

MATERIAL SAFETY DATA SHEET

SRM Supplier: National Institute of Standards and Technology
Standard Reference Materials Program
Bldg. 202 Rm. 211
Gaithersburg, Maryland 20899

SRM Number: 3133
MSDS Number: 3133
SRM Name: Mercury Standard Solution
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SECTION I. MATERIAL IDENTIFICATION

Material Name: Mercury Standard Solution

Description: SRM 3133 is a single element solution prepared gravimetrically to contain a nominal 10 mg/mL of mercury with a nitric acid volume fraction of 10 %.

Other Designations: Mercury (quicksilver; hydrargyrum) in Nitric Acid (aqua fortis; hydrogen nitrate; azotic acid; engravers acid); *Mercuric Nitrate (mercury nitrate monohydrate; mercury nitrate; mercuric nitrate monohydrate) in Spectrometric Solution

Name	Chemical Formulas	CAS Registration Numbers
Nitric Acid	HNO ₃	7697-37-2
Mercury	Hg	7439-97-6
Mercuric Nitrate	Hg(NO ₃) ₂	7783-34-8

DOT Classification: Nitric Acid, Solution
ID#: UN2031

Manufacturer/Supplier: Available from a number of suppliers

*The addition of mercury to nitric acid, (along with other intermediate chemical reactions), forms mercuric nitrate which will precipitate upon evaporation or drying of the solution.

SECTION II. HAZARDOUS INGREDIENTS

Hazardous Components	Nominal Concentration (%)	Exposure Limits and Toxicity Data
Nitric Acid	10	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 ₅₀ : 430 mg/kg
Mercuric Nitrate	1.62	ACGIH TLV-TWA: 0.05 mg/m ³ (vapor/skin) OSHA TLV-TWA: 0.025 mg/m ³ (metal and inorganic compounds) Rat, Oral: LD ₅₀ : 26 mg/kg
Mercury	1	ACGIH TLV-TWA: 0.05 mg/m ³ (vapor/skin) OSHA TLV-TWA: 0.025 mg/m ³ (metal and inorganic compounds) Rat, Inhalation: TC _{LO} : 1 mg/m ³ /24 hrs/5 wks continuous

SECTION III. PHYSICAL/CHEMICAL CHARACTERISTICS

Nitric Acid	Mercuric Nitrate	Mercury
Appearance and Odor: A white to slightly yellow liquid that darkens to a brownish color upon aging and exposure to light.	Appearance and Odor: A white to yellow deliquescent powder.	Appearance and Odor: An odorless, gray, metallic liquid.
Relative Molecular Mass: 63.02	Relative Molecular Mass: 342.61	Relative Atomic Mass: 200.59
Density: 1.0543 (10% nitric acid)	Density: 4.3	Density: 13.5939
Solubility in Water: Soluble	Solubility in Water: Soluble.	Solubility in Water: Insoluble
Solvent Solubility: Decomposes in alcohol.	Solvent Solubility: Soluble in nitric acid.	Solvent Solubility: Soluble in hot sulfuric acid, nitric acid and lipids.

Note: The physical and chemical data provided are for the pure components. Physical and chemical data for this mercury/nitric acid solution do not exist. The actual behavior of the solution may differ from the individual components.

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 and mercuric nitrate do not burn, they are powerful oxidizing agents that can react with combustible materials to cause fires. Mercury is a negligible fire hazard when exposed to heat or flames.

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. Mercury is incompatible with metals, amines, halogens, oxidizing materials, acids and metal carbides; mercury nitrate should be kept from combustible materials, cyanides, acids, metal salts, and reducing agents.

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

Hazardous Decomposition or Byproducts: Hazardous decomposition of nitric acid and/or mercuric nitrate can produce various nitrogen oxides, including nitric oxide (NO), nitrogen dioxide (NO₂), nitrous oxide (N₂O), as well as nitric acid mist or vapor. Thermal decomposition of mercury may release toxic and/or hazardous gases.

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: 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* (localized death of living tissue), *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.

Mercury and Mercury Nitrate: Inhalation of high levels of mercury and mercury compound vapors can cause almost immediate *dyspnea* (difficult or labored breathing), cough, fever, nausea, vomiting, diarrhea, headache, *stomatitis* (inflammatory diseases of the mouth), salivation, *gingivitis*, and metallic taste. Respiratory irritation may occur with chest pain and tightness. Acidosis and renal damage leading to renal failure may also occur.

Repeated exposures to these vapors may cause *mercurialism*, which is characterized by fine tremors and erethism. Tremors may effect the hands first, but may also become evident in the face, arms and legs. Erethism may be manifested by abnormal shyness, blushing, self-consciousness, depression or despondency, irritability, headache, fatigue, and insomnia. In severe cases, hallucinations, loss of memory and mental deterioration may occur. Concentrations as low as 0.03 mg/m³ have induced psychiatric symptoms in humans. Renal involvement may be indicated by *proteinuria*, *enzymuria*, and *anuria* (the absence of urine formation). Discoloration of the cornea and crystalline lens, tremor of the eyelids and rarely, disturbances of vision and extraocular muscles have been reported. Other effects may include salivation, *gingivitis*, *stomatitis*, loosening of the teeth, blue lines on the gums, diarrhea, weight loss, *anorexia*, speech and sensory disorders, unsteady gait, chronic *pneumonitis* and mild *anemia*. Repeated exposures to mercury and its compounds may result in sensitization. Mercury is excreted in breast milk. Several studies have revealed that inorganic mercury can cause reproductive effects such as chromosomal aberrations in humans and animals. There is transplacental passage in female humans and animals. Decreased ovulation, lengthening of the estrus cycle, increased infant mortality, and congenital malformation in development of the nervous system have also been reported.

Skin contact with mercury and its compounds may be corrosive and may cause redness, pain, and skin burns. Small amounts may be absorbed through intact skin. Repeated or prolonged exposure to the skin may result in sensitization. Repeated use of ointments containing mercurials have been reported to cause *nephrotic syndrome* and *renal tubular acidosis*.

Eye contact with mercury and its compounds are corrosive and may cause redness, pain and blurred vision. Contact with this material may be indicated by *mercurialentis* -- discoloration of the crystalline lens, on slit lamp examination of the eyes.

Ingestion of inorganic mercury compounds may cause burning of the mouth, sore throat, metallic taste, nausea, vomiting, bloody diarrhea, thirst, severe *gingivitis*, *stomatitis*, and *necrosis* of the intestinal mucosa. *Colitis*, abdominal pain, weakness, fatigue, pallor, *hematemesis* (the vomiting of blood), shock, and vascular collapse may occur. Severe ingestions may result in delayed *anuria* and acute renal failure. Repeated ingestion cause systemic effects as detailed by chronic inhalation.

Medical Conditions Generally Aggravated by Exposure: Immune system deficiencies and skin rashes.

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. Contact medical assistance if necessary.

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

Ingestion: If ingestion occurs, wash out mouth with water. **DO NOT** induce vomiting. Contact medical assistance if necessary.

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: **Nitric Acid:** The skin, teeth, eyes, and upper respiratory tract.
 Mercury and Mercury Nitrate: The immune system, kidneys and the nervous system.

SECTION VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be taken in Case Material is Released or Spilled: Notify safety personnel of spills. Surfaces contaminated with spills should be covered with soda ash or sodium bicarbonate to neutralize the acid. Place the neutralized material into containers suitable for eventual disposal, reclamation or destruction.

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

Handling and Storage: Provide general and local explosion proof ventilation systems to maintain airborne concentrations below the TLV. Provide approved respiratory apparatus for nonroutine 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.

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.

Store this material in its original bottle at room temperature. It must be tightly recapped after use and protected from moisture.

SECTION VIII. SOURCE DATA/OTHER COMMENTS

Sources: MDL Information Systems, Inc., MSDS *Mercury*, August 10, 1996.
MDL Information Systems, Inc., MSDS *Mercury Nitrate*, February 8, 1997.
MDL Information Systems, Inc., MSDS *Nitric Acid*, March 13, 1995.
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 on the NIST Certificate of Analysis.