Radionuclide Safety Data Sheet

PHYSICAL DATA

Radionuclide:	Sulfur-35 (S-35)
Decay Mode:	Beta (100% abundance)
Beta Energy:	167 keV (maximum); 49 keV (average)
Physical Half-Life:	87.44 days
Biological Half-Life:	90 days (unbound S-35); 623 days (bound S-35 in Testes)
Effective Half-Life:	44 - 76 days
Specific Activity:	42,710 curies / gram
Maximum Beta Range in Air:	26 cm = 10.5"
Maximum Beta Range in Water/Tissue*:	0.32 cm = 0.015”
Maximum Beta Range in Lucite/Plastic:	0.25 cm = 0.01”

RADIOLOGICAL DATA

Critical Organ:	Testes
Routes of Intake:	Ingestion, Inhalation, Puncture, Wound, Skin Contamination (Absorption)
Exposure Concerns:	Internal exposure & contamination are primary concerns; EXTERNAL EXPOSURE NOT A CONCERN

Annual Limit on Intake (ALI):

Form	Ingestion	Inhalation
Elemental sulfur, sulfides of Sr, Ba, Ge, Sn, Pb, As, Sb, Bi, Cu, Ag, Au, Zn, Cd, Hg, W, Mo and sulfates of Ca, Sr, Ba, Ra, As, Sb, Bi	6 mCi	2 mCi
All other sulfides and sulfates	10 mCi (8 mCi LLI Wall)	20 mCi
Vapor	NA	10 mCi

SHIELDING/LABELING

Shielding: None Required (< 3mm plexiglass)

Labeling: Container with $\geq$ 100 uCi must be labeled “Caution, Radioactive Material”

SURVEY INSTRUMENTATION

S-35 can be detected with a survey meter equipped with a GM pancake probe (15.5 cm^2 surface area), but probe must be at a close distance (< 1 inch)

Counting efficiency of S-35 with GM survey meters is about 4%

Wipes/smears should be counted on a liquid scintillation counter to detect S-35 contamination. Counting efficiency on a Perkin Elmer liquid scintillation counter is approximately 95%.

PERSONAL RADIATION MONITORING DOSIMETERS

Personnel dosimetry (whole body & ring badges) are **NOT** needed (S-35 beta energy is too weak).

BIOASSAY REQURIEMENTS

Not normally required. Notify Radiation Safety if an intake of S-35 is suspected

DOSIMETRY

Millicurie quantities of S-35 do not present a significant external exposure hazard because the low energy emissions barely penetrate the horny outer skin layer. The critical organ for S-35 is the whole body. The elimination rate of S-35 depends on the chemical form. Most S-35 labeled compounds are eliminated via the urine. Ninety days is a conservative biological half-life.

RADIOACTIVE WASTE

Isolate waste from other radionuclides in clearly labeled containers.
Sanitary sewer disposal limit is 1 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 (S-35)

(Permission from University of Michigan Radiation Safety Office)

- Inherent volatility (STP): **SIGNIFICANT** for S-35 methionine & cysteine
- Many S-35 compounds and metabolites are slightly volatile and may create contamination problems if not sealed or otherwise controlled. This occurs particularly when S-35 amino acids are thawed, and then they are added to cell culture media & incubated. Therefore vent thawing S-35 vials in a hood by inserting a needle of a charcoal packed syringe through the septum seal and vent incubated S-35 labeled tissue culture through a charcoal impregnated filter paper.
- Radiolysis of S-35 amino acids (cysteine & methionine) during storage & use may lead to the release of S-35 labeled volatile impurities. Volatile impurities are small (≤ 0.05%).
- Metabolic behavior of organic compounds of sulfur (cysteine & methionine) differs considerably from the metabolic behavior of inorganic compounds.
- Organic compounds of sulfur (cysteine & methionine) become incorporated into various metabolites. Thus, sulfur entering the body as an organic compound is often tenaciously retained.
- The fractional absorption of sulfur from the gastrointestinal tract is typically > 60% for organic compounds of sulfur. Elemental sulfur is less well absorbed from the GI tract than are inorganic compounds of the element (80% for all inorganic compounds of sulfur and 10% for sulfur in its elemental form). Elemental sulfur is an NRC inhalation Class W.
- Inhalation of the gases SO_2, COS, H_2S, and CS_2 must be considered. Sulfur entering the lungs in these forms is completely and instantaneously translocated to the transfer compartment and from there its metabolism is the

same as that of sulfur entering the transfer compartment following ingestion or inhalation of any other organic compound of sulfur.

- Contamination of internal surfaces of storage and reaction vessels may occur (rubber o-rings).
- Vials of S-35 labeled amino acids (cysteine & methionine) should be opened and used in ventilated enclosures (exhaust hoods). In addition, S-35 vapors may be released when opening vials containing labeled S-35 amino acids, during any incubating of culture cells containing S-35, and the storage of S-35 contaminated wastes.
- The volatile components of S-35 labeled cysteine & methionine are presumed to be hydrogen sulfide (H_2S) and methyl mercaptan (CH_3SH), respectively.
- Excessive contamination can be noted on the inside surfaces and in water reservoirs of incubators used for S-35 work. Most notable surface contamination can be found on rubber seals of incubators & centrifuges.
- Radiolytic breakdown may also occur during freezing process, releasing as much as 1.0 uCi of S-35 per 8 mCi vial of S-35 amino acid during the thawing process.
- S-35 labeled amino acids work should be conducted in an exhaust hood designated for radiolytic work.
- Vent S-35 amino acid stock vials with an open-ended charcoal-filled disposable syringe. Activated charcoal has a high affinity for S-35 vapors.
- Place an activated carbon or charcoal canister, absorbent sheet, or tray (50-100 grams of granules evenly distributed in a tray or dish) into an incubator to passively absorb S-35 vapors. Discard absorbers which exhibit survey meter readings of > 10-times facility background levels.
- Always wear a lab coat and disposable gloves when handling S-35.
- Monitor personnel (hands, clothing, shoes, etc), work areas, and floors using a G-M survey meter equipped with a G-M pancake / frisker probe for gross contamination.
- Monitor for removable surface contamination by smearing, swiping, swabbing, or wipe testing where S-35 is used. Count smears or swabs in a liquid scintillation counter (LSC).
- Research personnel must maintain a current inventory of S-35 sources at all times.
- Expelling S-35 solutions through syringe needles and pipette tips can generate airborne aerosols.
- Drying can cause airborne S-35 dust contamination and rapid boiling can volatilize S-35 or cause airborne S-35 aerosol contamination.
- Skin contamination (dose), ingestion, inhalation, puncture/injection, absorption through skin, and area contamination are primary radiological safety concerns.