Scandium-46 Handling Precautions

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.

**46Sc**

- 83.83 d
- $\beta^-$: 0.357
- $\gamma$: 0.889
  - 1.121
- E: 0.357

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**Physical data**

Principal radiation emissions\(^{(1)}\)

- Maximum beta energy: 0.357 MeV (100%)
- Gammas: 1.121 MeV (100%)
  - 0.889 MeV (100%)
- Maximum range of beta in air: 84 cm (33 in)\(^{(2)}\)

Unshielded exposure rate at 1 cm from a 1 mCi point source: 10.8 R/h\(^{(3)}\)

Unshielded exposure rate at 1 m from a 1 MBq point source: 7.6 nC/kg/h\(^{(3)}\)

Half-value layer for lead shielding: 8 mm (0.33 in)\(^{(3)}\)

**Dosimetry**

Gamma emissions from 46Sc present an external exposure hazard. Beta emissions from 46Sc contamination on skin can contribute a shallow dose which can be prevented by wearing gloves. It may be assumed that 40%, 30% and 10% of uptakes of 46Sc are transferred to the skeleton, liver and spleen respectively, and 20% uniformly distributed throughout all other organs and tissues of the body\(^{(5)}\). 10% and 90% of all 46Sc in the body may be assumed to be retained with biological half-lives of 5 and 1500 days respectively\(^{(6)}\).

**Occupational limits\(^{(5)}\)**

- Annual limit on intake: 900 µCi (33 MBq) for oral ingestion and 200 µCi (7 MBq) for inhalation
- Derived air concentration: $1 \times 10^{-7} \mu$Ci/ml (3.7 kBq/m\(^3\))

**Decay Table**

Physical half-life: 83.83 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](http://www.perkinelmer.com/toolkit) to use our online Radioactive Decay Calculator.

<table>
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<th>Days</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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General handling precautions for Scandium-46

1. Designate area for handling $^{46}\text{Sc}$ and clearly label all containers.
2. Store $^{46}\text{Sc}$ behind thick lead shields.
3. Wear extremity and whole body dosimeters while handling mCi (37 MBq) quantities.
4. Use shielding to minimize exposure while handling $^{46}\text{Sc}$.
5. Do not work over open containers.
6. Use tools to indirectly handle unshielded sources and potentially contaminated vessels.
7. Prohibit eating, drinking, smoking and mouth pipetting in room where $^{46}\text{Sc}$ is handled.
8. Use transfer pipets, spill trays and absorbent coverings to confine contamination.
9. Handle $^{46}\text{Sc}$ compounds that are potentially volatile or in powder form in ventilated enclosures.
10. Sample exhausted effluent and room air by continuously drawing a known volume through a membrane filter.
11. Wear disposable lab coat, gloves and wrist guards for secondary protection.
12. Select gloves appropriate for chemicals handled.
13. Maintain contamination and exposure control by regularly monitoring and promptly decontaminating gloves and surfaces.
14. Use pancake or end-window Geiger-Mueller detector, NaI(Tl) or liquid scintillation counter to detect $^{46}\text{Sc}$.
15. Submit urine samples for bioassay at least four hours after handling $^{46}\text{Sc}$ to indicate uptake.
16. Isolate waste in clearly labeled shielded container and hold for decay.
17. Establish air concentration, surface contamination and bio-assay action levels below regulatory limits. Investigate and correct any conditions that may cause these levels to be exceeded.
18. On completing an operation, secure all $^{46}\text{Sc}$; remove and dispose of protective clothing and coverings; monitor and decontaminate self and surfaces; wash hands and monitor them again.

References

3. Calculated with computer code ‘Gamma’ utilizing decay scheme data from Kocher$^{1(1)}$ 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.