SAFE HANDLING GUIDE

Iodine-131 Handling Precautions

This document contains general information designed to provide a basic understanding of radiation safety. While we believe the information to be accurate, regulatory requirements may change and information contained herein is not tailored to individual needs. A radiation protection specialist should be consulted for specific applications.

^{131}I
8.04 d
ß⁻ 0.606
γ 0.364
0.637
E 0.971

Physical data

Principal radiation emissions[1]
Maximum beta energies: 0.248 MeV (2.1%)
0.334 MeV (7.4%)
0.606 MeV (89.3%)

Gammas: 0.723 MeV (1.8%)
0.637 MeV (7.3%)
0.364 MeV (81.2%)
0.284 MeV (6.1%)
0.080 MeV (2.6%)
X-ray: 0.030 MeV (3.9%)
Maximum range of beta in air: 165 cm (65 in)[2]
Unshielded exposure rate at 1 cm from a 1 mCi point source: 2.16 R/h[3]
Unshielded exposure rate at 1 m from a 1 MBq point source: 1.5 nC/kg/h
Half-value layer for lead shielding: 2.3 mm (0.091 in)[3]

Occupational limits[3]

Annual limit on intake: 30 µCi (1.1 MBq) for oral ingestion and 50 µCi (1.8 MBq) for inhalation

Derived air concentration: 2 x 10^{-8} µCi/ml (740 Bq/m^3)

Dosimetry

Beta emission from ^{131}I can present an external exposure hazard to skin and eyes. Gamma emissions 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 committed dose is significantly reduced due to the short physical half-life of ^{131}I[5].

Decay table

Physical half-life: 8.04 days[1].

To use the decay table, find the number of days in the top and left hand columns of the chart, then find the corresponding decay factor. To obtain a precalibration number, divide by the decay factor. For a postcalibration number, multiply by the decay factor. Visit **www.perkinelmer.com/toolkit** to use our online Radioactive Decay Calculator.

Days

Days	0	1	2	3	4	5	6	7	8	9
0	1.000	0.917	0.842	0.772	0.708	0.650	0.596	0.547	0.502	0.460
10	0.422	0.387	0.355	0.326	0.299	0.274	0.252	0.231	0.212	0.194
20	0.178	0.164	0.150	0.138	0.126	0.116	0.106	0.098	0.090	0.082
30	0.075	0.069	0.063	0.058	0.053	0.049	0.045	0.041	0.038	0.035

PerkinElmer®
For the Better

PerkinElmer has developed the following suggestions for handling Iodine-131 after years of experience working with this beta, gamma and x-ray emitter.

General handling precautions for Iodine-131

1. Designate area for handling ^{131}I and clearly label all containers.
2. Store ^{131}I behind lead shielding.
3. Wear extremity and whole body dosimeters while handling mCi (37 MBq) quantities of ^{131}I.
4. Use shielding to minimize exposure while handling ^{131}I.
5. Do not work over open containers.
6. Use tools to indirectly handle unshielded sources and potentially contaminated vessels.
7. Prohibit eating, drinking, smoking and mouth pipetting in room where ^{131}I is handled.
8. Use transfer pipets, spill trays and absorbent coverings to confine contamination.
9. Handle potentially volatile compounds in ventilated enclosures.
10. Handle millicurie (37 MBq) quantities in closed systems vented through activated charcoal traps.
11. Sample exhausted effluent and room air by continuously drawing a known volume through cartridges containing activated charcoal.
12. Wear lab coat, wrist guards and disposable gloves for secondary protection.
13. Select gloves appropriate for chemicals handled.
14. Maintain contamination and exposure control by regularly monitoring and promptly decontaminating gloves and surfaces.
15. Use pancake or end-window Geiger-Mueller detector, NaI(Tl) detector or liquid scintillation counter to detect ^{131}I.
16. Submit urine samples for bioassay from 4 to 48 hours after handling ^{131}I to indicate uptake by personnel.
17. Monitor thyroid periodically with a NaI(Tl) detector to determine thyroid dose.
18. Isolate waste in sealed, clearly labeled shielded containers and hold for decay.
19. Establish surface contamination, air concentration, urinalysis and thyroid burden action levels below regulatory limits. Investigate and correct any conditions which may cause these levels to be exceeded.
20. On completing an operation, secure all ^{131}I; remove protective clothing and dispose of protective coverings; monitor and decontaminate self and surfaces; wash hands and monitor them again.

Store $Na^{131}I$ 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. Calculated with computer code "Gamma" utilizing decay scheme data from Kocher(1) and mass attenuation coefficient 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.
3. U.S. Nuclear Regulatory Commission. 10 CFR 20 Appendix B – Standards for Protection Against Radiation, 1994.
4. ICRP Publication 30, Part 1, Limits for Intakes of Radionuclides by Workers. Pergamon Press, Oxford, 1979.

PerkinElmer, Inc.
940 Winter Street
Waltham, MA 02451 USA
P: (800) 762-4000 or
(+1) 203-925-4602
www.perkinelmer.com

PerkinElmer®

007035B_01 Jul. 2010