



## **RADCALC SOFTWARE ADVISORY**

Issue Number: DOE/OPT/SA-04

Date: March 03, 2015

### **Overly Conservative Regulatory Values for U-235m and Four Other Radionuclides**

RADCALC 4.1 performs calculations relevant to transportation of radioactive materials in accordance with 49 CFR 173.433 and 49 CFR 173.435. For isotopes flagged with footnote (a) in 49 CFR 173.435, daughter products meeting the secular equilibrium requirements in 49 CFR 173.433 are omitted from the A1 and A2 sum-of-fractions calculations because their contributions to the radiation dose absorbed by the receptor are included in the dose from the parent isotope.

The RADCALC 4.1 methodology may calculate overly conservative A1 and A2 results in situations where footnote (a) was inadvertently omitted from isotopes where it should have been assigned during preparation of the regulations, or where advances in nuclear data have identified daughter products in secular equilibrium that were unknown at the time the dose calculations that serve as the basis for 49 CFR 173.435 were prepared. Examples of decay chains for which RADCALC 4.1 calculates overly conservative A1/A2 values include:

- As-73 decay to Ge-73m
- Pd-109 or Cd-109 decay to Ag-109m
- Tm-167 decay to Er-167m
- Os-191 decay to Ir-191m
- Pu-239 decay to U-235m

Overly conservative A1 and A2 results calculated by RADCALC 4.1 create undue difficulty for the radioactive material shipper due to excessive A1 and A2 values, ACEM, and ALEC values, and RQs as well. The following procedure is recommended to those shipping isotopes on the above list to eliminate problematic daughters:

1. Prepare a RADCALC 4.1 case using normal procedures, including the appropriate decay period.
2. Execute the RADCALC case.
3. Export the Source When Sealed to a spreadsheet or text file.
4. Delete the problematic daughter from the exported source term (U-235m, etc).
5. Import the source term back into RADCALC and zero the decay time.
6. Execute the RADCALC case.
7. Utilize the revised RADCALC outputs to prepare shipment documentation using normal procedures.

**What will the Office of Packaging and Transportation do about the proposed correction?** The Office of Packaging and Transportation will ensure consideration of these changes to be incorporated in RADCALC 4.2.

#### **Need more information?**

If you need additional information, please contact any of the following resources;

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