



571-9148

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7 November 2002

Ms. Julia Barto, Project Manager  
Licensing Section  
Spent Fuel Project Office  
Office of Nuclear Material Safety and Safeguards  
US Nuclear Regulatory Commission  
11555 Rockville Pike  
One White Flint  
Rockville, MD 20852

RE: Certificate of Compliance, USA\9148\B(U)

Dear Ms. Barto:

The following is submitted in response to the remaining items from your letter dated 26 May 02:

- 1.1 Enclosed, as part of Revision 3 to the 770 SAR, are revised descriptive assembly drawings for the 770. These revisions provide the additional dimensioning for the internal supporting/positioning structures as well as location references for the cover plates.

Regarding the size of the depleted uranium shield, no additional dimensional call-outs were added to the descriptives as the current dimensions are adequate for assessing general acceptability of the overall size and shape of the shield. Specifying further detailed physical shield dimensions is unnecessary as all shields are created from a poured mold process which provides general reproducibility in external dimensions from shield to shield. Where variances are more likely to impact shield quality is in the shield pouring process where various factors, such as cooling, flow rate, etc. can more significantly impact the shielding density, and therefore is shielding ability, during a specific shield pour.

The critical determining factor on acceptance of a shield is that, once assembled in the finished Type B configuration, it meets the radiation transport requirements of 10 CFR 71.47. Final acceptance of any Type B container requires that the device be assessed by a radiation profile of the package. This profile is performed at the package surface and at a distance of one meter from the package surface to ensure that the assembled container shielding is free of voids or defects which would prevent its compliance with 10 CFR 71.47. Compliance with the radiation profile is required on all 770 devices as part of the acceptance testing prior to use of that device under the Type B certificate.

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- 2.1 The values provided in section 2.5.1 and Table 2-1 were values for yield strength of the stainless steel where deformation of the material could be expected to begin. In assessing the package performance for the criteria in section 2.5.1 it is more appropriate to use the ultimate yield strength of 300 series stainless steel. This provides the point at which failure in the material will occur and for 300 series stainless steel this ultimate yield strength is 70,000 psi. Table 2-1 has been revised to include reference to the ultimate yield strength of the stainless steel. Section 2.5.1 has also been updated to reflect the breaking or ultimate yield strength of the steel in demonstrating the materials ability to comply with supporting three times the weight of the transport package.

Should you have any questions regarding this submission or require any additional information, please contact me at (781) 272-2000, extension 241.

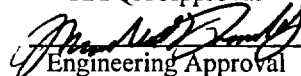
Sincerely,



Lori Podolak, CHP  
Product Licensing Specialist  
Regulatory/Health Physics Department

  
RA/QA Approval

8 Nov 02  
Date

  
Engineering Approval

6 Nov 02  
Date

Enclosures: Revision 3 of 770 SAR, pages 4, 6, 8, cover sheet and Appendix A  
List of Effected Pages




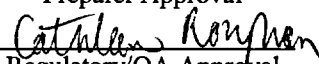
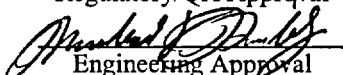
# Safety Analysis Report

AEA Technology QSA, Inc.

## Model 770 Type B (U)-85 Transport Package

November 2002

Revision 3

 Preparer Approval	<u>6 Nov 02</u> Date
 Regulatory/QA Approval	<u>8 Nov 02</u> Date
 Engineering Approval	<u>06 Nov 02</u> Date

### 1.2.2 *Technical Data*

Length: 61 cm (24 inches)  
Height: 50 cm (19½ inches)  
Width: 57 cm (22½ inches)  
Shipping Weight: 437 kg (970 pounds)  
Capacity: See Table 1-1  
Shielding: Depleted Uranium 191 kg (425 pounds)  
Transport Status: Type B(U) Package USA/9148/B(U)  
Sources: Special form  
Descriptive Drawing: R77090 Revision C

### 1.3 *Contents of Packaging*

The Model 770 Source Changer is designed for the use and transport of special form sources in activities listed in Table 1-1. The radioactive material is contained in metallic capsules, which are seal welded. The maximum activity, for industrial radiography sources, is defined as output Curies as required in ANSI N432 and 10 CFR 34.20. The heat output of the sources is shown in Table 2 below:

**Table 1-2: Radionuclide Decay Energy**

Radionuclide	Package Activity (Ci)	MeV/Decay	Watts/Package
Iridium-192	1,000	1.46	8.6
Co-60	800	2.82	14
Sc-46	800	2.73	13
Cs-137	1,000	1.18	7

Resource references:

Table of Isotopes, Volumes I & II, Eighth Edition John Wiley & Sons, Inc., 1996.

### 1.4 *Containment Boundary*

#### 1.4.1 *Containment Vessel*

The containment system for the Model 770 Source Changer is the special form radioactive source capsule referred to in Section 4.1.1 of this application. The capsules have been certified as Special Form Radioactive Material in accordance with 10 CFR Part 71, US Department of Transportation regulations (or equivalent), and IAEA Safety Series No. 6, 1985 (As Amended 1990).

### 1.5 *Drawings*

Descriptive assembly drawings for the 770 are included in Appendix A to this SAR.

**2.3 Mechanical Properties of Materials**

Table 2.1 lists the mechanical properties of the principal materials used in the package construction. The resources referred to in the last column of each are listed after the table.

**Table 2-1: Mechanical Properties of Principal Package Materials**

Material	Tensile Strength	Yield Strength	Elongation	Resource
Depleted Uranium	65 ksi	30 ksi	12%	Ref: #1, p. 20-35
Stainless Steel gr304 gr303	75 ksi 85 ksi typical	30 ksi 35 ksi typical 70 ksi ultimate	40% typical 50% typical	Ref: #2, p. 368 Ref: #2, p368

Resource references:

- Howard E. Boyer and Timothy L. Gall, Editors, *Metals Handbook*. Metals Park, Ohio: American Society for Metals, 1985.
- J.R. Davis, *Metals Handbook Desk Edition*, 2nd Edition ASM International.

**2.4 General Standards for All Packages**

**2.4.1 Minimum Package Size**

Reference:

- USNRC, 10 CFR 71.43(a)
- USDOT, 49 CFR 173.412(b)
- IAEA Safety Series No. 6, para. 525

The package is 24 inches (61 cm) long, 19½ inches (50 cm) high and 22½ inches (57 cm) wide therefore exceeding the minimum package size requirements specified by 10 CFR 71.43(a) and IAEA Safety Series No. 6, para. 525.

**2.4.2 Tamper Indicating Feature**

Reference:

- USNRC, 10 CFR 71.43(b)
- USDOT, 49 CFR 173 412(a)
- IAEA Safety Series No. 6, para. 526

The shipping cover fixing bolts are fitted with a seal wire which provide a tamper indicating feature in accordance with 10 CFR 71.43(b) and IAEA Safety Series No. 6, para. 526.

Therefore, the stress generated in the skid is 14,634 psi. With a Safety Factor of 3 applied, the maximum stress in the skid is 43,901 psi. This is below the ultimate yield strength of the stainless steel base, 70,000 psi. Therefore, the lifting device is capable of supporting more than three times the weight of the transport package as required by 10 CFR 71.45(a).

### 2.5.2 Tie-down Devices

Reference:

- USNRC, 10 CFR 71.45(b) (1) (2) (3)
- USDOT, 49 CFR 173.412 (I)
- IAEA Safety Series No. 6, para. 527

The Model 770 has no tie down attachments. The package can be blocked and braced according to standard transportation practices.

## 2.6 Normal Conditions of Transport

### 2.6.1 Heat

Reference:

- USNRC, 10 CFR 71.71(c)(1)
- IAEA Safety Series No. 6, para. 543

Table 2-2: Insolation Data

Surface	Insolation for a 12 hour period (g cal/cm <sup>2</sup> )
Horizontal base	None
Other horizontal flat surfaces	800
Non-horizontal flat surfaces	200
Curved surfaces	400

The heat source in the Model 770 Source Changer is a maximum of 800 Curies of Cobalt-60. Cobalt-60 decays with a total energy liberation of 2.82 MeV per disintegration or 17.5 milliwatts per curie. Assuming all the decay energy is transformed into heat, the heat generation rate for the 800 Curies of Cobalt-60 would be approximately 14 Watts.

#### 2.6.1.1 Engineering Analysis

This analysis determines the maximum surface temperature produced by solar heating of the package surface in accordance with 10 CFR 71.71(c)(1) and Table XII of IAEA Safety Series No. 6 (as amended 1990).


The model consists of taking a steady state heat balance over the surface of the package. In order to assure conservatism, the following assumptions are made:

## **APPENDIX A**


### *DRAWINGS*




**FIGURE WITHHELD UNDER 10 CFR 2.390**

 QSA 40 NORTH AVE, BURLINGTON, MA 01803		DESCRIPTIVE DRAWING	
TITLE		MODEL 770 SOURCE CHANGER DESCRIPTIVE ASSEMBLY	
SIZE	DWG. NO.	REV	
B	R77090	C	
SCALE:	4/1	SHEET	1 OF 6


**FIGURE WITHHELD UNDER 10 CFR 2.390**

		DESCRIPTIVE DRAWING	
40 NORTH AVE, BURLINGTON, MA 01803			
TITLE		MODEL 770 SOURCE CHANGER DESCRIPTIVE ASSEMBLY	
SIZE	DWG. NO.	R77090	REV
B	SCALE:	4/1	SHEET 2 OF 6 C

**FIGURE WITHHELD UNDER 10 CFR 2.390**

UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS ARE IN INCHES. SEE NOTE 1.			
		DESCRIPTIVE DRAWING	
40 NORTH AVE, BURLINGTON, MA 01803			
TITLE		MODEL 770 SOURCE CHANGER DESCRIPTIVE ASSEMBLY	
SIZE	DWG. NO.	R77090	REV
B	SCALE: 4/1	SHEET 3 OF 6	C

**FIGURE WITHHELD UNDER 10 CFR 2.390**

 QSA 40 NORTH AVE, BURLINGTON, MA 01803		DESCRIPTIVE DRAWING	
TITLE MODEL 770 SOURCE CHANGER DESCRIPTIVE ASSEMBLY			
SIZE	DWG. NO.	R77090	REV
B	SCALE: 4/1	SHEET 4 OF 6	C

**FIGURE WITHHELD UNDER 10 CFR 2.390**

ALL DIMENSIONS ARE IN INCHES. SEE NOTE 1.




40 NORTH AVE, BURLINGTON, MA 01803

DESCRIPTIVE  
DRAWING

TITLE MODEL 770 SOURCE CHANGER  
DESCRIPTIVE ASSEMBLY

SIZE	DWG. NO.	R77090	REV
B	SCALE:	4/1	C
		SHEET 5 OF 6	

**FIGURE WITHHELD UNDER 10 CFR 2.390**

 QSA 40 NORTH AVE, BURLINGTON, MA 01803		DESCRIPTIVE DRAWING	
TITLE		MODEL 770 SOURCE CHANGER DESCRIPTIVE ASSEMBLY	
SIZE	DWG. NO.	R77090	REV
B	SCALE:	2/1	SHEET 6 OF 6 C