IODINE-129
HANDLING PRECAUTIONS

^{129}I
1.57×10^{7} y
ß- 0.152
γ 0.040
E 0.152

PHYSICAL DATA

Principal Radiation Emissions[1]

Maximum Beta Energy:	0.152 MeV (100%)
Gamma:	0.040 MeV (7.5%)
$K\alpha_1$ X-ray:	0.030 MeV (37%)
$K\alpha_2$ X-ray:	0.029 MeV (20%)
Kβ X-ray:	0.034 MeV (13.2%)
L-1 Internal Conversion Electrons:	0.034 MeV (10.7%)

Maximum Range of Beta in Air: 23 cm (9 in.)[2]
Unshielded Exposure Rate at 1 cm from a 1 mCi Point Source: 0.65 R/h[3]

Unshielded Exposure Rate at 1 m from a 1 MBq Point Source: 0.46 nC/kg/h

Half-Value Layer for Lead Shielding: 0.02 mm (0.001 in.)[3]

OCCUPATIONAL LIMITS[3]

Annual Limit on Intake: 5 µCi (180 kBq) for oral ingestion and 9 µCi (330 kBq) for inhalation.

Derived Air Concentration: 4×10^{-9} µCi/mL (150 Bq/m^3).

DOSIMETRY

The low energy beta emissions from millicurie (37 MBq) quantities of ^{129}I do not present a significant external exposure hazard because they barely penetrate the outer dead layer of skin. Gamma and x-ray emissions from ^{129}I can present a penetrating external exposure hazard. Individual iodine metabolism can vary considerably[5]. It may be assumed that 30% of an uptake of iodine is translocated to the thyroid and 70% directly excreted in urine[5]. Iodine in the thyroid is retained with a biological half-life of 120 days in the form of organic iodine. Organic iodine is assumed to be uniformly distributed in all organs and tissues of the body except the thyroid, and retained with a biological half-life of 12 days[5]. 10% of organic iodine is directly excreted in feces and the rest is returned to the transfer compartment as inorganic iodine[5]. The uptake of ^{129}I to the thyroid is in practice limited by the physical mass of ^{129}I due to its very low specific activity.

General Handling Precautions for Iodine-129

1. Designate area for handling ^{129}I and clearly label all containers.
2. Store millicurie (37 MBq) quantities of ^{129}I in containers surrounded by 3-mm (0.125-in.) thick lead.
3. Wear extremity and whole body dosimeters while handling 10 mCi (370 MBq) quantities of ^{129}I.
4. Use shielding to minimize exposure while handling ^{129}I.
5. Use tools to indirectly handle unshielded multi-millicurie (multi-37 MBq) sources and potentially contaminated vessels.
6. Prohibit eating, drinking, smoking and mouth pipetting in room where ^{129}I is handled.
7. Use transfer pipettes, spill trays and absorbent coverings to confine contamination.
8. Handle potentially volatile compounds in ventilated enclosures.
9. Handle millicurie (37 MBq) quantities in closed systems vented through activated charcoal traps.
10. Sample exhausted effluent and room air by continuously drawing a known volume through cartridges containing activated charcoal.
11. Wear disposable lab coat, wrist guards and gloves for secondary protection.
12. Select gloves appropriate for chemicals handled.
13. Maintain contamination and exposure control by regularly monitoring and promptly decontaminating gloves and surfaces.
14. Use pancake or end-window Geiger-Mueller detector, thin crystal NaI(Tl) detector or liquid scintillation counter to detect ^{129}I.
15. Submit urine sample for bioassay from 4 to 48 hours after handling ^{129}I to indicate uptake by personnel.
16. Monitor thyroid periodically with a NaI(Tl) detector to determine thyroid dose.
17. Isolate waste in sealed, clearly labeled containers and dispose according to approved guidelines.
18. Establish surface contamination, air concentration and urinalysis and thyroid burden action levels below regulatory limits. Investigate and correct any conditions which may cause these levels to be exceeded.
19. On completing an operation, secure all ^{129}I; remove and dispose of protective clothing and coverings; monitor and decontaminate self and surfaces; wash hands and monitor them again.

Store $Na^{129}I$ solutions at room temperature because freezing results in volatilization. Avoid acidic solutions to minimize volatilization. Some radioiodine compounds may penetrate gloves and skin. Therefore, these compounds should be handled indirectly by using tools and wearing two pairs of gloves. The outer layer of gloves should be changed frequently and whenever they are suspected to be contaminated.

References

1. Kocher, David C., Radioactive Decay Data Tables, Springfield: National Technical Information Service, 1981 DOE/TIC-11026.
2. Kaplan, Irving, Nuclear Physics, New York: Addison-Wesley, 1964.
3. Calculated with computer code "Gamma" utilizing decay scheme data from Kocher(1) and mass attenuation coefficients for lead and mass energy absorption coefficients for air from the Radiological Health Handbook, Washington: Bureau of Radiological Health, 1970. The HVL reported here is the initial HVL for narrow beam geometry.
4. U.S. Nuclear Regulatory Commission. 10CFR 20 Appendix B – Standards for Protection Against Radiation, 1994.
5. ICRP Publication 30, Part 1, Limits for Intakes of Radionuclides by Workers. Pergamon Press, Oxford, 1979.

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