Tritium (3 H) safety information and specific handling precautions

General:

Tritium is a very low energy beta emitter and even large amounts of this isotope pose no external dose hazard to persons exposed. The beta radiation cannot penetrate the outer protective dead layer of the skin of the body. The major concern for individuals working with this isotope is the possibility of an internal exposure. Such an exposure may occur if an individual contaminates bare skin, accidentally ingests the material, or breathes it in the form of a gas or vapor. The critical organ for a tritium uptake is the water of the whole body. Three to four hours after an intake of tritiated water, the radioactive material is uniformly distributed throughout the body fluids. A tritium intake may be easily detected by analyzing a urine sample.

Many tritium compounds readily migrate through gloves and skin. Data from accidents involving tritium indicate that 80% of the body exposure occurs through skin absorption. Tritium compounds should be handled with gloved hands, and in some cases, with double gloves. Change gloves often. Tritiated DNA precursors are considered more toxic than tritiated water. However, they are generally less volatile and do not normally present a significantly greater hazard.

Physical Data:

Maximum beta energy: 0.019 MeV, 100% emission.
Maximum range in air: About 1/6 of an inch
Radiological Half-life: 12.28 years.
Internal Occupational Limits:
Annual Limits on Intake-
Inhalation: 80 mCi
Ingestion: 80 mCi

Precautions:

1. Follow General Safety Precautions for all isotopes.

2. Traps may be necessary to collect tritium if large gas or vapor releases are anticipated. This will reduce the release to the environment.

3. Monitor surfaces routinely and keep record of the results. Geiger counters (survey meters) are not sensitive to tritium radiation and therefore wipe tests and a liquid scintillation counter are necessary to determine levels of contamination. Radiation badges are not issued to individuals using only tritium because the radiation emitted by tritium is not of sufficient strength to penetrate the badge.

4. Submit urine samples for analysis if requested to do so by the Radiation Safety Section. Yale's current Nuclear Regulatory Commission license requires an individual to submit a urine sample when working with 100 mCi or more of tritium at one time.

5. High activity tritium experiments may be performed in one of two laboratories (KBT 1138 and BCMM B-01) maintained by the Radiation Safety Section. Storage space is also available for high activity tritium stock solutions.

6. Due to the long half-life of tritium, tritiated waste must be segregated from short-lived waste. 3 H and 14 C waste may be combined, but must be kept separate from 32 P,35 S,125 I and other radioactive waste.

7. Tritium can penetrate plastic and other materials. Stock vials should therefore be wipe tested routinely (ie, quarterly) to help prevent/control the escape of tritium from storage containers.

^3H LAB INFO SHEET

^3H Tritium

Very Low Energy Beta Emitter
Half-Life: 12.28 Years
Max energy: 19 KeV (at 100%)
Max range in air: 1/6th inch
ALI = 80mCi (Ingestion/Inhalation)
Critical Organ: Whole Body
Bioassay: Urine

Detection: Wipe test
Instrument: LSC ONLY (60-70%) efficient

LSC

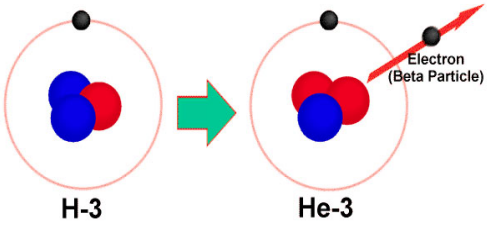
Shielding: None Required

PPE: Double gloves, Lab coat, Safety glasses

Dosimetry: None Needed

Notes and Special Precautions

- ^3H can NOT be detected with a portable survey meter. Surveys must be conducted using wipes and Liquid Scintillation Counting (LSC).
- Wipe tests required after each use.
- Liquid Scintillation Counter (LSC) efficiencies for ^3H= 60 -70%.
- ^3H spills are difficult to contain and time consuming to clean up. EHS Radiation Safety should be called immediately in the event of ANY ^3H incident.
- ^3H migrates - through containers (over time) and gloves.^3H can contaminate inside of freezer, thus double containment is advised. Labs are encouraged to dispose of ^3H when done using material. Even though ^3H has a long half life, chemically it degrades and may not be useful.
- Urine bioassays required for some users; specifically required for those using > 100 mCi at a time, but also performed sometimes when 10 mCi is handled, tritiated water is used, or as follow up to ^3H spills.



Class IV Waste ≥ 120 days Can be combined with ^{14}C

EMERGENCY SPILLS or SKIN CONTAMINATION **203-785-3555**

Yale *Environmental Health & Safety* 203-785-3550

NO EATING, DRINKING, OR SMOKING in lab.