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January 16, 2018

Mr. Michael Conroy
Radioactive Materials / Research and Development
Division of Engineering and Research
Office of Hazardous Materials Safety
U.S. Department of Transportation
1200 New Jersey Ave., S.E.
Washington, D.C. 20590

RE: Request for additional information for review of Nordion F-522 package

Dear Mr. Conroy,

Please find attached, a response that addresses the latest NRC comments on Nordion's F-522 transport package endorsement request. The remaining concern was shared with Nordion in an email from yourself to Nordion on December 7, 2017. This was further clarified in a conference call I had with the NRC on December 14, 2017.

The question surrounds the shielding model and control that Nordion proposes to address the package contents, specifically radioactive impurities that will accompany Mo-99. Nordion has compiled the attached response based on feedback from the NRC and the Regulatory Issues Summary 2013-04.

I am also including an affidavit requesting that this letter and attached response be withheld from the public domain.

Should you have any questions, please do not hesitate to contact me at (613) 592-3400 extension 2658, or e-mail at greg.fulford@nordion.com.

Yours truly,

Greg Fulford
Nuclear Transportation Specialist
Nordion

Encl.

Response to NRC RAI Question 3, in support of F-522 review

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Nordion's further response to Question 3 from the NRC request for additional information.

As per the guidance provided by RIS 2013-04, an isotopic bounding case is proposed to evaluate the potential impurities that are expected from the Mo-99 production process. These bounding limits are in addition to the 1850 GBq I-132 shielding equivalent limit previously discussed in the F-522 SAR so that both will need to be met to satisfy the endorsement.

During the production of Mo-99 at the MURR site, extraction processes will remove most impurities from the fission of uranium targets. Several gamma spectroscopy characterization experiments will be performed prior to the first shipment to demonstrate that the contents are below the following proposed limits:

Table 1: Activity bounding limits for Mo-99 process impurities at MURR

Isotope	Activity Bounding limit (TBq)	A ₂ value (TBq)	A ₂ ratio

^aThe A₂ value for Sb-127 is not found in the A values table from 49 CFR 173.435. The 0.02 A₂ value is taken for a general beta and gamma generating radionuclide from Table 7 of 49 CFR 173.433.

Please note that these activity limits are bounding limits for each individual isotope and the total activity will be lower than the 1850 GBq I-132 shielding equivalent. Small amounts of other fission impurities may also be present in quantities below their A₂ value and have been omitted as they will have no impact to the shielding of the transport container.



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The A_2 ratios for each impurity are included in Table 1 and are low when compared with the Mo-99 ratio of 610 (from 366 TBq). Only Sb-127 has a relatively high ratio of 370 when compared to the other impurities as its A_2 value is not found in the table from 49 CFR 173.435 and instead the general limit is used. The generally low ratios for the impurities demonstrate the safety of the impurity contents and the relatively low risk of release in an accident condition when compared to the Mo-99 contents.

The 1850 GBq I-132 equivalent limit is also conservative in respect to the regulatory surface dose limits. In a previous response to the USNRC, the highest expected dose was erroneously stated as

[REDACTED]

This is about 2/3 of the regulatory limit, providing an additional margin of safety.