Date of Issue:
01 October 2015

SAFETY DATA SHEET

1. Substance and Source Identification

Product Identifier

SRM Number: 3151
SRM Name: Silver (Ag) Standard Solution
Other Means of Identification: Not applicable.

Recommended Use of This Material and Restrictions of Use

This Standard Reference Material (SRM) is intended for use as a primary calibration standard for the quantitative determination of silver. A unit of SRM 3151 consists of five 10 mL sealed borosilicate glass ampoules of an acidified aqueous solution prepared gravimetrically to contain a known mass fraction of silver. The solution contains nitric acid at a volume fraction of approximately 10 %.

Company Information

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Standard Reference Materials Program
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2. Hazards Identification

Classification

Physical Hazard:	Not classified.	
Health Hazard:	Skin Corrosion/Irritation	Category 1B
	Serious Eye Damage/Eye Irritation	Category 1

Label Elements
Symbol

Signal Word
DANGER

Hazard Statement(s)

H314	Causes severe skin burns and eye damage.

Precautionary Statement(s)

P260	Do not breathe fume, mists, vapors, or spray.
P264	Wash hands thoroughly after handling.
P280	Wear protective gloves, protective clothing, and eye protection.
P301 + P330 + P331	If swallowed: Rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353	If on skin (or hair): Remove immediately all contaminated clothing. Rinse skin with water.
P304 + P340	If inhaled: Remove person to fresh air and keep 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.
P310	Immediately call a doctor.
P363	Wash contaminated clothing before reuse.

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: Nitric Acid/Silver Nitrate Solution

Other Designations:
Nitric acid (aqua fortis; hydrogen nitrate; azotic acid; engraver's acid)
Silver Nitrate [Lapis infernalis; silver mononitrate; nitric acid, silver (1+) salt]

NOTE: Silver in nitric acid solution forms a solvated silver nitrate salt.

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

Hazardous Component(s)	CAS Number	EC Number (EINECS)	Nominal Mass Concentration (%)
Nitric acid	7697-37-2	231-714-2	10
Silver Nitrate	7761-88-8	231-853-9	1.6
Non-Hazardous Component(s)			
Water	7732-18-5	231-791-2	>88

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: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get immediate medical attention. Thoroughly clean and dry contaminated clothing before reuse. Destroy contaminated shoes.

Eye Contact: Immediately flush eyes, including under the eyelids with copious amounts of water for at least 15 minutes. Seek immediate medical attention.

Ingestion: Contact a poison control center immediately for instructions. Do not induce vomiting. Give water to rinse out mouth. Never give liquids to a person with reduced awareness or becoming unconscious. If vomiting occurs, keep head lower than hips to prevent aspiration. If not breathing, give artificial respiration by qualified personnel. Seek immediate medical attention.

Most Important Symptoms/Effects, Acute and Delayed: Acid burns to skin, eyes, and lungs.

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: Thermal decomposition will form oxides of nitrogen and silver.

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

Personal Precautions, Protective Equipment and Emergency Procedures: Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment; see Section 8, "Exposure Controls and Personal Protection".

Methods and Materials for Containment and Clean up: Do not touch spilled material. Notify safety personnel of spills. Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Isolate hazard area and deny entry.

7. HANDLING AND STORAGE

Safe Handling Precautions: See Section 8, "Exposure Controls and Personal Protection". Handle glass ampoules with care.

Storage: Store and handling in accordance with all current regulations and standards. Keep separated from incompatible substances (See Section 10 "Stability and Reactivity").

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits:

Component: Nitric acid

NIOSH (REL):	5 mg/m^3 (2 ppm; TWA)
	10 mg/m^3 (4 ppm; STEL)
	65 mg/m^3(25 ppm; IDLH)
ACGIH (TLV):	5 mg/m^3 (2 ppm; TWA)
	10 mg/m^3 (4 ppm; STEL)
OSHA (PEL):	5 mg/m^3 (2 ppm; TWA)

Component: Silver Nitrate

No occupational limits established.

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 eyewash station should be readily available near areas of use.

Skin and Body Protection: Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Chemical-resistant gloves should be worn at all times when handling chemicals.

9. PHYSICAL AND CHEMICAL PROPERTIES

NOTE: The physical and chemical data provided are for the pure components. No physical or chemical data are available for this solution of silver nitrate and nitric acid. The actual behavior of the solution may differ from the individual components.

Descriptive Properties:	**Nitric acid (10 % of this SRM)**	**Silver Nitrate (1.6 % of this SRM)**
Appearance (physical state, color, etc.):	colorless to yellow liquid	solid
Molecular Formula:	HNO_3	$AgNO_3$
Molar Mass (g/mol):	63.01	169.87
Odor:	irritating odor	odorless
Odor threshold:	not available	not available
pH:	1 (1 M)	6
Evaporation rate:	not available	not available
Melting point/freezing point (ºC):	–42 (–43 ºF)	212 (413 ºF)
Relative Density (g/L) as specific gravity (water = 1):	1.5027 at 25 ºC	4.352 at 19 ºC
Vapor Pressure (mmHg):	47.9 at 20 ºC	not available
Vapor Density (air = 1):	3.2	not available
Viscosity (cP):	not available	not available
Solubility(ies):	miscible with water and ether	water 122 % at 20 ºC; ether, glycerol
Partition coefficient (n-octanol/water):	not available	not available
Particle Size:	not applicable	not available
Thermal Stability Properties:		
Autoignition Temperature (ºC):	not applicable	not applicable
Thermal Decomposition (ºC):	not applicable	444 (831 ºF)
Initial boiling point and boiling range (ºC):	83 (181 ºF)	not available
Explosive Limits, LEL (Volume %):	not applicable	not available
Explosive Limits, UEL (Volume %):	not applicable	not available
Flash Point (ºC):	not applicable	not available
Flammability (solid, gas):	not applicable	not available

10. STABILITY AND REACTIVITY

Reactivity: Stable at normal temperatures and pressure.

Stability: X Stable _____ Unstable

Possible Hazardous Reactions: None listed.

Conditions to Avoid: Contact with combustible or incompatible materials.

Incompatible Materials: Acids, combustible materials, halo carbons, amines, bases, oxidizing materials, metals, halogens, metal salts, metal oxides, reducing agents, peroxides, metal carbide, cyanides.

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

Hazardous Decomposition: Thermal decomposition will produce oxides of nitrogen and silver.

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 skin corrosion, eye, lung, and blood damage, and cancer.

Potential Health Effects (Acute, Chronic and Delayed):

Inhalation: Inhalation of nitric 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. Inhalation of silver nitrate may cause irritation, chronic inhalation may result argyria which may first be recognized by a slate-gray, blue to black discoloration in the conjunctiva and skin starting with the face and spreading to most uncovered parts of the body, including the fingernails which may become a deep chocolate brown color.

Skin Contact: Nitric 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. Silver compounds may cause irritation pain ulceration, prolonged exposure ma cause argyria.

Eye Contact: Nitric acid compounds can cause severe eye irritation, corneal burns, permanent eye damage, or blindness. Severity of the damage depends on the concentration and duration of exposure. Exposure to dust or solutions of silver nitrate may cause severe irritation and burns; permanent corneal opacification, loss of epithelium and blindness may result; chronic exposure may cause conjunctivitis or symptoms similar to those in acute exposure.

Ingestion: Ingestion of this material is unlikely under normal conditions of use. If ingested, nitric acid can cause severe burns and damage to the gastrointestinal tract. Ingestion of silver nitrate may cause pain and burning in the mouth, throat and epigastrium, salivation, violent abdominal pain and rigidity, black vomitus, diarrhea, anuria, collapse, shock, vertigo, convulsions, coma and death. Repeated ingestion may cause argyria Signs and symptoms may occur as described in chronic inhalation, as well as anemia, nephritis, and possibly methemoglobinemia.

Numerical Measures of Toxicity:

Acute Toxicity: Not classified.
Nitric acid, Rat, Inhalation LC50: 130 mg/m^3 (4 h)
Silver nitrate, Rat, Oral LD50: 1173 mg/kg

Skin Corrosion/Irritation: This SRM contains >1 % of nitric acid and it is classified as Category 1B.

Serious Eye damage/Eye irritation: This SRM contains >1 % nitric acid and it is classified as Category 1.

Respiratory Sensitization: No data available.

Skin Sensitization: Not classified.

Germ Cell Mutagenicity: Not classified.
Silver nitrate, Human: 76 µmol/L
Silver nitrate, Mouse: 20 g/kg

Carcinogenicity: Not classified.

Listed as a Carcinogen/Potential Carcinogen _____ Yes X No
Nitric acid is not listed by NTP, IARC or OSHA as a carcinogen.
Silver nitrate is not listed by NTP, IARC or OSHA as a carcinogen.

Reproductive Toxicity: Not classified.
Nitric acid, Rat, Oral TDLo: 21 150 mg/kg (pregnant 1 d to 21 d)
Nitric acid, Rat, Oral TDLo: 2345 mg/kg (pregnant 18 d)
Silver nitrate, Rat, Oral TDLo: 28.56 g/kg (17 week)

Specific Target Organ Toxicity, Single Exposure: Not classified.

Specific Target Organ Toxicity, Repeated Exposure: Not classified.

Aspiration Hazard: No data available.

12. ECOLOGICAL INFORMATION

Ecotoxicity Data:

Nitric acid:	Starfish (*Asterias rubens*) LC50: 100-300 mg/L (48 h, renewal/aerated water)
Silver nitrate:	Rainbow trout (*Oncorhynchus mykiss*) LC50: 0.00839 - 0.1802 mg/L (96 h, static).
	Water flea (*Daphnia magna*) EC50: 0.0008 - 0.0011 mg/L (48 h, static)

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: Dispose of waste in accordance with all applicable federal, state, and local regulations.
Nitric acid subject to disposal regulations: U.S. EPA 40 CFR 262, Hazardous Waste Numbers: D001, D002.
Silver Nitrate subject to disposal regulations: U.S. EPA 40 CFR 262, Hazardous Waste Numbers: D011, regulatory level 5 mg/L.

14. TRANSPORTATION INFORMATION

U.S. DOT and IATA: UN1760, Corrosive liquid, n.o.s. (contains nitric acid), Hazard Class 8, Packing Group II, Excepted Quantities E2.

15. REGULATORY INFORMATION

U.S. Regulations:

CERCLA Sections 102a/103 (40 CFR 302.4):	Nitric acid, 1000 lbs (454 kg) RQ
SARA Title III Section 302 (40 CFR 355.30):	Nitric acid, 1000 lbs (454 kg) TPQ
SARA Title III Section 304 (40 CFR 355.40):	Nitric acid, 1000 lbs (454 kg) EPCRA RQ
SARA Title III Section 313 (40 CFR 372.65):	Nitric acid, 1 % de minimis concentration. Silver nitrate, 1 % de minimis concentration.
OSHA Process Safety (29 CFR 1910.119):	Regulated for nitric acid at higher concentrations 500 lbs TQ (≥94.5 % by weight).

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

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

State Regulations:
California Proposition 65: Not listed.

U.S. TSCA Inventory: Nitric acid and silver nitrate are listed.

TSCA 12(b), Export Notification: Not listed.

Canadian Regulations:
WHMIS Information: Not provided for this material.

16. OTHER INFORMATION

Issue Date: 01 October 2015

Sources: ChemAdvisor, Inc., MSDS *Nitric Acid*, 20 March 2015.

ChemAdvisor, Inc., MSDS *Silver Nitrate*, 20 March 2015.

CDC; NIOSH; *NIOSH Pocket Guide to Chemical Hazards*; Department of Health and Human Services (DHHS), Centers for Disease Control and Prevention (CDC), National Institute for Safety and Health; *Nitric Acid*, 18 November 2010; available at http://www.cdc.gov/niosh/npg/npgd0447.html (accessed Sep 2015).

Hazardous Substances Data Bank (HSDB), National Library of Medicine's TOXNET system, *Nitric Acid CAS No. 7697-37-2*; available at http://toxnet.nlm.nih.gov (accessed Sep 2015).

Key of Acronyms:

ACGIH	American Conference of Governmental Industrial Hygienists	NRC	Nuclear Regulatory Commission
ALI	Annual Limit on Intake	NTP	National Toxicology Program
CAS	Chemical Abstracts Service	OSHA	Occupational Safety and Health Administration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	PEL	Permissible Exposure Limit
CFR	Code of Federal Regulations	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
LC50	Lethal Concentration, 50 %	STEL	Short Term Exposure Limit
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
NIOSH	National Institute for Occupational Safety and Health	UEL	Upper Explosive Limit
NIST	National Institute of Standards and Technology	WHMIS	Workplace Hazardous Materials Information System
n.o.s.	Not Otherwise Specified		

Disclaimer: Physical and chemical data contained in this SDS are provided only for use in assessing the hazardous nature of the 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 of Analysis.

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.