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

1.1 Product identifier

Trade name/designation	Carbon monoxide
Art-Nr(n).	0500 - 0506
Substance name	carbon monoxide
INDEX No.	006-001-00-2
EC No.	211-128-3
REACH No.	01-2119480165-39
CAS No.	630-08-0

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

Process categories [PROC]
PROC1 Use in closed process, no likelihood of exposure
PROC2 Use in closed, continuous process with occasional controlled exposure
PROC3 Use in closed batch process (synthesis or formulation)
PROC4 Use in batch and other process (synthesis) where opportunity for exposure arises
PROC8b Transfer of substance or mixture (charging and discharging) at dedicated facilities
PROC9 Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

Environmental release categories [ERC]
ERC2 Formulation into mixture
ERC6a Industrial use resulting in manufacture of another substance (use of intermediates)
ERC6b Industrial use of reactive processing aids
ERC8d Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor)

* **Use of the substance/mixture**
Basic substance

1.3 Details of the supplier of the safety data sheet

Supplier
GHC Gerling, Holz & Co. Handels GmbH
Ruhrstraße 113
D-22761 Hamburg
Telephone +49 40 853 123 0
E-mail hamburg@ghc.de
Website www.ghc.com

Department responsible for information:
GHC Gerling, Holz & Co. Handels GmbH
Telephone +49 40 853 123 0

E-mail (competent person):
msds@ghc.de

* 1.4 Emergency telephone number

EN: Poison Information Center Mainz +49 6131 19240

* SECTION 2: Hazards identification

* 2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008 [CLP]	Classification procedure
Flam. Gas 1B, H221	
Press. Gas (Comp.), H280	
Acute Tox. 3, H331	
Repr. 1A, H360D	
STOT RE 1, H372	

Hazard statements for physical hazards
H221 Flammable gas.
H280 Contains gas under pressure; may explode if heated.

Hazard statements for health hazards
H331 Toxic if inhaled.
H360D May damage the unborn child.
H372 Causes damage to heart through prolonged or repeated exposure if inhaled.

* **2.2 Label elements**

* **Labelling according to Regulation (EC) No. 1272/2008 [CLP]**

Hazard pictograms

GHS02 GHS06 GHS08

Signal word
Danger

Hazard statements
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 heart through prolonged or repeated exposure if inhaled.

* **Precautionary statements**
P210 Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P260 Do not breathe gas/vapours.
P280 Wear protective gloves/protective clothing and eye protection/face protection.
P304 + P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P308 + P313 IF exposed or concerned: Get medical advice/attention.
P403 Store in a well-ventilated place.
P405 Store locked up.

* **Supplemental hazard information**
EIGA0803 Restricted to professional users.
Please return container with residual pressure.

* **2.3 Other hazards**

* **Adverse human health effects and symptoms**
Contact with liquid may cause cold burns/frostbite.

* **Other adverse effects**
The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

* **Results of PBT and vPvB assessment**
The substance/mixture does not contain components meeting the PBT/vPvB criteria of the Reach Regulation, Annex XIII, at levels of 0.1% or higher.

* SECTION 3: Composition / information on ingredients

* **3.1 Substances**

Substance name	carbon monoxide
INDEX No.	006-001-00-2
EC No.	211-128-3
REACH No.	01-2119480165-39
CAS No.	630-08-0
ATE	ATE(): 1300 ppm

Additional information
Content: >= 99 %

3.2 Mixtures

not applicable

* SECTION 4: First aid measures

* 4.1 Description of first aid measures

* **General information**
Remove contaminated, saturated clothing immediately.
Call a physician immediately.
First aider: Pay attention to self-protection!

* **Following inhalation**
Remove casualty to fresh air and keep warm and at rest.
In case of breathing difficulties give oxygen.
In case of respiratory standstill give artificial respiration by respiratory bag (Ambu bag) or respirator. Obtain medical assistance.

* **Following skin contact**
In case of skin contact rinse with warm water.
In case of frostbite, wash with plenty of water; do not remove clothing.
In case of frostbite rinse with lukewarm (not hot) water for at least 15 minutes. Do not remove clothing frozen to the skin.
Thaw with lukewarm water. Apply a sterile dressing. Obtain medical assistance.

* **After eye contact**
Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Obtain medical assistance.

Following ingestion
Ingestion is not considered a potential route of exposure.

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

* **Symptoms**
Circulatory collapse
Unconsciousness
Convulsions
Impairment of vision
Headache

Effects
Cardiac arrhythmias
Pulmonary oedema

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

* **Notes for the doctor**
Treat symptomatically.
Where appropriate artificial ventilation.
To supervise the blood circulation.

* SECTION 5: Firefighting measures

* 5.1 Extinguishing media

* **Suitable extinguishing media**
Extinguishing powder
Foam
Water spray jet

Unsuitable extinguishing media
Carbon dioxide (CO_2)
Full water jet

*** 5.2 Special hazards arising from the substance or mixture**

*** Hazardous combustion products**
In case of fire may be liberated:
Carbon dioxide (CO_2)

*** 5.3 Advice for firefighters**

*** Special protective equipment for firefighters**
Wear a self-contained breathing apparatus and chemical protective clothing.

*** Additional information**
If possible, shut off gas valves and move containers to a safe location.
Use water spray jet to protect personnel and to cool endangered containers.
Exposure to fire may cause rupture / explosion of the containers.
Do not extinguish a leaking gas flame unless absolutely necessary. Spontaneous/explosive re-ignition may occur. Extinguish any other fire.
Dispose of fire residues and contaminated extinguishing water in accordance with local, official regulations.

* SECTION 6: Accidental release measures

*** 6.1 Personal precautions, protective equipment and emergency procedures**

*** For non-emergency personnel**
Use personal protection equipment.
Leave the danger area.
Keep people away and stay on the upwind side.

*** For emergency responders**
Personal protection by wearing close-fitting protective clothing and breathing apparatus.
Eliminate all ignition sources if safe to do so.
Remove persons to safety.

*** 6.2 Environmental precautions**

If possible, stop flow of product.
Do not allow to enter into soil/subsoil.
Do not allow to enter into surface water or drains.

*** 6.3 Methods and material for containment and cleaning up**

*** For containment**
If necessary, secure leaky pressure receptacles using a salvage container.
Prevent the liquid from spreading over a wide area (set up barriers, cover sewage systems).
Limit expansion of the gas (water spray jet).

*** For cleaning up**
Leave to vapourize.
Provide adequate ventilation.

*** 6.4 Reference to other sections**

Disposal: see section 13
Personal protection equipment: see section 8

* SECTION 7: Handling and storage

* 7.1 Precautions for safe handling

* **Protective measures**

Use only in well-ventilated areas.
Transfer and handle product only in closed systems.
Usual measures for fire prevention.
Containers' temperature should not be increased above 50 °C.
The working pressure in the receptacle must not exceed the saturation vapour pressure of the pure product resulting at a temperature of 50 °C.
Prevent cylinders from falling over.
Take precautionary measures against static discharges. Ground barrels and installations. Use only antistatically equipped (spark-free) tools.
Use explosion-proof machinery, apparatus, ventilation facilities, tools etc.
Ensure valve protection device is correctly fitted.
Ensure valve outlet cap nut or plug (where provided) is correctly fitted.
Open valve slowly to avoid pressure shock.
Do not allow backflow into the container.
Entering of water into the container must be prevented.
No water to valves, flanges and other fittings.
Purging of pipes and valves with inert gases - to avoid: water, solvents.

* **Advices on general occupational hygiene**

When using do not eat, drink, smoke, sniff.
Wash hands before breaks and after work.
Remove contaminated clothing and protective equipment before entering eating areas.

* 7.2 Conditions for safe storage, including any incompatibilities

* **Requirements for storage rooms and vessels**

All regulations and local requirements for the storage of containers have to be respected.
Keep container tightly closed and in a well-ventilated place.
Containers' temperature should not be increased above 50 °C.
Prevent cylinders from falling over.
Only use containers specifically approved for the substance/product.
Information on suitable materials for receptacles and valves see ISO 11114.

Storage class

2A Gases (except aerosol dispensers and lighters)

* **Materials to avoid**

Do not store together with explosives.
Do not store together with flammable liquids.
Do not store together with flammable solids.
Do not store together with pyrophoric and self-heating substances.
Do not store together with oxidizing liquids or oxidizing solids.
Do not store together with toxic liquids or toxic solids.
Do not store together with infectious substances.
Do not store together with radioactive material.
Do not store together with food or feed.

7.3 Specific end use(s)

Recommendation

Exposure scenarios (ES) see annex to this safety data sheet.

* SECTION 8: Exposure controls/personal protection

* 8.1 Control parameters

* **Occupational exposure limit values**

CAS No.	EC No.	Substance name	occupational exposure limit value
630-08-0	211-128-3	Carbon monoxide	20 [ml/m³(ppm)] 23 [mg/m³] Short-term(ml/m³) 100 (1) Short-term(mg/m³) 117 (1) (1) 15 minutes average value (IE)

* **DNEL worker**

CAS No.	Substance name	DNEL value	DNEL type	Remark
630-08-0	carbon monoxide	23 mg/m³	long-term inhalative (local)	
630-08-0	carbon monoxide	23 mg/m³	long-term inhalative (systemic)	
630-08-0	carbon monoxide	117 mg/m³	acute inhalative (systemic)	
630-08-0	carbon monoxide	117 mg/m³	acute inhalative (local)	

* **8.2 Exposure controls**

Appropriate engineering controls

Technical measures to prevent exposure
Transfer and handle only in enclosed systems.

* **Personal protection equipment**

Eye/face protection
Protective goggles according to EN 166, in case of increased risk add protective face shield.

* **Hand protection**
Safety gloves according to EN 388:
Chromate-free leather

* **Body protection:**
Safety shoes with steel toecap.
Body covering work clothing or chemical resistant suit at increased risk.

* **Respiratory protection**
Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe.
Respiratory protection complying with EN 137.
Do not use any filter apparatus.

* **Thermal hazards**
Use cold-resistant protective equipment.

* **Environmental exposure controls**

* **Remark**
Prevent release to the environment.

* SECTION 9: Physical and chemical properties

* **9.1 Information on basic physical and chemical properties**

Physical state
compressed gas

Colour
colourless

Odour
odourless

Safety relevant basis data

	Value	Method	Source, Remark
Odour threshold:			not determined
Melting point/freezing point			not applicable
Boiling point or initial boiling point and boiling range	-191.5 °C pressure 1013 hPa		
flammability			inflammable
Lower and upper explosion limit	Upper explosion limit 75.6 Vol-%		

	Value	Method	Source, Remark
Lower and upper explosion limit	Lower explosion limit 11.3 Vol-%		
Flash point			not applicable
Auto-ignition temperature	605 °C		
Decomposition temperature			No decomposition if used as directed.
pH			not applicable
Viscosity			not applicable
Solubility(ies)	Water solubility 24.9 mg/L (20°C)		
Partition coefficient n-octanol/water (log value)	1.78		
Vapour pressure			not determined
Density and/or relative density			not applicable
Relative vapour density	0.97		
particle characteristics			not applicable

* **9.2 Other information**

* **Information with regard to physical hazard classes**

* **Gases under pressure**

Safety characteristics

	Value	Method, Result	Source, Remark
Critical temperature	-140.2 °C		

* **Other information**
Vapours are less heavy than air.

* SECTION 10: Stability and reactivity

* 10.1 Reactivity

May form an explosive mixture with air.

* 10.2 Chemical stability

The substance is chemically stable under recommended conditions of storage, use and temperature.

* 10.3 Possibility of hazardous reactions

Must not be mixed with air or oxygen.
Danger of fire and explosion with oxidants, alkali metals and earth alkali metals.

* 10.4 Conditions to avoid

Heat sources / heat - risk of bursting.
Ignition sources, open flames, glowing metal surfaces, etc.

* 10.5 Incompatible materials

Aluminium
Amines
Ammonia
Chlorine
Fluorine

10.6 Hazardous decomposition products

When handled and stored appropriately, no dangerous decomposition products are known.

* SECTION 11: Toxicological information

11.1 Information on hazard classes as defined in Regulation (EC) No 1272/2008

*** Acute toxicity**

*** Animal data**

	Effective dose	Method,Evaluation	Source, Remark
Acute oral toxicity			Study technically not feasible.
Acute dermal toxicity			Study technically not feasible.
Acute inhalation toxicity	CAS No.630-08-0 carbon monoxide LC50: 1300 ppm Species Rat Exposure time 4 h	OECD 403	

*** Assessment/classification**
Toxic if inhaled.

*** Skin corrosion/irritation**

*** Other information**
Study technically not feasible.

*** Serious eye damage/irritation**

*** Other information**
Study technically not feasible.

*** Sensitisation to the respiratory tract**

*** Other information**
No data available

*** Skin sensitisation**

*** Other information**
Study technically not feasible.

*** Germ cell mutagenicity**

*** Other information**
No data available

*** Carcinogenicity**

Animal data

	Value	Method	Result / Evaluation	Remark
Carcinogenicity	inhalative LOAEL (C): 200 ppm Species Rat Exposure duration 504 d	OECD 451	Longterm experiments do not indicate carcinogenic effects.	

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

*** Reproductive toxicity**

Animal data

	Value	Method	Result / Evaluation	Remark
Reproductive toxicity				Study scientifically not necessary.

*** Assessment/classification**
May cause harm to the unborn child.

* **STOT-single exposure**

* **STOT SE 1 and 2**

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

* **STOT-repeated exposure**

Animal data

	Effective dose	Method	Specific effects:	Organs affected:	Source, Remark
Inhalative specific target organ toxicity (repeated exposure)	LOAEL(C): 200 ppm Species Rat (female) Exposure duration 504 d				

* **Assessment/classification**
Causes damage to heart through prolonged or repeated exposure if inhaled.

* **Aspiration hazard**

* **Assessment/classification**
Study technically not feasible.

11.2 Information on other hazards

No data available

* SECTION 12: Ecological information

12.1 Toxicity

Aquatic toxicity

	Effective dose	Method,Evaluation	Source, Remark
Acute (short-term) fish toxicity	LC50: 672.6 mg/L Test duration 96 h	QSAR	
Chronic (long-term) fish toxicity	not determined		
Acute (short-term) toxicity to crustacea	LC50 307.5 mg/L Test duration 48 h	QSAR	
Chronic (long-term) toxicity to aquatic invertebrate	not determined		
Acute (short-term) toxicity to algae and cyanobacteria	EC50 124.4 mg/L Test duration 96 h	QSAR	
Chronic (long-term) toxicity to aquatic algae and cyanobacteria	not determined		
Toxicity to other aquatic plants/organisms	not determined		
Toxicity to microorganisms	not determined		

* **12.2 Persistence and degradability**

	Value	Method	Source, Remark
Biodegradation			The methods for determining the biological degradability are not applicable to inorganic substances.

* **12.3 Bioaccumulative potential**

* **Assessment/classification**
Based on the n-octanol/water partition coefficient accumulation in organisms is not expected.

12.4 Mobility in soil

Assessment/classification
High mobility
Adsorption in soil is not likely.

* 12.5 Results of PBT and vPvB assessment

The substance/mixture does not contain components meeting the PBT/vPvB criteria of the Reach Regulation, Annex XIII, at levels of 0.1% or higher.

* 12.6 Endocrine disrupting properties

	Effective dose	Method,Evaluation	Source, Remark
Endocrine disrupting properties			See section 2.3

12.7 Other adverse effects

No data available

* SECTION 13: Disposal considerations

* 13.1 Waste treatment methods

Waste codes/waste designations according to EWC/AVV

Waste code product	Waste name
160504 *	gases in pressure containers (including halons) containing hazardous substances

* **Appropriate disposal / Product**
Waste disposal according to directive 2008/98/EC, covering waste and dangerous waste.
Prevent release to the environment. No disposal via the sewage.

Appropriate disposal / Package
Transportable pressure equipment (empty, residual pressure): Return to supplier / manufacturer.

* SECTION 14: Transport information

	Land transport (ADR/RID)	Sea transport (IMDG)	Air transport (ICAO-TI / IATA-DGR)
14.1 UN number or ID number	UN 1016	UN 1016	UN 1016
14.2 UN proper shipping name	CARBON MONOXIDE, COMPRESSED	CARBON MONOXIDE, COMPRESSED	Carbon monoxide, compressed
14.3 Transport hazard class(es)	2.3 (2.1)	2.3 (2.1)	2.3 (2.1)
14.4 Packing group	-	-	-
14.5 Environmental hazards	No	No	No

14.6 Special precautions for user

The protective measures listed in Sections 6, 7 and 8 of the Safety Data Sheet have to be considered.

14.7 Maritime transport in bulk according to IMO instruments

No carriage in bulk.

Land transport (ADR/RID)

UN number or ID number	UN 1016
UN proper shipping name	CARBON MONOXIDE, COMPRESSED
Transport hazard class(es)	2.3 (2.1)
Hazard label(s)	2.3+2.1
Classification code	1TF
Packing group	-
Environmental hazards	No

Limited quantity (LQ)	0
Special provisions	-
Tunnel restriction code	B/D

*** Sea transport (IMDG)**

UN number or ID number	UN 1016
UN proper shipping name	CARBON MONOXIDE, COMPRESSED
Transport hazard class(es)	2.3 (2.1)
Packing group	-
Environmental hazards	No
Limited quantity (LQ)	0
Marine pollutant	No
EmS	F-D, S-U

*** Air transport (ICAO-TI / IATA-DGR)**

UN number or ID number	UN 1016
UN proper shipping name	Carbon monoxide, compressed
Transport hazard class(es)	2.3 (2.1)
Packing group	-
Environmental hazards	No

* SECTION 15: Regulatory information

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

*** EU legislation**

*** Restrictions of occupation**
Observe employment restrictions under the Maternity Protection Directive (92/85/EEC) for expectant or nursing mothers.
Observe restrictions to employment for juvenils according to the 'juvenile work protection guideline' (94/33/EC).

*** Other regulations (EU)**

*** To follow:**
Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), Annex XVII No 28 - 30.
Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), Annex XVII No 40.
Directive 2012/18/EU on the control of major-accident hazards involving dangerous substances.
National and local regulations concerning chemicals shall be observed.

* 15.2 Chemical Safety Assessment

*** National regulations**

For this substance a chemical safety assessment has been carried out.

* SECTION 16: Other information

Key literature references and sources for data
Information from our suppliers and data from the "GESTIS Substances Database" and the "Registered Substances" database of the European Chemicals Agency (ECHA) were used to create this safety data sheet.

*** Additional information**
The information contained herein is based on the state of our knowledge. It characterizes the product with regard to the appropriate safety precautions. It does not represent a guarantee of the properties of the product.

Relevant H- and EUH-phrases (Number and full text)

H220	Extremely 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.

Indication of changes
* Data changed compared with the previous version

Industrial uses, closed contained conditions

1.1. Title section

Industrial uses, closed contained conditions	

Processes, tasks, activities covered	Industrial uses, including product transfers and associated laboratory activities within different closed or contained systems

Environment	Use descriptors
CS1	ERC2, ERC6a, ERC6b, ERC8d

Worker	Use descriptors
CS2	PROC1
CS3	PROC2
CS4	PROC3, PROC4
CS5	PROC8b
CS6	PROC9

Assessment method	ECETOC TRA 2.0

1.2. Conditions of use affecting exposure

1.2.1. Control of environmental exposure: ERC2, ERC6a, ERC6b, ERC8d

ERC2	Formulation into mixture
ERC6a	Use of intermediate
ERC6b	Use of reactive processing aid at industrial site (no inclusion into or onto article)
ERC8d	Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor)

Product (article) characteristics	
Physical form of product	See section 9 of the SDS, No additional information
Concentration of substance in product	≤ 100 %

Amount used, frequency and duration of use (or from service life)	
The actual tonnage handled per site is not considered to influence the immissions as such for this scenario as there is practically no release	
Covers frequency up to:	5 days/week

Emission Days (days/year)	220

Technical and organisational conditions and measures	
Wastewater emission controls are not applicable as there is no direct release to wastewater	
Soil emission controls are not applicable as there is no direct release to soil	
Ensure operatives are trained to minimise releases	

Conditions and measures related to sewage treatment plant	
Not applicable as there is no release to wastewater	

Conditions and measures related to treatment of waste (including article waste)	
External treatment and disposal of waste should comply with applicable local and/or national regulations	
See section 13 of the SDS	

Other conditions affecting environmental exposure	
No additional information	

1.2.2. Control of worker exposure: PROC1

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

Product (article) characteristics	
Physical form of product	See section 9 of the SDS, No additional information
Concentration of substance in product	≤ 100 %

Amount used (or contained in articles), frequency and duration of use/exposure	
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 and level of containment/automation (as reflected in the technical conditions) is the main determinant of the process-intrinsic emission potential.	
Exposure duration	≤ 8 h/day
Covers frequency up to:	5 days/week

Technical and organisational conditions and measures	
Handle product within a closed system	
Apply a good standard of general or controlled ventilation when maintenance activities are carried out.	

See sections 2 and 7 of the SDS.	
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	

Conditions and measures related to personal protection, hygiene and health evaluation	
Self contained breathing apparatus is recommended, where unknown exposure may be expected, e.g. during maintenance activities on installation systems.	
See section 8 of the SDS.	

Other conditions affecting workers exposure	
Indoor or outdoor use	

1.2.3. Control of worker exposure: PROC2

PROC2	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Product (article) characteristics	
Physical form of product	See section 9 of the SDS, No additional information
Concentration of substance in product	≤ 100 %

Amount used (or contained in articles), frequency and duration of use/exposure	
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 and level of containment/automation (as reflected in the technical conditions) is the main determinant of the process-intrinsic emission potential.	
Exposure duration	≤ 8 h/day
Covers frequency up to:	5 days/week

Technical and organisational conditions and measures	
Handle product within a closed system	
During indoor processes or in cases where natural ventilation is not sufficient, LEV should be in place at points were emissions could occur. Outdoor, LEV is not generally required.	
Ensure samples are obtained under containment or extract ventilation.	
Drain down and flush system prior to equipment break-in or maintenance.	
Apply a good standard of general or controlled ventilation when maintenance activities are carried out.	
See sections 2 and 7 of the SDS.	
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	

Conditions and measures related to personal protection, hygiene and health evaluation	
Self contained breathing apparatus is recommended, where unknown exposure may be expected, e.g. during maintenance activities on installation systems.	
See section 8 of the SDS.	

Other conditions affecting workers exposure	
Indoor or outdoor use	

1.2.4. Control of worker exposure: PROC3, PROC4

PROC3	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
PROC4	Chemical production where opportunity for exposure arises

Product (article) characteristics	
Physical form of product	See section 9 of the SDS, No additional information
Concentration of substance in product	≤ 100 %

Amount used (or contained in articles), frequency and duration of use/exposure	
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 and level of containment/automation (as reflected in the technical conditions) is the main determinant of the process-intrinsic emission potential.	
Exposure duration	≤ 8 h/day
Covers frequency up to:	5 days/week

Technical and organisational conditions and measures	
Handle product within a closed system	
During indoor processes or in cases where natural ventilation is not sufficient, LEV should be in place at points were emissions could occur. Outdoor, LEV is not generally required.	
Ensure samples are obtained under containment or extract ventilation.	
Drain down and flush system prior to equipment break-in or maintenance.	
Apply a good standard of general or controlled ventilation when maintenance activities are carried out.	
See sections 2 and 7 of the SDS.	
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	

Conditions and measures related to personal protection, hygiene and health evaluation	
Self contained breathing apparatus is recommended, where unknown exposure may be expected, e.g. during maintenance activities on installation systems.	
See section 8 of the SDS.	

Other conditions affecting workers exposure	
Indoor or outdoor use	

1.2.5. Control of worker exposure: PROC8b

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

Product (article) characteristics	
Physical form of product	See section 9 of the SDS, No additional information
Concentration of substance in product	≤ 100 %

Amount used (or contained in articles), frequency and duration of use/exposure	
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 and level of containment/automation (as reflected in the technical conditions) is the main determinant of the process-intrinsic emission potential.	
Exposure duration	≤ 8 h/day
Covers frequency up to:	5 days/week

Technical and organisational conditions and measures	
Handle product within a closed system	
During indoor processes or in cases where natural ventilation is not sufficient, LEV should be in place at points were emissions could occur. Outdoor, LEV is not generally required.	
Fill containers at dedicated fill points supplied with local extract ventilation.	
Ensure samples are obtained under containment or extract ventilation.	
Drain down and flush system prior to equipment break-in or maintenance.	
Apply a good standard of general or controlled ventilation when maintenance activities are carried out.	
See sections 2 and 7 of the SDS.	
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	

Conditions and measures related to personal protection, hygiene and health evaluation	
Self contained breathing apparatus is recommended, where unknown exposure may be expected, e.g. during maintenance activities on installation systems.	

Other conditions affecting workers exposure	
Indoor or outdoor use	

1.2.6. Control of worker exposure: PROC9

PROC9	Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

Product (article) characteristics	
Physical form of product	See section 9 of the SDS, No additional information
Concentration of substance in product	≤ 100 %

Amount used (or contained in articles), frequency and duration of use/exposure	
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 and level of containment/automation (as reflected in the technical conditions) is the main determinant of the process-intrinsic emission potential.	
Exposure duration	≤ 8 h/day
Covers frequency up to:	5 days/week

Technical and organisational conditions and measures	
Handle product within a closed system	
During indoor processes or in cases where natural ventilation is not sufficient, LEV should be in place at points were emissions could occur. Outdoor, LEV is not generally required.	
Fill containers at dedicated fill points supplied with local extract ventilation.	
Ensure samples are obtained under containment or extract ventilation.	
Drain down and flush system prior to equipment break-in or maintenance.	
Apply a good standard of general or controlled ventilation when maintenance activities are carried out.	
See sections 2 and 7 of the SDS.	
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	

Conditions and measures related to personal protection, hygiene and health evaluation	
Self contained breathing apparatus is recommended, where unknown exposure may be expected, e.g. during maintenance activities on installation systems.	

Other conditions affecting workers exposure	
Indoor or outdoor use	

1.3. Exposure estimation and reference to its source

1.3.1. Environmental release and exposure: ERC2, ERC6a, ERC6b, ERC8d

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

1.3.2. Worker exposure: PROC1

Route of exposure and type of effects	Exposure estimate	Assessment conditions	RCR
Inhalation - Long-term - systemic effects	0.011 mg/m³	Indoor use , Without LEV	< 0.001
Inhalation - Acute - systemic effects	0.023 mg/m³	Indoor use , Without LEV	≤ 0.001

1.3.3. Worker exposure: PROC2

Route of exposure and type of effects	Exposure estimate	Assessment conditions	RCR
Inhalation - Long-term - systemic effects	5.84 mg/m³	Indoor use , With LEV	0.254
Inhalation - Acute - systemic effects	11.7 mg/m³	Indoor use , With LEV	0.1

1.3.4. Worker exposure: PROC3, PROC4

Route of exposure and type of effects	Exposure estimate	Assessment conditions	RCR
Inhalation - Long-term - systemic effects	11.7 mg/m³	Indoor use , With LEV	0.509
Inhalation - Acute - systemic effects	23.4 mg/m³	Indoor use , With LEV	0.2

1.3.5. Worker exposure: PROC8b

Route of exposure and type of effects	Exposure estimate	Assessment conditions	RCR
Inhalation - Long-term - systemic effects	17.5 mg/m³	Indoor use , With LEV	0.761
Inhalation - Acute - systemic effects	35 mg/m³	Indoor use , With LEV	0.299

1.3.6. Worker exposure: PROC9

Route of exposure and type of effects	Exposure estimate	Assessment conditions	RCR
Inhalation - Long-term - systemic effects	0.025 mg/m³	Measured value	0.001
Inhalation - Acute - systemic effects	46.6 mg/m³	Indoor use , With LEV	0.398

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

1.4.1. Environment

Guidance - Environment	Check that RMMs and OCs are as described above or of equivalent efficiency

1.4.2. Health

Guidance - Health	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

End of document