

RADIONUCLIDE SAFETY DATA SHEET

RADIONUCLIDE: Mo-99

FORMS: Soluble

PHYSICAL CHARACTERISTICS

Half-life: 65.924 hours

DECAY EMISSIONS

Gammas / X-rays		Betas / Positrons (+) / Electrons		Alphas	
E (keV)	%	E (keV, max)	%	E (keV)	%
18.4	1.8	19.5	3.36		
181.1	6.1	437.2	16.4		
366.4	1.2	848.7	1.16		
739.5	12.2	1215.1	82.2		

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): ≤ 12 mCi - No DRS protocol required

B – level (moderate hazard): > 12 mCi and ≤ 24 mCi - DRS approval required for ceiling increase

A – level (high hazard): > 24 mCi - DRS protocol required

EXTERNAL RADIATION HAZARDS

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

2 mrem/hr

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

400 mrem/hr

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

7000 mrem/hr

INTERNAL RADIATION HAZARDS

Annual Limit on Intake:

Ingestion: 1 mCi

Inhalation: 1 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:

23.4 mm Pb will decrease exposure by 90%.

Betas/electrons:

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

DOSIMETRY AND BIOASSAY REQS

Dosimetry may be required when working with Mo-99. 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:

- Contamination monitoring for Mo-99 should be performed with a pancake GM probe. Typical GM probe efficiency is 16%.
- Mo-99 should be handled with remote tools when possible.
- Ensure Mo-99 is properly shielded when in storage and use. Shield waste containers containing Mo-99 waste.
- Always wear lab coat, gloves, and protective eyewear when handling Mo-99.
- Source vials must be secured in a locked container when not in use.
- Mo-99 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).
- Mo-99 is likely in secular equilibrium with Tc-99m. Dose rates and meter efficiencies given use this assumption.

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.
- Delacroix, D., Guerre, J. P., Leblanc, P., Hickman, C., Radionuclide and Radiation Protection Data Handbook 2002.
- 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.
- Ehs.stanford.edu/reference Radionuclide Fact Sheets