Iron-59

1. Radioactive Material Identification

Common Names: Iron-59

Atomic Number: 26

Chemical Form: Soluble

Chemical Symbol: Fe-59 or ^{59}Fe

Mass Number: 59 (33 neutrons)

2. Radiation Characteristics

Physical half-life: 44.51 days

Specific Activity (TBq/g): 89.1

Principle Emissions	^{E}Max (keV)	^{E}eff (keV)	Dose Rate (mrad/h/µCi at 1m)	Shielding Required
Beta* (β)	0.466 (53%) 0.273 (45%) 0.131 (1%)	0.149 0.081 0.036	397	0.16cm Plexiglas, 0.08cm Aluminum
Gamma (γ) / X-rays	1.292 (43%) 1.099 (57%) 0.192 (3%)	-	20	18cm Concrete, 3.1cm Lead
Alpha (α)	-	-	-	-
Neutron (n)	-	-	-	-

Progeny: Cobalt-59, Co-59

3. Detection and Measurement

Methods of detection (in order of preference):

1. Liquid Scintillation Counting is to be used when conducting wipe tests for analyzing contamination.
2. Ion chamber survey meter (Fluke)
3. A radiation survey meter equipped with an energy-compensated Geiger Mueller pancake/frisker detector. (Ludlum)

Dosimetry

Whole Body __x___ Skin_____ Extremity __x____ Neutron _____

Internal: In the event of loss of containment by the sealed source, all precautions should be taken to prevent inhalation or ingestion of the material. Urine bioassay (taken 4 to 24 hours after event) or whole body counting may be required for suspected skin contamination or ingestion.

Critical Organ(s): Spleen (blood), lungs (inhalation) and LLI (ingestion)

Annual Dose Limits: Non-radiation workers: 0.1 rem per year
Radiation workers: 5 rem per year, 10 rem total over five years
Pregnant radiation workers: 0.4 rem over the balance of the pregnancy

4. Preventative Measures

Engineering Controls: Use shielding when handling Fe-59.

Personal Protective Equipment: For normal handling of unsealed sources only. Always wear disposable gloves, safety glasses, and whatever personal protective equipment and clothing appropriate to the material handled.

Special Storage Requirements: Store Fe-59 behind lead shielding, lead bricks may be necessary. Use tools to handle Fe-59 sources and contaminated objects; avoid direct hand contact.

5. Control Levels

Oral Ingestion	**Inhalation**	
ALI (kBq)	ALI (kBq)	DAC (Bq/ml)
30,000 (D)	11,000 (D) 19,000 (W)	0.0037 (D) 0.0074 (W)
Exemption Quantity (EQ):	370,000 Bq	

6. Non-radiological Hazards

Prolonged exposure to airborne particles may result in cell damage, with the potential for subsequent cancers.

OSHA Permissible Exposure Limit (PEL):
0.1 mg/m^3

7. Emergency Procedures

Personal Decontamination Procedures

- Remove loose contamination. Use care to prevent the spread of contamination and be extra careful around wounds
- Wash contaminated areas. Use mild soap or detergent initially; use a mild abrasive soap for more persistent contamination
- Do not abrade skin, only blot dry

Spill and Leak Control

- Alert everyone in the area
- Confine the problem or emergency (includes the use of absorbent material)
- Clear area
- Summon aid
- If a release of powdered or gaseous material, evacuate all personnel from room immediately and turn off any equipment that needs constant attention. Prevent others from entering the room.

Damage to Sealed Radioactive Source Holder

- Evacuate the immediate vicinity around the source holder
- Place a barrier at a safe distance from the source holder (minimum 5 meters)
- Identify area as a radiation hazard
- Contact emergency number posted on local warning sign

Suggested Emergency Protective Equipment

- Gloves
- Footwear Covers
- Safety Glasses
- Outer layer or easily removed protective clothing (as situation requires)