



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
1/56

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

1.1 Product identifier

Product name: Carbon monoxide, compressed

Trade name: Gasart 473 Kohlenmonoxid 2.0, Gasart 474 Kohlenmonoxid, Kohlenmonoxid 3.7, Kohlenmonoxid 4.7, Kohlenmonoxid 3.0

Additional identification

Chemical name: Carbon monoxide
Chemical formula: CO
INDEX No. 006-001-00-2
CAS-No. 630-08-0
EC No. 211-128-3
REACH Registration No. 01-2119480165-39

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

Identified uses: Catalytic agent Use as an Intermediate (transported, on-site isolated). Use for electronic component manufacture. Use of gas to manufacture pharmaceutical products. Using gas alone or in mixtures for the calibration of analysis equipment. Using gas as a monomer in polymer production. Using gas as feedstock in chemical processes. Using gas for metal treatment. Formulation of mixtures with gas in pressure receptacles.

Uses advised against

1.3 Details of the supplier of the safety data sheet

Supplier

Linde Gas GmbH
Carl-von-Linde-Platz 1
A-4651 Stadl-Paura

Telephone: +43 50 4273

E-mail: office@at.linde-gas.com

1.4 Emergency telephone number: Emergency number UMC0: +49 89 220 61012 (German), +44 1865 407333 (English)

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008 as amended.

Physical Hazards

Flammable gas

Category 1B

H221: Flammable gas.



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

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Version: 1.5

SDS No.: 000010021698
2/56

Gases under pressure

Compressed gas H280: Contains gas under pressure; may explode if heated.

Health Hazards

Acute toxicity (Inhalation - gas)

Category 3

H331: Toxic if inhaled.

Toxic to reproduction

Category 1A

H360D: May damage the unborn child.

Specific Target Organ Toxicity -
Repeated Exposure

Category 1

H372: Causes damage to organs through prolonged or repeated exposure.

2.2 Label Elements

Contains:

Carbon monoxide



Signal Word:

Danger

Hazard Statement(s):

H221: Flammable gas.
H280: Contains gas under pressure; may explode if heated.
H331: Toxic if inhaled.
H360D: May damage the unborn child.
H372: Causes damage to organs through prolonged or repeated exposure.

Precautionary Statements

General

None.

Prevention:

P202: Do not handle until all safety precautions have been read and understood.
P210: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P260: Do not breathe gas/vapors.

Response:

P304+P340+P315: IF INHALED: Remove person to fresh air and keep comfortable for breathing. Get immediate medical advice/attention.
P308+P313: IF exposed or concerned: Get medical advice/attention.
P377: Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P381: In case of leakage, eliminate all ignition sources.

Storage:

P403: Store in a well-ventilated place.
P405: Store locked up.



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
3/56

Disposal None.

2.3 Other hazards None.

SECTION 3: Composition/information on ingredients

3.1 Substances

Chemical name Carbon monoxide
INDEX No.: 006-001-00-2
CAS-No.: 630-08-0
EC No.: 211-128-3
REACH Registration No.: 01-2119480165-39
Purity: 100%

The purity of the substance in this section is used for classification only, and does not represent the actual purity of the substance as supplied, for which other documentation should be consulted.

Trade name: Gasart 473 Kohlenmonoxid 2.0, Gasart 474 Kohlenmonoxid, Kohlenmonoxid 3.7, Kohlenmonoxid 4.7, Kohlenmonoxid 3.0

Chemical name	Chemical formula	Concentration	CAS-No.	REACH Registration No.	M-Factor:	Notes
Carbon monoxide	CO	100%	630-08-0	01-2119480165-39	-	#

The concentrations of the components in the SDS header, product name on page one and in section 3.2 are in mol due to regulatory requirements. All concentrations are nominal.

This substance has workplace exposure limit(s).

PBT: persistent, bioaccumulative and toxic substance.

vPvB: very persistent and very bioaccumulative substance.

SECTION 4: First aid measures

General: Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.

4.1 Description of first aid measures

Inhalation: 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: May cause temporary eye irritation. Adverse effects not expected from this product.



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Carbon monoxide, compressed

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Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
4/56

Skin Contact: Not relevant, due to the form of the product.

Ingestion: Ingestion is not considered a potential route of exposure.

4.2 Most important symptoms and effects, both acute and delayed: May be fatal if inhaled. Symptoms may include: Dizziness. Headache. Nausea, vomiting. Loss of co-ordination. Symptoms may be delayed.

4.3 Indication of any immediate medical attention and special treatment needed

Hazards: May be fatal if inhaled.

Treatment: Treat with a corticosteroid spray as soon as possible after inhalation. In case of exposure, provide oxygen.

SECTION 5: Firefighting measures

General Fire Hazards: Heat may cause the containers to explode.

5.1 Extinguishing media

Suitable extinguishing media: Use water spray to reduce vapors or divert vapor cloud drift. Water. Dry powder. Foam.

Unsuitable extinguishing media: Carbon Dioxide.

5.2 Special hazards arising from the substance or mixture: Fire or excessive heat may produce hazardous decomposition products. None.

5.3 Advice for firefighters

Special fire fighting procedures: In case of fire: Stop leak if safe to do so. Use of water may result in the formation of very toxic aqueous solutions. Keep run-off water out of sewers and water sources. Dike for water control. Continue water spray from protected position until container stays cool. Use extinguishants to contain the fire. Isolate the source of the fire or let it burn out. In case of fire: Stop leak if safe to do so. Keep run-off water out of sewers and water sources. Dike for water control. Continue water spray from protected position until container stays cool. Use extinguishants to contain the fire. Isolate the source of the fire or let it burn out.



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Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
5/56

Special protective equipment for fire-fighters:

Gas tight chemically protective clothing (Type 1) in combination with self contained breathing apparatus. Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.
Guideline: EN 943-2 Protective clothing against liquid and gaseous chemicals, aerosols and solid particles. Performance requirements for gas-tight (Type 1) chemical protective suits for emergency teams (ET) Guideline: EN 469 Protective clothing for firefighters. Performance requirements for protective clothing for firefighting. EN 15090 Footwear for firefighters. EN 659 Protective gloves for firefighters. EN 443 Helmets for fire fighting in buildings and other structures. EN 137 Respiratory protective devices - Self-contained open-circuit compressed air breathing apparatus with full face mask - Requirements, testing, marking.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures:

Evacuate area. Provide adequate ventilation. Consider the risk of potentially explosive atmospheres. In case of leakage, eliminate all ignition sources. Monitor the concentration of the released product. Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe. EN 137 Respiratory protective devices - Self-contained open-circuit compressed air breathing apparatus with full face mask - Requirements, testing, marking.

6.2 Environmental Precautions:

Prevent further leakage or spillage if safe to do so. Reduce vapour with fog or fine water spray. Keep run-off water out of sewers and water sources. Dike for water control.

6.3 Methods and material for containment and cleaning up:

Provide adequate ventilation. Eliminate sources of ignition. Wash contaminated equipment or sites of leaks with copious quantities of water. Provide adequate ventilation. Eliminate sources of ignition.

6.4 Reference to other sections:

Refer to sections 8 and 13.



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Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
6/56

SECTION 7: Handling and storage:

7.1 Precautions for safe handling:

Only experienced and properly instructed persons should handle gases under pressure. Avoid exposure - obtain special instructions before use. Use only properly specified equipment which is suitable for this product, its supply pressure and temperature. Purge system with dry inert gas (e.g. helium or nitrogen) before gas is introduced and when system is placed out of service. Purge air from system before introducing gas. Containers, which contain or have contained flammable or explosive substances, must not be inerted with liquid carbon dioxide. Assess the risk of a potentially explosive atmosphere and the need for suitable equipment i.e. explosion-proof. Take precautionary measures against static discharges. Keep away from ignition sources (including static discharges). Provide electrical earthing of equipment and electrical equipment usable in explosive atmospheres. Use non-sparking tools. Installation of a cross purge assembly between the container and the regulator is recommended. Excess pressure must be vented through an appropriate scrubber system. Refer to supplier's handling instructions. The substance must be handled in accordance with good industrial hygiene and safety procedures. Ensure the complete system has been (or is regularly) checked for leaks before use. Protect containers from physical damage; do not drag, roll, slide or drop. Do not remove or deface labels provided by the supplier for the identification of the container contents. When moving containers, even for short distances, use appropriate equipment eg. trolley, hand truck, fork truck etc. Secure cylinders in an upright position at all times, close all valves when not in use. Provide adequate ventilation. Suck back of water into the container must be prevented. Do not allow backfeed into the container. Avoid suckback of water, acid and alkalis. Keep container below 50°C in a well ventilated place. Observe all regulations and local requirements regarding storage of containers. When using do not eat, drink or smoke. Store in accordance with local/regional/national/international regulations. Never use direct flame or electrical heating devices to raise the pressure of a container. 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. Damaged valves should be reported immediately to the 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. Replace valve outlet caps or plugs and container caps where supplied as soon as container is disconnected from equipment. Keep container valve outlets clean and free from contaminants particularly oil and water. If user experiences any difficulty operating container valve discontinue use and contact supplier. Never attempt to transfer gases from one container to another. Container valve guards or caps should be in place.



SAFETY DATA SHEET

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Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
7/56

7.2 Conditions for safe storage, including any incompatibilities:

All electrical equipment in the storage areas should be compatible with the risk of a potentially explosive atmosphere. Segregate from oxidant gases and other oxidants being stored. Containers should not be stored in conditions likely to encourage corrosion. Stored containers should be periodically checked for general conditions and leakage. Keep away from food, drink and animal feeding stuffs. Container valve guards or caps should be in place. Store containers in location free from fire risk and away from sources of heat and ignition. Keep away from combustible material.

7.3 Specific end use(s):

None.

SECTION 8: Exposure controls/personal protection

8.1 Control Parameters

Occupational Exposure Limits

Chemical name	Type	Exposure Limit Values	Source
Carbon monoxide	MAK	20 ppm 23 mg/m ³	Austria. MAK List, OEL Ordinance (GwV), BGBl. II, no. 184/2001, as amended (04 2021)
	MAK STEL	60 ppm 66 mg/m ³	Austria. MAK List, OEL Ordinance (GwV), BGBl. II, no. 184/2001, as amended (04 2021)
	STEL	100 ppm 117 mg/m ³	EU. Indicative Exposure Limit Values in Directives 91/322/EEC, 2000/39/EC, 2006/15/EC, 2009/161/EU, 2017/164/EU, as amended (02 2017)
	TWA	20 ppm 23 mg/m ³	EU. Indicative Exposure Limit Values in Directives 91/322/EEC, 2000/39/EC, 2006/15/EC, 2009/161/EU, 2017/164/EU, as amended (02 2017)

DNEL-Values

Critical component	Type	Value	Remarks
Carbon monoxide	Workers - Inhalation, Local, long-term	23 mg/m ³	-
	Workers - Inhalation, Systemic, long-term	23 mg/m ³	-
	Workers - Inhalation, Systemic, short-term	117 mg/m ³	-
	Workers - Inhalation, Local, short-term	117 mg/m ³	-



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Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
8/56

8.2 Exposure controls

Appropriate engineering controls:

Consider a work permit system e.g. for maintenance activities. Ensure adequate air ventilation. Provide adequate general and local exhaust ventilation. Keep concentrations well below occupational exposure limits. Gas detectors should be used when toxic quantities may be released. Gas detectors should be used when quantities of flammable gases or vapours may be released. Systems under pressure should be regularly checked for leakages. Product to be handled in a closed system and under strictly controlled conditions. Only use permanent leak tight installations (e.g. welded pipes). Take precautionary measures against static discharges. Do not eat, drink or smoke when using the product.

Individual protection measures, such as personal protective equipment

General information:

A risk assessment should be conducted and documented in each work area to assess the risks related to the use of the product and to select the PPE that matches the relevant risk. The following recommendations should be considered. Keep self contained breathing apparatus readily available for emergency use. Keep suitable chemically resistant protective clothing readily available for emergency use. Personal protective equipment for the body should be selected based on the task being performed and the risks involved. Protect eyes, face and skin from contact with product. Refer to local regulations for restriction of emissions to the atmosphere. See section 13 for specific methods for waste gas treatment.

Eye/face protection:

Wear eye protection to EN 166 when using gases.
Guideline: EN 166 Personal Eye Protection.

Skin protection

Hand Protection:

Guideline: EN 388 Protective gloves against mechanical risks.
Additional Information: Wear working gloves while handling containers
Guideline: EN 374-1/2/3 Protective gloves against chemicals and micro-organisms.
Additional Information: Chemically resistant gloves complying with EN 374 should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Body protection:

Wear fire resistant or flame retardant clothing.
Guideline: ISO/TR 2801:2007 Clothing for protection against heat and flame --
General recommendations for selection, care and use of protective clothing.

Other:

Wear safety shoes while handling containers
Guideline: ISO 20345 Personal protective equipment - Safety footwear.

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Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
9/56

Respiratory Protection:	Reference should be made to European Standard EN 689 for methods for the assessment of exposure by inhalation to chemical agents and national guidance documents for methods for the determination of hazardous substances. When allowed by a risk assessment Respiratory Protective Equipment (RPE) may be used. The selection of the Respiratory Protective Device (RPD) must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected RPD. Self-contained breathing apparatus (SCBA) or positive pressure airline with mask are to be used in oxygen-deficient atmospheres. Never use any kind of filtering respiratory protection equipment when working with this substance due to it having poor or no warning properties. Guideline: EN 137 Respiratory protective devices - Self-contained open-circuit compressed air breathing apparatus with full face mask - Requirements, testing, marking.
Thermal hazards:	No precautionary measures are necessary.
Hygiene measures:	Obtain special instructions before use. Specific risk management measures are not required beyond good industrial hygiene and safety procedures. Do not eat, drink or smoke when using the product.
Environmental exposure controls:	For waste disposal, see section 13 of the SDS.

SECTION 9: Physical and chemical properties**9.1 Information on basic physical and chemical properties****Appearance**

Physical state:	Gas
Form:	Compressed gas
Color:	Colorless
Odor:	Odorless
Odor Threshold:	Odor threshold is subjective and is inadequate to warn of over exposure.
pH:	Not applicable.
Melting Point:	-205 °C Experimental result, Key study
Boiling Point:	-191,5 °C (1.013,25 hPa) Experimental result, Key study
Sublimation Point:	Not applicable.
Critical Temp. (°C):	-140,0 °C
Flash Point:	Not applicable to gases and gas mixtures.
Evaporation Rate:	Not applicable to gases and gas mixtures.
Flammability (solid, gas):	Flammable Gas
Flammability Limit - Upper (%):	74 %(V) Other, Supporting study



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Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
10/56

Flammability Limit - Lower (%):	10,9 %(V)
Vapor pressure:	> 101,325 kPa (20 °C)
Vapor density (air=1):	0,968 AIR=1
Relative density:	0,97 (20 °C)
Solubility(ies)	
Solubility in Water:	29 g/l (20 °C)
Partition coefficient (n-octanol/water):	1,78
Autoignition Temperature:	+/- 607 °C Experimental result, Key study
Decomposition Temperature:	Not known.
Viscosity	
Kinematic viscosity:	No data available.
Dynamic viscosity:	No data available.
Explosive properties:	Not applicable.
Oxidizing properties:	Not applicable.
9.2 Other information:	None.
Molecular weight:	28,01 g/mol (CO)

SECTION 10: Stability and reactivity

10.1 Reactivity:	No reactivity hazard other than the effects described in sub-section below.
10.2 Chemical Stability:	Stable under normal conditions.
10.3 Possibility of hazardous reactions:	Can form a potentially explosive atmosphere in air. May react violently with oxidants.
10.4 Conditions to avoid:	Avoid moisture in the installation. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
10.5 Incompatible Materials:	Air and oxidizers. Moisture. For material compatibility see latest version of ISO-11114.
10.6 Hazardous Decomposition Products:	Under normal conditions of storage and use, hazardous decomposition products should not be produced.



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Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
11/56

SECTION 11: Toxicological information

General information: Carbon monoxide: Has been shown to produce adverse effects to the cardiovascular, central nervous, and reproductive systems in laboratory animals and chronically exposed humans.

11.1 Information on toxicological effects

Acute toxicity - Oral Product Based on available data, the classification criteria are not met.

Acute toxicity - Dermal Product Based on available data, the classification criteria are not met.

Acute toxicity - Inhalation Product Toxic if inhaled.

Carbon monoxide
LC 50 (Rat, 4 h): 1300 ppm
LC 50 (Rat, 1 h): 3760 ppm

Repeated dose toxicity
Carbon monoxide
LOAEL (Rat(Female), Inhalation, 72 Weeks): 200 ppm(m) Inhalation Experimental result, Key study
LOAEC (Rat, Inhalation): 200 ppm (Target Organ(s): Respiratory system)

Skin Corrosion/Irritation Product Based on available data, the classification criteria are not met.
Carbon monoxide Not classified as an irritant.

Serious Eye Damage/Eye Irritation Product Based on available data, the classification criteria are not met.
Carbon monoxide Not classified as an irritant.

Respiratory or Skin Sensitization Product Based on available data, the classification criteria are not met.



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
12/56

Carbon monoxide No known effects from this product.

Germ Cell Mutagenicity Product

Based on available data, the classification criteria are not met.

Carbon monoxide There is no evidence of mutagenic potential.

Carcinogenicity Product

Based on available data, the classification criteria are not met.

Carbon monoxide No evidence of carcinogenic effects.

Reproductive toxicity Product

May damage fertility or the unborn child.

Carbon monoxide May damage fertility or the unborn child.

Reproductive toxicity (Fertility)

Carbon monoxide NOAEC (embryotoxicity): 65 ppm

Developmental toxicity (Teratogenicity)

Carbon monoxide LOAEC: 125 ppm

Specific Target Organ Toxicity - Single Exposure

Product Based on available data, the classification criteria are not met.

Carbon monoxide
Route of Exposure: Inhalation
Target Organ(s): Blood
Causes damage to red blood cells (haemolytic poison). Carbon monoxide binds reversibly to haemoglobin (Hb) to form carboxyhaemoglobin (CoHb), reducing the capacity of the blood to transport oxygen.

Specific Target Organ Toxicity - Repeated Exposure

Product Causes damage to organs through prolonged or repeated exposure.



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Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
13/56

Carbon monoxide

Route of Exposure: Inhalation

Target Organ(s): Heart

Risk of serious health injuries in case of long term exposure.

Aspiration Hazard
Product

Not applicable to gases and gas mixtures..

SECTION 12: Ecological information

12.1 Toxicity

Acute toxicity
Product

No ecological damage caused by this product.

Acute toxicity - Fish
Carbon monoxide

LC 50 (Fish (no species mentioned)): 672,6 mg/l Remarks: QSAR QSAR, Supporting study

Acute toxicity - Aquatic Invertebrates

Carbon monoxide

LC 50 (48 h): 307,5 mg/l Remarks: QSAR QSAR, Supporting study

12.2 Persistence and Degradability Product

Not applicable to gases and gas mixtures..

Carbon monoxide

Will not undergo hydrolysis.

Biodegradation

Carbon monoxide

Not readily biodegradable. Inorganic compound.

12.3 Bioaccumulative potential Product

The subject product is expected to biodegrade and is not expected to persist for long periods in an aquatic environment.

Carbon monoxide

Because of the low log Kow, accumulation in organisms is not expected.

12.4 Mobility in soil Product

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



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Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
14/56

Carbon monoxide Because of its high volatility, the product is unlikely to cause ground or water pollution.

12.5 Results of PBT and vPvB assessment Product

Not classified as PBT or vPvB.

12.6 Other adverse effects: No ecological damage caused by this product.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

General information: Must not be discharged to atmosphere. Consult supplier for specific recommendations.

Disposal methods: 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. Dispose of container via supplier only. Discharge, treatment, or disposal may be subject to national, state, or local laws.

European Waste Codes

Container: 16 05 04*: Gases in pressure containers (including halons) containing dangerous substances.

SECTION 14: Transport information

ADR

14.1 UN Number:	UN 1016
14.2 UN Proper Shipping Name:	CARBON MONOXIDE, COMPRESSED
14.3 Transport Hazard Class(es)	
Class:	2
Label(s):	2.3, 2.1
Hazard No. (ADR):	263
Tunnel restriction code:	(B/D)
14.4 Packing Group:	–
14.5 Environmental hazards:	Not applicable
14.6 Special precautions for user:	–



SAFETY DATA SHEET

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Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
15/56

RID

14.1 UN Number:	UN 1016
14.2 UN Proper Shipping Name	CARBON MONOXIDE, COMPRESSED
14.3 Transport Hazard Class(es)	
Class:	2
Label(s):	2.3, 2.1
14.4 Packing Group:	–
14.5 Environmental hazards:	Not applicable
14.6 Special precautions for user:	–

IMDG

14.1 UN Number:	UN 1016
14.2 UN Proper Shipping Name:	CARBON MONOXIDE, COMPRESSED
14.3 Transport Hazard Class(es)	
Class:	2.3
Label(s):	2.3, 2.1
EmS No.:	F-D, S-U
14.4 Packing Group:	–
14.5 Environmental hazards:	Not applicable
14.6 Special precautions for user:	–

IATA

14.1 UN Number:	UN 1016
14.2 Proper Shipping Name:	Carbon monoxide, compressed
14.3 Transport Hazard Class(es):	
Class:	2.3
Label(s):	–
14.4 Packing Group:	–
14.5 Environmental hazards:	Not applicable
14.6 Special precautions for user:	–
Other information	
Passenger and cargo aircraft:	Forbidden.
Cargo aircraft only:	Forbidden.

14.7 Transport in bulk according to Annex II of MARPOL and the IBC Code: Not applicable

Additional identification:

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. Before transporting product containers ensure that they are firmly secured. Ensure that the container valve is closed and not leaking. Container valve guards or caps should be in place. Ensure adequate air ventilation.

**SAFETY DATA SHEET**

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressedIssue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
16/56**SECTION 15: Regulatory information****15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture:****EU Regulations**

Regulation (EC) No. 1907/2006 Annex XVII Substances subject to restriction on marketing and use as amended:

The packaging shall be visibly, legibly and indelibly marked as follows:
Restricted to professional users.

Chemical name	CAS-No.	Concentration
Carbon monoxide	630-08-0	100%

Directive 92/85/EEC: on the safety and health of pregnant workers and workers who have recently given birth or are breast feeding.:

Chemical name	CAS-No.	Concentration
Carbon monoxide	630-08-0	100%

EU. Directive 2012/18/EU (SEVESO III) on major accident hazards involving dangerous substances, Annex 1, as amended.:

Classification	Lower-tier Requirements	Upper-tier Requirements
H2: ACUTE TOXIC (Category 2, all exposure routes; Category 3, inhalation)	50 t	200 t
P2: Flammable gases, Category 1 or 2	10 t	50 t

Directive 98/24/EC on the protection of workers from the risks related to chemical agents at work as amended:

Chemical name	CAS-No.	Concentration
Carbon monoxide	630-08-0	100%



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
17/56

National Regulations

Council Directive 89/391/EEC on the introduction of measures to encourage improvements in the safety and health of workers at work Directive 2016/425/EEC on personal protective equipment Directive 2014/34/EU on equipment and protective systems intended for use in potentially explosive atmospheres (ATEX) Only products that comply with the food regulations (EC) No. 1333/2008 and (EU) No. 231/2012 and are labelled as such may be used as food additives.
This Safety Data Sheet has been produced to comply with Regulation (EU) 2015/830.

15.2 Chemical safety assessment: Chemical Safety Assessment has been carried out.

SECTION 16: Other information

Revision Information: Not relevant.

Key literature references and sources for data:

Various sources of data have been used in the compilation of this SDS, they include but are not exclusive to:
Agency for Toxic Substances and Diseases Registry (ATSDR) (<http://www.atsdr.cdc.gov/>).
European Chemical Agency: Guidance on the Compilation of Safety Data Sheets.
European Chemical Agency: Information on Registered Substances <http://apps.echa.europa.eu/registered/registered-sub.aspx#search>
European Industrial Gases Association (EIGA) Doc. 169 "Classification and Labelling guide", as amended.
International Programme on Chemical Safety (<http://www.inchem.org/>)
ISO 10156:2010 Gases and gas mixtures - Determination of fire potential and oxidizing ability for the selection of cylinder valve outlets.
Matheson Gas Data Book, 7th Edition.
National Institute for Standards and Technology (NIST) Standard Reference Database Number 69.
The ESIS (European chemical Substances Information System) platform of the former European Chemicals Bureau (ECB) ESIS (<http://ecb.jrc.ec.europa.eu/esis/>).
The European Chemical Industry Council (CEFIC) ERICards.
United States of America's National Library of Medicine's toxicology data network TOXNET (<http://toxnet.nlm.nih.gov/index.html>)
Threshold Limit Values (TLV) from the American Conference of Governmental Industrial Hygienists (ACGIH).
Substance specific information from suppliers.
Details given in this document are believed to be correct at the time of publication.



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
18/56

Wording of the H-statements in section 2 and 3

H221	Flammable gas.
H280	Contains gas under pressure; may explode if heated.
H331	Toxic if inhaled.
H360D	May damage the unborn child.
H372	Causes damage to organs through prolonged or repeated exposure.

Training information:

Users of breathing apparatus must be trained. Ensure operators understand the toxicity hazard. Ensure operators understand the flammability hazard.

Classification according to Regulation (EC) No 1272/2008 as amended.

Flam. Gas 1B, H221
Acute Tox. 3, H331
Repr. 1A, H360D
STOT RE 1, H372
Press. Gas Compr. Gas, H280

Other information:

Before using this product in any new process or experiment, a thorough material compatibility and safety study should be carried out. Ensure adequate air ventilation. Ensure all national/local regulations are observed. 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.

Last revised date:

24.04.2023

Disclaimer:

This information is provided without warranty. The information is believed to be correct. This information should be used to make an independent determination of the methods to safeguard workers and the environment.

**SAFETY DATA SHEET**

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressedIssue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
19/56

Annex to the extended Safety Data Sheet (eSDS)

Content

Exposure Scenario 1)	Formulation & (re)packing of substances and mixtures, Industrial use
Exposure Scenario 2)	Using gas for metal treatment., Industrial use
Exposure Scenario 3)	Use for electronic component manufacture., Industrial use
Exposure Scenario 4)	Use of gas to manufacture pharmaceutical products., Industrial use
Exposure Scenario 5)	Using gas as feedstock in chemical processes., Industrial use
Exposure Scenario 6)	Using gas alone or in mixtures for the calibration of analysis equipment., Professional use

Exposure Scenario 1)**Exposure Scenario worker****1. Formulation & (re)packing of substances and mixtures, Industrial use**

List of use descriptors	
Sector(s) of use	
Product categories [PC]:	

Name of contributing environmental scenario and corresponding ERC	<u>Formulation & (re)packing of substances and mixtures:</u> ERC2: Formulation into mixture
---	--

Contributing Scenarios	<u>Formulation & (re)packing of substances and mixtures:</u> PROC1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities
------------------------	--

2.1. Contributing exposure scenario controlling environmental exposure for: Formulation & (re)packing of substances and mixtures**Product characteristics**



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
 Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
 20/56

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.
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Physical form of the product	See section 9 of the SDS.
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Viscosity:	
Kinematic viscosity:	No data available.
Dynamic viscosity:	No data available.

Amounts used

The actual tonnage handled per site is not considered to influence the immissions as such for this scenario as there is practically no release
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Frequency and duration of use

Batch process:	220 Emission days
Continuous process:	not relevant

Environment factors not influenced by risk management

Other given operational conditions affecting environmental exposure

Other relevant operational conditions	not relevant
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Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release

See section 8 of the safety data sheet (Environmental exposure controls).

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Air	Handle substance within a closed system. Effectiveness: 100 %.
Soil	not relevant
Water	not relevant
Sediment:	not relevant
Remarks:	not relevant



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
21/56

Organisational measures to prevent/limit release from site:

none

Conditions and measures related to sewage treatment plant

type:	not relevant
Discharge rate:	not relevant
Treatment effectiveness:	not relevant
Sludge treatment technique:	not relevant
Measures to limit air emissions:	not relevant
Remarks:	Wastewater emission controls are not applicable as there is no direct release to wastewater.

Conditions and measures related to external treatment of waste for disposal

Fraction of used amount transferred to external waste treatment:

Suitable waste treatment	Treatment effectiveness	Remarks
See section 13 of the SDS		External treatment and disposal of waste should comply with applicable local and/or national regulations.

Conditions and measures related to external recovery of waste

Fraction of used amount transferred to external waste treatment:

Suitable recovery operations:	Treatment effectiveness	Remarks
See section 13 of the SDS		External recovery and recycling of waste should comply with applicable local and/or national regulations.

Additional good practice advice beyond the REACH Chemical Safety Report

Ensure operatives are trained to minimise releases

2.2. Contributing exposure scenario controlling worker exposure for: Formulation & (re)packing of substances and mixtures

Process Categories:	PROC1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions
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**SAFETY DATA SHEET**

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressedIssue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
22/56

	PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities
--	---

Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.
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Physical form of the product:	See section 9 of the SDS.
Vapour pressure:	> 101,325 kPa
Process temperature:	>= 20 °C
Remarks	not relevant

Amounts used

The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation (industrial vs. professional) and level of containment/automation (as reflected in the PROCs and technical conditions) is the main determinant of the process-intrinsic emission potential.

Frequency and duration of use

	Use duration:	Frequency of use:	Remarks
Hours per shift	8 h	5 days per week	

Human factors not influenced by risk management

This information is not available.

Other given operational conditions affecting workers exposure

Other relevant operational conditions:	. See section 8 of the SDS.
--	-----------------------------

Risk management measures (RMM)**Technical conditions and measures at process level (source) to prevent release**

See section 8 of the safety data sheet

Technical conditions and measures to control dispersion from source towards the worker

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
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SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
 Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
 23/56

Provide a basic standard of general ventilation (1 to 3 air changes per hour).				Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions
Provide a basic standard of general ventilation (1 to 3 air changes per hour).				Transfer of substance or mixture (charging and discharging) at dedicated facilities
Local exhaust ventilation				Transfer of substance or mixture (charging and discharging) at dedicated facilities

Organisational measures to prevent/limit releases, dispersion and exposure

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
See section 7 of the SDS.				

Conditions and measures related to personal protection, hygiene and health evaluation

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
				See section 8 of the safety data sheet (Personal protection equipment)

Additional good practice advice beyond the REACH Chemical Safety Report

See section 7 of the SDS. Handle product within a closed system. Apply a good standard of general or controlled ventilation when maintenance activities are carried out. Ensure operatives are trained to minimise exposure. Ensure supervision is in place to check that the RMMs are in place and are being used correctly and that the OCs are being followed.

3. Exposure estimation

Environment:
 Formulation & (re)packing of substances and mixtures:
 ERC2:

SDS_AT - 000010021698



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
 Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
 24/56

Compartment	Predicted environmental concentration (PEC)	Risk characterisation ratio (RCR)	Method	Remarks
Air		< 1	ECETOC TRA, EUSES v2.1	Closed systems

ERC2:

Compartment	Predicted environmental concentration (PEC)	Risk characterisation ratio (RCR)	Method	Remarks
Water		< 1	ECETOC TRA, EUSES v2.1	The exposure of aquatic, terrestrial, sediment and sewage treatment microorganisms is considered to be negligible because the substance partitions primarily to air when released to the environment. The resulting environmental exposure is not expected to add significantly to already present background levels of the gas in the environment

Health:

Formulation & (re)packing of substances and mixtures:

PROC1:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
inhalative, long-term, systemic	Indoor use, without local exhaust ventilation	0,011 mg/m ³	< 0,001	ECETOC TRA, EUSES v2.1	none

PROC1:



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
25/56

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
inhalative, short-term, systemic, (acute)	Indoor use, without local exhaust ventilation	0,023 mg/m ³	<= 0,001	ECETOC TRA, EUSES v2.1	none

PROC8b:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
inhalative, long-term, systemic	Indoor use, with local exhaust ventilation	17,5 mg/m ³	0,761	ECETOC TRA, EUSES v2.1	none

PROC8b:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
inhalative, short-term, systemic, (acute)	Indoor use, with local exhaust ventilation	35 mg/m ³	0,299	ECETOC TRA, EUSES v2.1	none

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

Check that RMMs and OCs are as described above or of equivalent efficiency. Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. For scaling see <http://www.ecetoc.org/tra>

Exposure Scenario 2)

Exposure Scenario worker

1. Using gas for metal treatment., Industrial use

List of use descriptors

SDS_AT - 000010021698



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
26/56

Sector(s) of use	SU14: Manufacture of basic metals, including alloys SU15: Manufacture of fabricated metal products, except machinery and equipment
Product categories [PC]:	PC14: Metal surface treatment products

Name of contributing environmental scenario and corresponding ERC	<u>Using gas for metal treatment.:</u> ERC6b: Use of reactive processing aid at industrial site (no inclusion into or onto article)
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Contributing Scenarios	<u>Using gas for metal treatment.:</u> PROC22: Manufacturing and processing of minerals and/or metals at substantially elevated temperature
------------------------	--

2.1. Contributing exposure scenario controlling environmental exposure for: Using gas for metal treatment., Industrial use

Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.
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Physical form of the product	See section 9 of the SDS.
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Viscosity:	
Kinematic viscosity:	No data available.
Dynamic viscosity:	No data available.

Amounts used

The actual tonnage handled per site is not considered to influence the immissions as such for this scenario as there is practically no release

Frequency and duration of use

Batch process:	220 Emission days
Continuous process:	not relevant

Environment factors not influenced by risk management



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
27/56

Other given operational conditions affecting environmental exposure

Other relevant operational conditions	not relevant
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Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release

See section 8 of the safety data sheet (Environmental exposure controls).

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Air	Handle substance within a closed system. Effectiveness: 100 %.
Soil	not relevant
Water	not relevant
Sediment:	not relevant
Remarks:	not relevant

Organisational measures to prevent/limit release from site:

none

Conditions and measures related to sewage treatment plant

type:	not relevant
Discharge rate:	not relevant
Treatment effectiveness:	not relevant
Sludge treatment technique:	not relevant
Measures to limit air emissions:	not relevant
Remarks:	Wastewater emission controls are not applicable as there is no direct release to wastewater.

Conditions and measures related to external treatment of waste for disposal

Fraction of used amount transferred to external waste treatment:

Suitable waste treatment	Treatment effectiveness	Remarks
See section 13 of the SDS		External treatment and disposal of waste



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
 Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
 28/56

		should comply with applicable local and/or national regulations.
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Conditions and measures related to external recovery of waste

Fraction of used amount transferred to external waste treatment:

Suitable recovery operations:	Treatment effectiveness	Remarks
See section 13 of the SDS		External recovery and recycling of waste should comply with applicable local and/or national regulations.

Additional good practice advice beyond the REACH Chemical Safety Report

Ensure operatives are trained to minimise releases

2.2. Contributing exposure scenario controlling worker exposure for: Using gas for metal treatment., Industrial use

Process Categories:	PROC22: Manufacturing and processing of minerals and/or metals at substantially elevated temperature
---------------------	--

Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.
Physical form of the product:	See section 9 of the SDS.
Vapour pressure:	> 101,325 kPa
Process temperature:	>= 20 °C
Remarks	not relevant

Amounts used

The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation (industrial vs. professional) and level of containment/automation (as reflected in the PROCs and technical conditions) is the main determinant of the process-intrinsic emission potential.

Frequency and duration of use

	Use duration:	Frequency of use:	Remarks
Hours per shift	8 h	5 days per week	

Human factors not influenced by risk management

SDS_AT - 000010021698

**SAFETY DATA SHEET**

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressedIssue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
29/56

This information is not available.

Other given operational conditions affecting workers exposure

Other relevant operational conditions: . See section 8 of the SDS.

Risk management measures (RMM)**Technical conditions and measures at process level (source) to prevent release**

See section 8 of the safety data sheet

Technical conditions and measures to control dispersion from source towards the worker

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
Provide a basic standard of general ventilation (1 to 3 air changes per hour).				Manufacturing and processing of minerals and/or metals at substantially elevated temperature
Local exhaust ventilation				Manufacturing and processing of minerals and/or metals at substantially elevated temperature

Organisational measures to prevent/limit releases, dispersion and exposure

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
See section 7 of the SDS.				

Conditions and measures related to personal protection, hygiene and health evaluation

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
				See section 8 of the safety data sheet (Personal protection equipment)

**SAFETY DATA SHEET**

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013

Version: 1.5

SDS No.: 000010021698

Last revised date: 24.04.2023

30/56

Additional good practice advice beyond the REACH Chemical Safety Report

See section 7 of the SDS. Handle product within a closed system. Apply a good standard of general or controlled ventilation when maintenance activities are carried out. Ensure operatives are trained to minimise exposure. Ensure supervision is in place to check that the RMMs are in place and are being used correctly and that the OCs are being followed.

3. Exposure estimation

Environment:

Using gas for metal treatment., Industrial use:

ERC6b:

Compartment	Predicted environmental concentration (PEC)	Risk characterisation ratio (RCR)	Method	Remarks
Air		< 1	ECETOC TRA, EUSES v2.1	Closed systems

ERC6b:

Compartment	Predicted environmental concentration (PEC)	Risk characterisation ratio (RCR)	Method	Remarks
Water		< 1	ECETOC TRA, EUSES v2.1	The exposure of aquatic, terrestrial, sediment and sewage treatment microorganisms is considered to be negligible because the substance partitions primarily to air when released to the environment. The resulting environmental exposure is not expected to add significantly to already present background levels of the gas in the environment.



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
31/56

Health:

Using gas for metal treatment., Industrial use:

PROC22:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
inhalative, long-term, systemic	Indoor use, with local exhaust ventilation	11,7 mg/m ³	0,509	ECETOC TRA, EUSES v2.1	none

PROC22:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
inhalative, short-term, systemic, (acute)	Indoor use, with local exhaust ventilation	23,4 mg/m ³	0,2	ECETOC TRA, EUSES v2.1	none

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

Check that RMMs and OCs are as described above or of equivalent efficiency. Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. For scaling see <http://www.ecetoc.org/tra>

Exposure Scenario 3)

Exposure Scenario worker

1. Use for electronic component manufacture., Industrial use

List of use descriptors	
Sector(s) of use	SU16: Manufacture of computer, electronic and optical products, electrical equipment
Product categories [PC]:	PC33: Semiconductors
Name of contributing environmental scenario and corresponding ERC	Use for electronic component manufacture.: ERC6a: Use of intermediate



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
32/56

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Contributing Scenarios	Use for electronic component manufacture.: PROC1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions
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2.1.Contributing exposure scenario controlling environmental exposure for: Use for electronic component manufacture., Industrial use
--

Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.
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Physical form of the product	See section 9 of the SDS.
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Viscosity:	
Kinematic viscosity:	No data available.
Dynamic viscosity:	No data available.

Amounts used

The actual tonnage handled per site is not considered to influence the immissions as such for this scenario as there is practically no release
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Frequency and duration of use

Batch process:	220 Emission days
Continuous process:	not relevant

Environment factors not influenced by risk management

Other given operational conditions affecting environmental exposure

Other relevant operational conditions	not relevant
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Risk management measures (RMM)



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
33/56

Technical conditions and measures at process level (source) to prevent release

See section 8 of the safety data sheet (Environmental exposure controls).

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Air	Handle substance within a closed system. Effectiveness: 100 %.
Soil	not relevant
Water	not relevant
Sediment:	not relevant
Remarks:	not relevant

Organisational measures to prevent/limit release from site:

none

Conditions and measures related to sewage treatment plant

type:	not relevant
Discharge rate:	not relevant
Treatment effectiveness:	not relevant
Sludge treatment technique:	not relevant
Measures to limit air emissions:	not relevant
Remarks:	Wastewater emission controls are not applicable as there is no direct release to wastewater.

Conditions and measures related to external treatment of waste for disposal

Fraction of used amount transferred to external waste treatment:

Suitable waste treatment	Treatment effectiveness	Remarks
See section 13 of the SDS		External treatment and disposal of waste should comply with applicable local and/or national regulations.

Conditions and measures related to external recovery of waste

Fraction of used amount transferred to external waste treatment:

Suitable recovery operations:	Treatment effectiveness	Remarks
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SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
34/56

See section 13 of the SDS	External recovery and recycling of waste should comply with applicable local and/or national regulations.
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Additional good practice advice beyond the REACH Chemical Safety Report

Ensure operatives are trained to minimise releases

2.2. Contributing exposure scenario controlling worker exposure for: Use for electronic component manufacture., Industrial use

Process Categories:	PROC1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions
---------------------	---

Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.
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Physical form of the product:	See section 9 of the SDS.
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Vapour pressure:	> 101,325 kPa
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Process temperature:	>= 20 °C
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Remarks	not relevant
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Amounts used

The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation (industrial vs. professional) and level of containment/automation (as reflected in the PROCs and technical conditions) is the main determinant of the process-intrinsic emission potential.

Frequency and duration of use

	Use duration:	Frequency of use:	Remarks
Hours per shift	8 h	5 days per week	

Human factors not influenced by risk management

This information is not available.

Other given operational conditions affecting workers exposure

Other relevant operational conditions:	. See section 8 of the SDS.
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**SAFETY DATA SHEET**

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressedIssue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
35/56**Risk management measures (RMM)****Technical conditions and measures at process level (source) to prevent release**

See section 8 of the safety data sheet

Technical conditions and measures to control dispersion from source towards the worker

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
Provide a basic standard of general ventilation (1 to 3 air changes per hour).				Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Organisational measures to prevent/limit releases, dispersion and exposure

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
See section 7 of the SDS.				

Conditions and measures related to personal protection, hygiene and health evaluation

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
				See section 8 of the safety data sheet (Personal protection equipment)

Additional good practice advice beyond the REACH Chemical Safety Report

See section 7 of the SDS. Handle product within a closed system. Apply a good standard of general or controlled ventilation when maintenance activities are carried out. Ensure operatives are trained to minimise exposure. Ensure supervision is in place to check that the RMMs are in place and are being used correctly and that the OCs are being followed.

3. Exposure estimation



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013

Version: 1.5

SDS No.: 000010021698

Last revised date: 24.04.2023

36/56

Environment:

Use for electronic component manufacture., Industrial use:

ERC6a:

Compartment	Predicted environmental concentration (PEC)	Risk characterisation ratio (RCR)	Method	Remarks
Air		< 1	ECETOC TRA, EUSES v2.1	Closed systems

ERC6a:

Compartment	Predicted environmental concentration (PEC)	Risk characterisation ratio (RCR)	Method	Remarks
Water		< 1	ECETOC TRA, EUSES v2.1	The exposure of aquatic, terrestrial, sediment and sewage treatment microorganisms is considered to be negligible because the substance partitions primarily to air when released to the environment. The resulting environmental exposure is not expected to add significantly to already present background levels of the gas in the environment

Health:

Use for electronic component manufacture., Industrial use:

PROC1:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
inhalative, long-term, systemic	Indoor use, without local	0,011 mg/m ³	< 0,001	ECETOC TRA, EUSES v2.1	none



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
37/56

	exhaust ventilation				
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PROC1:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
inhalative, short-term, systemic, (acute)	Indoor use, without local exhaust ventilation	0,023 mg/m ³	<= 0,001	ECETOC TRA, EUSES v2.1	none

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

Check that RMMs and OCs are as described above or of equivalent efficiency Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. For scaling see <http://www.ecetoc.org/tra>

Exposure Scenario 4)

Exposure Scenario worker

1. Use of gas to manufacture pharmaceutical products., Industrial use

List of use descriptors	
Sector(s) of use	SU9: Manufacture of fine chemicals
Product categories [PC]:	PC29: Pharmaceuticals

Name of contributing environmental scenario and corresponding ERC	Use of gas to manufacture pharmaceutical products.: ERC6a: Use of intermediate
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Contributing Scenarios	<p><u>Use of gas to manufacture pharmaceutical products.:</u> PROC2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions</p> <p>PROC3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition</p>
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**SAFETY DATA SHEET**

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressedIssue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
38/56

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2.1. Contributing exposure scenario controlling environmental exposure for: Use of gas to manufacture pharmaceutical products., Industrial use**Product characteristics**

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.
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Physical form of the product	See section 9 of the SDS.
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Viscosity:	
Kinematic viscosity:	No data available.
Dynamic viscosity:	No data available.

Amounts used

The actual tonnage handled per site is not considered to influence the immissions as such for this scenario as there is practically no release

Frequency and duration of use

Batch process:	220 Emission days
Continuous process:	not relevant

Environment factors not influenced by risk management**Other given operational conditions affecting environmental exposure**

Other relevant operational conditions	not relevant
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Risk management measures (RMM)**Technical conditions and measures at process level (source) to prevent release**

See section 8 of the safety data sheet (Environmental exposure controls).

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
 Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
 39/56

Air	Handle substance within a closed system. Effectiveness: 100 %.
Soil	not relevant
Water	not relevant
Sediment:	not relevant
Remarks:	not relevant

Organisational measures to prevent/limit release from site:

none

Conditions and measures related to sewage treatment plant

type:	not relevant
Discharge rate:	not relevant
Treatment effectiveness:	not relevant
Sludge treatment technique:	not relevant
Measures to limit air emissions:	not relevant
Remarks:	Wastewater emission controls are not applicable as there is no direct release to wastewater.

Conditions and measures related to external treatment of waste for disposal

Fraction of used amount transferred to external waste treatment:

Suitable waste treatment	Treatment effectiveness	Remarks
See section 13 of the SDS		External treatment and disposal of waste should comply with applicable local and/or national regulations.

Conditions and measures related to external recovery of waste

Fraction of used amount transferred to external waste treatment:

Suitable recovery operations:	Treatment effectiveness	Remarks
See section 13 of the SDS		External recovery and recycling of waste should comply with applicable local and/or national regulations.

Additional good practice advice beyond the REACH Chemical Safety Report

**SAFETY DATA SHEET**

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressedIssue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
40/56

Ensure operatives are trained to minimise releases

2.2. Contributing exposure scenario controlling worker exposure for: Use of gas to manufacture pharmaceutical products., Industrial use**Process Categories:**PROC2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions
PROC3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition**Product characteristics**

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.
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Physical form of the product:	See section 9 of the SDS.
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Vapour pressure:	> 101,325 kPa
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Process temperature:	>= 20 °C
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Remarks	not relevant
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Amounts used

The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation (industrial vs. professional) and level of containment/automation (as reflected in the PROCs and technical conditions) is the main determinant of the process-intrinsic emission potential.

Frequency and duration of use

	Use duration:	Frequency of use:	Remarks
Hours per shift	8 h	5 days per week	

Human factors not influenced by risk management

This information is not available.

Other given operational conditions affecting workers exposure

Other relevant operational conditions:	. See section 8 of the SDS.
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Risk management measures (RMM)



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
 Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
 41/56

Technical conditions and measures at process level (source) to prevent release

See section 8 of the safety data sheet

Technical conditions and measures to control dispersion from source towards the worker

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
Provide a basic standard of general ventilation (1 to 3 air changes per hour).				Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions
Local exhaust ventilation				Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions
Provide a basic standard of general ventilation (1 to 3 air changes per hour).				Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Local exhaust ventilation				Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Organisational measures to prevent/limit releases, dispersion and exposure

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
See section 7 of the SDS.				

Conditions and measures related to personal protection, hygiene and health evaluation



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
42/56

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
				See section 8 of the safety data sheet (Personal protection equipment)

Additional good practice advice beyond the REACH Chemical Safety Report

See section 7 of the SDS. Handle product within a closed system. Apply a good standard of general or controlled ventilation when maintenance activities are carried out. Ensure operatives are trained to minimise exposure. Ensure supervision is in place to check that the RMMs are in place and are being used correctly and that the OCs are being followed.

3. Exposure estimation

Environment:

Use of gas to manufacture pharmaceutical products., Industrial use:

ERC6a:

Compartment	Predicted environmental concentration (PEC)	Risk characterisation ratio (RCR)	Method	Remarks
Air		< 1	ECETOC TRA, EUSES v2.1	Closed systems

ERC6a:

Compartment	Predicted environmental concentration (PEC)	Risk characterisation ratio (RCR)	Method	Remarks
Water		< 1	ECETOC TRA, EUSES v2.1	The exposure of aquatic, terrestrial, sediment and sewage treatment microorganisms is considered to be negligible because the substance partitions primarily to air when released to the environment. The resulting environmental exposure is



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
43/56

				not expected to add significantly to already present background levels of the gas in the environment
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Health:

Use of gas to manufacture pharmaceutical products., Industrial use:

PROC2:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
inhalative, long-term, systemic	Indoor use, with local exhaust ventilation	5,84 mg/m ³	0,254	ECETOC TRA, EUSES v2.1	none

PROC2:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
inhalative, short-term, systemic, (acute)	Indoor use, with local exhaust ventilation	11,7 mg/m ³	0,1	ECETOC TRA, EUSES v2.1	none

PROC3:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
inhalative, long-term, systemic	Indoor use, with local exhaust ventilation	11,7 mg/m ³	0,509	ECETOC TRA, EUSES v2.1	none

PROC3:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio	Method	Remarks
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SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
44/56

			(RCR)		
inhalative, short-term, systemic, (acute)	Indoor use, with local exhaust ventilation	23,4 mg/m ³	0,2	ECETOC TRA, EUSES v2.1	none

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

Check that RMMs and OCs are as described above or of equivalent efficiency Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. For scaling see <http://www.ecetoc.org/tra>

Exposure Scenario 5)

Exposure Scenario worker

1. Using gas as feedstock in chemical processes., Industrial use

List of use descriptors	
Sector(s) of use	SU8: Manufacture of bulk, large scale chemicals (including petroleum products) SU9: Manufacture of fine chemicals
Product categories [PC]:	PC21: Laboratory chemicals

Name of contributing environmental scenario and corresponding ERC	<u>Using gas as feedstock in chemical processes.:</u> ERC6a: Use of intermediate
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Contributing Scenarios	<u>Using gas as feedstock in chemical processes.:</u> PROC1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities
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2.1. Contributing exposure scenario controlling environmental exposure for: Using gas as feedstock in chemical processes., Industrial use



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
 Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
 45/56

Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.
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Physical form of the product	See section 9 of the SDS.
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Viscosity:

Kinematic viscosity:	No data available.
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Dynamic viscosity:	No data available.
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Amounts used

The actual tonnage handled per site is not considered to influence the immissions as such for this scenario as there is practically no release
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Frequency and duration of use

Batch process:	220 Emission days
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Continuous process:	not relevant
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Environment factors not influenced by risk management

Other given operational conditions affecting environmental exposure

Other relevant operational conditions	not relevant
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Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release

See section 8 of the safety data sheet (Environmental exposure controls).

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Air	Handle substance within a closed system. Effectiveness: 100 %.
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Soil	not relevant
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Water	not relevant
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Sediment:	not relevant
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SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
46/56

Remarks:	not relevant
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Organisational measures to prevent/limit release from site:

none

Conditions and measures related to sewage treatment plant

type:	not relevant
Discharge rate:	not relevant
Treatment effectiveness:	not relevant
Sludge treatment technique:	not relevant
Measures to limit air emissions:	not relevant
Remarks:	Wastewater emission controls are not applicable as there is no direct release to wastewater.

Conditions and measures related to external treatment of waste for disposal

Fraction of used amount transferred to external waste treatment:

Suitable waste treatment	Treatment effectiveness	Remarks
See section 13 of the SDS		External treatment and disposal of waste should comply with applicable local and/or national regulations.

Conditions and measures related to external recovery of waste

Fraction of used amount transferred to external waste treatment:

Suitable recovery operations:	Treatment effectiveness	Remarks
See section 13 of the SDS		External recovery and recycling of waste should comply with applicable local and/or national regulations.

Additional good practice advice beyond the REACH Chemical Safety Report

Ensure operatives are trained to minimise releases
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2.2. Contributing exposure scenario controlling worker exposure for: Using gas as feedstock in chemical processes., Industrial use



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
47/56

Process Categories:	PROC1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities
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Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.
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Physical form of the product:	See section 9 of the SDS.
Vapour pressure:	> 101,325 kPa
Process temperature:	>= 20 °C
Remarks	not relevant

Amounts used

The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation (industrial vs. professional) and level of containment/automation (as reflected in the PROCs and technical conditions) is the main determinant of the process-intrinsic emission potential.

Frequency and duration of use

	Use duration:	Frequency of use:	Remarks
Hours per shift	8 h	5 days per week	

Human factors not influenced by risk management

This information is not available.

Other given operational conditions affecting workers exposure

Other relevant operational conditions:	. See section 8 of the SDS.
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Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release

See section 8 of the safety data sheet

Technical conditions and measures to control dispersion from source towards the worker



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
 Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
 48/56

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
Provide a basic standard of general ventilation (1 to 3 air changes per hour).				Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions
Provide a basic standard of general ventilation (1 to 3 air changes per hour).				Transfer of substance or mixture (charging and discharging) at dedicated facilities
Local exhaust ventilation				Transfer of substance or mixture (charging and discharging) at dedicated facilities

Organisational measures to prevent/limit releases, dispersion and exposure

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
See section 7 of the SDS.				

Conditions and measures related to personal protection, hygiene and health evaluation

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
				See section 8 of the safety data sheet (Personal protection equipment)

Additional good practice advice beyond the REACH Chemical Safety Report

See section 7 of the SDS. Handle product within a closed system. Apply a good standard of general or controlled ventilation when maintenance activities are carried out. Ensure operatives are trained to minimise exposure. Ensure supervision is in place to check that the RMMs are in place and are being used correctly and that the OCs are being followed.

3. Exposure estimation

Environment:

SDS_AT - 000010021698



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013

Version: 1.5

SDS No.: 000010021698

Last revised date: 24.04.2023

49/56

Using gas as feedstock in chemical processes., Industrial use:

ERC6a:

Compartment	Predicted environmental concentration (PEC)	Risk characterisation ratio (RCR)	Method	Remarks
Air		< 1	ECETOC TRA, EUSES v2.1	Closed systems

ERC6a:

Compartment	Predicted environmental concentration (PEC)	Risk characterisation ratio (RCR)	Method	Remarks
Water		< 1	ECETOC TRA, EUSES v2.1	The exposure of aquatic, terrestrial, sediment and sewage treatment microorganisms is considered to be negligible because the substance partitions primarily to air when released to the environment. The resulting environmental exposure is not expected to add significantly to already present background levels of the gas in the environment

Health:

Using gas as feedstock in chemical processes., Industrial use:

PROC1:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
inhalative, long-term, systemic	Indoor use, without local exhaust	0,011 mg/m ³	< 0,001	ECETOC TRA, EUSES v2.1	none



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
50/56

	ventilation				
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PROC1:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
inhalative, short-term, systemic, (acute)	Indoor use, without local exhaust ventilation	0,023 mg/m ³	<= 0,001	ECETOC TRA, EUSES v2.1	none

PROC8b:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
inhalative, long-term, systemic	Indoor use, with local exhaust ventilation	17,5 mg/m ³	0,761	ECETOC TRA, EUSES v2.1	none

PROC8b:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
inhalative, short-term, systemic, (acute)	Indoor use, with local exhaust ventilation	35 mg/m ³	0,299	ECETOC TRA, EUSES v2.1	none

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

Check that RMMs and OCs are as described above or of equivalent efficiency. Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. For scaling see <http://www.ecetoc.org/tra>

Exposure Scenario 6)

Exposure Scenario worker

1. Using gas alone or in mixtures for the calibration of analysis equipment., Professional use

SDS_AT - 000010021698



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
 Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
 51/56

List of use descriptors	
Sector(s) of use	SU24: Scientific research and development
Product categories [PC]:	PC21: Laboratory chemicals

Name of contributing environmental scenario and corresponding ERC	<u>Using gas alone or in mixtures for the calibration of analysis equipment.:</u> ERC8a: Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor)
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Contributing Scenarios	<u>Using gas alone or in mixtures for the calibration of analysis equipment.:</u> PROC15: Use as laboratory reagent
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2.1. Contributing exposure scenario controlling environmental exposure for: Using gas alone or in mixtures for the calibration of analysis equipment., Professional use

Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.
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Physical form of the product	See section 9 of the SDS.
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Viscosity:	
Kinematic viscosity:	No data available.
Dynamic viscosity:	No data available.

Amounts used

The actual tonnage handled per site is not considered to influence the immissions as such for this scenario as there is practically no release

Frequency and duration of use

Batch process:	220 Emission days
Continuous process:	not relevant

Environment factors not influenced by risk management

SDS_AT - 000010021698



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
 Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
 52/56

Other given operational conditions affecting environmental exposure

Other relevant operational conditions	not relevant
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Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release

See section 8 of the safety data sheet (Environmental exposure controls).

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Air	Handle substance within a closed system. Effectiveness: 100 %.
Soil	not relevant
Water	not relevant
Sediment:	not relevant
Remarks:	not relevant

Organisational measures to prevent/limit release from site:

none

Conditions and measures related to sewage treatment plant

type:	not relevant
Discharge rate:	not relevant
Treatment effectiveness:	not relevant
Sludge treatment technique:	not relevant
Measures to limit air emissions:	not relevant
Remarks:	Wastewater emission controls are not applicable as there is no direct release to wastewater.

Conditions and measures related to external treatment of waste for disposal

Fraction of used amount transferred to external waste treatment:

Suitable waste treatment	Treatment effectiveness	Remarks
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SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
53/56

See section 13 of the SDS		External treatment and disposal of waste should comply with applicable local and/or national regulations.
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Conditions and measures related to external recovery of waste

Fraction of used amount transferred to external waste treatment:

Suitable recovery operations:	Treatment effectiveness	Remarks
See section 13 of the SDS		External recovery and recycling of waste should comply with applicable local and/or national regulations.

Additional good practice advice beyond the REACH Chemical Safety Report

Ensure operatives are trained to minimise releases

2.2. Contributing exposure scenario controlling worker exposure for: Using gas alone or in mixtures for the calibration of analysis equipment., Professional use

Process Categories:	PROC15: Use as laboratory reagent
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Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.
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Physical form of the product:	See section 9 of the SDS.
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Vapour pressure:	> 101,325 kPa
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Process temperature:	>= 20 °C
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Remarks	not relevant
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Amounts used

The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation (industrial vs. professional) and level of containment/automation (as reflected in the PROCs and technical conditions) is the main determinant of the process-intrinsic emission potential.

Frequency and duration of use

	Use duration:	Frequency of use:	Remarks
Hours per shift	8 h	5 days per week	



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
54/56

Human factors not influenced by risk management

This information is not available.

Other given operational conditions affecting workers exposure

Other relevant operational conditions: . See section 8 of the SDS.

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release

See section 8 of the safety data sheet

Technical conditions and measures to control dispersion from source towards the worker

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
Provide a basic standard of general ventilation (1 to 3 air changes per hour).				Use as laboratory reagent
Local exhaust ventilation				Use as laboratory reagent

Organisational measures to prevent/limit releases, dispersion and exposure

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
See section 7 of the SDS.				

Conditions and measures related to personal protection, hygiene and health evaluation

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
				See section 8 of the safety data sheet (Personal protection equipment)

Additional good practice advice beyond the REACH Chemical Safety Report

SDS_AT - 000010021698

**SAFETY DATA SHEET**

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressedIssue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
55/56

See section 7 of the SDS. Handle product within a closed system. Apply a good standard of general or controlled ventilation when maintenance activities are carried out. Ensure operatives are trained to minimise exposure. Ensure supervision is in place to check that the RMMs are in place and are being used correctly and that the OCs are being followed

3. Exposure estimation**Environment:**

Using gas alone or in mixtures for the calibration of analysis equipment., Professional use:

ERC8a:

Compartment	Predicted environmental concentration (PEC)	Risk characterisation ratio (RCR)	Method	Remarks
Air		< 1	ECETOC TRA, EUSES v2.1	Closed systems

ERC8a:

Compartment	Predicted environmental concentration (PEC)	Risk characterisation ratio (RCR)	Method	Remarks
Water		< 1	ECETOC TRA, EUSES v2.1	The exposure of aquatic, terrestrial, sediment and sewage treatment microorganisms is considered to be negligible because the substance partitions primarily to air when released to the environment. The resulting environmental exposure is not expected to add significantly to already present background levels of the gas in the environment

Health:

Using gas alone or in mixtures for the calibration of analysis equipment., Professional use:



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Carbon monoxide, compressed

Issue Date: 16.01.2013
Last revised date: 24.04.2023

Version: 1.5

SDS No.: 000010021698
56/56

PROC15:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
inhalative, long-term, systemic	Indoor use, with local exhaust ventilation	0,0117 mg/m ³	0,0005	ECETOC TRA, EUSES v2.1	none

PROC15:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
inhalative, short-term, systemic, (acute)	Indoor use, with local exhaust ventilation	0,0234 mg/m ³	0,0002	ECETOC TRA, EUSES v2.1	none

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

Check that RMMs and OCs are as described above or of equivalent efficiency. Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. For scaling see <http://www.ecetoc.org/tra>