1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND THE COMPANY/UNDERTAKING

Identification of the substance/preparation	:	Nitrous oxide
Chemical formula	:	N2O
Other means of identification	:	Nitrous oxide
Use of the Substance/Mixture	:	General Industrial
Restrictions on Use	:	No data available.
Manufacturer/Importer/Distributor	:	Versum Materials Singapore Pte. Ltd. 2 International Business Park #03-24, The Strategy Singapore 609930 Toll Free No: 800 448 1755
Email Address – Technical Information	:	prodinfo@airproducts.com
Telephone	:	800 448 1755
Emergency telephone number (24h)	:	800-101-2201 / +(65)-31581349

2. HAZARDS IDENTIFICATION

GHS classification

Oxidizing gases - Category 1
Gases under pressure - Liquefied gas.

GHS label elements

Hazard pictograms/symbols

Signal Word: Danger

Hazard Statements:

H270:May cause or intensify fire; oxidiser.
H280:Contains gas under pressure; may explode if heated.

Precautionary Statements:

Prevention	:	P220:Keep away from clothing and other combustible materials. P244:Keep valves and fittings free from oil and grease.
Response	:	P370+P376 :In case of fire: Stop leak if safe to do so.
Storage	:	P403:Store in a well-ventilated place.

Other hazards which do not result in classification

Use a back flow preventative device in the piping.
Use only with equipment of compatible materials of construction, rated for cylinder pressure.
Use only with equipment cleaned for oxygen service and rated for cylinder pressure.
Open valve slowly.
Close valve after each use and when empty.
Vigorously accelerates combustion.
Keep oil, grease, and combustibles away.
May react violently with combustible materials.
Compressed liquefied gas.
Direct contact with liquid can cause frostbite.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance/Mixture : Substance

Components	Chemical formula	CAS Number	Concentration (Volume)
Dinitrogen oxide	N2O	10024-97-2	100 %

Concentration is nominal. For the exact product composition, please refer to technical specifications.

4. FIRST AID MEASURES

General advice	:	Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.
Eye contact	:	Seek medical advice.
Skin contact	:	In case of frostbite, obtain medical treatment immediately.
Ingestion	:	Ingestion is not considered a potential route of exposure.
Inhalation	:	Move to fresh air. If breathing has stopped or is labored, give assisted respirations. Supplemental oxygen may be indicated. If the heart has stopped, trained personnel should begin cardiopulmonary resuscitation immediately. In case of shortness of breath, give oxygen. Consult a doctor.

Notes to physician

Treatment	:	If exposed or concerned: Get medical attention/advice.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media	:	All known extinguishing media can be used.

Specific hazards	:	Upon exposure to intense heat or flame, cylinder will vent rapidly and or rupture violently. Oxidant. Strongly supports combustion. May react violently with combustible materials. Some materials which are noncombustible in air may burn in the presence of an oxidizer. Gas is heavier than air and may collect in low areas or travel along the ground where there may be an ignition source present. Move away from container and cool with water from a protected position. If possible, stop flow of product. Keep adjacent cylinders cool by spraying with large amounts of water until the fire burns itself out.
Special protective equipment for fire-fighters	:	Wear self contained breathing apparatus for fire fighting if necessary. Standard protective clothing and equipment (Self Contained Breathing Apparatus) for fire fighters. Standard EN 137 - Self-contained open-circuit compressed air breathing apparatus with full face mask. Standard EN 469 - Protective clothing for firefighters. Standard - EN 659: Protective gloves for firefighters.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions	:	Evacuate personnel to safe areas. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe. Ventilate the area.
Environmental precautions	:	Do not discharge into any place where its accumulation could be dangerous. Prevent further leakage or spillage if safe to do so.
Methods for cleaning up	:	Ventilate the area.
Additional advice	:	If possible, stop flow of product. Increase ventilation to the release area and monitor concentrations. If leak is from cylinder or cylinder valve, call the emergency telephone number. If the leak is in the user's system, close the cylinder valve, safely vent the pressure, and purge with an inert gas before attempting repairs.

7. HANDLING AND STORAGE

Handling

Only experienced and properly instructed persons should handle compressed gases/cryogenic liquids. Protect cylinders from physical damage; do not drag, roll, slide or drop. Do not allow storage area temperature to exceed 50°C (122°F). Before using the product, determine its identity by reading the label. Know and understand the properties and hazards of the product before use. When doubt exists as to the correct handling procedure for a particular gas, contact the supplier. Do not remove or deface labels provided by the supplier for the identification of the cylinder contents. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Leave valve protection caps in place until the container has been secured against either a wall or bench or placed in a container stand and is ready for use. Use an adjustable strap wrench to remove over-tight or rusted caps. Before connecting the container, check the complete gas system for suitability, particularly for pressure rating and materials. Before connecting the container for use, ensure that back feed from the system into the container is prevented. Ensure the complete gas system is compatible for pressure rating and materials of construction. Ensure the complete gas system has been checked for leaks before use. Employ suitable pressure regulating devices on all containers when the gas is being emitted to systems with lower pressure rating than that of the container. Never insert an object (e.g. wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing a leak to occur. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier. Close container valve after each use and when empty, even if still connected to equipment. Never attempt to repair or modify container valves or safety relief devices. Damaged valves should be reported immediately to the supplier. Do not use containers as rollers or supports or for any other

purpose than to contain the gas as supplied. Never strike an arc on a compressed gas cylinder or make a cylinder a part of an electrical circuit. Do not smoke while handling product or cylinders. Never re-compress a gas or a gas mixture without first consulting the supplier. Never attempt to transfer gases from one cylinder/container to another. Always use backflow protective device in piping. When returning cylinder install valve outlet cap or plug leak tight. Never permit oil, grease, or other readily combustible substances to come into contact with valves or containers containing oxygen or other oxidants. Do not use rapidly opening valves (e.g. ball valves). Open valve slowly to avoid pressure shock. Never pressurize the entire system at once. Use only with equipment cleaned for oxygen service and rated for cylinder pressure. Never use direct flame or electrical heating devices to raise the pressure of a container. Containers should not be subjected to temperatures above 50°C (122°F).

Storage

Containers should be stored in a purpose build compound which should be well ventilated, preferably in the open air. Full containers should be stored so that oldest stock is used first. Stored containers should be periodically checked for general condition and leakage. Observe all regulations and local requirements regarding storage of containers. Protect containers stored in the open against rusting and extremes of weather. Containers should not be stored in conditions likely to encourage corrosion. Containers should be stored in the vertical position and properly secured to prevent toppling. The container valves should be tightly closed and where appropriate valve outlets should be capped or plugged. Container valve guards or caps should be in place. Keep containers tightly closed in a cool, well-ventilated place. Store containers in location free from fire risk and away from sources of heat and ignition. Full and empty cylinders should be segregated. Do not allow storage temperature to exceed 50°C (122°F). Display "No Smoking or Open Flames" signs in the storage areas. Return empty containers in a timely manner.

Technical measures/Precautions

Containers should be segregated in the storage area according to the various categories (e.g. flammable, toxic, etc.) and in accordance whit local regulations.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering measures

Ensure adequate ventilation.

Personal protective equipment

Respiratory protection	:	Keep self contained breathing apparatus readily available for emergency use. Self contained breathing apparatus (SCBA) or positive pressure airline with mask are to be used in oxygen-deficient atmospheres. Users of breathing apparatus must be trained.
Hand protection	:	Wear working gloves when handling gas containers. Gloves must be clean and free of oil and grease. Standard EN 388 - Protective gloves against mechanical risk.
Eye protection	:	Safety glasses recommended when handling cylinders. Wear goggles and a face shield when transfilling or breaking transfer connections. Standard EN 166 - Personal eye-protection.
Skin and body protection	:	Safety shoes are recommended when handling cylinders. Standard EN ISO 20345 - Personal protective equipment - Safety footwear.
Special instructions for	:	Ensure adequate ventilation, especially in confined areas.

protection and hygiene

Exposure limit(s)

Dinitrogen oxide	Time Weighted Average (TWA): EH40 WEL	100 ppm	183 mg/m3

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Liquefied gas. Colorless gas
Odor	:	Sweet. Poor warning properties at high concentrations.
Odor threshold	:	No data available.
pH	:	Not applicable.
Melting point/range	:	-131 °F (-90.81 °C)
Boiling point/range	:	-127 °F (-88.5 °C)
Flash point	:	Not applicable.
Evaporation rate	:	Not applicable.
Flammability (solid, gas)	:	Refer to product classification in Section 2
Upper/lower explosion/flammability limit	:	No data available.
Vapor pressure	:	736.77 psia (50.80 bara) at 68 °F (20 °C)
Water solubility	:	0.0022 g/l
Relative vapor density	:	1.5 (air = 1)
Relative density	:	1.2 (water = 1)
Partition coefficient (n-octanol/water)	:	Not applicable.
Auto-ignition temperature	:	No data available.
Decomposition temperature	:	No data available.
Viscosity	:	Not applicable.
Molecular Weight	:	44 g/mol
Density	:	0.112 lb/ft3 (0.0018 g/cm3) at 70 °F (21 °C) Note: (as vapor)
Specific Volume	:	8.74 ft3/lb (0.5456 m3/kg) at 70 °F (21 °C)

10. STABILITY AND REACTIVITY

Chemical Stability	:	Stable under normal conditions.
Conditions to avoid	:	Direct sources of heat. At temperatures over 575°C (1067 °F) and at atmospheric pressure, nitrous oxide decomposes into nitrogen and oxygen. Pressurized nitrous oxide can also decompose at temperatures equal or greater than 300°C (572 °F). In the presence of catalysts (e.g. halogen products, mercury, nickel, platinum) the decomposition rate will increase and decomposition can occur at lower temperatures. The decomposition of nitrous oxide is irreversible and exothermic and will lead to a substancial pressure increase.
Reactivity/Incompatible Materials	:	Flammable materials. Organic materials. Avoid oil, grease and all other combustible materials.

11. TOXICOLOGICAL INFORMATION

Likely routes of exposure

Effects on Eye	:	Contact with liquid may cause cold burns/frostbite.
Effects on Skin	:	Contact with liquid may cause cold burns/frostbite.
Inhalation Effects	:	In high concentrations may cause asphyxiation. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation. Asphyxiation may bring about unconsciousness without warning and so rapidly that victim may be unable to protect themselves.
Ingestion Effects	:	Ingestion is not considered a potential route of exposure.
Symptoms	:	No data available.

Acute toxicity

Acute Oral Toxicity	:	No data is available on the product itself.
Inhalation	:	LC50 (4 h) : 36514 ppm Species : Rat.
Acute Dermal Toxicity	:	No data is available on the product itself.
Serious eye damage/eye irritation	:	No data available.
Sensitization.	:	No data available.

Chronic toxicity or effects from long term exposures

Carcinogenicity	:	No data available.
Reproductive toxicity	:	No data is available on the product itself.

Germ cell mutagenicity	:	No data is available on the product itself.
Specific target organ systemic toxicity (single exposure)	:	No data available.
Specific target organ systemic toxicity (repeated exposure)	:	In humans, repeated high-level exposure (>3000 hours within the prior 10 years) to Nitrous Oxide (N2O) has caused adverse liver and kidney effects and neurological damage with such symptoms as numbness or tingling of the extremities, weakness, and depression. In monkeys, exposure to 50% N2O for 2 months caused incoordination, progressive ataxia and spinal cord demyelination with spongy degeneration. Nitrous oxide inactivates vitamin B12 (an essential cofactor of certain enzymes) that adversely affects folate metabolism, DNA synthesis and blood formation (RBC, WBC, and platelets).
Aspiration hazard	:	No data available.

12. ECOLOGICAL INFORMATION

Ecotoxicity effects

Aquatic toxicity	:	No data is available on the product itself.
Toxicity to other organisms	:	No data available.

Persistence and degradability

Biodegradability	:	No data is available on the product itself.
Mobility	:	Because of its high volatility, the product is unlikely to cause ground pollution.
Bioaccumulation	:	Refer to Section 9 "Partition Coefficient (n-octanol/water)".

Further information

This product has no known eco-toxicological effects.

13. DISPOSAL CONSIDERATIONS

Waste from residues / unused products	:	Return unused product in original cylinder to supplier. Contact supplier if guidance is required. Refer to the EIGA code of practice Doc. 30 "Disposal of Gases", downloadable at http://www.eiga.org for more guidance on suitable disposal methods. List of hazardous waste codes: 16 05 04: Gases in pressure containers (including halons) containing dangerous substances.
Contaminated packaging	:	Return cylinder to supplier.

14. TRANSPORT INFORMATION

ADR

UN/ID No.	:	UN1070
Proper shipping name	:	NITROUS OXIDE
Class or Division	:	2

Tunnel Code : (C/E)
Label(s) : 2.2 (5.1)
ADR/RID Hazard ID no. : 25
Marine Pollutant : No

IATA

UN/ID No. : UN1070
Proper shipping name : Nitrous oxide
Class or Division : 2.2
Label(s) : 2.2 (5.1)
Marine Pollutant : No

IMDG

UN/ID No. : UN1070
Proper shipping name : NITROUS OXIDE
Class or Division : 2.2
Label(s) : 2.2 (5.1)
Marine Pollutant : No
Segregation Group: : None

RID

UN/ID No. : UN1070
Proper shipping name : NITROUS OXIDE
Class or Division : 2
Label(s) : 2.2 (5.1)
Marine Pollutant : No

Further Information
Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. The transportation information is not intended to convey all specific regulatory data relating to this material. For complete transportation information, contact customer service.

15. REGULATORY INFORMATION

Workplace Safety and Health Act & Workplace Safety and Health (General Provisions) Regulations

Workplace Health and Safety Act , SS586 Labeling.

Country	Regulatory list	Notification
USA	TSCA	Included on Inventory.
EU	EINECS	Included on Inventory.
Canada	DSL	Included on Inventory.
Australia	AICS	Included on Inventory.
Japan	ENCS	Included on Inventory.
South Korea	ECL	Included on Inventory.
China	SEPA	Included on Inventory.
Philippines	PICCS	Included on Inventory.

16. OTHER INFORMATION

Ensure all national/local regulations are observed.

Prepared by : Versum Materials, Product Regulatory Department

For additional information, please visit our Versum Materials' Product Stewardship web site.
http://www.versummaterials.com/productstewardship/