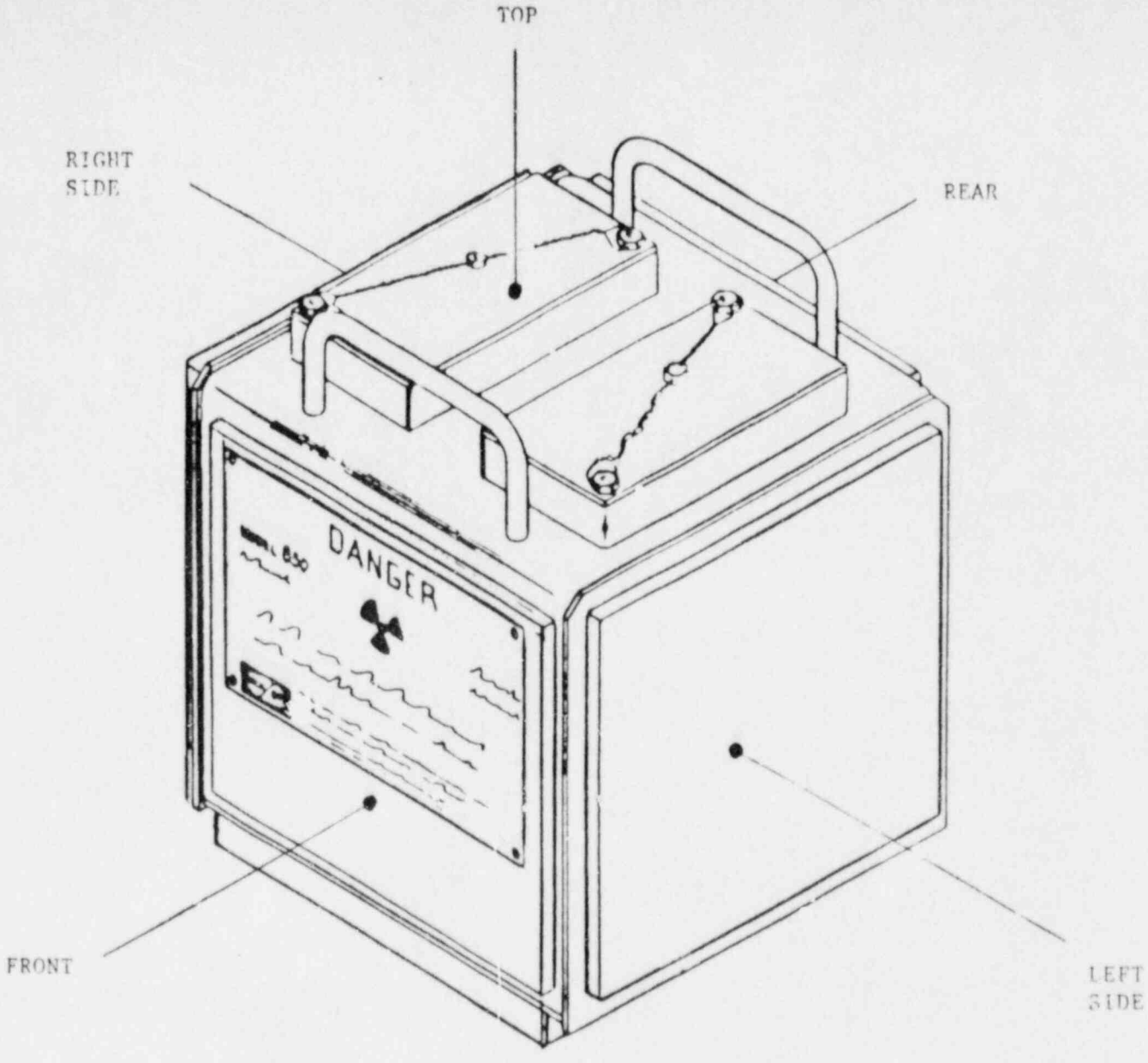
On February 24, 1988 a Model 850, S/N 9, source changer modified with extra shielding plates was subjected to drop and puncture tests. The puncture test was in accordance with the requirements of 10CFR 71.73 (C)(2) and IAEA Safety Series NO. 6, Paragraph 719 (b). The drop test was in accordance with the requirements of 10CFR 71.73 (C)(1) and IAEA Safety Series NO. 6, Paragraph 719(a). These tests were performed at Valley Tree Service in Groveland, MA.

The Model 850 was dropped twice from a height of 9.1 meters (30 feet) onto a target. The target consisted of a concrete cube, each side measuring 1.2 meters (48 inches) upon which had been wet-floated a steel plate 0.9 meters (36 inches) wide, 0.9 meters (36 inches) long, and 25mm (one inch) thick. This target conforms to the guidelines for an essentially unyielding surface as prescribed in paragraph 701 of IAEA Safety series NO. 37.

In the first drop a bottom corner impacted the target. This resulted in a very slight dent in this corner (25mm or less).

In the second drop the package impacted on a top corner, bounced onto the handles (one handle to the other) and came to rest. This slightly bent the handles and caused a small dent on the top corner where the first impact occurred.

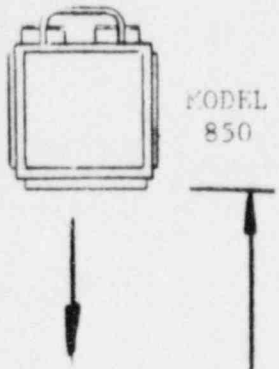
In the third drop the package was subjected to the puncture test. In this test the package was dropped from a height of one meter onto a target. The target consisted of a right circular cylindrical steel billet, 152mm (6 inches) in diameter and (203mm) 8 inches high, mounted onto the target used in the drop test. The top of the package between the two handles was dropped onto the target. There was no visible damage due to this test.



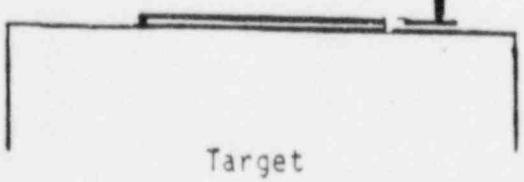
MODEL 850 PACKAGE ORIENTATION

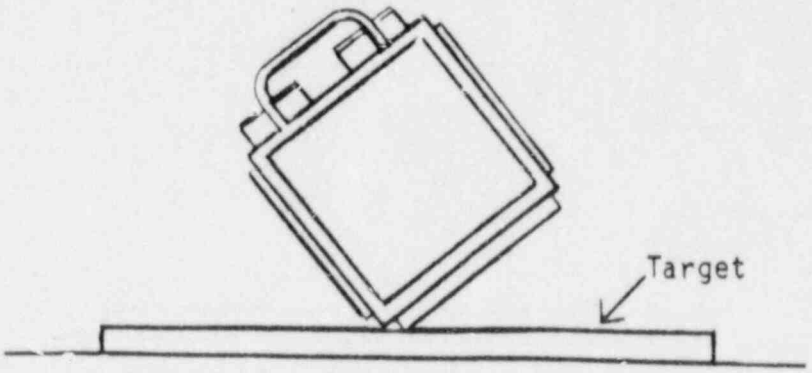
Free Drop Target:

Consists of a concrete cube, each side measuring 1.2 m (48 inches) upon which had been wet floated a steel plate 0.9 m (36 inches) wide, 0.9 m (36 inches) long and 25 mm (1 inch) thick.

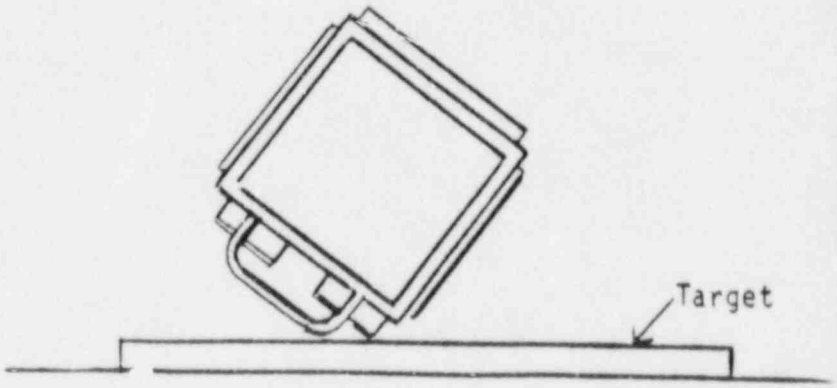


9.1 meters (30 feet)



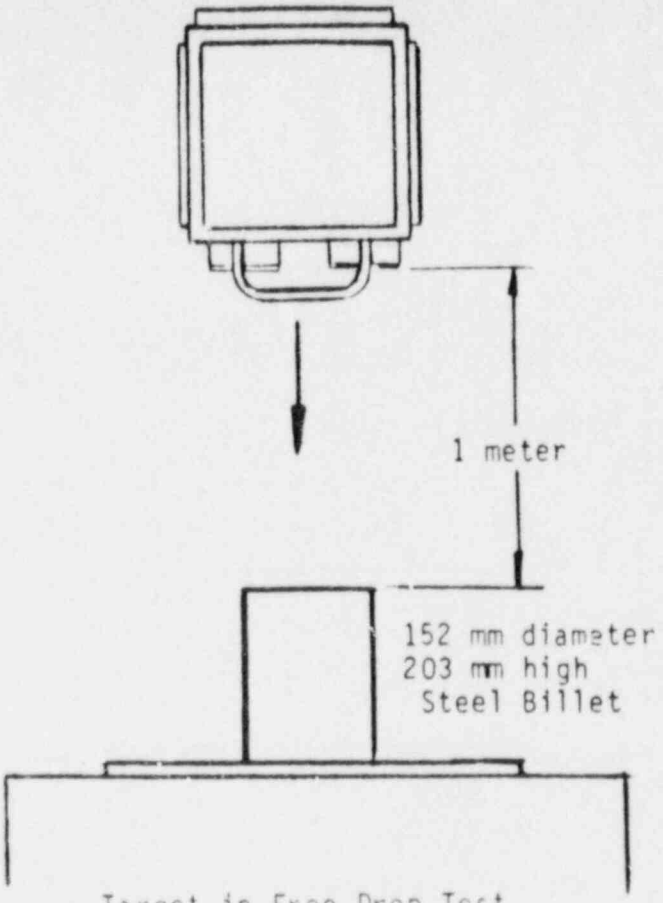


CORNER OF BOTTOM PLATE IMPACT

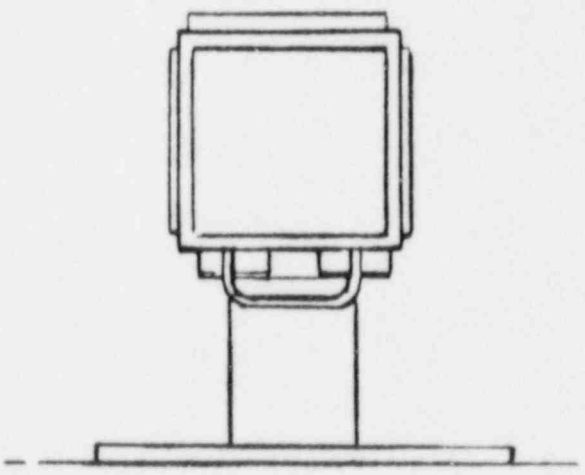


Cover Plate Impact

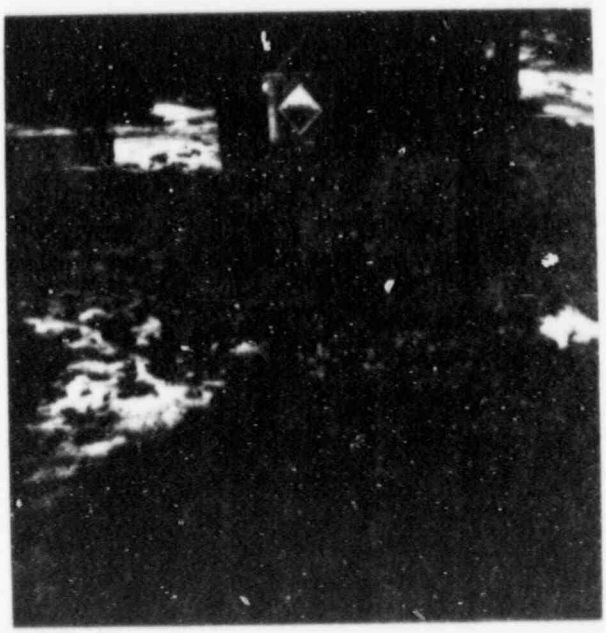
MODEL 850
FREE DROP TEST

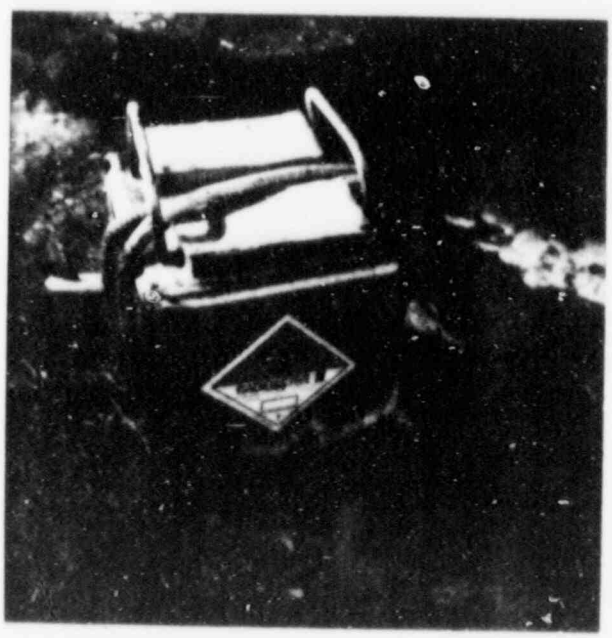


Target in Free Drop Test



TOP FACE IMPACT
COVER PLATES CLOSED





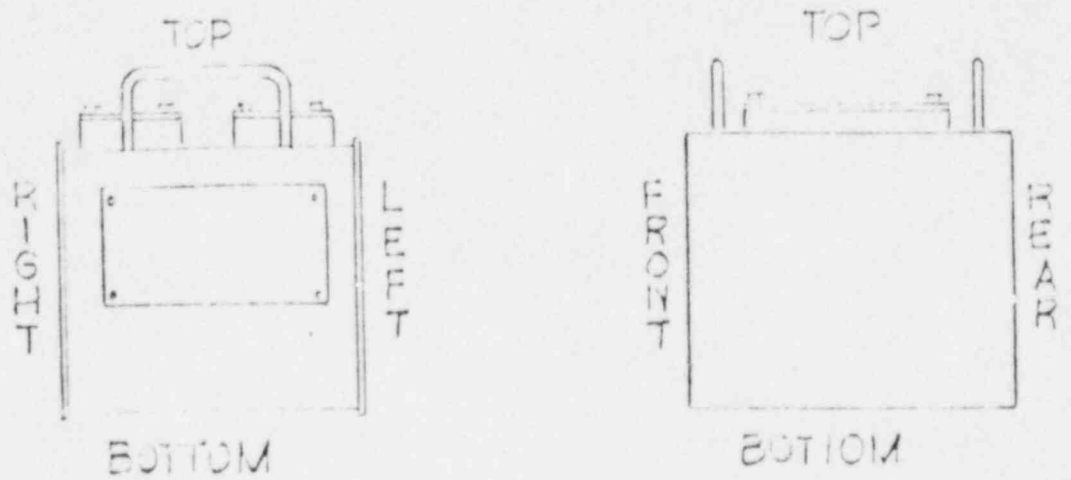
5.5 Appendix

5.5.1 Radiation Profile - Model 850, Serial Number 1

5.5.2 Radiation Profile - Model 850, Serial Number 1
After hypothetical accident conditions

5.5.3 Radiation Profile - Modified 850 Serial Number 9
After hypothetical accident conditions

5.5.3 Radiation Profile modified Model 850 S.N. 9
(additional shielding plates and shielded shipping plugs))
After free fall and puncture tests



Containing Source:

S.N. 1489: 170Ci Iridium-192

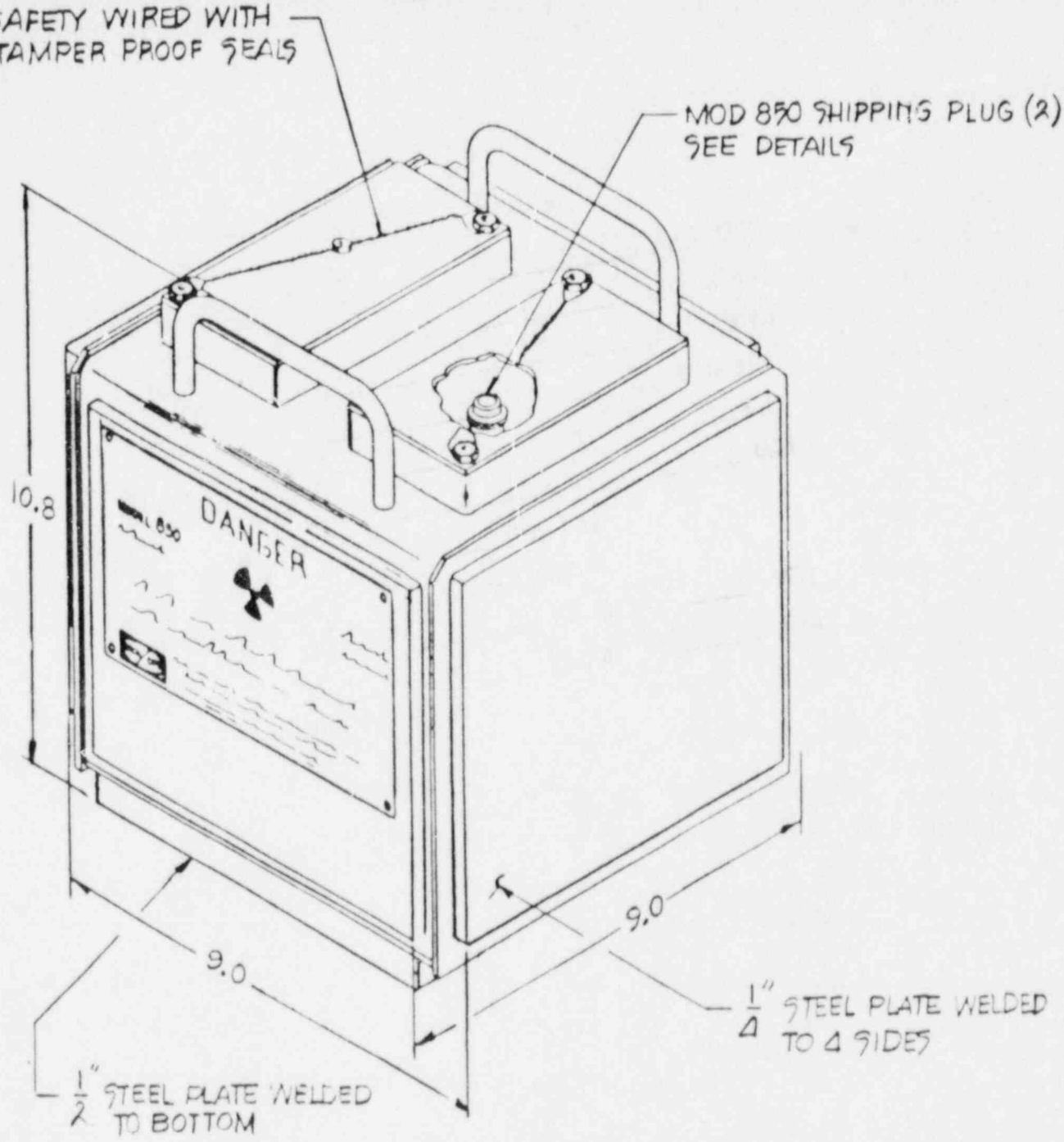
Total Activity: 170 Curies of Iridium-192

Maximum Dose Rates (mR/hr)

	at surface	at one meter
Top	110	0.9
Front	60	0.5
Right	55	0.4
Rear	85	0.5
Left	60	0.5
Bottom	70	0.5

Measurements made with AN/PDR-27(J)

REV.	DATE	DESCRIPTION



USED ON: AS NOTED		RELEASED FOR PRODUCTION ON _____ BY _____
MATERIALS		Amersham Tech Ops — Amersham Corporation, BURLINGTON, MA 01803
FINISH		DWG TITLE: MODEL 850 SOURCE CHANGER DESCRIPTIVE ASSEMBLY
DRAWN BY: [illegible]	UNLESS OTHERWISE SPECIFIED TOLERANCES ARE	
CHECKED BY	X ± 0.1	
	.XX ± 0.01	
	.XXX ± 0.005	CLASSIFICATION: SIZE A; DWG NO. 85090; REV
APPROVED BY	ANGLES ± 0.5°	
	FRACTIONS ± 1/64	SCALE; SHEET 1 OF

DOCKET NO. 11-9147
CONTROL NO. 29195
DATE OF DOC. 3/30/88
DATE RCVD. 4/11/88
FCUF ____ PDR ✓
FCAF ____ LPDR ____
I&E REF. ✓
FCTC ✓ SAFEGUARDS ____
DATE 4/11/88 OTHER ____
INITIAL ____