Date of Issue:
04 October 2018

SAFETY DATA SHEET

1. Substance and Source Identification

Product Identifier

SRM Number: 4427H
SRM Name: Yttrium-90 Solution
Other Means of Identification: Not applicable.

Recommended Use of This Material and Restrictions of Use

A unit of Standard Reference Material (SRM) 4427H consists of 5 mL of a 0.1 M (0.4 %) hydrochloric acid solution in which a certified quantity of radioactive Yttrium 90 is dissolved. The solution is contained in a 5 mL flame sealed borosilicate glass ampoule. This SRM is intended primarily for the calibration of instruments that are used to measure radioactivity and for the monitoring of radiochemical procedures.

Company Information

National Institute of Standards and Technology
Standard Reference Materials Program
100 Bureau Drive, Stop 2300
Gaithersburg, Maryland 20899-2300

Telephone: 301-975-2200
FAX: 301-948-3730
E-mail: SRMMSDS@nist.gov
Website: https://www.nist.gov/srm

Emergency Telephone ChemTrec:
1-800-424-9300 (North America)
+1-703-527-3887 (International)

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 4427H is a radioactive material, Yttrium-90, with a total activity of approximately 50 MBq in a hydrochloric acid solution. Yttrium-90 decays by beta-particle emission. During the decay process, X-Rays and gamma rays with energies from approximately 2 keV to 2.2 MeV are emitted. In addition, the beta particles emitted from Yttrium-90 produce bremsstrahlung photons with energies up to 2.3 MeV. THIS SRM SHOULD ONLY BE USED BY PERSONS QUALIFIED TO HANDLE RADIOACTIVE MATERIAL!!

Classification

Physical Hazard: Corrosive to Metals: Category 1
Health Hazard: Not classified

Label Elements

Symbol

Signal Word
WARNING

Hazard Statement(s)

H290	May be corrosive to metals

Precautionary Statement(s)

P234	Keep only in original container.
P390	Absorb spillage to prevent material damage.
P406	Store in corrosive resistant container.

Hazards Not Otherwise Classified: None.

Ingredients(s) with Unknown Acute Toxicity: None.

3. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Substance: Yttrium-90 in hydrochloric acid, solution.

Other Designations:

Hydrochloric acid: HCl; muriatic acid.
Yttrium-90: Not applicable.

This SRM contains trace amounts of YCl_3. 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 (%)
Hydrochloric acid	7647-01-0	231-595-7	0.4
Yttrium-90	Not applicable	Not applicable	0.000 00005
Non-Hazardous Component(s)			
Yttrium Chloride			0.00002–0.0001
Water	7732-18-5	231-791-2	>95

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: Acid burns to skin and eyes.

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: Negligible fire hazard. See Section 9, "Physical and Chemical Properties" for flammability properties.

Extinguishing Media:

Suitable: Use extinguishing media appropriate to the surrounding fire.
Unsuitable: None listed.

Specific Hazards Arising from the Chemical: Oxides of nitrogen.

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:

Y-90:
ALI_{inh}: 700 μCi or 25.9 MBq (See NRC 10 CFR 20 Appendix B)
ALI_{ing}: 400 μCi or 14.8 MBq (LLI wall)
OSHA: See OSHA 29 CFR and NRC 10 CFR 20.
ACGIH: See International Commission on Radiological Protection guidelines

Hydrochloric Acid:
OSHA (PEL): 5 ppm (7 mg/m^3) ceiling.
ACGIH (TLV): 2 ppm ceiling.
NIOSH (REL): 5 ppm (7 mg/m^3) recommended 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.):	colorless liquid
Molecular Formula:	not applicable
Molar Mass (g/mol):	not applicable
Odor:	Irritating odor, slightly pungent
Odor threshold:	(1 to 5) ppm for most people
pH:	~1
Evaporation rate:	< 1
Melting point/freezing point (ºC):	0.5 ºC
Relative Density (g/L) as specific gravity (water = 1):	1.00 at 20 ºC
Vapor Pressure (mmHg):	2 kPa (17 mmHg) at 20 ºC (total)
Vapor Density (air = 1):	1.27 (HCl vapor)
Kinematic Viscosity (mm^2/s = centiStokes):	1.00 at 20 ºC
Solubility(ies):	Soluble in water and alcohols
Partition coefficient (n-octanol/water):	not available
Particle Size	not applicable

Thermal Stability Properties:

Autoignition Temperature (ºC):	not applicable
Thermal Decomposition (ºC):	not applicable
Initial boiling point and boiling range (ºC):	100.1 ºC
Explosive Limits, LEL (Volume %):	not applicable
Explosive Limits, UEL (Volume %):	not applicable
Flash Point (ºC):	not applicable
Flammability (solid, gas):	not applicable

10. STABILITY AND REACTIVITY

Reactivity: This material is stable at normal temperatures and pressure.

Stability: X Stable _____ Unstable

Possible Hazardous Reactions: None listed.

Conditions to Avoid: Avoid heat, flames and contact with combustible and incompatible materials.

Incompatible Materials: Cyanides, metals, amines, bases, metal carbide, oxidizing materials, acids, halo carbons, combustible materials, halogens, metal salts.

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

Hazardous Decomposition: Hydrogen chloride.

Hazardous Polymerization: _____ Will Occur X Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Exposure: X Inhalation X Skin X Ingestion

Symptoms Related to the Physical, Chemical and Toxicological Characteristics: Burning pain and severe corrosive skin damage. Permanent eye damage including blindness could result.

Potential Health Effects (Acute, Chronic and Delayed):

Inhalation: Inhalation of hydrochloric acid can damage the mucous membranes and upper respiratory tract. Short term exposure may cause irritation and inflammation of the upper respiratory tract, coughing, choking, sore throat, shortness of breath, headache, dizziness, and nausea. Long term exposure to acid fumes may cause damage to teeth, bronchial irritation, chronic cough, bronchial pneumonia, and gastrointestinal disturbances.

Skin Contact: Hydrochloric acid can cause severe skin burns. Severity of the damage depends on the concentration and duration of exposure. Effects of acid burns may be delayed.

Eye Contact: Hydrochloric acid can cause severe eye irritation, corneal burns, permanent eye damage, or blindness. Severity of the damage depends on the concentration and duration of exposure.

Ingestion: If ingested, concentrated hydrochloric acid can cause burns to the gastrointestinal tract.

Numerical Measures of Toxicity:

Acute Toxicity: Not classified.
Hydrochloric acid: Rat, Inhalation LC50: 1.68 mg/L (1 h)
Hydrochloric acid: Rabbit, Dermal LD50: >5010 mg/kg
Hydrochloric acid: Rat, Oral LD50: 238-277 mg/kg

Skin Corrosion/Irritation: Not classified.

Serious Eye Damage/Eye Irritation: Not classified.

Respiratory Sensitization: No data available.

Skin Sensitization: No data available.

Germ Cell Mutagenicity: No data available.

Carcinogenicity: No data available.

Listed as a Carcinogen/Potential Carcinogen _____ Yes __X__ No
Hydrochloric acid is not listed by NTP, IARC or OSHA as a carcinogen.

Radiological Hazard: Yttrium-90
Ionizing radiation is a known carcinogen.

Reproductive Toxicity: Not classified.
Hydrochloric acid: Rat, Oral TDLo: 450 mg/kg (1 h, prior to copulation 1 d)

Specific Target Organ Toxicity, Single Exposure: No data available.

Specific Target Organ Toxicity, Repeated Exposure: No data available.

Aspiration Hazard: No data available.

12. ECOLOGICAL INFORMATION

Ecotoxicity Data:

Component: Hydrochloric Acid
Invertebrate: shrimp, LC50: 100-330 ppm (48 hrs, salt water)

Component: Yttrium-90
No ecotoxicity data listed.

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: Radioactive Material, Type A Package, Class 7, UN2915.
Subsidiary Risk: Dangerous Goods in Excepted Quantities, Hazard Class 8.

15. REGULATORY INFORMATION

U.S. Regulations:

CERCLA Sections 102a/103 (40 CFR 302.4): Hydrochloric Acid: 5000 lb (2 270 kg) final RQ.

SARA Title III Section 302 (40 CFR 355.30): Hydrochloric Acid: 500 lb TPQ (gas only).

SARA Title III Section 304 (40 CFR 355.40): Hydrochloric Acid: 5000 lb RQ (gas only).

SARA Title III Section 313 (40 CFR 372.65): Hydrochloric Acid: 1.0 % de minimis concentrations; (acid aerosols including mists, vapors, gas, fog, and other airborne forms of any particle size).

OSHA Process Safety (29 CFR 1910.119): Hydrochloric Acid: 5000 lbs (2270 kg) TQ (anhydrous).

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

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

State Regulations:

California Proposition 65: No components are regulated.

U.S. TSCA Inventory: Hydrochloric acid listed.

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

Canadian Regulations:

WHMIS Information: Not provided for this material.

16. OTHER INFORMATION

Issue Date: 04 October 2018

Sources: ChemAdvisor, Inc., MSDS *Hydrochloric Acid*, 09 December 2015.

United States National Library of Medicine, Hazardous Substance Database (HSDB), *Yttrium Radioactive*; available at https://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB (accessed Oct 2018).

National Oceanic and Atmospheric Administration, Computer-Aided Management of Emergency Operations (CAMEO) Chemicals; Hydrochloric Acid Solution; available at https://cameochemicals.noaa.gov/chris/HCL.pdf (accessed Oct 2018).

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 Transport Association	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 https://www.nist.gov/srm.