

MATERIAL SAFETY DATA SHEET

SRM Supplier: National Institute of Standards and Technology
Standard Reference Materials Program
100 Bureau Drive, Mail Stop 2321
Gaithersburg, Maryland 20899

SRM Number: 4324B
MSDS Number: 4324B
SRM Name: Uranium-232 Radioactivity Standard
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SECTION I. MATERIAL IDENTIFICATION

Material Name: Uranium-232 Radioactivity Standard

Description: SRM 4324B consists of radioactive uranium-232 nitrate and nitric acid dissolved in 5 mL of distilled water. The resulting solution is 12 wt. % nitric acid.

Other Designations: Uranium-232 in **Nitric Acid** (aqua fortis; hydrogen nitrate; azotic acid; engravers acid) **Solution**

Name	Chemical Formula	CAS Registry Number
Nitric Acid	HNO ₃	7697-37-2

DOT Classification: Nitric Acid, UN2031

Manufacturer/Supplier: Available from a number of suppliers

SRM 4324A is a radioactive material with a massic activity of approximately 40 Bq•g⁻¹. The hazard information supplied in this MSDS is for the Chemical Hazard Only! For the hazard documentation concerning the radioactive material, refer to the packaging information and insert sheet.

SECTION II. HAZARDOUS INGREDIENTS

Hazardous Components	Nominal Concentration (%)	Exposure Limits and Toxicity Data
Nitric Acid	12	ACGIH TLV-TWA: 2 mg/kg or 5 mg/m ³
		OSHA TLV-TWA: 2 mg/kg or 5 mg/m ³
		Human, Oral: LD _{Lo} : 430 mg/kg
Uranium-232	5 x 10 ⁻⁹	N/A*

*For the radiation hazard, refer to the packaging information and insert sheet.

SECTION III. PHYSICAL/CHEMICAL CHARACTERISTICS

Nitric Acid	
Appearance and Odor: a white to slightly yellow liquid that darkens to a brownish color upon aging and exposure to light; pungent odor	Melting Point: not available
Relative Molecular Mass: 63.02	Odor Threshold: not available
Density: 1.05 (10 % nitric acid)	Water Solubility: soluble
Boiling Point: 83 °C	Solvent Solubility: soluble in ether; decomposes in alcohol

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A

Method Used: N/A

Autoignition Temperature: N/A

Flammability Limits in Air (Volume %): UPPER: N/A
LOWER: N/A

Unusual Fire and Explosion Hazards: Although nitric acid does not burn, it is a powerful oxidizing agent that can react with combustible materials to cause fires.

Extinguishing Media: Use extinguishing media that is appropriate to the surrounding fire. Use a water spray to dilute nitric acid and to absorb liberated oxides of nitrogen.

Special Fire Procedures: Fire fighters should wear a self-contained breathing apparatus (SCBA) with a full face piece in the pressure demand or positive mode and other protective clothing.

SECTION V. REACTIVITY DATA

Stability: X Stable Unstable

Conditions to Avoid: Avoid contact with incompatible materials.

Incompatibility (Materials to Avoid): Keep nitric acid away from organic materials, plastics, rubber, and some forms of coatings. Nitric acid is incompatible with chlorine and metal ferrocyanide.

See Section IV: *Unusual Fire and Explosion Hazards*.

Hazardous Decomposition or Byproducts: Hazardous decomposition of nitric acid can produce various nitrogen oxides, including nitric oxide (NO), nitrogen dioxide (NO₂), nitrous oxide (N₂O), as well as nitric acid mist or vapor.

Hazardous Polymerization Will Occur X Will Not Occur

SECTION VI. HEALTH HAZARD DATA

Route of Entry: X Inhalation X Skin X Ingestion

Health Hazards (Acute and Chronic): Nitric acid is extremely irritating to the skin, eyes, and mucous membranes. Inhalation of acidic substances may cause severe respiratory irritation with coughing, choking, and possible yellowish burns of the mucous membranes. Other initial symptoms may include dizziness, headache, nausea, and weakness. In nonfatal cases, complete recovery may occur within a few days or weeks. In severe exposures, death due to *anoxia* (the absence or reduced supply of oxygen in inspired gases, arterial blood or tissues) may occur within a few hours after the onset of symptoms of *pulmonary edema* (an abnormal excess of accumulation of serous fluid in the connective tissue of the lungs) or following a relapse. Repeated or prolonged exposures to an acidic substance may cause erosion of the teeth, inflammatory and ulcerative changes in the mouth, and possibly jaw *necrosis* (localized death of living tissue). Bronchial irritation with cough and frequent attacks of *bronchial pneumonia* may occur. Gastrointestinal disturbances are also possible.

Direct skin contact with nitric acid may cause severe pain, burns, and possibly yellowish stains. Dilute solutions of nitric acid may produce mild irritation and harden the epidermis without destroying it. Repeated or prolonged exposure to acidic substances may result in dermatitis or effects similar to acute exposure. Eye contact with acidic substances may cause pain and *lacrimation* (the excessive secretion of tears), *photophobia* (abnormal intolerance of light), and burns. The extent of the injury depends on the concentration and duration of contact.

Ingestion of acidic substances may cause burns and corrosion of the mucous membranes of the mouth, throat, and esophagus.

Medical Conditions Generally Aggravated by Exposure: Immune system deficiencies and skin rashes are affected by nitric acid.

Listed as a Carcinogen/Potential Carcinogen:

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens	_____	<u> X </u>
In the International Agency for Research on Cancer (IARC) Monographs	_____	<u> X </u>
By the Occupational Safety and Health Administration (OSHA)	_____	<u> X </u>

EMERGENCY AND FIRST AID PROCEDURES:

Skin Contact: Remove contaminated shoes and clothing. Rinse affected area with large amounts of water followed by washing the area with soap and water. Watch for chemical irritations and treat them accordingly. Obtain medical assistance if necessary.

Eye Contact: Immediately flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Obtain medical assistance if necessary.

Inhalation: If inhaled, move the victim to fresh air. If breathing is difficult, give oxygen; if the victim is not breathing, give artificial respiration. Obtain medical assistance if necessary.

Ingestion: If ingestion occurs, wash out mouth with water. **DO NOT** induce vomiting. Obtain medical assistance immediately.

Note to Physician (Nitric Acid): Wash affected skin areas with 5% solution of sodium bicarbonate (NaHCO₃). If ingested, the risk versus the benefit of the passage of a naso-gastric tube is debatable. Activated charcoal is of no value. **DO NOT** give the exposed person bicarbonate to neutralize the material.

TARGET ORGAN(S) OF ATTACK: skin, teeth, eyes, and upper respiratory tract

SECTION VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be taken in Case Material Is Released or Spilled: Notify safety personnel of spills. Spills should be handled according to radioactive spill procedures.

Waste Disposal: Follow all federal, state, and local laws governing disposal of radioactive materials.

Handling and Storage: Provide general and local explosion proof ventilation systems to maintain airborne concentrations below the TLV. Provide approved respiratory apparatus for non-routine or emergency use. Use an approved filter and vapor respirator when the vapor or mist concentrations are high. Wear gloves and chemical safety glasses where contact with the liquid or high vapor concentrations may occur. An eye wash station and washing facilities should be readily available near handling and use areas. Wash exposed skin areas several times a day with soap and warm water. The sample container should be handled by persons qualified to handle both radioactive material and strong acid solutions.

Note: Contact lenses pose a special problem; soft lenses may absorb irritants and all lenses concentrate them. **DO NOT** wear contact lenses in the laboratory.

This material should be stored and used at a temperature between 5 °C and 65 °C.

SECTION VIII. SOURCE DATA/OTHER COMMENTS

Sources: MDL Information Systems, Inc., MSDS *Nitric Acid*, 16 December 2002.
Hawley's Condensed Chemical Dictionary, 11th ed., 1987.
The American Heritage: Stedman's Medical Dictionary, 1995.
Webster's Ninth New Collegiate Dictionary, 1990.

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