SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier : Nitrous oxide

CAS No. : 10024-97-2

Chemical formula : N2O

Synonyms : Nitrous oxide

REACH Registration Number: 01-2119970538-25

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the Substance/Mixture : General Industrial

Restrictions on Use : No data available.

1.3. Details of the supplier of the safety data sheet : Versum Materials UK, Limited
5th Floor
6 St. Andrew Street
London
EC4A 3AE

Email Address – Technical Information : techinfo@versummaterials.com

Telephone :

1.4. Emergency telephone number :

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Gases under pressure - Liquefied gas. H280:Contains gas under pressure; may explode if heated.
Oxidizing gases - Category 1 H270:May cause or intensify fire; oxidiser.
Specific target organ toxicity - single exposure - Category 3 H336:May cause drowsiness or dizziness.

2.2. 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.
H336:May cause drowsiness or dizziness.
Do not inhale product on purpose because of the risk of asphyxiation.

Precautionary Statements:

Prevention : P220:Keep away from clothing and other combustible materials.
P244:Keep valves and fittings free from oil and grease.
P260:Do not breathe dust/fume/gas/mist/vapours/spray.

Response : P304+P340 :IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P315 :Get immediate medical advice/attention.
P370+P376 :In case of fire: Stop leak if safe to do so.

Storage : P403:Store in a well-ventilated place.

2.3. Other hazards

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.

SECTION 3: Composition/information on ingredients

3.1. Substances

Components	EINECS / ELINCS Number	CAS Number	Concentration (Volume)
Dinitrogen oxide	233-032-0	10024-97-2	100 %

Components	Classification (CLP)	REACH Reg. #
Dinitrogen oxide	Press. Gas (Liq.) ;H280 Ox. Gas 1 ;H270 STOT SE 3 ;H336	01-2119970538-25

Refer to section 16 for full text of each relevant hazard statement (H).

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

3.2. Mixtures : Not applicable.

SECTION 4: First aid measures

4.1. Description of 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.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms : No data available.

4.3. Indication of any immediate medical attention and special treatment needed

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

SECTION 5: Firefighting measures

5.1. Extinguishing media

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

Extinguishing media which must not be used for safety reasons. : No data available.

5.2. Special hazards arising from the substance or mixture

: 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.

5.3. Advice for firefighters

: 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.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

: Evacuate personnel to safe areas. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe. Ventilate the area.

6.2. Environmental precautions	:	Do not discharge into any place where its accumulation could be dangerous. Prevent further leakage or spillage if safe to do so.
6.3. Methods and material for containment and 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.
6.4. Reference to other sections	:	For more information refer to Sections 8 & 13

SECTION 7: Handling and storage

7.1. Precautions for safe 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).

7.2. Conditions for safe storage, including any incompatibilities

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.

7.3. Specific end use(s)

Refer to section 1 or the extended SDS if applicable.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Exposure limit(s)

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

If applicable, refer to the extended section of the SDS for further information on CSA.

8.2. Exposure controls

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/face 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 protection and hygiene	:	Ensure adequate ventilation, especially in confined areas.
Environmental Exposure Controls	:	If applicable, refer to the extended section of the SDS for further information on CSA.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

(a/b) Physical state/Colour	:	Liquefied gas. Colorless gas

(c) Odour	:	Sweet. Poor warning properties at high concentrations.
(d) Density	:	0.0018 g/cm3 (0.112 lb/ft3) at 21 °C (70 °F) Note: (as vapor)
(e) Relative Density	:	1.2 (water = 1)
(f) Melting point / freezing point	:	-131 °F (-90.81 °C)
(g) Boiling point/range	:	-127 °F (-88.5 °C)
(h) Vapor pressure	:	736.77 psia (50.80 bara) at 68 °F (20 °C)
(i) Water solubility	:	1.5 g/l
(j) Partition coefficient: n-octanol/water [log Kow]	:	0.4
(k) pH	:	Not applicable for gases and gas mixtures.
(l) Viscosity	:	No reliable data available.
(m) Particle characteristics	:	Not applicable for gases and gas mixtures.
(n) Upper and lower explosion / flammability limits	:	Non flammable.
(o) Flash point	:	Not applicable for gases and gas mixtures.
(p) Autoignition temperature	:	Non flammable.
(q) Decomposition temperature	:	Not applicable.

9.2. Other information

Explosive properties	:	Not applicable.
Oxidizing properties	:	Ci =0.6
Molecular Weight	:	44 g/mol
Odor threshold	:	Odour threshold is subjective and inadequate to warn of overexposure.
Evaporation rate	:	Not applicable for gases and gas mixtures.
Flammability (solid, gas)	:	Refer to product classification in Section 2
Specific Volume	:	0.5456 m3/kg (8.74 ft3/lb) at 21 °C (70 °F)
Relative vapor density	:	1.5 (air = 1) Heavier than air.

SECTION 10: Stability and reactivity

10.1. Reactivity	:	No reactivity hazard other than the effects described in sub-sections below.
10.2. Chemical stability	:	Stable under normal conditions.
10.3. Possibility of hazardous reactions	:	Violently oxidises organic material.
10.4. 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.
10.5. Incompatible materials	:	Flammable materials. Organic materials. Avoid oil, grease and all other combustible materials.
10.6. Hazardous decomposition products	:	No data available.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

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.
Acute Inhalation Toxicity	:	LC50 (4 h) : 36514 ppm Species : Rat.
Acute Dermal Toxicity	:	No data is available on the product itself.
Skin corrosion/irritation	:	No data available.
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 : Exposure to Nitrous Oxide has produced embryofetal toxicity in animals as evidenced by reduced fetal weight, delayed ossification, and increased incidence of visceral and skeletal variations. Nitrous Oxide exposure may be associated with increased incidence of fetal miscarriage in humans.

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.

Other Health Hazard

IARC : Inadequate data.
IARC : Inadequate data.
IARC : 3 - Not classifiable as to carcinogenicity to humans.

SECTION 12: Ecological information

12.1. Toxicity

Aquatic toxicity : No data is available on the product itself.

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

12.2. Persistence and degradability

No data available.

12.3. Bioaccumulative potential

Refer to Section 9 "Partition Coefficient (n-octanol/water)".

12.4. Mobility in soil

Because of its high volatility, the product is unlikely to cause ground pollution.

12.5. Results of PBT and vPvB assessment

If applicable, refer to the extended section of the SDS for further information on CSA.

12.6. Other adverse effects

This product has no known eco-toxicological effects.

Effect on the ozone layer

Ozone Depleting Potential	:	No data available.
Global Warming Potential	:	No data available.

SECTION 13: Disposal considerations

13.1. Waste treatment methods	:	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.

SECTION 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

Transport in bulk according to Annex II of Marpol and the IBC Code
For complete transportation information, contact customer service.
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.

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

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.

Other Regulations
REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC.

COMMISSION REGULATION (EU) 2015/830 of 28 May 2015 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).

Regulation (EC) No 1272/2008 the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006.

Control of Substances Hazardous to Health Regulations 2002 (as amended)

Health and Safety at Work etc. Act 1974

Management of Health and Safety at Work Regulations (Northern Ireland) 2000 c.388, and as amended

The Health and Safety at Work etc. Act 1974 (Application to Environmentally Hazardous Substances) Regulations 2002 (England and Wales and Scotland) 11 March 2002 c.282, and as amended

Health and Safety at Work Order (Application to Environmentally Hazardous Substances) Regulations (Northern Ireland) 2003 (Northern

Ireland) 14 March 2003 c52, and as amended

The Control of Major Accident Hazards Regulations 2015 c483

The Control of Major Accident Hazards Regulations (Northern Ireland) 2015 c325

The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2011 c1885, and as amended

The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations with amendments (Northern Ireland) 2011 c365

The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 c.407

The Water Environment Regulations (Northern Ireland) 2017 c.81

Pollution Prevention and Control Act 1999 c.24

The Fluorinated Greenhouse Gases Regulations 2015 c.310

The Fluorinated Greenhouse Gases Regulations (Northern Ireland) 2015 c.425

The Acetylene Safety (England and Wales and Scotland) Regulations 2014 c.1639

The Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972 c.917

The Highly Flammable Liquids and Liquefied Petroleum Gases Regulations (Northern Ireland) 1975 c.256

Dangerous Substances and Explosive Atmospheres Regulations (Northern Ireland) 2003 c.152

The Dangerous Substances and Explosive Atmospheres Regulations 2002 c.2776

Pollution Prevention and Control Act 1999

The Environmental Permitting (England and Wales) Regulations 2016

Ozone Depleting Substances Regulations 2015

15.2. Chemical safety assessment

A CSA has not yet been carried out.

SECTION 16: Other information

Ensure all national/local regulations are observed.

Hazard Statements:
H270 May cause or intensify fire; oxidiser.
H280 Contains gas under pressure; may explode if heated.
H336 May cause drowsiness or dizziness.

Indication of Method:
Gases under pressure Liquefied gas. Contains gas under pressure; may explode if heated. Calculation method

Oxidizing gases Category 1 May cause or intensify fire; oxidiser. Calculation method

Specific target organ toxicity - single exposure Category 3 May cause drowsiness or dizziness. Calculation method

Abbreviations and acronyms:
ATE - Acute Toxicity Estimate
CLP - Classification Labelling Packaging Regulation; Regulation (EC) No 1272/2008
REACH - Registration, Evaluation, Authorisation and Restriction of Chemicals Regulation (EC) No 1907/2006
EINECS - European Inventory of Existing Commercial Chemical Substances
ELINCS - European List of Notified Chemical Substances
CAS# - Chemical Abstract Service number
PPE - Personal Protection Equipment
Kow - octanol-water partition coefficient
DNEL - Derived No Effect Level
LC50 - Lethal Concentration to 50 % of a test population
LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose)
NOEC - No Observed Effect Concentration
PNEC - Predicted No Effect Concentration
RMM - Risk Management Measure
OEL - Occupational Exposure Limit
PBT - Persistent, Bioaccumulative and Toxic
vPvB - Very Persistent and Very Bioaccumulative
STOT - Specific Target Organ Toxicity
CSA - Chemical Safety Assessment
EN - European Standard
UN - United Nations
ADR - European Agreement concerning the International Carriage of Dangerous Goods by Road
IATA - International Air Transport Association
IMDG - International Maritime Dangerous Goods
RID - Regulations concerning the International Carriage of Dangerous Goods by Rail
WGK - Water Hazard Class

Key literature references and sources for data:
ECHA - Guidance on the compilation of safety data sheets
ECHA - Guidance on the application of the CLP Criteria
ARIEL database

Prepared by : Versum Materials, Product Regulatory Department

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

This Safety Data Sheet has been established in accordance with the applicable European Directives and applies to all countries that have translated the Directives in their national laws. COMMISSION REGULATION (EU) 2015/830 of 28 May 2015 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the

Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).

Details given in this document are believed to be correct at the time of going to press. Whilst proper care has been taken in the preparation of this document, no liability for injury or damage resulting from its use can be accepted.