

# Cobalt 57 (Co)

## Handling Precautions

\*Half life: 270.9 days

Decay mode: Electron Capture

Decays to Fe-57 (Stable)

Provided as Cobalt Chloride (CoCl<sub>2</sub>)

0.1 M HCl (pH ≈2)

Volume ≈ 5 ml.

Activity: 0.1 – 1 Ci

### Cobalt 57 Decay Table

Physical Half-life 270.9 days

DAYS	DAYS									
	0	10	20	30	40	50	60	70	80	90
0	1.000	0.975	0.950	0.926	0.903	0.880	0.858	0.836	0.815	0.794
100	0.774	0.755	0.736	0.717	0.699	0.681	0.664	0.647	0.631	0.615
200	0.599	0.584	0.570	0.555	0.541	0.527	0.514	0.501	0.488	0.476
300	0.464	0.452	0.441	0.430	0.419	0.408	0.398	0.388	0.378	0.369
400	0.359	0.350	0.341	0.333	0.324	0.316	0.308	0.300	0.293	0.285
500	0.278	0.271	0.264	0.258	0.251	0.245	0.239	0.233	0.227	0.221
600	0.215	0.210	0.205	0.199	0.194	0.190	0.185	0.180	0.176	0.171
700	0.167	0.163	0.158	0.154	0.151	0.147	0.143	0.139	0.136	0.132
800	0.129	0.126	0.123	0.120	0.117	0.114	0.111	0.108	0.105	0.103
900	0.100	0.097	0.095	0.093	0.090	0.088	0.086	0.084	0.081	0.079
1000	0.077	0.075	0.074	0.072	0.070	0.068	0.066	0.065	0.063	0.061
1100	0.060	0.058	0.057	0.056	0.054	0.053	0.051	0.050	0.049	0.048
1200	0.046	0.045	0.044	0.043	0.042	0.041	0.040	0.039	0.038	0.037

### \*Radiations emitted:

Radiation Types	Energy (keV)	Intensity (%)
Auger- L	0.67	249 3
Auger- K	5.62	105.5 14
ce-K- 1	7.3007	69.5 3
ce-L- 1	13.5666	7.78
c e - NNO - 1	14.3198	1.15
ce-K- 2	114.951	1.838
ce-L- 2	121.217	0.183
ce-K- 3	129.364	1.42
ce-L- 3	135.630	0.147
X-ray L	0.7	0.8
X-ray K $\alpha$ 2	6.39084	16.6 5
X-ray K $\alpha$ 1	6.40384	32.8 8
X-ray K $\beta$	7	6.62 21

Radiation Types	Energy (keV)	Intensity (%)
$\lambda$ 1	14.4127 4	9.54 12
$\lambda$ 2	122.063 3	85.51 19
$\lambda$ 3	136.476 3	10.60 18
$\lambda$ 9	692.00 3	0.160 5

6 weak  $\gamma$ 's omitted:  $E_{\gamma}$  (avg) = 536.0:  $E I_{\gamma}$  = 0.03%

Unshielded exposure rate at 1 cm from a 1 mCi (37 MBq) point source  $\approx$  0.9 R/hr.

Half value layer for lead shielding  $\approx$  0.002 inches (0.05 mm)

Occupational limits (from USNRC 10 CFR 20, Appendix B) for Class W, all compounds except Class Y compounds (oxides, hydroxides, halides, and nitrates).

Oral ingestion ALI:	8,000 uCi (296MBq)
Inhalation ALI:	3,000 uCi (111 MBq)
*Derived Air Concentration:	1E-6 uCi/ml (4E-8 MBq/ml)

Internal Dosimetry: ICRP 30 indicates that 50% of systemic Cobalt is excreted with a 0.5 day half life and 30% with a 6 day half life. 70% of the systemic excretion is via the urine. 30% of the systemic excretion is via the feces.

Cobalt 57 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