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: 3118a
MSDS Number: 3118a
SRM Name: Gadolinium Standard Solution
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SECTION I. MATERIAL IDENTIFICATION

Material Name: Gadolinium Standard Solution

Description: SRM 3118a is a single element solution prepared gravimetrically to contain a nominal 10 mg/g of gadolinium with a nitric acid volume fraction of 10 %.

Other Designations: Gadolinium in **Nitric Acid** (aqua fortis; hydrogen nitrate; azotic acid; engravers acid); **Gadolinium Nitrate*** (nitric acid, gadolinium (+3) salt pentahydrate; gadolinium (III) trinitrate pentahydrate) in **Standard Solution**

Name	Chemical Formula	CAS Registry Number
Nitric Acid	HNO_3	7697-37-2
Gadolinium Nitrate	$Gd(NO_3)_3 \bullet 5\ H_2O$	52788-53-1
Gadolinium	Gd	7440-54-2

DOT Classification: Nitric Acid, Solution, UN2031

Manufacturer/Supplier: It is available from a number of suppliers.

* The addition of gadolinium to nitric acid, along with other intermediate chemical reactions, forms gadolinium 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_{LO}: 430 mg/kg
Gadolinium Nitrate	2.8	No ACGIH TLV-TWA established
		Rat, Oral: LD_{50}: 3805 mg/kg
Gadolinium	1	No ACGIH TLV-TWA established

SECTION III. PHYSICAL/CHEMICAL CHARACTERISTICS

Nitric Acid	Gadolinium Nitrate	Gadolinium
Appearance and Odor: a colorless to slightly yellow liquid that darkens to a brownish color upon aging and exposure to light; a pungent odor	**Appearance and Odor:** colorless to faintly yellow metal	**Appearance and Odor:** colorless to faintly yellow metal
Relative Molecular Mass: 63.02	**Relative Molecular Mass:** 433.40	**Relative Atomic Mass:** 157.25
Density: 1.05 g/mL (10 % nitric acid)	**Density:** 2.332 g/mL	**Density:** 7.886 g/mL
Solubility in Water: soluble	**Solubility in Water:** soluble	**Solubility in Water:** insoluble
Solvent Solubility: decomposes in alcohol	**Solvent Solubility:** soluble in alcohol	**Solvent Solubility:** soluble in acids

NOTE: The physical and chemical data provided are for the pure components. Physical and chemical data for this gadolinium/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 does not burn, it is a powerful oxidizing agent that can react with combustible materials to cause fires. Gadolinium is pyrophoric upon cutting or filing. Gadolinium nitrate is an oxidizer; contact with combustible materials may cause a fire.

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 heat, flames, and other sources of ignition. Avoid contact with combustible and other 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. Avoid contact with acids, bases, amines, halogens, halocarbons, cyanides, metals, metal oxides, metal salts, metal carbides, peroxides, oxidizing materials, and reducing agents. Gadolinium is incompatible with halogens and oxidizing materials.

See Section IV: *Unusual Fire and Explosion Hazards*

Hazardous Decomposition or Byproducts: Hazardous decomposition of nitric acid and/or praseodymium nitrate can produce various nitrogen oxides, including nitric oxide (NO), nitrogen dioxide (NO_2), nitrous oxide (N_2O), as well as nitric acid mist or vapor. Thermal decomposition of gadolinium may release toxic and/or hazardous gases of gadolinium oxides.

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 may be fatal if inhaled, swallowed, or absorbed through the skin. This material causes burns and is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin. Inhalation may be fatal as a result of spasm, inflammation, and edema of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting.

Gadolinium and Gadolinium Nitrate: Gadolinium nitrate may be harmful by inhalation, ingestion, or skin absorption. Exposure may cause irritation to the skin, eyes, mucous membranes, and upper respiratory tract. Inhalation of sufficient amounts of rare earths may cause itching, sensitivity to heat, and an increased awareness of odor and taste. The oral toxicity of rare earth metals and salts is low due to poor gastrointestinal absorption. Ingestion may result in tearing, diarrhea, and liver damage. Eye contact may cause conjunctivitis; skin contact may lead to hair loss. Nitrates may cause dermatoses if absorbed through the skin. Rare earth compounds may effect the blood's ability to clot.

Medical Conditions Generally Aggravated by Exposure: Nitric Acid: may caued eye disorders, skin disorders, respiratory disorders, and allergies

Gadolinium Nitrate: may effect the blood's ability to clot

Listed as a Carcinogen/Potential Carcinogen:

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

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.

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

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 (Nitric Acid): Wash affected skin areas with 5 % solution of sodium bicarbonate ($NaHCO_3$). 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:** skin, teeth, eyes, and upper respiratory tract
Gadolinium and Gadolinium Nitrate: blood, liver and skin

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 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.

> **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 at room temperature.

SECTION VIII. SOURCE DATA/OTHER COMMENTS

Sources:
MDL Information Systems, Inc., MSDS *Nitric Acid*, 16 September 1999.
MDL Information Systems, Inc., MSDS *Gadolinium*, 2 June 1999.
MDL Information Systems, Inc., MSDS *Gadolinium Nitrate*, 7 December 1999.
The Merck Index, 11th Ed., 1989.
The Sigma-Aldrich Library of Chemical Safety Data, Ed. II, 1988.