

SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

Product Identifier

SRM Number: 4947c
SRM Name: Tritiated Toluene Radioactivity Standard for Liquid Scintillation Counting
Other Means of Identification: Not applicable.

Recommended Use of This Material and Restrictions of Use

This Standard Reference Material (SRM) is intended primarily for the calibration of instruments that are used to measure radioactivity by liquid scintillation counting and for the monitoring of radiochemical procedures. A unit of SRM 4947c consists of 4 mL of tritiated-toluene in flame sealed borosilicate glass ampoule.

Company Information

National Institute of Standards and Technology
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2. HAZARDS IDENTIFICATION

Radiological Hazard

Warning: THIS MATERIAL SHOULD ONLY BE USED BY PERSONS QUALIFIED TO HANDLE RADIOACTIVE MATERIAL!

This product contains licensed radioactive material and is therefore subject to the requirements of 10 CFR Part 20 (e.g., public and occupational exposure limits, waste disposal). At a minimum, the basic radiation safety principles of time, distance, and shielding, and appropriate radiation contamination control should be practiced to avoid/minimize any external and/or internal exposure. Consult with your Radiation Safety office for your facility's radiation safety requirements/precautions specific to the radionuclide(s) (including its activity and chemical/physical form) in this Radioactive SRM.

SRM 4947c is a radioactive material, Hydrogen-3-toluene, with a massic activity of approximately 308 kBq·g⁻¹. Hydrogen-3-toluene decays by beta-particle emission. During the decay process no photons are emitted.

Classification

Physical Hazard:	Flammable liquid	Category 2
Health Hazard:	Acute Toxicity, Inhalation	Category 4
	Skin Corrosion/Irritation	Category 2
	Serious Eye Damage/Eye Irritation	Category 2B
	Reproductive Toxicity	Category 2
	STOT, Single Exposure	Category 3
	STOT, Repeated Exposure	Category 2
	Aspiration Hazard	Category 1

Label Elements
Symbol



Signal Word
DANGER

Hazard Statement(s)

- H225 Highly flammable liquid and vapor.
- H304 May be fatal if swallowed and enters airways.
- H315+H320 Causes skin and eye irritation.
- H332 Harmful if inhaled.
- H336 May cause drowsiness or dizziness.
- H361 Suspected of damaging fertility or the unborn child.
- H373 May cause damage to organs (eyes, skin, respiratory system, central nervous system, liver, kidneys) through prolonged or repeated exposure (inhalation, ingestion, skin contact).

Precautionary Statement(s)

- P201 Obtain special instructions before use.
- P202 Do not handle until all safety precautions have been read and understood.
- P210 Keep away from heat, sparks, open flames, and hot surfaces. No smoking.
- P241 Use explosion-proof electrical, ventilating, and lighting equipment.
- P242 Use only non-sparking tools.
- P243 Take precautionary measures against static discharge.
- P260 Do not breathe fumes, gas, mist, vapors, or spray.
- P264 Wash hands thoroughly after handling.
- P271 Use only in a well-ventilated area.
- P280 Wear protective gloves, clothing, and eye protection.

- P301+P310 If swallowed: Immediately call a doctor.
- P303+P361+P353 If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water.
- P304+P340 If inhaled: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
- P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- P308+P313 If exposed or concerned: Get medical attention.
- P331 Do NOT induce vomiting.
- P362+P364 Take off contaminated clothing and wash it before reuse.

- P403+P233 Store in a well-ventilated place. Keep container tightly closed.
- P405 Store locked up.

- P501 Dispose of contents and container according to local regulations.

Hazards Not Otherwise Classified: Not applicable.

Ingredients(s) with Unknown Acute Toxicity: Not applicable.

3. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Substance: Tritiated-toluene

Other Designations:

Toluene: Methylbenzene; toluol; 1-methylbenzene; methylbenzol; phenylmethane; methyl benzene

Hydrogen-3 toluene: Not applicable.

Components are listed in compliance with OSHA's 29 CFR 1910.1200; for the actual values see the NIST Certificate.

Hazardous Component(s)	CAS Number	EC Number (EINECS)	Nominal Mass Concentration (%)
Toluene	108-88-3	203-625-9	>99.9
Hydrogen-3 toluene	not applicable	not applicable	0.000 000 09

4. FIRST AID MEASURES

Description of First Aid Measures:

Inhalation: If adverse effects occur, remove to uncontaminated area. If not breathing, give artificial respiration or oxygen by qualified personnel. Seek immediate medical attention.

Skin Contact: Rinse affected area with copious amounts of water followed by washing with soap and water for at least 15 minutes while removing contaminated clothing. Seek medical attention, if needed.

Eye Contact: Immediately flush eyes, including under the eyelids with copious amounts of water for at least 30 minutes. Seek immediate medical attention.

Ingestion: Contact a poison control center immediately for instructions. Wash out mouth with water, but do not induce vomiting. Seek medical aid at once, and bring the container or label.

Most Important Symptoms/Effects, Acute and Delayed: Respiratory tract, skin, and eye irritation; aspiration hazard, nervous system depression, and nerve damage.

Indication of any immediate medical attention and special treatment needed, if necessary: If any of the above symptoms are present, seek immediate medical attention.

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Severe fire hazard. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back. Vapor/air mixtures are explosive. Electrostatic discharges may be generated by flow or agitation resulting in ignition or explosion. See Section 9, "Physical and Chemical Properties" for flammability properties.

Extinguishing Media:

Suitable: Regular dry chemical, carbon dioxide, water, regular foam.

Unsuitable: None listed.

Specific Hazards Arising from the Chemical: Thermal decomposition products: oxides of carbon, hydrocarbons.

Special Protective Equipment and Precautions for Fire-Fighters: Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH approved self-contained breathing apparatus (SCBA).

NFPA Ratings: (0 = Minimal; 1 = Slight; 2 = Moderate; 3 = Serious; 4 = Severe)

Health = 3

Fire = 0

Reactivity = 0

6. ACCIDENTAL RELEASE MEASURES

This material is radioactive. DO NOT touch spilled material. Immediately notify safety personnel of a spill.

Personal Precautions, Protective Equipment, Methods and Materials for Containment and Clean up:

Radiological Emergency Procedures:

The following is a guide for first responders. The following actions, including remediation, should be carried out by qualified individuals. In cases where a life-threatening injury occurs concurrent with personal contamination, treat the injury first.

Do not touch damaged packages or spilled material. Handle as a radioactive material spill. In addition to those actions described below, the guidelines in the Emergency Response Guidebook (ERG) provide more specific measures that should be followed.

Spill and Leak Control:

Alert and clear everyone from the area affected by the spill.

Take actions to limit the spread of contamination.

Summon aid.

Damage to the Radioactive Source:

Evacuate the immediate vicinity around the source.

Place a barrier at a safe distance from the source.

Identify area as a radiation hazard.

Suggested Emergency Protective Equipment:

Gloves
Footwear Covers
Outer layer or easily removed protective clothing (as situation requires)

7. HANDLING AND STORAGE

Safe Handling Precautions and Storage: This material is radioactive. Store and handle in accordance with all current regulations and standards. See NRC 10 CFR 20 or state regulations. See Section 8, "Exposure Controls and Personal Protection".

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits:**Hydrogen-3:**

ALI_{inh}: 8000 µCi or 296 MBq (See NRC 10 CFR 20 Appendix B)
ALI_{ing}: 8000 µCi or 296 MBq
OSHA: See OSHA 29 CFR and NRC 10 CFR 20.
ACGIH: See International Commission on Radiological Protection guidelines.

Toluene:

NIOSH (REL): 375 mg/m³; 100 ppm (TWA)
560 mg/m³; 150 ppm (STEL)
1885 mg/m³; 500 ppm (IDLH)
ACGIH (TLV): 75 mg/m³; 20 ppm (TWA)
OSHA (PEL): 750 mg/m³; 200 ppm (TWA)
1130 mg/m³; 300 ppm (Ceiling)

Engineering Controls: Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

Personal Protection: In accordance with OSHA 29 CFR 1910.132, subpart I, wear appropriate Personal Protective Equipment (PPE) to minimize exposure to this material.

Respiratory Protection: If workplace conditions warrant a respirator, a respiratory protection program that meets OSHA 29CFR 1910.134 must be followed. Refer to NIOSH 42 CFR 84 for applicable certified respirators.

Eye/Face Protection: Wear splash resistant safety goggles with a face shield. An eye wash station should be readily available near areas of use.

Skin and Body Protection: Wear protective clothing to prevent contact with skin. Wear appropriate gloves.

9. PHYSICAL AND CHEMICAL PROPERTIES

Descriptive Properties:

Appearance (physical state, color, etc.):
Molecular Formula:
Molar Mass (g/mol):
Odor:
Odor threshold:
pH:
Evaporation rate (butyl acetate = 1):
Melting point/freezing point (°C):
Sublimation Point (°C):
Decomposition (°C):
Relative Density as specific gravity (water = 1):
Vapor Pressure:
Vapor Density (air = 1):
Viscosity (cP):
Solubility(ies):

Toluene

clear, colorless liquid
C₇H₈
92.14
distinct odor
10 ppm to 15 ppm
not available
2.24
-95 (-139 °F)
not applicable
not applicable
0.8669
22 mmHg at 20 °C
3.14
0.560 cP at 25 °C
water solubility: 0.05 % at 20 °C; soluble in alcohol, ether, benzene, chloroform, ligroin, acetic acid, carbon disulfide, acetone
log Kow = 2.73

Partition coefficient (n-octanol/water):

Thermal Stability Properties:

Autoignition Temperature (°C):	480 (896 °F)
Thermal Decomposition (°C):	not applicable
Initial boiling point and boiling range (°C):	111 (232 °F)
Explosive Limits, LEL (Volume %):	1.2
Explosive Limits, UEL (Volume %):	7.1
Flash Point (Closed Cup):	4 °C (39.2 °F)
Flammability (solid, gas):	not applicable

10. STABILITY AND REACTIVITY

Reactivity: Stable at normal temperatures and pressure.

Stability: Stable Unstable

Possible Hazardous Reactions: No data available.

Conditions to Avoid: Avoid heat, flames, sparks and other sources of ignition. Ampoules may rupture or explode if exposed to heat. Keep out of water supplies and sewers.

Incompatible Materials: Oxidizing materials, halogens, combustible materials, acids, metal salts.

Fire/Explosion Information: See Section 5, "Fire Fighting Measures".

Hazardous Decomposition: Thermal decomposition will produce oxides of carbon, hydrocarbons.

Hazardous Polymerization: Will Occur Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Exposure: Inhalation Skin Ingestion

Symptoms Related to the Physical, Chemical and Toxicological Characteristics: Respiratory tract, skin, and eye irritation; aspiration hazard, nervous system depression, and nerve damage.

Potential Health Effects (Acute, Chronic and Delayed):

Inhalation: Exposure to 100 ppm may cause irritation. Levels of 200 ppm to 600 ppm for up to 8 h caused fatigue, weakness, confusion, headache, nausea, impaired coordination and reaction time, paresthesias of the skin, euphoria, dizziness, and dilated pupils. Exposure to 800 ppm caused rapid irritation, nasal mucous secretion, metallic taste, drowsiness, and impaired balance. After effects including nervousness, muscular fatigue, and insomnia lasted for several days.

Skin Contact: Contact with liquid may cause irritation and dermatitis due to defatting.

Eye Contact: Irritation with redness and pain and conjunctivitis.

Ingestion: Aspiration hazard; ingestion of toluene can cause lung damage and death.

Numerical Measures of Toxicity:

Acute Toxicity: Category 4, inhalation.

Toluene: Rat, Oral LD50: 636 mg/kg
Rat, Dermal LD50: 8390 mg/kg
Rat, Inhalation LC50: 12.5 mg/L (4 h)

Skin Corrosion/Irritation: Category 2

Toluene: Rabbit, Dermal: 435 mg (mild); 500 mg (moderate); 20 mg (moderate, 24 h)

Serious Eye Damage/Irritation: Category 2B

Toluene: Rabbit, Eye: 870 µg (mild); 100 mg/30 s rinse (mild); 2 mg (severe, 24 h)

Respiratory Sensitization: No data available.

Skin Sensitization: No data available.

Germ Cell Mutagenicity: Not classified.

Toluene: Human, Inhalation: 252 µg/L (19 years)

Carcinogenicity: Not classified.

Listed as a Carcinogen/Potential Carcinogen Yes No
Toluene is not listed by NTP or OSHA as a carcinogen; IARC lists toluene as Group 3, not classifiable.

Radiological Hazard: Hydrogen-3-toluene
Ionizing radiation is a known carcinogen.

Reproductive Toxicity: Category 2B

Toluene: Endpoints listed for reproductive effects on embryo or fetus
Rat, Oral, TDLo: 7280 mg/kg (pregnant 6 d to 19 d),
fetotoxicity (except death, e.g., stunted fetus)
Mouse, Oral, TDLo: 9 g/kg (pregnant 6 d to 15 d), fetal death

Specific Target Organ Toxicity, Single Exposure: Category 3 (narcotic effects)
See health effects listed in "Potential Health Effects (Acute, Chronic and Delayed)".

Specific Target Organ Toxicity, Repeated Exposure: Category 2

Prolonged or repeated exposure may cause mucous membrane irritation, vomiting, insomnia, nosebleeds, chest pains, euphoria, headache, vertigo, nausea, anorexia, momentary loss of memory, loss of coordination and impairment of reaction time, tinnitus, impaired speech, vision, and/or hearing, alcohol intolerance, and petechiae and abnormal bleeding. Volunteers exposed to 200 ppm for 6 hours/day for 2 days showed a significant increase in heart rate. Cardiac sensitization may occur and may result in cardiac arrest due to ventricular fibrillation. Repeated inhalation to the point of euphoria has caused irreversible encephalopathy with cerebellar ataxia, rhythmic limb movements, disequilibrium, bizarre behavior, emotional lability, optic atrophy, and diffuse cerebral atrophy.

Aspiration Hazard: Category 1
Toluene is reported as an aspiration hazard.

12. ECOLOGICAL INFORMATION

Ecotoxicity Data:

Fish Toxicity: Rainbow trout (*Oncorhynchus mykiss*) LC50 (flow-through): 5.9 mg/L to 7.8 mg/L (96 h)
Invertebrate: Freshwater water flea (*Daphnia magna*) EC50 (static): 5.5 mg/L to 9.8 mg/L (48 h)

Persistence and Degradability: No data available.

Bioaccumulative Potential: No data available.

Mobility in Soil: No data available

Other Adverse effects: No data available.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: This material is radioactive. Dispose in accordance with all applicable federal, state, and local regulations for **RADIOACTIVE** materials. See NRC 10 CFR 20 subpart K.

14. TRANSPORTATION INFORMATION

U.S. DOT and IATA:

Primary Risk: UN1294, Toluene, Hazard Class 3, Packing Group II, Excepted Quantity E2.

Subsidiary Risk: Not radioactive for shipping purposes.

15. REGULATORY INFORMATION

U.S. Regulations:

CERCLA Sections 102a/103 (40 CFR 302.4): Toluene, 1000 lbs; 454 kg RQ.

SARA Title III Section 302 (40 CFR 355.30): Not regulated.

SARA Title III Section 304 (40 CFR 355.40): Not regulated.

SARA Title III Section 313 (40 CFR 372.65): Toluene, 1.0 % de minimis concentrations.

OSHA Process Safety (29 CFR 1910.119): Not regulated.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE HEALTH: Yes.
CHRONIC HEALTH: Yes.
FIRE: Yes.
REACTIVE: No.
PRESSURE: No.

State Regulations:

California Proposition 65: Warning! This product contains a chemical known to the state of California to cause reproductive/developmental effects.

U.S. TSCA Inventory: Toluene is listed.

TSCA 12(b), Export Notification: No components are listed.

Canadian Regulations: WHMIS Information is not provided for this material.

16. OTHER INFORMATION

Issue Date: 20 July 2015

Sources: ChemAdvisor, Inc., SDS *Toluene*, 20 March 2015.

Hazardous Substances Data Bank, National Library of Medicine, *Toluene CAS 108-88-3*, Full Record, available at <http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB> (accessed July 2015).

NIOSH Pocket Guide to Chemical Hazards, *Toluene CAS 108-88-3*, (04 April 2011), available at <http://www.cdc.gov/niosh/npg/npgd0619.html> (accessed July 2015); also see *RTECS #*: *XS5250000*, (May 2009); at <http://www.cdc.gov/niosh-rtecs/XS501BD0.html> (accessed July 2015).

OSHA 29 CFR, Subpart Z, Ionizing radiation, 1910.1096.

NRC 10 CFR 20, Standards for Protection Against Radiation.

DOT 49 CFR 173, Shippers General Requirements for Shipments and Packages.

Key of Acronyms:

ACGIH	American Conference of Governmental Industrial Hygienists	NIOSH	National Institute for Occupational Safety and Health
ALI	Annual Limit on Intake	NIST	National Institute of Standards and Technology
CAS	Chemical Abstracts Service	NRC	Nuclear Regulatory Commission
CEN	European Committee for Standardization	NTP	National Toxicology Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	OSHA	Occupational Safety and Health Administration
CFR	Code of Federal Regulations	PEL	Permissible Exposure Limit
CPSU	Coal Mine Dust Personal Sample Unit	RCRA	Resource Conservation and Recovery Act
DOT	Department of Transportation	REL	Recommended Exposure Limit
EC50	Effective Concentration, 50 %	RM	Reference Material
EINECS	European Inventory of Existing Commercial Chemical Substances	RQ	Reportable Quantity
EPCRA	Emergency Planning and Community Right-to-Know Act	RTECS	Registry of Toxic Effects of Chemical Substances
IARC	International Agency for Research on Cancer	SARA	Superfund Amendments and Reauthorization Act
IATA	International Air Transportation Agency	SCBA	Self-Contained Breathing Apparatus
IDLH	Immediately Dangerous to Life and Health	SRM	Standard Reference Material
ISO	International Organization for Standardization	STEL	Short Term Exposure Limit
LC50	Lethal Concentration, 50 %	TDLo	Toxic Dose Low
LD50	Lethal Dose, 50 %	TLV	Threshold Limit Value
LEL	Lower Explosive Limit	TPQ	Threshold Planning Quantity
MSDS	Material Safety Data Sheet	TSCA	Toxic Substances Control Act
NFPA	National Fire Protection Association	TWA	Time Weighted Average
MSHA	Mine Safety and Health Administration	UEL	Upper Explosive Limit
		WHMIS	Workplace Hazardous Materials Information System

Disclaimer: Physical and chemical data contained in this SDS are provided only for use in assessing the hazardous nature of this material. The SDS was prepared carefully, using current references; however, NIST does not certify the data in the SDS. The certified values for this material are given in the NIST Certificate.

Users of this SRM should ensure that the SDS in their possession is current. This can be accomplished by contacting the SRM Program: telephone (301) 975-2200; fax (301) 948-3730; e-mail srmmsds@nist.gov; or via the Internet at <http://www.nist.gov/srm>.