SAFE HANDLING GUIDE

Calcium-45 Handling Precautions

^{45}Ca
163 d
ß⁻ 0.257
No γ
E 0.257

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.

Physical data

Maximum beta energy: 0.257 MeV (100%)[1]
Maximum range of beta in air: 48 cm (19 in)[2]

Occupational limits(3)

Annual limit on intake: 2 mCi (74 MBq) for oral ingestion and 800 µCi (30 MBq) for inhalation
Derived air concentration: 4 x 10^{-7} µCi/ml (15 kBq/m^3)

Dosimetry

Millicurie (37 MBq) quantities of ^{45}Ca 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 ^{45}Ca are mostly deposited in the bone[4]. ^{45}Ca is assumed to be uniformly distributed in mineral bone and re-tained with a long biological half-life of 1.8 x 104 days[4]. A smaller fraction is rapidly eliminated[4]. ^{45}Ca is initially eliminated via the urine, but eventually half the radionuclide is eliminated via the feces[4].

Decay table

Physical half-life: 163 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	0	5	10	15	20	25	30	35	40	45
0	1.000	0.979	0.958	0.938	0.918	0.899	0.880	0.862	0.844	0.826
50	0.808	0.791	0.775	0.759	0.743	0.727	0.712	0.697	0.682	0.668
100	0.654	0.640	0.626	0.613	0.600	0.588	0.575	0.563	0.551	0.540
150	0.528	0.517	0.506	0.496	0.485	0.475	0.465	0.455	0.446	0.436
200	0.427	0.418	0.409	0.401	0.392	0.384	0.376	0.368	0.360	0.353
250	0.345	0.338	0.331	0.324	0.317	0.311	0.304	0.298	0.291	0.285
300	0.279	0.273	0.268	0.262	0.257	0.251	0.246	0.241	0.236	0.231
350	0.226	0.221	0.216	0.212	0.207	0.203	0.199	0.195	0.191	0.186

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PerkinElmer has developed the following suggestions for handling Calcium-45 after years of experience working with this low-energy beta emitter.

General handling precautions for Calcium-45

1. Designate area for handling ^{45}Ca and clearly label all containers.
2. Prohibit eating, drinking, smoking and mouth pipetting, in room where ^{45}Ca is handled.
3. Use transfer pipets, spill trays and absorbent coverings to confine contamination.
4. Handle ^{45}Ca compounds that are potentially volatile or in powder form in ventilated enclosures.
5. Sample exhausted effluent and room air by continuously drawing a known volume through membrane filters.
6. Wear disposable lab coat, gloves and wrist guards for secondary protection.
7. Select gloves appropriate for chemicals handled.
8. Maintain contamination control by regularly monitoring and promptly decontaminating gloves and surfaces.
9. Use pancake or end-window Geiger-Mueller detectors or liquid scintillation counter to detect ^{45}Ca.
10. Submit periodic urine samples for bioassay to determine uptake by personnel.
11. Isolate waste in clearly labeled containers according to approved guidelines.
12. Establish air concentration, surface contamination and bioassay action levels below regulatory limits. Investigate and correct any conditions that cause these levels to be exceeded.
13. On completing an operation, secure all ^{45}Ca, remove and dispose of protective clothing and 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. 10 CFR 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.

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