71-9263

spec
SOURCE OF QUALITY

ATTN: Director, Spent Fuel Project Office
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

November 13, 2009

Subject: Certificate of Compliance Revision Request
SPEC-150 Transport Package, Certificate Number USA/9263/B(U)-96

Dear Sirs:

Source Production and Equipment Co., Inc. (SPEC) submitted a request on October 19, 2009 for timely renewal and revision to the certificate which is due to expire on June 30, 2010. We have one supplemental request at this time. We are requesting the addition of two more radionuclides to the approved contents, ^{75}Selenium and ^{169}Ytterbium. These radionuclides will be contained, secured and locked within the SPEC-150 in exactly the same manner as the ^{192}Iridium sealed sources.

Neither of these radionuclides is fissionable. In addition, ^{75}Selenium and ^{169}Ytterbium weigh less, have a lower decay heat rate, and lower exposure rates. Therefore there will be no adverse affect on the SPEC-150 package's ability to acceptably contain and shield the additional isotopes and lower gamma ray energies.

This request is similar to the request that NRC approved in 2006 to add ^{75}Selenium and ^{169}Ytterbium to the approved contents for the SPEC Model C-1, Certificate of Compliance No. 9036, Revision No. 11. The capacity of the C-1 is 300 curies vs 150 curies for the SPEC-150. At that time, NRC stated in the Safety Evaluation Report that "The staff also performed a simple MicroShield test to verify that any dose-rates created by 300Ci of Selenium-75 or Ytterbium-169 would be bounded by 300Ci of Iridium-192.".

An in depth analysis of these issues is attached. Should you require any additional information please do not hesitate to contact me.

Sincerely,

Kelley Richardt

Kelley Richardt
Regulatory and Quality Manager

Enclosure: Supplemental Renewal Application dated November 13, 2009

NMSS01

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SUPPLEMENTAL RENEWAL APPLICATION
for
NRC CERTIFICATE OF COMPLIANCE
USA/9263/B(U)-96

November 13, 2009
Revision (1)

Model SPEC-150
Type B(U) Radioactive Material Package

SOURCE PRODUCTION AND EQUIPMENT CO., INC.
113 Teal Street St. Rose, Louisiana 70087

Pressure and Heat of Decay:

In our 1999 application (section 1.3.4 F., 2.4.7, 2.4.8, 3.1, and 4.2.2), we state that the heat of decay for 150 curies of Ir-192 is infinitesimal, and that the void space in the source capsule is negligible, therefore pressure build up is not a factor. The following analysis demonstrates that the heat of decay for Se-75 and Yb-169 is less than that for Ir-192. Therefore, pressure build up will not be a factor for either of these two additional radioisotopes.

The total decay heat rate (Power) generated from a source is the product of the energy released per decay (Q) and the activity of the source. The decay heat rate can be calculated by multiplying the Q-Value for the radionuclide by disintegrations per second by the conversion constant.

A good reference for the Q-Values for radionuclides (the total energy released in the transformation from the Ground-State of the parent radionuclide to the Ground-State of the daughter radionuclide) is the Brookhaven National Laboratory site (http://www.nndc.bnl.gov/nudat2/indx_dec.jsp). This site provides the following data:

Parent Radionuclide	Daughter Radionuclide	Decay Type	Decay Fraction	Q-Value (MeV)
^{192}Iridium	^{192}Osmium	EC	4.87%	1.0462
	^{192}Platinum	β^-	95.13%	1.4597
^{75}Selenium	^{75}Arsenic	EC	100%	0.8636
^{169}Ytterbium	^{169}Thulium	EC	100%	0.9080

Using the conversion constant of 1.602×10^{-13} W-s/MeV, the decay heat generation rates for the radionuclides of interest are:

Radionuclide	Decay Heat Rate (mW/Ci)	Decay Heat Rate for 150Ci
^{192}Iridium	8.53	1.28 Watts
^{75}Selenium	5.12	0.77 Watts
^{169}Ytterbium	5.38	0.81 Watts

Clearly, the decay heat generated by ^{75}Selenium and ^{169}Ytterbium sources is lower than the decay heat generated by an equivalent activity ^{192}Iridium source. Consequently, the effect of decay heat generation for the source capsules and SPEC-150 packages containing ^{75}Selenium and ^{169}Ytterbium sources will be less than when containing ^{192}Iridium sources of equivalent activity.

Exposure Rates

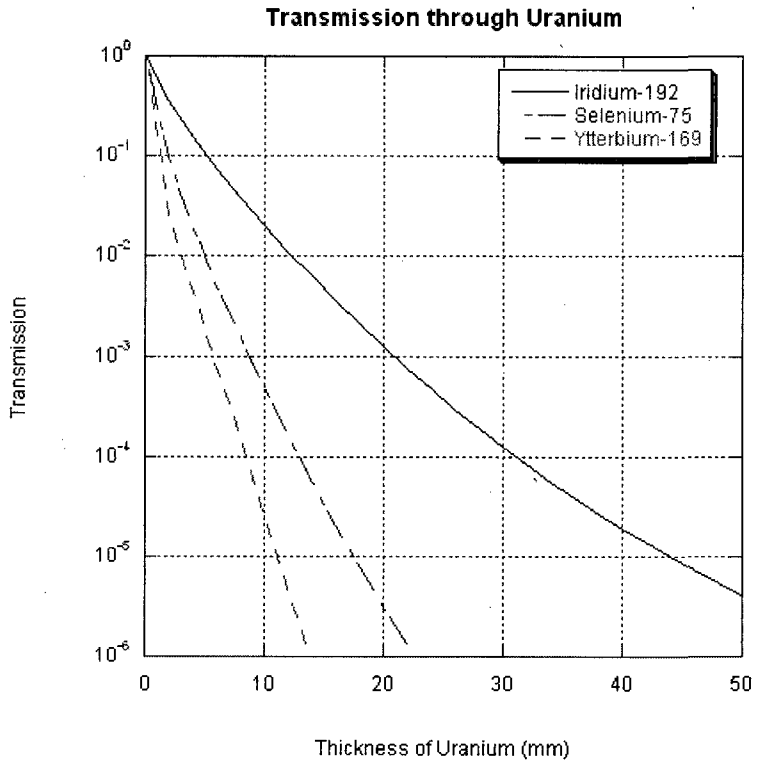
In our 1999 application (sections 2.4.11, 5, 5.1, 5.2, 5.3 and 5.6), we state that the exposure rate for the SPEC-150 when loaded with ^{192}Iridium is acceptable. Those values would be even lower for Se-75 and Yb-169 as their exposure rates are less than those for Ir-192.

The Specific Gamma Ray Constants and outputs per curie for ^{75}Selenium and ^{169}Ytterbium are lower than those for ^{192}Iridium:

Radionuclide	Specific Gamma Ray Constant (R m^2/h Ci)
^{192}Iridium	0.480
^{75}Selenium	0.203
^{169}Ytterbium	0.125

Therefore, for equivalent activity, ^{75}Selenium and ^{169}Ytterbium sources will exhibit lower unshielded exposure rates than for an equivalent activity source of ^{192}Iridium.

Additionally, the photon energies of ^{75}Selenium and ^{169}Ytterbium are generally lower than those of ^{192}Iridium. Therefore, the photons from ^{75}Selenium and ^{169}Ytterbium are more greatly attenuated by a given thickness of shielding than the photons of ^{192}Iridium. The attached figure shows the relative transmission of photons from each of these radionuclides through Uranium:



This demonstrates that the shielding thickness that is sufficient for ^{192}Iridium will be more efficient for the attenuation of photons from ^{75}Selenium and ^{169}Ytterbium.

Consequently, because of the lower specific gamma ray constant and the greater shielding efficiency, the exposure rates on the outside of a SPEC-150 package containing ^{75}Selenium or ^{169}Ytterbium will be substantially lower than the exposure rates from ^{192}Iridium for an equivalent activity.

Weight: In the discussion of the inner packaging contents (section 1.3.4 D.), we state that the weight of the iridium pellets is negligible, the two new isotopes weigh even less than iridium.

Radioisotope	Ir-192	Se-75	Yb-169
grams / cm^3	22.5	4.79	6.96

Conclusion:

The only difference between the ^{192}Iridium sources that the SPEC-150 is approved to contain and the proposed ^{75}Selenium and ^{169}Ytterbium sources is the radioisotope. As fabricated, the ^{75}Selenium and ^{169}Ytterbium sources will weigh slightly less, have a lower decay heat rate, lower exposure rates, and lower photon energies than ^{192}Iridium. Therefore there will be no adverse affect on the SPEC-150 packages ability to acceptably contain the additional isotopes and shield the lower gamma ray energies.