Radionuclide Safety Data Sheet

PHYSICAL DATA

Radionuclide:	Iodine-125 (I-125)
Decay Mode:	Electron Capture
Gamma Energy:	Gamma = 35 .5 keV (6.5%)
	K x-ray = 27 keV (112.5%)
	K x-ray = 31 keV (25.4%)
Gamma Constant:	0.27 mR/hr per mCi at 1 meter
Physical Half-Life:	60.14 days
Biological Half-Life:	120 – 138 days(unbound iodine)
Effective Half-Life:	42 days (unbound iodine in thyroid)
Specific Activity:	17,353 curies / gram
Half-value Layer (HVL) lead:	0.0018 cm = 0.02 mm
Half-value Layer (HVL) Water/tissue:	1.7 cm = 2/3”
Half-value Layer (HVL) concrete:	0.21 cm

RADIOLOGICAL DATA

Critical Organ:	Thyroid
Routes of Intake:	Ingestion, Inhalation, Puncture, Wound, Skin Contamination (Absorption)
Exposure Concerns:	External & Internal exposure & contamination
Committed Dose Equivalent (CDE):	1273 mrem/ uCi I-125 ingested (Thyroid)
	799 mrem/ uCi I-125 inhaled (Thyroid)
Committed Effective Dose Equivalent (CEDE):	50 mrem/ uCi I-125 ingested (WB)
	25 mrem/ uCi I-125 inhaled (WB)
Annual Limit on Intake (ALI):	40 uCi (Thyroid from ingestion)
	60 uCi (Thyroid from inhalation)
	1 ALI = 50,000 mrem CDE to the Thyroid

SHIELDING/LABELING

Shielding:	Lead foil or sheets (1/32” – 1/16” thick)
	0.152 mm lead foil will reduce exposure rate by 99%
	7.2 mm lead impregnated plastic or acrylic shield will reduce exposure rate >> 99.9%
Labeling:	Container with $\geq$ 1 uCi must be labeled “Caution, Radioactive Material”

SURVEY INSTRUMENTATION

Survey meter equipped with a low-energy NaI scintillation probe (1" crystal) is preferred for the detection of I-125
Low-energy NaI probe efficiency for I-125 ~ 13%.
Survey meter equipped with G-M pancake/frisker (15.5 cm^2 area) is very inefficient for detection of the low energy I-125 gamma/x-rays (G-M efficiency ~ 0.5% at 1 cm).
Wipes/smears should be counted on a liquid scintillation counter or gamma well detector to detect I-125 contamination.
Counting efficiency on a Perkin Elmer liquid scintillation counter is approximately 78%
Counting efficiency of a COBRA well detector is 82% (2" NaI crystal) and 83% (3" NaI crystal)

PERSONAL RADIATION MONITORING DOSIMETERS

Personnel dosimetry (whole body & ring badges) recommended when working with I-125
Dose rates from an unshielded 1 millicurie point source of I-125:

1 cm = 2750 mrem/hr 10 cm = 27.5 mrem/hr 100 cm = 0.27 mrem/hr

BIOASSAYS

The following activities if handled at any one time or processed in a three (3) month period require a thyroid bioassay:

Open room or bench:	0.1 mCi (volatile); 1 mCi (non-volatile)
Certified Hood:	1 mCi (volatile); 10 mCi (non-volatile)

When required, bioassays must be performed at a minimum on a quarterly basis. If more frequent monitoring is desired, it must be performed within 6 to 72 hours after suspected intake.

DOSIMETRY

The thyroid is the critical organ for I-125 uptake. Individual uptake and metabolism vary over a wide range. The thyroid may be assumed to accumulate 30% of soluble radioiodine uptake to the body and retain iodine with a 138 day biological half-life. All radioiodine in the body can be assessed to be eliminated via the urine.

RADIOACTIVE WASTE

Isolate waste from other radionuclides in clearly labeled containers.
Sanitary sewer disposal limit is 10 uCi in any one day via a designated "hot" sink provided it is readily soluble, dispersible in water, and contains no hazardous materials. A sewer log must be maintained.

GENERAL RADIOLOGICAL SAFETY INFORMATION (I-125)

(Permission from University of Michigan Radiation Safety Office)

- Inherent Volatility (STP): "SUBSTANTIAL" [volatilization is a very significant concern with I-125 especially in disassociated (free) form or in acidic solutions]
- Caution should be used when making low pH (acidic) solutions of I-125 (volatilization)

- Internal exposure and contamination represent the primary hazards for most I-125 applications. Iodine-125 is easily shielded using 1/32 – 1/16" lead sheets to reduce external radiation exposures.
- Acidic and frozen solutions enhance radioiodine volatility.
- Soluble iodide ion is oxidized to elemental (free) iodine which has low solubility in water and high vapor pressure. Acidic solutions enhance the oxidation of sodium iodide to elemental (free) iodine; thereby, increasing volatility.
- Alkaline sodium thiosulfate should be used to chemically stabilize I-125 prior to initiating decontamination of an I-125 spill (0.1 M NaI, 0.1 M NaOH, and 0.1 M Na2S2O3).
- Store at room temperature: DO NOT FREEZE (whenever possible)
- Radioiodine labeled compounds should be assumed to be potentially volatile since radiolytic decomposition can give rise to free iodine in solution. Radiolytic decomposition is minimized by maintaining solutions at low (dilute) concentrations.
- Addition of antioxidants (sodium thiosulfate) to either labeled or NaI solutions of I-125 will help reduce both decomposition & volatilization.
- Regulatory limits on personal intake and environmental releases of I-125 are quite restrictive because of the relatively high radiotoxicity relative to other common university-related radionuclides.
- The urinary excretion rate decreases by about two orders of magnitude during the first 5-days after intake. Thus, uncertainties in interpretation of urinary excretion that arise because of the unknown time of intake in routine monitoring may be large.