

Radionuclide Safety Data Sheet

RADIONUCLIDE: Ra-223

FORMS: Soluble

PHYSICAL CHARACTERISTICS

Half-life: 11.44 Days

DECAY EMISSIONS

Gammas / X-rays		Betas / Positrons (+) / Electrons		Alphas	
E (keV)	%	E (keV, max)	%	E (keV)	%
269.5	13.3	171.1	8.47	5747.0	8.90
83.8	24.3	55.8	18.6	5716.2	51.2
81.1	14.7	45.8	12.8	5606.7	25.0
11.7	22.5	23.9	7.67	5539.8	8.90

Only the four most likely emissions of each type are included. Emission must be > 10 keV and > 1% frequency.

NIH HAZARD CATEGORY

C – level (low hazard): n/a

B – level (moderate hazard): n/a

A – level (high hazard): Any Quantity of Ra-223 - DRS protocol required

EXTERNAL RADIATION HAZARDS

Gamma dose rate, point source @ 1 foot, 1 mCi:

Beta dose rate to skin, point source @ 1 foot, 1 mCi:

Contamination skin dose, uniform deposit of 1 $\mu\text{Ci}/\text{cm}^2$

INTERNAL RADIATION HAZARDS

Annual Limit on Intake:

Ingestion: 5 μCi

Inhalation: 0.7 μCi

The value(s) above indicate the activity taken into the body that would result in either 5 rem to the whole body (CEDE) or 50 rem to an organ or tissue (CDE).

SHIELDING

Gammas/X-rays:

4.22 mm Pb will decrease exposure by 90%.

Betas/electrons:

0.3 mm Lucite will stop all electrons.

DOSIMETRY AND BIOASSAY REQS

Dosimetry may be required when working with Ra-223. Fill out Dosimetry Evaluation Form, and DRS will determine if it is required.

Urine bioassay may be required after spills, contamination, or other abnormal occurrences.

SPECIAL PRECAUTIONS:

1. Contamination monitoring for Ra-223 should be performed with a Zinc Sulfide probe. Typical probe efficiency is 20%.
2. Always wear lab coat, gloves, and protective eyewear when handling Ra-223.
3. Source vials must be secured in a locked container when not in use.
4. Ra-223 waste must be segregated from long half-life radionuclides (> 120 days). Multi-hazard waste must be segregated from medium and long half-life radionuclides (> 30 days but $\leq$ 120 days and > 120 days respectively).
5. A DRS protocol is required to possess any activity of Ra-223.
6. Ra-223 decays to Radium gas which can build up in the source container. Vent source container in a fume hood before use.

References:

- Brookhaven National Laboratory, National Nuclear Data Center, Decay Radiation Search, Version 3/25/2022.
- National Institutes of Health Division of Radiation Safety, DRS-214 Form - Activity Control System - Cumulative Inventory Ceilings, Revised 10/4/2021.
- Nuclear Regulatory Commission, 10 Code of Federal Regulation Part 20 Appendix B.
- National Institute of Standards and Technology, ESTAR: Stopping Power and Range Tables for Electrons, July 2017
- Smith, D., Stabin, M. Exposure Rate Constants and Lead Shielding Values for over 1,100 Radionuclides. Health Physics Journal. March 2012.
- Nuclear Regulatory Commission. Varskin+ Version 1.0
- Stanford Environmental Health and Safety. Safety Fact Sheets. <https://ehs.stanford.edu/safety-fact-sheets>