Radionuclide Safety Data Sheet

PHYSICAL DATA

Radionuclide:	Technetium-99m (Tc-99m)
Decay Mode:	Gamma
Gamma Energies (primary):	140.5 keV (89% abundance) 18.4 keV (4% abundance) 18.3 keV (2% abundance)
Gamma Constant:	0.076 mR/hr per mCi at 1 meter (760 mR/hr per mCi at 1 cm)
Physical Half-Life:	6.02 hours
Biological Half-Life:	24 hours
Effective Half-Life:	4.8 hours (Biological & Effective half-life varies with radiopharmaceutical)
Specific Activity:	5.244 E6 curies / gram ("carrier free"/pure Tc-99m) 3.4 E6 curies/gram (99m Tc-pertechnetate form)

RADIOLOGICAL DATA

Critical Organ:	Carrier/radiopharmaceutical specific
Exposure Concerns:	External & Internal exposure & contamination
Committed Dose Equivalent (CDE):	0.41 mrem / uCi (puncture/thyroid/adult) 0.313 mrem / uCi (ingestion/thyroid)
Annual Limit on Intake (ALI):	80 mCi (all compounds)* (oral ingestion / CEDE / Whole Body(* (all compounds, except oxides hydroxides, halides, and nitrates) 200 mCi (all compounds) (inhalation / CEDE / WB / 5 rem / Class "D" or “W) 1 ALI = 5000 mrem CEDE (Whole Body)

SHIELDING/LABELING

Shielding: ¼" – ½" lead shielding is adequate for Tc-99m 140 keV gammas

Half-Value Layer (HVL / Lead):	0.027 cm = 0.011“ (140 keV)
Tenth-Value Layer (TVL / Lead):	0.083 cm = 0.033” (140 keV)
Tenth-Value Layer (TVL / Concrete):	6.60 cm = 2.60”
Half-Value Layer (HVL / Water or Tissue):	4.60 cm = 1.81”

Attenuation Coefficient (100) Lead:	0.16 cm = 0.063”
Attenuation Coefficient (1000):	0.25 cm = 0.104”

Labeling: Container with $\geq$ 1 mCi must be labeled “Caution, Radioactive Material”

SURVEY INSTRUMENTATION

Survey meter equipped with a 1" x 1" or a low-energy NaI scintillation probe is preferred for the detection of Tc-99m contamination
Typical counting efficiencies for a 1" x 1" NaI probe = 39% and for a low-energy NaI probe = 12%

Survey meters equipped with a G-M pancake/frisker (15.5 cm2 surface area) can be used for gross contamination; however, they exhibit very low counting efficiencies (approximately, 1.2%) for the detection of low-energy Tc-99m gamma rays.

Indirect counting using a liquid scintillation counter (LSC) or gamma counter should be used to detect removable Tc-99m contamination on smears, swabs, or swipes.

PERSONAL RADIATION MONITORING DOSIMETERS

Personnel dosimetry (whole body & ring badges) recommended when working with Tc-99m
Dose rates from an unshielded 1 millicurie point source of Tc-99m:

1 cm = 760 mrem/hr 10 cm = 7.6 mrem/hr 100 cm = 0.0.76 mrem/hr

Skin Contamination Dose Rate (Basal Cells): 718 millirad/hour per uCi/cm2

BIOASSAYS

Bioassays NOT required for Tc-99m use

DOSIMETRY

Tc-99m is carrier/compound (radiopharmaceutical) specific:

- Tc-99m Pertechnetate ($^{99m}Tc0_4$) - (MUGA Scans) behaves similar to iodine and concentrates in thyroid, salivary glands, brain, blood pool, urinary bladder, and stomach. Stomach receives majority of dose and contains 25% of administered dose after 4 hours.
- Tc-99m-Labeled Sulfur Colloid - approximately 70-80% of the administered dose (3 mCi/injected) is localized in the liver. Used for liver, spleen, and bone-marrow scanning.
- Tc-99m-Labeled Macroaggregated Albumin (^{99m}Tc MAA) - primarily used for lung scanning; 90-95% of administered dose (3mCi/injected) is trapped in the capillary bed of the lungs within a few seconds after intravenous administration.
- Tc-99m (MUGA) - spleen receives approximately 2.6 rad/mCi.
- Tc-99m (DTPA) - brain or kidney scan; administered dose is 20 mCi (injected); bladder (0.5 rad/mCi); whole body (20 mrad/mCi)

RADIOACTIVE WASTE

Isolate waste from other radionuclides in clearly labeled containers.
Sanitary sewer disposal limit is 10 mCi 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 (Tc-99m)

- Inherent Volatility (STP): Insignificant / Negligible
- Tc-99m is used in clinical and research diagnostic scanning and imaging.
- Whole body & extremity exposures, skin contamination (dose), ingestion, inhalation, puncture/injection, absorption through skin, and area contamination are primary radiological safety concerns.
- Drying can cause airborne Tc-99m dust contamination and rapid boiling can cause airborne Tc-99m aerosol contamination. Expelling Tc-99m solutions through syringe needles and pipette tips can generate airborne aerosols.
- Always wear a lab coat and disposable gloves when handling Tc-99m.
- Monitor personnel, work areas, and floors using a survey meter equipped with a 1" x 1" or a low-energy NaI scintillation probe for Tc-99m contamination. A survey meter equipped with a G-M pancake/frisker probe (15.5 cm^2 surface area) can be used for the detection of gross Tc-99m contamination.
- Monitor for removable surface contamination by smearing, swiping, swabbing, or wipe-testing where Tc-99m is used. Count smears or swabs in a liquid scintillation counter (LSC) or a gamma counter.
- Store millicurie amounts of Tc-99m behind ¼-inch thick lead shielding. Use a syringe shield when administering Tc-99m dosages via a syringe unless contraindicated.