

SAFETY DATA SHEET

Version 4.1
Revision Date 25.01.2017
Supersedes Version: 4.0

SDS Number 300000000103
Print Date 16.12.2017

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

1.1. Product identifier : Nitrogen Trifluoride

Chemical formula : NF₃

Synonyms : Nitrogen trifluoride

REACH Registration Number: 01-2119962459-23

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

Oxidizing gases - Category 1 H270:May cause or intensify fire; oxidiser.

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Acute toxicity - Inhalation Category 4 H332:Harmful if inhaled.
Gases under pressure - Compressed gas. H280:Contains gas under pressure; may explode if heated.
Specific target organ toxicity - repeated exposure - Inhalation Category 2 H373:May cause damage to organs through prolonged or repeated exposure.

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.
H332:Harmful if inhaled.
H373:May cause damage to organs through prolonged or repeated exposure.

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	: P314 :Get medical advice/attention if you feel unwell.
Storage	: P403:Store in a well-ventilated place.
Disposal	: P501:Disposal of contents/container to be specified in accordance with regulations.

2.3. Other hazards

Use a back flow preventative device in the piping.

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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.
High pressure, oxidizing gas.
Vigorously accelerates combustion.
Keep oil, grease, and combustibles away.
May react violently with combustible materials.

SECTION 3: Composition/information on ingredients

3.1. Substances

Components	EINECS / ELINCS Number	CAS Number	Concentration (Volume)
Nitrogen trifluoride	232-007-1	7783-54-2	100 %

Components	Classification (CLP)	REACH Reg. #
Nitrogen trifluoride	Ox. Gas 1 ;H270 Acute Tox. Inha 4 ;H332 Press. Gas (Comp.) ;H280 STOT RE Inha 2 ;H373	01-2119962459-23

If REACH registration numbers do not appear the substance is either exempt from registration, does not meet the minimum volume threshold for registration, or the registration date has not yet come due.
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 : IF exposed or concerned: Get medical advice/attention.

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- Skin contact : Adverse effects not expected from this product. IF exposed or concerned: Get medical advice/attention.
- 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.

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

- Symptoms : Cyanosis. Weakness, dizziness, and confusion are some of the effects associated with reduction of the oxygen supply in blood.

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

- : Exposure to high temperatures may yield toxic by-products which may be corrosive in the presence of moisture. Exposure to high temperatures may yield toxic by-products which may be corrosive in the presence of moisture. 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. Move away from container and cool with water from a protected position. Keep adjacent cylinders cool by spraying with large amounts of water until the fire burns itself out. If possible, stop flow of product.

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.

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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

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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 with local regulations.

7.3. Specific end use(s)

Refer to section 1 or the extended SDS if applicable.

SECTION 8: Exposure controls/personal protection

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8.1. Control parameters

Exposure limit(s)

Nitrogen trifluoride	Time Weighted Average (TWA): EH40 WEL	-	2.5 mg/m ³
Nitrogen trifluoride	Time Weighted Average (TWA): EU ELV	-	2.5 mg/m ³
Nitrogen trifluoride	Time Weighted Average (TWA): EU SCOELS	-	2.5 mg/m ³

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 : Not required under normal use. Self contained breathing apparatus (SCBA) or positive pressure airline with mask are to be used in oxygen-deficient atmosphere.
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.
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 : Compressed gas. Colorless gas

(c) Odour : No odor warning properties.

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(d) Density : 0.0030 g/cm³ (0.187 lb/ft³) at 21 °C (70 °F)
Note: (as vapor)

(e) Relative Density : 1.5 (water = 1)

(f) Melting point / freezing point : -341 °F (-207 °C)

(g) Boiling point/range : -200 °F (-129 °C)

(h) Vapor pressure : Not applicable.

(i) Water solubility : 0.061 g/l

(j) Partition coefficient
(n-octanol/water) : Not applicable.

(k) pH : Not applicable.

(l) Viscosity : Not applicable.

(m) Particle characteristics : No data available.

(n) Upper and lower explosion /
flammability limits : No data available.

(o) Flash point : Not applicable.

(p) Autoignition temperature : No data available.

(q) Decomposition
temperature : No data available.

9.2. Other information

Explosive properties : No data available.

Oxidizing properties : Ci =1.6

Molecular Weight : 71 g/mol

Odor threshold : No data available.

Evaporation rate : Not applicable.

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Flammability (solid, gas) : Refer to product classification in Section 2
Specific Volume : 0.3390 m³/kg (5.43 ft³/lb) at 21 °C (70 °F)
Lower flammability limit : Not applicable.
Relative vapor density : 2.4 (air = 1) Heavier than air.

SECTION 10: Stability and reactivity

10.1. Reactivity : Refer to possibility of hazardous reactions and/or incompatible materials sections.
10.2. Chemical stability : Stable under normal conditions.
10.3. Possibility of hazardous reactions : Violently oxidises organic material.
10.4. Conditions to avoid : Heat. None under recommended storage and handling conditions (see section 7).
10.5. Incompatible materials : Flammable materials.
Organic materials.
Avoid oil, grease and all other combustible materials.
10.6. Hazardous decomposition products : High temperature disassociation can produce very reactive fluorine species that may react with surrounding material to form additional toxic fluoride compounds.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Likely routes of exposure

Effects on Eye : May cause eye irritation. In case of direct contact with eyes, seek medical advice.
Effects on Skin : Adverse effects not expected from this product.

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- Inhalation Effects : Acute or repeated exposures can reduce the blood's ability to transport oxygen. Exposure to NF3 can lead to the destruction of red blood cells.
- Ingestion Effects : Ingestion is not considered a potential route of exposure.
- Symptoms : Cyanosis. Weakness, dizziness, and confusion are some of the effects associated with reduction of the oxygen supply in blood.

Acute toxicity

- Acute Oral Toxicity : No data is available on the product itself.
- Acute Inhalation Toxicity : LC50 (1 h) : 6700 ppm Species : Rat. Rats exposed to 1000 ppm of Nitrogen Trifluoride for 4 hours exhibited methemoglobinemia (cyanosis). These effects were not observed when rats were exposed to 3000 ppm for 10 minutes. Rats exposed to 1000 ppm of Nitrogen Trifluoride for 4 hours exhibited methemoglobinemia (cyanosis). These effects were not observed when rats were exposed to 3000 ppm for 10 minutes.
- 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 : No data is available on the product itself.
- Germ cell mutagenicity : Nitrogen Trifluoride (NF3) was tested at various times to determine its mutagenic potential. The current status of knowledge is as follows: NF3 sometimes produces a very weak mutagenic response in bacterial test systems (some of the Ames Salmonella strains and in one strain of E. coli) both with and without metabolic activation. The concentrations which produced the sometimes positive responses vary from 0.5% (5000 ppm) to 5% (50,000 ppm). The test results are often equivocal (e.g. the same sample gives negative or borderline positive responses at different times), which is a

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characteristic of weak mutagens. NF3 was found to be non-mutagenic in the mammalian cell (mouse lymphoma) test system when the cells were exposed to NF3 concentrations of up to 10% (100,000 ppm) both with and without metabolic activation. NF3 was not mutagenic in the mouse micronucleus test when whole animals were exposed to 2500 ppm of NF3 by inhalation.

Specific target organ systemic toxicity (single exposure) : No data available.

Specific target organ systemic toxicity (repeated exposure) : In a repeated dose study rats were exposed to NF3 concentrations of 0, 5, 20, 50, and 100 ppm, 6 hrs per day, 5 days per week for 13 weeks. Rats in the 100 ppm group (both sexes) and in the 50 ppm group (females) exhibited adverse blood effects indicative of hemolytic anemia. Mild to moderate red blood cell effects and increased methemoglobin were observed in rats exposed to ≥ 20 ppm. Organ weight, macroscopic and/or microscopic changes were noted in the liver, kidneys, spleen and bone marrow of the rats exposed to ≥ 5 ppm. These pathological effects were considered secondary responses to hemolytic anemia.

Aspiration hazard : No data available.

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.

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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

Contains fluorinated greenhouse gases covered by Kyoto Protocol. For quantities see concentrations or cylinder contents.

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. : UN2451
Proper shipping name : NITROGEN TRIFLUORIDE
Class or Division : 2
Tunnel Code : (C/E)
Label(s) : 2.2 (5.1)
ADR/RID Hazard ID no. : 25
Marine Pollutant : No

IATA

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UN/ID No. : UN2451
Proper shipping name : Nitrogen trifluoride
Class or Division : 2.2
Label(s) : 2.2 (5.1)
Marine Pollutant : No

IMDG

UN/ID No. : UN2451
Proper shipping name : NITROGEN TRIFLUORIDE
Class or Division : 2.2
Label(s) : 2.2 (5.1)
Marine Pollutant : No
Segregation Group: : None

RID

UN/ID No. : UN2451
Proper shipping name : NITROGEN TRIFLUORIDE
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	Not on Inventory.
Japan	ENCS	Included on Inventory.
South Korea	ECL	Included on Inventory.

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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

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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

If this product does not contain exposure scenarios, the components in this product are either exempt from REACH, do not meet the minimum volume threshold for a CSA, or the CSA has not yet been completed.

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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.
H332 Harmful if inhaled.
H373 May cause damage to organs through prolonged or repeated exposure.

Indication of Method:

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

Acute toxicity Category 4 Harmful if inhaled. Calculation method

Gases under pressure Compressed gas. Contains gas under pressure; may explode if heated. Calculation method

Specific target organ toxicity - repeated exposure Category 2 May cause damage to organs through prolonged or repeated exposure. 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

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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.
