

RADIONUCLIDE SAFETY DATA SHEET

RADIONUCLIDE: **Zr-89**

FORMS: Soluble

PHYSICAL CHARACTERISTICS

Half-life: 78.41 Hours

DECAY EMISSIONS

Gammas / X-rays		Betas / Positrons (+) / Electrons		Alphas	
E (keV)	%	E (keV, max)	%	E (keV)	%
909.2	99.04	902 (+)	22.74		
511	45.48	12.7	19.47		
15	26.74				
14.9	13.88				

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): ≤ 1.5 mCi - No DRS protocol required

B – level (moderate hazard): > 1.5 mCi and ≤ 3 mCi - DRS approval required for ceiling increase

A – level (high hazard): > 3 mCi - 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: 2 mCi

Inhalation: 2 mCi

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:

3 cm Pb will decrease exposure by 90%

Betas/electrons:

3.4 mm Lucite will stop all betas. Lead may be needed if Bremsstrahlung is detectable through plastic shielding.

DOSIMETRY AND BIOASSAY REQS

Ring and whole-body dosimetry should be worn while working with Zr-89.

Whole body count may be required after spills, contamination, or other abnormal occurrences.

SPECIAL PRECAUTIONS:

1. Contamination monitoring for Zr-89 should be performed with a Pancake GM probe. Typical GM probe efficiency is 3%.
2. Zr-89 should be handled with remote tools when possible.
3. Ensure Zr-89 is properly shielded when in storage and use. Shield waste containers containing Zr-89 waste.
4. Always wear lab coat, gloves, and protective eyewear when handling Zr-89
5. Source vials must be secured in a locked container when not in use.
6. Zr-89 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 ≤ 120 days and > 120 days respectively).

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
- Ehs.stanford.edu/reference Radionuclide Fact Sheets