^{3}H

12.28y
β-0.019
noγ
E 0.019

TRITIUM
Handling Precautions

Du Pont has developed the following suggestions for handling tritium after years of experience working with this low energy beta emitter.

PHYSICAL DATA

Maximum Beta Energy: 0.019 MeV (100%)[1]
Maximum Range of Beta in Air: about 4.7 mm (0.19 inches)[2]

OCCUPATIONAL LIMITS[1]

Maximum Permissible Air Concentration (based on forty-hour working week) = 5×10^{-6} μCi/ml (190 kBq/m^3) [3]
Quarterly Inhalation Intake Limit = 6.3 mCi (230 MBq) [3]

DOSIMETRY

Millicurie quantities of tritium do not present an external exposure hazard because the low energy betas emitted cannot penetrate the outer dead layer of skin. The critical organ for tritium uptake is the whole body water. Three to four hours after intake, tritiated water is uniformly distributed in all body water.[5] On average, tritiated water is eliminated with a ten-day biological half-life. Elimination rates may be increased by increasing water intake.[5]

PRECAUTIONS

1. Designate area for handling ^{3}H and clearly label all containers.
2. Prohibit smoking, eating, and drinking in the room where ^{3}H is handled.
3. Confine contamination by using transfer pipets, spill trays, and absorbent coverings.
4. Handle potentially volatile compounds in ventilated enclosures.
5. If enhanced containment is necessary, handle volatile compounds in closed systems vented through suitable traps.
6. Sample exhausted effluent by drawing a known quantity through a membrane filter followed by a water impinger.
7. Wear disposable lab coat, gloves and wrist guards for secondary protection.
8. Select gloves appropriate for chemicals handled.
9. Maintain control by regular monitoring and prompt decontamination of gloves and surfaces.
10. Use open window ionization detector or liquid scintillation counter to detect ^{3}H.
11. Submit periodic urine samples for bioassay to determine uptake by personnel.
12. Isolate, label, and dispose wastes according to approved guidelines.
13. Establish air concentration, surface contamination and bioassay action levels below maximum permissible limits. Investigate any causes that threaten these levels to be exceeded.
14. On completing an operation, secure all ^{3}H, remove and dispose of protective clothing and coverings, monitor and decontaminate self and surfaces, wash hands and monitor hands again.

Many tritium compounds readily penetrate gloves and skin. Handle these compounds remotely, wear two pairs of gloves and change the outer layer at least every twenty minutes. Tritiated DNA precursers are considered more toxic than tritiated water.[6] However, they are generally less volatile and do not normally present a significantly greater hazard.

REFERENCES

[1] Kocher, David C., Radioactive Decay Data Tables. (Springfield: National Technical Information Service) 1981. DOE/TIC-11026.

[2] Kaplon, Irving, Nuclear Physics, New York: Addison-Wesley, 1964.

[3] 10 CFR 20 – Standards for Protection Against Radiation.

[4] Recommendations of the International Commission on Radiological Protection, ICRP Publication 2, Pergamon Press, London, 1959.

[5] Recommendations of the International Commission on Radiological Protection, ICRP Publication 10, Pergamon Press, London, 1968.

[6] Tritium and Other Radionuclide Labeled Organic Compounds Incorporated in Genetic Material, NCRP Report No. 63, 1979.

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