

RADIONUCLIDE SAFETY DATA SHEET

RADIONUCLIDE: Fe-59

FORMS: Soluble

PHYSICAL CHARACTERISTICS

Half-life: 44.49 days

DECAY EMISSIONS

Gammas / X-rays		Betas / Positrons (+) / Electrons		Alphas	
E (keV)	%	E (keV, max)	%	E (keV)	%
142.7	1.02	130.7	1.31		
192.3	3.08	273.4	45.3		
1099.2	56.5	465.7	53.1		
1291.6	43.2				

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): ≤ 6 mCi - No DRS protocol required

B – level (moderate hazard): > 6 mCi and ≤ 12 mCi - DRS approval required for ceiling increase

A – level (high hazard): > 12 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: 800 μCi

Inhalation: 300 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:

43.1 mm Pb will decrease exposure by 90%.

Betas/electrons:

1.4 mm Lucite will stop all electrons. Lead may be needed if Bremsstrahlung is detectable through Lucite.

DOSIMETRY AND BIOASSAY REQS

Dosimetry may be required when working with Fe-59. Fill out Dosimetry Evaluation Form, and DRS will determine if it is required.

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

SPECIAL PRECAUTIONS:

1. Contamination monitoring for Fe-59 should be performed with a Pancake GM probe. Typical GM probe efficiency is 9%.
2. Fe-59 should be handled with remote tools when possible.
3. Ensure Fe-59 is properly shielded when in storage and use. Shield waste containers containing Fe-59 waste.
4. Always wear lab coat, gloves, and protective eyewear when handling Fe-59
5. Source vials and sealed sources must be secured in a locked container when not in use.
6. Fe-59 waste must be segregated from long half-life radionuclides (> 120 days). Multi-hazard waste must be segregated from short and long half-life radionuclides (≤ 30 days and > 120 days respectively).
7. Fe-59 has been found as an activation product in items experiencing the neutron flux seen in the NIH Cyclotron facility. DRS clearance is required before releasing items stored in the cyclotron vaults.

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.
- Smith, D., Stabin, M. Exposure Rate Constants and Lead Shielding Values for over 1,100 Radionuclides. Health Physics Journal. March 2012.
- Delacroix, D., Guerre, J. P., Leblanc, P., Hickman, C., Radionuclide and Radiation Protection Data Handbook 2002.
- National Institute of Standards and Technology, ESTAR: Stopping Power and Range Tables for Electrons, July 2017
- Stanford Environmental Health and Safety. Safety Fact Sheets. <https://ehs.stanford.edu/safety-fact-sheets>
- [Ehs.stanford.edu/reference](https://ehs.stanford.edu/reference) Radionuclide Fact Sheets