



INDIUM-111

HANDLING PRECAUTIONS

^{111}In 2.83 d EC γ 0.245 E 0.85

PHYSICAL DATA

Principal Radiation Emissions⁽¹⁾

Gammas:	0.171 MeV (90%) 0.245 MeV (94%)
K α X-ray:	0.023 MeV (68%)
K β X-ray:	0.026 MeV (15%)
K Internal Conversion	
Electrons:	0.145 MeV (8%) 0.219 MeV (5%)
K Auger Electron:	0.019 MeV (16%)
L Auger Electron:	0.003 MeV (100%)

Unshielded Exposure Rate at 1 cm from a 1 mCi Point Source: 3.2 R/h⁽²⁾

Unshielded Exposure Rate at 1 m from a 1 MBq Point Source: 2.2 nC/kg/h

Half-Value Layer for Lead Shielding: 0.22 mm (0.01 in.)⁽²⁾

DOSIMETRY

^{111}In presents an external radiation exposure hazard. It may be assumed that 30%, 20%, 7%, 2% and 41% of ^{111}In uptakes in the transfer compartment are translocated to red bone marrow, liver, kidneys, spleen and all other organs and tissues respectively⁽⁴⁾. Indium is assumed to be retained indefinitely, however the committed dose is significantly reduced due to the short physical half-life of ^{111}In ⁽⁴⁾.

OCCUPATIONAL LIMITS⁽³⁾

Annual Limit on Intake: 4 mCi (150 MBq) for oral ingestion and 6 mCi (220 MBq) for inhalation.
 Derived Air Concentration: 3×10^{-6} $\mu\text{Ci/mL}$ (110 kBq/m³).

DECAY TABLE

Physical Half-Life: 2.83 Days⁽¹⁾

To use the decay table, find the number of days in the left hand column and the number of hours along the top 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.

		<i>Hours</i>											
		0	2	4	6	8	10	12	14	16	18	20	22
<i>Days</i>	0	1.000	0.980	0.960	0.941	0.922	0.903	0.885	0.867	0.849	0.832	0.815	0.799
	1	0.783	0.767	0.751	0.736	0.721	0.707	0.693	0.679	0.665	0.651	0.638	0.625
	2	0.613	0.600	0.588	0.576	0.565	0.553	0.542	0.531	0.520	0.510	0.500	0.490
	3	0.480	0.470	0.461	0.451	0.442	0.433	0.424	0.416	0.407	0.399	0.391	0.383
	4	0.375	0.368	0.360	0.353	0.346	0.339	0.332	0.326	0.319	0.312	0.306	0.300
	5	0.294	0.288	0.282	0.276	0.271	0.265	0.260	0.255	0.250	0.245	0.240	0.235
	6	0.230	0.225	0.221	0.216	0.212	0.208	0.204	0.200	0.195	0.191	0.188	0.184

**GENERAL HANDLING
PRECAUTIONS FOR INDIUM-111**

1. Designate area for handling ^{111}In and clearly label all containers.
2. Store ^{111}In behind 6-mm (0.25-in.) thick lead shields.
3. Wear extremity and whole body dosimeters while handling mCi (37 MBq) quantities.
4. Use lead shielding and syringe shields to minimize exposure.
5. Use tools to indirectly handle unshielded sources and potentially contaminated vessels.
6. Practice routine operations to improve dexterity and speed before using ^{111}In .
7. Prohibit eating, drinking, smoking and mouth pipetting in room where ^{111}In is handled.
8. Use transfer pipettes, spill trays and absorbent coverings to confine contamination.
9. Handle potentially volatile chemical forms in ventilated enclosures.
10. Sample exhausted effluent and room air by continuously drawing a known volume through membrane filters.
11. Wear lab coat, wrist guards and disposable gloves for secondary protection.
12. Maintain contamination and exposure control by regularly monitoring and promptly decontaminating gloves and surfaces.
13. Use end-window Geiger-Mueller detectors, NaI(Tl) detector or liquid scintillation counter to detect ^{111}In .
14. Submit urine samples for bioassay after handling ^{111}In to indicate uptake.
15. Isolate waste in clearly labeled, shielded containers and hold for decay.
16. Establish surface contamination, air concentration and urinalysis action levels below regulatory limits. Investigate and correct any conditions that may cause these levels to be exceeded.
17. On completing an operation, secure all ^{111}In ; monitor and remove protective coverings; monitor and decontaminate self and surfaces; wash hands and monitor them again.

REFERENCES

1. Koehler, 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 Koehler(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.
3. U.S. Nuclear Regulatory Commission. 10CFR 20 Appendix B – Standards for Protection Against Radiation, 1994.
4. ICRP Publication 30, Part 2, Limits for Intakes of Radionuclides by Workers. Pergamon Press, Oxford, 1980.

