



*Risk Reduction and Environmental Stewardship
Division
Off-Site Source Recovery (OSR) Project*

To/MS: OSR Project File
From/MS: J. Andrew Tompkins, RRES-
SA/OSR, J552
Phone/Fax: 770-517-4320 / 770-517-4317
Symbol: RRES-SA-2003-335
Date: January 15, 2003

**SUBJECT: SPECIAL FORM CHARACTER OF AMERICIUM-241 RADIOACTIVE
SEALED SOURCES DESIGNATED MRC 2720 SERIES-BT**

The following analysis was performed to assure by available documentation and engineering analysis that the americium (Am)-241 sealed sources Model 2720 series-BT, manufactured by Monsanto Research Corporation, meet the US Department of Transportation (DOT) requirements for Special Form.

Monsanto Research Corporation (MRC) manufactured Model 2720 series capsules from 1970-1984 when the company went out of business. The 2720 series had an A, B, and C sub-series all of whose special form character is documented in an engineering evaluation letter to the USDOT dated 12-10-81 (attachment 1). The model 2720 series-BT variants changed the basic capsule design by adding 0.25 inch of head thickness to the bottom of the outer capsule, to accommodate a 0.25" deep threaded hole. The designation BT stands for Bottom Threaded.

Since the only change is a thickening of one of the outer capsule heads, that is then penetrated to an equal depth, that leaves the minimum capsule head thickness unchanged, thus the original pressure vessel evaluation of stresses in the capsule are unchanged. This change in capsule length greatly strengthened the capsule head by increasing outer capsule head thickness by a factor of 3.5. The only real change is that the MRC 2723-BT variant is 14.5 grams heavier than the Model 2723 capsule. The information provided in this memorandum will evaluate the potential effect of increasing the outer capsule weight by 14.5 grams.

Capsule Description

A comparison of the 2720 series-BT variants with the MRC 2720-A series capsules will reveal the following differences:

MRC Model	Overall Length (inches)	Outer Cap Head A series (thickness, inches)	Capsule weight (grams)	Outer Cap Head BT variant (thickness, inches)	BT Capsule Weight Increase (grams)
2722	0.700	0.100	15.4		
2723	0.870	0.100	38.6	0.350	14.5
2724	1.120	0.100	71.2		
2725	1.500	0.100	95.3		
2726	2.000	0.100	117.5		
2727	2.500	0.100	284.9		
2728	3.500	0.100	365.1		

Source cladding: 304 SS

Am-241, maximum activity (model 2723-A): 3 Ci

External physical dimensions were determined by measurement at a licensee's facility. (0.75" OD x 1.12" OL).

Analysis

The Special Form capsule tests (49CFR173.469) that would apply to the MRC 2723-BT capsule are; Impact, Percussion, Heat test, and Immersion test. The only test that would be significantly affected by a 14.5 gram mass increase is the impact test. The potential energy applied to the 2723-BT capsule by the Impact test would be as follows:

$$\text{Potential energy (PE}_{\text{Impact}}) = 900 \text{ cm} \times (38.6 \text{ g} + 14.5 \text{ g}) = 47,800 \text{ cm-grams}$$

The potential energy applied to the 2723-BT capsule by the Percussion test is as follows:

$$\text{PE}_{\text{percussion}} = 100 \text{ cm} \times 1,400 \text{ grams} = 140,000 \text{ cm-grams}$$

A comparison of the different potential energies applied to the 2723 and 2723-BT capsule indicates that 2.9 times as much energy is applied by the Percussion test. Since the 2723 capsule passed the Percussion test, it is my engineering judgment that the 2723-BT capsule would have passed the 9 m Impact test. Therefore it is my opinion that since the MRC 2723 capsule was shown to be Special Form material (USA/0043/S), then the MRC 2723-BT capsule is special form as well.

Conclusions

Historically, special form equivalency documentation submitted to the US DOT for approval has consisted predominantly of comparisons to similar sources of known manufacture. Therefore, it has been concluded by comparison to similar sources per 49CFR173.469, that the subject source capsule (MRC 2723-BT) would meet special form criteria.

J.A. Tompkins, CHP
OSR Project Engineer

JAT/jja

Cy: RRES-SA File
OSR File