

MATERIAL SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

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

SRM Number: 3139a
MSDS Number: 3139a
SRM Name: Phosphorus Standard Solution

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Description: This Standard Reference Material (SRM) is intended for use as a primary calibration standard for the quantitative determination of phosphorus. Each unit consists of five 10-mL sealed borosilicate glass ampoules of an acidified aqueous solution prepared gravimetrically to contain a known mass fraction of phosphorus. The solution contains nitric acid at a volume fraction of 0.8 %.

Material Name: Phosphorus Standard Solution

Other Designations

Nitric Acid: Aqua fortis; hydronitrate; azotic acid; engraver's acid.

Ammonium Phosphate: Ammonium dihydrogen orthophosphate; ammonium monobasic phosphate; monoammonium dihydrogen phosphate.

2. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Component	CAS Registry	EC Number (EINECS)	Concentration (%)
Nitric Acid	7697-37-2	231-714-2	0.8
Ammonium Phosphate	7722-76-1	231-764-5	3.7

EC Classification, R/S Phrases: Refer to Section 15, "Regulatory Information".

3. HAZARDS IDENTIFICATION

NFPA Ratings (Scale 0-4): Health = 3 Fire = 0 Reactivity = 1

Major Health Hazards: Nitric acid can cause severe or fatal burns by inhalation, ingestion, or contact with skin or eyes. Ammonium phosphate can irritate the respiratory tract, skin, eyes, or GI tract.

Physical Hazards: None documented. Container may shatter.

Potential Health Effects

Inhalation: Nitric acid can damage the mucous membranes and respiratory tract, causing spasm, inflammation of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Symptoms may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting. Teeth may also be damaged. Inhalation of ammonium phosphate may irritate the mucous membranes and upper respiratory tract.

- Skin Contact:** Nitric acid can cause severe skin burns. Effects of acid burns may be delayed. Ammonium phosphate can cause skin irritation. Repeated or prolonged contact may cause chronic dermatitis.
- Eye Contact:** Nitric acid can cause severe eye irritation, corneal burns, permanent eye damage, or blindness. Ammonium phosphate can cause eye irritation.
- Ingestion:** Nitric acid can cause severe burns and damage to the GI tract. Ingestion of large amounts of ammonium phosphate can irritate the GI tract, causing abdominal pain, nausea, vomiting, and diarrhea.

Medical Conditions Aggravated by Exposure: Any pre-existing conditions affecting the respiratory tract, skin, eyes, GI tract, or other target organs.

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>

4. FIRST AID MEASURES

Inhalation: Move the person to fresh air immediately. Qualified medical personnel may start CPR or give oxygen if necessary. Get medical aid at once, and bring the container or label.

Skin Contact: Remove contaminated clothing and shoes. Flush affected skin with water for at least 15 minute, and then wash thoroughly with soap and water. If burns are severe or if skin irritation persists, get medical aid and bring the container or label. Wash contaminated clothing before reusing.

Eye Contact: Remove contact lenses (if any). Do not allow victim to rub eyes or keep eyes closed. Flush eyes with large amounts of running water for at least 30 minutes, keeping eyelids open and raising lids to remove all chemical. Get medical aid at once, and bring the container or label.

Ingestion: Contact a poison control center immediately for instructions. Wash out mouth with water, but do not induce vomiting. Get medical aid at once, and bring the container or label.

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Nitric acid is a powerful oxidizing agent that can react with combustible materials to cause fires. Ammonium phosphate is not flammable, combustible, or explosive. No data are available for the mixture, and its behavior may differ from that of the individual components.

Extinguishing Media: Use extinguishing media appropriate to the surrounding fire: water spray, dry chemical, carbon dioxide, or foam. Use a water spray to dilute nitric acid and to absorb liberated oxides of nitrogen. (These guidelines apply to the mixture; when the components are considered separately, different precautions may apply.)

Fire Fighting: Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH-approved self-contained breathing apparatus (SCBA).

Flash Point (°C): N/A

Autoignition (°C): N/A

Lower Explosive Limit (LEL): N/A

Upper Explosive Limit (UEL): N/A

Flammability Class (OSHA): N/A

Products of Combustion: Thermal decomposition of this material may produce oxides of nitrogen, oxides of phosphorus, and ammonia.

6. ACCIDENTAL RELEASE MEASURES

Occupational Release: Notify safety personnel of spills. Surfaces contaminated with this material 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.

Disposal: Refer to Section 13, "Disposal Considerations".

7. HANDLING AND STORAGE

Storage: Store unopened containers of this material in a dry place at room temperature. Protect from physical damage, heat, and light, and isolate from incompatible materials. Use opened containers immediately or discard.

Safe Handling Precautions: Wear gloves and chemical safety goggles. If contact with this material occurs, wash hands or change clothing as required.

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Nitric Acid:

ACGIH (TLV): 5 mg/m³ (2 ppm) TWA

OSHA (PEL): 5 mg/m³ (2 ppm) TWA

UK WEL: 5.2 mg/m³ (2 ppm)

Ammonium Phosphate: No occupational exposure limits established.

Ventilation: Use local or general exhaust to keep employee exposures below limits. Local exhaust ventilation is preferred because it can control contaminant emissions at the source, preventing dispersion into the general work area. Refer to the ACGIH document *Industrial Ventilation, a Manual of Recommended Practices*.

Respirator: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements must be followed if workplace conditions warrant a respirator. Refer to the "NIOSH Guide to the Selection and Use of Particulate Respirators Certified under 42 CFR 84" for selection and use of respirators certified by NIOSH.

Eye Protection: Use chemical safety goggles where dusting or splashing of solutions may occur. See OSHA standard (29 CFR 1910.133) or European Standard EN166. The employer should provide an emergency eye wash fountain and safety shower in the immediate work area.

Personal Protection: Wear appropriate gloves and protective clothing to prevent contact with skin.

9. PHYSICAL AND CHEMICAL PROPERTIES

Nitric Acid	Ammonium Phosphate
Appearance and Odor: Colorless to slightly yellow liquid, darkens to brown upon aging and exposure to light; irritating, pungent odor.	Appearance and Odor: Colorless to white crystals, granules, or powder; no odor or faint acid odor.
Relative Molecular Weight: 63.02	Relative Molecular Weight: 115.03
Molecular Formula: HNO ₃	Molecular Formula: NH ₄ H ₂ PO ₄
Specific Gravity: 1.05 (10 %)	Specific Gravity: 1.80 @ 19 °C
Solvent Solubility: Decomposes in alcohol	Solvent Solubility: Slightly soluble in alcohol; insoluble in acetone
Water Solubility: Soluble	Water Solubility: 22.7 % @ 0°C
Boiling Point (°C): 86 (187 °F)	Boiling Point: N/A (decomposes)
Melting Point (°C): N/A	Melting Point: N/A
Vapor Pressure (Pa): 946 @ 20 °C	Vapor Pressure (Pa): <100 @ 20 °C (68 °F)
Vapor Density (Air=1): 2.17	Vapor Density (Air=1): N/A
Critical Solution Temperature: N/A	Critical Solution Temperature: N/A
pH: 1.0 (0.1 M solution)	pH: N/A

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

10. STABILITY AND REACTIVITY

Stability: Stable Unstable

Stable at normal temperatures and pressure.

Conditions to Avoid: Dust generation; contact with incompatible materials.

Incompatible Materials:

Nitric Acid: Incompatible with numerous materials including organic materials, plastics, rubber, chlorine, and metal ferrocyanide.

Ammonium Phosphate: Incompatible with sodium hypochlorite, metals, bases, amines, and oxidizing materials.

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

Hazardous Decomposition: Thermal decomposition of this material may produce oxides of nitrogen, oxides of phosphorus, and ammonia.

Hazardous Polymerization: Will Occur Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Entry: X Inhalation X Skin X Ingestion

Nitric Acid:

Human, oral: LD_{Lo} = 430 mg/kg
Rat, oral: LD₅₀ > 90 mg/kg
Rat, inhalation: LC₅₀ (4 hrs) = 130 mg/m³

Ammonium Phosphate:

Rat, oral: LD₅₀ = 5750 mg/kg
Rabbit, skin: LD₅₀ > 7940 mg/kg

Target Organ(s): Skin, eyes, respiratory tract, GI tract.

Mutagen/Teratogen: Nitric acid has caused birth defects in animals under experimental conditions, and has also been investigated as a possible mutagen. Ammonium phosphate is not classified as a reproductive hazard.

Health Effects: See Section 3.

12. ECOLOGICAL INFORMATION

Nitric Acid, Ecotoxicity Data:

Green shore crab (*Carcinus maenas*): LC₅₀ (48 hrs) = 180,000 µg/L
Starfish (*Asterias rubens*): LC₅₀ (48 hrs) = 100,000 to 330,000 µg/L
Hooknose (*Agonus cataphractus*): LC₅₀ (48 hrs) = 100,000 to 330,000 µg/L
Brook trout (*Salvelinus fontinalis*): NR-LETH = 1,562 µg/L
Cockle (*Cerastoderma edule*): LC₅₀ (48 hrs) = 330,000 to 1,000,000 µg/L

Ammonium Phosphate:

Fathead minnow (*Pimephales promelas*): LC₅₀ (96 hrs) = 155 ppm

Environmental Summary: This mixture may be slightly toxic to aquatic life. Phosphates in general promote eutrophication of surface waters. Do not release to the environment.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: One or more components of this mixture is a RCRA hazardous waste. Dispose of container and unused contents in accordance with federal, state, and local requirements for acid waste, which vary according to location. Decontaminate containers before recycling. Processing, use, or contamination of this product may change the waste management options.

14. TRANSPORTATION INFORMATION

U.S. DOT and IATA: Corrosive liquid, N.O.S. (contains nitric acid); UN 1760; Hazard Class 8, Packing Group II; Excepted quantity (5 × 10 mL).

15. REGULATORY INFORMATION

U.S. REGULATIONS

CERCLA Sections 102a/103 (40 CFR 302.4):

Nitric Acid: RQ = 1000 lb.

Ammonium Phosphate: Not regulated.

SARA Title III Section 302: Nitric acid is regulated.

SARA Title III Section 304: Nitric acid is regulated.

SARA Title III Section 313: Nitric acid is regulated.

OSHA Process Safety (29 CFR 1910.119): Nitric acid at higher concentrations ($\geq 94.5\%$) is regulated

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

ACUTE: Yes

CHRONIC: Yes

FIRE: No

REACTIVE: Yes

SUDDEN RELEASE: No

STATE REGULATIONS

California Proposition 65: Not regulated.

CANADIAN REGULATIONS

WHMIS Classification:

Nitric Acid: C (oxidizing material), D1A (very toxic material), E (corrosive material)

Ammonium Phosphate: D2B (toxic)

WHMIS Ingredient Disclosure List: Nitric acid is regulated.

EUROPEAN REGULATIONS

EU/EC Classification:

Nitric Acid: O (Oxidizer), C (Corrosive)

Ammonium Phosphate: Xi (Irritant); not classified in Annex I of Directive 67/548/EEC.

Risk Phrases (mixture):

R23 Toxic by inhalation)

R25 Toxic if swallowed)

R34 Causes burns

R36/37/38 Irritating to eyes, respiratory system and skin)

Safety Phrases (mixture):

S20/21 When using, do not eat, drink or smoke)

S28 Wash after contact with skin)

S45 In case of accident or illness, see doctor; show label)

S60 Dispose of this material and its container as hazardous waste)

NATIONAL INVENTORY STATUS

U.S. Inventory (TSCA): Both components are listed.

TSCA 12(b), Export Notification: Neither component is listed.

16. OTHER INFORMATION

Sources:

IUCLID Chemical Data Sheet: Ammonium Phosphate.

PAN Pesticide Database: Nitric Acid.

U.S. National Institute for Occupational Safety and Health, *NIOSH Pocket Guide to Chemical Hazards*, September 2005 edition. DHHS (NIOSH) Publication No. 2005-151.

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