



PHOSPHORUS-33

HANDLING PRECAUTIONS

³³ P
25.4 d
β ⁻ 0.249
No γ
E 0.249

PHYSICAL DATA

Maximum Beta Energy: 0.249 MeV (100%)⁽¹⁾
 Maximum Range of Beta in Air: 46 cm (18 in.)⁽²⁾

OCCUPATIONAL LIMITS⁽³⁾

Annual Limit on Intake: 6 mCi (220 MBq) for oral ingestion and 3 mCi (110 MBq) for inhalation.

DOSIMETRY

Millicurie (37 MBq) quantities of ³³P do not present a significant external exposure hazard because the low-energy betas emitted barely penetrate gloves and the outer dead layer of skin. Uptakes of phosphorus are assumed to be retained with a biological half-life of 0.5 days⁽⁴⁾. Of this phosphorus, 15% is rapidly excreted; 15% is retained in intracellular fluids with a biological half-life of 2 days; 40% is retained in soft tissue with a biological half-life of 19 days; and 30% retained permanently in mineral bone where ³³P is reduced by radioactive decay⁽⁴⁾.

DECAY TABLE

Physical Half-Life: 25.4 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.

		<i>Days</i>									
		0	1	2	3	4	5	6	7	8	9
<i>Days</i>	0	1.000	0.973	0.947	0.921	0.897	0.872	0.849	0.826	0.804	0.782
	10	0.761	0.741	0.721	0.701	0.683	0.664	0.646	0.629	0.612	0.595
	20	0.579	0.564	0.549	0.534	0.520	0.506	0.492	0.479	0.466	0.453
	30	0.441	0.429	0.418	0.406	0.395	0.385	0.374	0.364	0.355	0.345
	40	0.336	0.327	0.318	0.309	0.301	0.293	0.285	0.277	0.270	0.263
	50	0.256	0.249	0.242	0.236	0.229	0.223	0.217	0.211	0.205	0.200
	60	0.195	0.189	0.184	0.179	0.174	0.170	0.165	0.161	0.156	0.152
	70	0.148	0.144	0.140	0.136	0.133	0.129	0.126	0.122	0.119	0.116
	80	0.113	0.110	0.107	0.104	0.101	0.098	0.096	0.093	0.091	0.088
	90	0.086	0.084	0.081	0.079	0.077	0.075	0.073	0.071	0.069	0.067
	100	0.065	0.064	0.062	0.060	0.059	0.057	0.055	0.054	0.053	0.051
	110	0.050	0.048	0.047	0.046	0.045	0.043	0.042	0.041	0.040	0.039
	120	0.038	0.037	0.036	0.035	0.034	0.033	0.032	0.031	0.030	0.030

GENERAL HANDLING PRECAUTIONS FOR PHOSPHORUS-33

1. Designate area for handling ^{33}P and clearly label all containers.
2. Prohibit eating, drinking, smoking and mouth pipetting in room where ^{33}P is handled.
3. Use transfer pipettes, spill trays and absorbent coverings to confine contamination.
4. Handle ^{33}P compounds that are potentially volatile or in powder form in ventilated enclosures.
5. If airborne activity is suspected, sample exhausted effluent and room air by continuously drawing a known volume through membrane filters.
6. Wear lab coat, wrist guards and disposable gloves for secondary protection.
7. Maintain contamination control by regularly monitoring and promptly decontaminating gloves and surfaces.
8. Use pancake or end-window Geiger-Mueller detector or liquid scintillation counter to detect ^{33}P .
9. Submit urine samples for bioassay from two hours to seven days after handling ^{33}P to indicate uptake by personnel.
10. Isolate waste in clearly labeled containers and hold for decay.
11. Establish surface contamination, air concentration and urinalysis action levels below regulatory limits. Investigate and correct any conditions which may cause these levels to be exceeded.
12. On completing an operation, secure all ^{33}P ; remove protective clothing; dispose of protective coverings; monitor and decontaminate self and surfaces; wash hands and monitor them again.

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. U.S. Nuclear Regulatory Commission. 10CFR 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.

