RADCALC - An Analytical Tool for Shippers of Radioactive Material and Waste, Including Transuranic Waste Transportation and Hydrogen Gas Determinations

The U.S. Department of Energy (DOE) ships radioactive materials in support of its research and development, environmental restoration and cleanup, and National defense activities. Similar to other shippers, DOE follows the necessary and applicable International, Federal, State, and local government requirements. The Radcalc software program was developed to assist DOE sites' packaging and transportation personnel in packaging and transportation determinations (*e.g. regulatory classification, decay heat, radioactivity, and hydrogen gas generation*) for shipment of radioactive materials and waste.

Radcalc is a user-friendly NQA-1 validated software program to provide consistency, accuracy, reproducibility, timeliness, quality, compliance and appropriate documentation to shippers of radioactive materials and waste at DOE facilities nationwide.

Hundreds of shippers and engineers throughout the DOE complex routinely use this software to automate various determinations and to validate compliance with the regulations.

Radcalc performs transportation classification determinations based on selected U.S. Department of Transportation (DOT) definitions and methodologies outlined in 49 CFR, Subchapter C. Radcalc calculations are also in accordance with selected methods prescribed by DOE, the U.S. Nuclear Regulatory Commission (NRC), the U.S. Environmental Protection Agency, and the International Commission on Radiological Protection. The table below lists these capabilities.

Radcalc 4.1 Packaging and Transportation Classification Capabilities

Radioactive	49 CFR 173.403, 173.433, 173.435, 173.436
Type A or Type B	49 CFR 173.403, 173.433, 173.435
Effective A_1 or A_2 for mixture	49 CFR 173.433
Limited quantity	49 CFR 173.403, 173.421
Low specific activity	49 CFR 173.403, 173.427
Highway route controlled quantity	49 CFR 173.403
Fissile	49 CFR 173.403
Fissile excepted	49 CFR 173.453
Reportable quantity	49 CFR 172.101, Table 2 to Appendix A
Transuranic	DOE M 435.1-1, Chg. 1
^{239}Pu fissile gram equivalent	CH-TRAMPAC, Rev. 2, NRC Docket No. 71-9218 (WTS 2005)
^{239}Pu-equivalent activity	DOE/WIPP-02-3122, Rev. 6.2
Container category I, II, or III	Regulatory Guide 7.11 (NRC 1991)
^{239}Pu dose-equivalent curie	ICRP Publications 71/72; FGR11
Facility/onsite shipment Hazard Category 2 and Category 3	DOE-STD-1027, Chg 1

Radcalc also categorizes the radioactive contents in three levels of safety (i.e., Category I, II, or III) in accordance with NRC's Regulatory Guide. Radcalc calculates dose-equivalent curie values. Radcalc also performs unit conversions and radioactive decay (based on a library of 1927 radionuclides), decay heat, radiolytic production of hydrogen gas, and helium production from alpha decay.

Radcalc has the capability to automatically import and export data from your clipboard or file to reduce entry errors and allows information to be entered, evaluated and reported within minutes.

System Requirements

At a minimum, Radcalc requires:

- PC-compatible computer
- Pentium processor 90 MHz, equivalent, or higher
- 128 MB memory (required); 256 MB (recommended)
- Microsoft Windows 2000, XP, or Vista Professional operating system
- A printer driver installed on the operating system (even if there is no printer)
- Internet Explorer 6.0, Service Pack 1 or newer version installed
- Microsoft Jet 4.0, Service Pack 8 database engine installed
- Microsoft Data Access Components (MDAC), version 2.7, or newer installed
- Microsoft .NET redistributable framework, version 1.1 or newer installed
- Windows Management Instrumentation Core, Version 1.5 or newer.

Radcalc has been verified and validated in accordance with ASME NQA-1-2000, *Quality Assurance Requirements for Nuclear Applications*, "Subpart 2.7, Quality Assurance Requirements for Computer Software for Nuclear Facility Operations," and may be used for safety–related calculations within the limitations of the software.
Radcalc is revised periodically to reflect changes in the regulations and customer requirements; however, it is the shipper's responsibility to verify that current regulations are properly interpreted and implemented. The effective use of software by DOE sites contributes towards minimizing risk involved in radioactive material shipments and assuring the safety of workers and the public.

Radcalc Steering Group (RSG)

The Office of Transportation has chartered an advisory group composed of Federal and/or contractor packaging experts from DOE/EM sites. The RSG objective is to provide technical input in identifying and resolving issues. The RSG mission is to increase accuracy, consistency, and cost- effectiveness of radioactive material packaging documentation through Radcalc use by site's transportation personnel. For more information about RSG, please contact the Office of Packaging and Transportation.

Additional information may be obtained from:
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http://www.em.doe.gov/Pages/Transportation.aspx

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