Date of Issue:
13 June 2017

SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

Product Identifier

SRM Number: 1664a
SRM Name: Sulfur Dioxide in Nitrogen (Nominal amount-of-substance 2500 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 for which the amount-of-substance fraction, expressed as concentration, may be related to secondary working standards. The SRM is intended for the calibration of instruments used for sulfur dioxide determinations. This SRM mixture is 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 0.70 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 sulfur dioxide mixture.

Company Information

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Standard Reference Materials Program
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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: None.

Ingredients(s) with Unknown Acute Toxicity: None.

3. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Substance: Sulfur dioxide in nitrogen, compressed gas.

Other Designations: Sulfur dioxide (sulfur oxide; SO_2); Nitrogen (dinitrogen; diatomic nitrogen).

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 (%)
Nitrogen, compressed gas	7727-37-9	231-783-9	99.4
Sulfur dioxide	7446-09-5	231-195-2	0.6

4. FIRST AID MEASURES

Description of First Aid Measures

Inhalation: If adverse effects occur, remove to well-ventilated (uncontaminated) area. If breathing is difficult, qualified personnel may administer oxygen. If not breathing, qualified personnel should give artificial respiration. 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: Not applicable.

Most Important Symptoms/Effects, Acute and Delayed: Respiratory tract burns, allergic reactions, nausea, suffocation, confusion, unconsciousness, coma.

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. Cylinder may rupture or explode if exposed to heat.

Extinguishing Media

Suitable: Use extinguishing agents appropriate for surrounding fire.
Unsuitable: Not applicable.

Specific Hazards Arising from the Chemical: Cylinder may rupture or explode if exposed to heat.

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 by-products. 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: Isolate hazard area and deny entry. Stay upwind and keep out of low areas. Refer to Section 8, "Exposure Controls and Personal Protection".

Methods and Materials for Containment and Clean up: Stop leak if possible without personal risk.

7. HANDLING AND STORAGE

Safe Handling Precautions: See Section 8, "Exposure Controls and Personal Protection".

Storage and Incompatible Materials: Subject to storage regulations: U.S. OSHA 29 CFR 1910.101. Store and handle in accordance with all current regulations and standards. Secure cylinder to prevent physical damage. Keep valve protective cap on cylinder when not in use. Store in a well-ventilated area. Keep separated from incompatible substances (metals and oxidizing materials). Avoid heat, flames, sparks and other sources of ignition. Minimize contact with material.

8. Exposure Controls and Personal Protection

Exposure Limits

Sulfur dioxide

OSHA (PEL): 13 mg/m^3 (5 ppm) TWA
ACGIH (TLV): 0.25 ppm STEL
NIOSH (REL): 5 mg/m^3 (2 ppm) TWA
13 mg/m^3 (5 ppm) STEL
100 ppm IDLH

Nitrogen, compressed gas

No occupational limits established.

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 Protection: Eye protection is not required but recommended.

Skin and Body Protection: Protective clothing and gloves are not required but recommended.

9. Physical and Chemical Properties

Descriptive Properties	Nitrogen, Compressed Gas (99.4 %)	Sulfur Dioxide (0.6 %)
Molar Mass (g/mol)	28.01	64.06
Molecular Formula	N_2	SO_2
Appearance (physical state, color, etc.)	colorless, gas	colorless, gas
Odor	odorless	irritating odor
Odor threshold	not applicable	3 ppm to 5 ppm
pH	not applicable	acidic in solution
Evaporation rate (butyl acetate = 1)	not applicable	>1
Melting point/freezing point	–210 °C	–73 °C (–99 °F)
Relative Density	1.2506 g/L	1.434 g/L at –10 °C
Vapor Pressure	760 mmHg at –196 °C	2538 mmHg at 21 °C
Vapor Density (air = 1)	0.967	2.26
Viscosity	0.01787 cP at 27 °C	0.0124 mP at 18 °C
Solubilities	water: 1.6 % at 20 °C solvent: soluble in liquid ammonia; slightly soluble in alcohol	water: 22.8 % at 0 °C solvent: alcohol, acetic acid, sulfuric acid, ether. chloroform, acetone, aromatic carbides, benzene, nitrobenzenes, sulfuryl chloride, toluene
Partition coefficient (n-octanol/water)	not available	not available
Thermal Stability Properties		
Autoignition Temperature	not applicable	not applicable
Thermal Decomposition	not applicable	not applicable
Initial boiling point and boiling range	–196 °C (–321 °F)	–10 °C (liquid) (14 °F)
Explosive Limits, LEL	not applicable	not applicable
Explosive Limits, UEL	not applicable	not applicable
Flash Point	not applicable	not applicable
Flammability (solid, gas)	not applicable	not applicable

10. Stability and Reactivity

Reactivity: This material is not reactive at normal temperatures and pressure.

Stability: X Stable _____ Unstable

Possible Hazardous Reactions: Not applicable.

Conditions to Avoid: Protect from physical damage and heat. Containers may rupture or explode if exposed to heat.

Incompatible Materials: Metals and oxidizing materials.

Hazardous Decomposition: Oxides of nitrogen and oxides of sulfur.

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: Irritation, nausea, vomiting, chest pain, difficulty breathing, irregular heartbeat, headache, disorientation, emotional disturbances, pain in extremities, tremors, loss of coordination, hearing loss, visual disturbances.

Potential Health Effects (Acute, Chronic, and Delayed)

Inhalation:

Sulfur dioxide has been reported to cause increased pulse rate, and a shallow, rapid respiratory rate at concentrations of 1 ppm to 8 ppm. Higher levels may cause intense irritation of the mucous membranes, severe choking, violent cough, hoarseness, sneezing, rhinorrhea, chest pain, bronchoconstriction dyspnea, cyanosis, nausea, vomiting, abdominal pain, urinary incontinence, anxiety, mental confusion, and unconsciousness. Death may be due to respiratory paralysis, pulmonary edema, or systemic acidosis.

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: Sulfur dioxide gas contact with moist skin may cause irritation or chemical burns. Prolonged exposure may cause dermatitis.

Eye Contact: Irritation from sulfur dioxide gas may begin around 10 ppm to 20 ppm, with smarting and lacrimation. Higher concentrations may cause intense irritation and inflammation of the conjunctiva.

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

Numerical Measures of Toxicity

Acute toxicity: Not classified, concentration of sulfur dioxide is below cut-off value of 1 %.
Nitrogen, compressed gas: Simple asphyxiant.
Sulfur dioxide: Rat, Inhalation LC_{50}: 2500 ppm (1 h).

Skin corrosion/irritation: Not classified.

Serious eye damage/ eye irritation: Not classified.
Sulfur dioxide: Rabbit, Eyes: 6 ppm (32 d), mild.

Respiratory sensitization: Not classified, concentration of sulfur dioxide is below cut-off value of 1 %.
Sulfur dioxide may aggravate respiratory disorders.

Skin sensitization: Not classified, concentration of sulfur dioxide is below cut-off value of 1 %.
Sulfur dioxide may cause dermatitis on moist skin.

Germ Cell Mutagenicity: Not classified, concentration of sulfur dioxide is below cut-off value of 1 %.
Sulfur dioxide: 5700 ppb human; 14 μg/L (4 h, 7 d) mouse.

Carcinogenicity: Not classified.

Listed as a Carcinogen/Potential Carcinogen _____ **Yes** X **No**

IARC lists sulfur dioxide as Group 3, *not classifiable as to its carcinogenicity to humans*.

Reproductive Toxicity: Not classified, concentration of sulfur dioxide is below cut-off value of 1 %.
No adverse effects have been reported for nitrogen, compressed gas.
Sulfur dioxide, Rat, Inhalation TCLo: 30 ppm (6 h, 21 week)

Specific target organ toxicity, single exposure: Not classified, concentration of sulfur dioxide is below cut-off value of 1 %. Sulfur dioxide may cause reduced lung capacity and airway resistance at low concentrations.

Specific target organ toxicity, repeated exposure: Not classified, concentration of sulfur dioxide is below cut-off value of 1 %. Sulfur dioxide may cause sensitization.

Aspiration hazard: Not applicable to this material.

12. ECOLOGICAL INFORMATION

Ecotoxicity Data:
There is no ecotoxicity data available for the pure, individual components or the mixture.

Persistence and Degradability: Sulfur dioxide will degrade into sulfuric acid and sulfates.

Bioaccumulative Potential: No bioaccumulation expected.

Mobility in Soil: Not applicable.

Other Adverse effects: Not applicable.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: Dispose in accordance with all applicable federal, state, and local regulations.

14. TRANSPORTATION INFORMATION

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

15. REGULATORY INFORMATION

U.S. Regulations

CERCLA Sections 102a/103 (40 CFR 302.4): Not regulated.

SARA Title III Section 302 (40 CFR 355.30): Not applicable to NIST identified cylinder.

SARA Title III Section 304 (40 CFR 355.40): Not applicable to NIST identified cylinder.

SARA Title III Section 313 (40 CFR 372.65): Not regulated.

OSHA Process Safety (29 CFR 1910.119): Not applicable to NIST identified cylinder.

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: Warning! This product contains a chemical (sulfur dioxide) known to the state of California to cause reproductive/developmental effects.

U.S. TSCA Inventory: Sulfur dioxide and nitrogen, compressed gas are listed.

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

Canadian Regulations:

WHMIS Information: Not provided for this material.

16. OTHER INFORMATION

Issue Date: 13 June 2017

Sources: ChemADVISOR, Inc., MSDS *Sulfur Dioxide*, 09 December 2015.

ChemADVISOR, Inc., MSDS, *2 Comp. Mix Sulfur Dioxide >1 ppm Bal. Air or Inert Gas*, 17 June 2013.

ChemADVISOR, Inc., MSDS *Nitrogen, Compressed Gas*, 09 December 2015.

Key of Acronyms:

ACGIH	American Conference of Government Industrial Hygienists	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
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	STEL	Short Term Exposure Limit
LD50	Median Lethal Dose or 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

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.