

Lead 203 (Pb-203)

Handling Precautions

*Half life: 52.1 hours.
 Decay mode: Electron Capture
 Decays to Tl-203 (Stable).

Provided as Lead Chloride - PbCl₂
 0.5 M HCl, pH ≈ 0.3
 Volumes 0.02 -5 ml
 Activity: 3 – 200 mCi

Lead 203 Decay Table

Physical Half-life 52.1 Hours

		HOURS									
		0	3	6	9	12	15	18	21	24	27
	0	1.000	0.961	0.923	0.887	0.852	0.819	0.787	0.756	0.727	0.698
	30	0.671	0.645	0.619	0.595	0.572	0.550	0.528	0.507	0.488	0.468
	60	0.450	0.433	0.416	0.399	0.384	0.369	0.354	0.340	0.327	0.314
	90	0.302	0.290	0.279	0.268	0.257	0.247	0.238	0.228	0.219	0.211
	120	0.203	0.195	0.187	0.180	0.173	0.166	0.159	0.153	0.147	0.141
	150	0.136	0.131	0.125	0.121	0.116	0.111	0.107	0.103	0.099	0.095
HOURS	180	0.091	0.088	0.084	0.081	0.078	0.075	0.072	0.069	0.066	0.064
	210	0.061	0.059	0.056	0.054	0.052	0.050	0.048	0.046	0.044	0.043
	240	0.041	0.039	0.038	0.036	0.035	0.034	0.032	0.031	0.030	0.029
	270	0.028	0.026	0.025	0.024	0.023	0.023	0.022	0.021	0.020	0.019
	300	0.018	0.018	0.017	0.016	0.016	0.015	0.015	0.014	0.013	0.013
	330	0.012	0.012	0.011	0.011	0.011	0.010	0.010	0.009	0.009	0.009
	360	0.008	0.008	0.008	0.007	0.007	0.007	0.007	0.006	0.006	0.006

*Radiations emitted:

Radiation Types	Energy (keV)	Intensity (%)
Auger-L	7.78	59
Auger-K	55.2	3.1
ce-K- 1	193.6	16.8
ce-L- 1	263.8	4.32
ce-M- 1	275.5	1.052
ce-N OP- 1	278.3	0.338
ce-K- 2	315.8	0.050
x-ray L	10.3	39
x-ray Kα ₂	70.8	26.6
x-ray Kα ₁	72.9	45.1
x-ray Kβ	82.6	20
γ 1	279.2	76.8
γ 2	401.3	3.3
γ 3	660.5	0.67

Unshielded exposure rate at 1 cm from a 1 mCi (37 MBq) point source \approx 1.7 R/hr.

First half value layer for Pb shielding \approx 0.001 inches (0.025 mm)

Tenth value layer for Pb shielding \approx 0.1 inches (2.5 mm)

Occupational limits (from USNRC 10 CFR 20, Appendix B) for Class D (all compounds):

Oral ingestion ALI:	5,000 uCi (185MBq)
Inhalation ALI:	9,000 uCi (333 MBq)
*Derived Air Concentration:	4E-6 uCi/ml (2E-7 MBq/ml)

Internal Dosimetry: ICRP 30 indicates that 69% of systemic lead is excreted with a 12 day half life and 19% with a 180 day half life. Only 11% of the systemic excretion is via the urine. 89% of the systemic excretion is via the feces.

Lead 203 should be handled using standard radiation safety precautions to minimize external exposure and to prevent contamination, including the following:

1. Clearly label containers as containing radioactive material as appropriate.
2. Store activity in and/or behind lead shielding.
3. Use appropriate radiation detection instruments to measure exposure rates in work areas, and wear external dosimetry to measure dose when handling mCi (37MBq) quantities of activity.
4. Use shielding when handling activity, and minimize the time spent in radiation fields.
5. Use remote handling tools like tongs to reduce extremity exposure when manipulating unshielded containers and potentially contaminated objects.
6. Prohibit eating, drinking, etc., in work areas.
7. Use spill trays and absorbent or cleanable liners to confine contamination.
8. Conduct operations that may give rise to airborne contamination in appropriately ventilated areas.
9. Consider sampling of exhaust air and/or room air to detect airborne contamination.
10. Use protective clothing such as disposable gloves, lab coats, and safety glasses as secondary protection against personal contamination.
11. Regularly monitor for contamination using a NaI scintillation detector or a pan-cake GM detector and promptly decontaminate surfaces to maintain contamination control.
12. Use urine bioassay and/or whole body counts to detect uptake of activity by personnel.
13. Isolate wastes in sealed, labeled containers.

References:

*Kocher's Radioactive Decay Data Tables. Springfield National Technical Information Services. 1981. DOE/TC-11026