Date of Issue:
09 November 2023

SAFETY DATA SHEET

1. Substance and Source Identification

Product Identifier

SRM Number: 1683b
SRM Name: Nitric Oxide in Nitrogen (Nominal Amount-of-Substance Fraction 50 µmol/mol)
Other Means of Identification: Not Applicable.

Recommended Use of This Material and Restrictions of Use

This Standard Reference Material (SRM) is a primary gas mixture of nitric oxide in nitrogen supplied in a DOT 3AL specification aluminum (6061 alloy) cylinder with a water volume of 6 L. This SRM is a primary gas mixture supplied in a DOT 3AL-specification aluminum (6061 alloy) cylinder with a water volume of 6 L. Mixtures are shipped with a nominal pressure exceeding 12.4 MPa (1800 psig), which provides the user with 0.73 m^3 (25.8 ft^3) of useable mixture. The cylinder is the property of the purchaser and is equipped with a CGA-660 stainless steel valve, which is the recommended outlet for this nitric oxide mixture.

Company Information

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

Telephone: 301-975-2200
E-mail: SRMMSDS@nist.gov
Website: http://www.nist.gov/srm

Emergency Telephone ChemTrec:
1-800-424-9300 (North America)
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2. Hazards Identification

Classification

Physical Hazard: Compressed Gas
Health Hazard: Simple Asphyxiant

Label Elements
Symbol



Signal Word
WARNING

Hazard Statement(s)

H280	Contains gas under pressure; may explode if heated.
------	May displace oxygen and cause rapid suffocation.

Precautionary Statement(s)

P410 + P403	Protect from sunlight. Store in a well-ventilated place.

Hazards Not Otherwise Classified: Not applicable.

Ingredients(s) with Unknown Acute Toxicity: Not applicable.

3. Composition and Information on Hazardous Ingredients

Substance: Nitric oxide in nitrogen, compressed gas

Other Designations:

Nitrogen (Dinitrogen; nitrogen compressed)
Nitric oxide (Nitrogen oxide; nitrogen monoxide; nitric oxide trimer; NO)

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

Hazardous Components	CAS Number	EC Number (EINECS)	Nominal Mass Concentration (%)
Nitrogen	7727-37-9	231-783-9	>99.0
Nitric oxide	10102-43-9	233-271-0	≤0.025

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: Not applicable.

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

Ingestion: Ingestion of a gas is unlikely.

Most Important Symptoms/Effects, Acute and Delayed: Nausea, headache, weakness, drowsiness, difficulty breathing, and suffocation.

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 applicable to the identified NIST cylinder. Cylinders may rupture or explode if exposed to heat. 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: Oxides of nitrogen.

Special Protective Equipment and Precautions for Fire-Fighters: Move cylinder from fire area if it can be done without personal risk. Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH approved self-contained breathing apparatus (SCBA).

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". Shut off gas supply if this can be done safely. Isolate area until gas has dispersed.

Methods and Materials for Containment and Clean up: Stop leak if possible without personal risk. Isolate hazard area and deny entry. Ventilate closed spaces before entering.

7. Handling and Storage

Safe Handling Precautions: Secure cylinder to prevent physical damage. Close valve after each use and when empty. Keep valve protection cap on cylinder when not in use.

Storage: Store and handle in accordance with all current regulations and standards. Keep separated from incompatible substances. Store in well-ventilated area. Subject to storage regulations, OSHA 29 CFR 1910.101.

8. Exposure Controls and Personal Protection

Exposure Limits:

Nitric oxide

NIOSH (REL):	30 mg/m^3 (25 ppm) TWA
NIOSH (REL):	123 mg/m^3 (100 ppm) IDLH
ACGIH (TLV):	30 mg/m^3 (25 ppm) TWA
OSHA (PEL):	30 mg/m^3 (25 ppm) TWA

Nitrogen
ACGIH (TLV): Simple asphyxiant.

Engineering Controls: Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

Personal Protection Measures: 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

Descriptive Properties:

Appearance (physical state, color, etc.):	colorless compressed gas
Molar Mass (g/mol):	28
Odor:	sweet odor (NO)[a]
Odor threshold:	0.27 ppm to 0.9 ppm[a]
pH:	not applicable
Evaporation rate:	not applicable
Melting point/freezing point (ºC):	–210 (–346 ºF)
Relative Density (g/L):	1.2506
Vapor Pressure (mmHg):	760 (–196 ºC) (nitrogen)
Vapor Density (air = 1):	0.968[a]
Viscosity (cP):	0.01787 at 27 ºC (nitrogen)
Solubility(ies):	water, 1.485[a]
Partition coefficient (n-octanol/water):	not available
Particle Size:	not applicable
Thermal Stability Properties:	
Autoignition Temperature:	not applicable
Thermal Decomposition	not applicable
Initial boiling point and boiling range (ºC):	–196 (–321 ºF) (nitrogen)
Explosive Limits, LEL:	not applicable
Explosive Limits, UEL:	not applicable
Flash Point:	not applicable
Flammability (solid, gas):	not applicable

[a]Properties listed in vendor MSDS.

10. STABILITY AND REACTIVITY

Reactivity: Stable at normal temperature and pressure.

Stability: X Stable _____ Unstable

Possible Hazardous Reactions: None listed.

Conditions to Avoid: Avoid heat, flames, sparks, and other sources of ignition. Minimize contact with material. Containers may rupture or explode if exposed to heat.

Incompatible Materials: Oxidizing materials, halogens, metal oxides, metals, combustible materials, metal salts, halocarbons.

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

Hazardous Decomposition: Miscellaneous decomposition products.

Hazardous Polymerization: _____ Will Occur X Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Exposure: X Inhalation _____ Skin _____ Ingestion

Symptoms Related to the Physical, Chemical and Toxicological Characteristics: Nausea, headache, weakness, drowsiness, difficulty breathing, and suffocation.

Potential Health Effects (Acute, Chronic and Delayed):

Inhalation:
Nitric oxide: Acute exposure to nitric oxide at low concentrations in a one-time exposure may cause mild coughing, respiratory tract irritation, fatigue, headache, nausea and vomiting choking abdominal pain, and dyspnea. Exposure to 25 ppm for 60 minutes may cause irritation and minor chest pain; 50 ppm may lead to pulmonary edema with possible recovery; 100 ppm may cause pulmonary edema and death.

Nitrogen: Nitrogen compressed gas is a simple asphyxiant. Release in an enclosed space may result in asphyxiation. The symptoms of asphyxia depend on the rapidity with which the oxygen deficiency develops and how long it continues. In sudden acute asphyxia, unconsciousness may be immediate. With slow development, there may be rapid respiration and pulse, air hunger, dizziness, reduced awareness, tightness in the head, tingling sensations, incoordination, faulty judgment, emotional instability, and rapid fatigue. As the asphyxia progresses, nausea, vomiting, collapse, unconsciousness, convulsions, deep coma, and death are possible.

Skin Contact: Nitric oxide at low concentrations may cause skin irritation.

Eye Contact: Nitric oxide at low concentrations in air may cause a stinging sensation of the eyes.

Ingestion: Ingestion of a gas is unlikely under normal conditions of use.

Numerical Measures of Toxicity:

Acute Toxicity: Not classified.
Nitric oxide: Rat, Inhalation LC50: 115 ppm (1 h); 57.5 ppm (4 h); 1068 mg/m^3 (4 h)
Nitrogen: Simple asphyxiant.

Skin Corrosion/Irritation: No data available.

Serious Eye Damage/Irritation: No data available.

Respiratory Sensitization: No data available.

Skin Sensitization: No data available.

Germ Cell Mutagenicity: No data available.

Carcinogenicity: Not classified.

Listed as a Carcinogen/Potential Carcinogen _____ Yes X No
Nitrogen and nitric oxide are not listed by NTP, IARC or OSHA as carcinogens.

Reproductive Toxicity: No data available.

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: No data available.

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.

14. TRANSPORTATION INFORMATION

U.S. DOT and IATA: UN1956, Compressed gas, n.o.s. (nitric oxide in nitrogen), Hazard Class 2.2.

15. REGULATORY INFORMATION

U.S. Regulations:

CERCLA Sections 102a/103 (40 CFR 302.4): Identified cylinder not regulated.

SARA Title III Section 302 (40 CFR 355.30): Identified cylinder not regulated.

SARA Title III Section 304 (40 CFR 355.40): Identified cylinder not regulated

SARA Title III Section 313 (40 CFR 372.65): Identified cylinder not regulated.

OSHA Process Safety (29 CFR 1910.119): Identified cylinder not regulated.

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

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

State Regulations:

California Proposition 65: Not listed.

U.S. TSCA Inventory: Nitrogen and nitric oxide are listed.

TSCA 12(b), Export Notification: No components are listed.

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

16. OTHER INFORMATION

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Sources: ChemADVISOR, Inc., SDS, *Nitrogen, Compressed Gas*, 09 December 2015.

ChemADVISOR, Inc., SDS, *Nitric Oxide*, 09 December 2015.

Air Liquide, Vendor MSDS, *Nitric Oxide in Nitrogen*; 21 December 2011

NIOSH Pocket Guide to Chemical Hazards, *Nitrogen Monoxide, CAS No. 10102-43-9*; 30 October 2019; available at http://www.cdc.gov/niosh/npg/npgd0448.html (accessed Nov 2023).

NIOSH RTECS, *Nitrogen Monoxide, No QX0525000, CAS No. 10102-43-9*; March 2019; available at http://www.cdc.gov/niosh-rtecs/QX802C8.html (accessed Nov 2023).

National Library of Medicine, Hazardous Substances Databank (HSDB), *Nitrogen Monoxide, CAS No. 10102-43-9*; available at https://pubchem.ncbi.nlm.nih.gov/compound/145068 (accessed Nov 2023).

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 Transport Association	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
NIOSH	National Institute for Occupational Safety and Health	TWA	Time Weighted Average
NIST	National Institute of Standards and Technology	UEL	Upper Explosive Limit
n.o.s.	Not Otherwise Specified	WHMIS	Workplace Hazardous Materials Information System

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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; e-mail srmmsds@nist.gov; or via the Internet at http://www.nist.gov/srm.