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February 22, 2018

The Honorable Kristine L. Svinicki, Chairman
U.S. Nuclear Regulatory Commission
Mail Stop O-16B33
Washington, DC 20555-0001

Re: Request for NRC Designation of an Exempt Quantity for Californium-257

Dear Chairman Svinicki:

This letter is to request action by the Nuclear Regulatory Commission to designate an exempt quantity for the radioisotope Californium-252 to facilitate the production and availability of exempt neutron check sources, which are needed in the areas of clinical radiology safety and neutron detector/source research for homeland security needs.

The attached summary sheet outlines the background and need for this designation.

I apologize for starting at the top of the Commission, but it was not clear where such a request should be submitted to the NRC. I trust that you will forward it to the appropriate entity within the NRC. Thank you for addressing this need.

Sincerely,

Daniel R. Knapp

Daniel R. Knapp, Ph.D.
Distinguished University Professor Emeritus

Enclosure: Proposal for designation of Californium-252 exempt quantity.

Request to NRC for Designation of an Exempt Quantity for Californium-252.

The Need – There is presently no source in the U.S. for exempt neutron detector check sources. Californium-252 would be the most obvious isotope for such sources, but there is presently no designated exempt quantity for Californium-252. The lack of such check sources is a significant problem in at least two areas:

1. Safety Monitoring of Clinical Particle Accelerators - Particle accelerators used for clinical cancer therapy are routinely monitored for extraneous neutron production as a safety precaution. This monitoring is typically done by radiation safety staff of the institution or by a contractor, typically using a Helium-3 based neutron detector (e.g. a so called "Bonner Ball" detector using a Helium-3 detector tube in a spherical moderator). In most cases, the personnel doing this monitoring do not have access to a positive control check source. Typically the detectors used are sent to the detector vendor for function check and calibration at two year intervals. Without a positive control check source, a defective detector could give false negative readings. For example, if a detector were damaged in shipment back from the vendor check and calibration, it could produce false negative readings for an entire next two years of safety checks. Readily available exempt check sources would solve this problem.
2. Positive Control Testing of Neutron Detectors in Neutron Detector and Neutron Source Research – Homeland security needs have driven a resurgence of research on new approaches to neutron detection and nonisotopic neutron production for detection of clandestine nuclear materials using both passive and active interrogation methods. There is need in this research for readily available neutron detector check sources.

Background - NRC Regulations (10 CFR) § 30.71 Schedule B lists Exempt Quantities for an extensive number of radioisotope by-product materials. Californium-252 is presently the only readily available neutron producing isotope. Californium-252 is not listed explicitly in Schedule B. At the end of Schedule B, it is stated, "Any radioactive material not listed above other than alpha emitting radioactive material.... 0.1 (microcuries)." Other alpha emitters listed in Schedule B, e.g. Polonium-210 have an exempt quantity of 0.1 microcuries. Californium-252 is an alpha emitter. It undergoes alpha decay 96.9% of the time to form Curium-248 while the remaining 3.1% of decays are spontaneous fission, producing an average of 3.7 neutrons per spontaneous fission. It is this neutron production that makes Californium-252 useful as a neutron source. Exempt Quantity Use (10 CFR 30.18) is stated in the regulations as "Exempt quantity use includes the use of small quantities of byproduct material such as in check sources and calibration standards for commercial distribution." The absence of a stated exempt quantity for Californium-252 has precluded commercial production and availability of exempt Californium-252 neutron check sources.

Californium-252 is produced in the U.S. at Oak Ridge National Laboratory, and Californium-252 sources are produced and sold in the U.S. by commercial vendors (Frontier Technology Corp., Xenia, OH; QSA Global Inc., Burlington, MA). Commercial Californium-252 neutron sources are typically much larger and more expensive than check sources and are used for applications such as nuclear reactor startup and oil well logging. There are no easily available small quantity neutron check sources. Vendors have at times made old decayed Californium-252 sources available to universities, but current regulations covering these sources require specific licensing and expensive shipping containers.

Requested NRC Action – It is requested that the NRC designate an exempt quantity for Californium-252 to facilitate the production and availability of needed exempt neutron test sources.

Submitted by Daniel R. Knapp, Ph.D.
Medical University of South Carolina
February 22, 2018

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