SAFETY DATA SHEET
according to Regulation (EC) No. 1907/2006, as amended by Commission Regulation (EU) 2020/878

BUTADIENE

Version	Revision Date:	SDS Number:	Date of last issue: -
1.0	09/02/2026	BEN227	Date of first issue: 09/02/2026

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

1.1 Product identifier

Trade name	:	BUTADIENE
Synonyms	:	buta-1,3-diene (Stabilized), buta-1,3-diene, Refined Butadiene, BD, Bivinyl, Erythrene, Diolefin hydrocarbon
Substance name	:	1,3-butadiene
Substance No.	:	203-450-8

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

Identified uses	:	Manufacture of substances; Distribution of substance; Use as intermediate; Formulation of preparations; Use as a fuel; Manufacture of rubber products; Polymer production; Polymer processing; Use in laboratories
Prohibited uses	:	Cosmetics; Personal care products

1.3 Details of the supplier of the safety data sheet

Company	Registration number	Telephone
Velogy Polyoléfines France SAS Chemin départemental 54 B.P. 14 13131 Berre l'Etang Cedex France	01-2119471988-16-0008	+33 (0) 4 42 74 42 74
Raffinerie de Berre		
MUO Polyolefine GmbH Berghauser Weg 50 85126 Münchsmünster Germany	01-2119471988-16	+49 (0)8402 76329

E-mail address Responsible/issuing person : RegulatoryComplianceROP@velogy.com

1.4 Emergency telephone number

Velogy Polyoléfines France SAS	+33 (0) 4 42 74 42 74
MUO Polyolefine GmbH	+49 (0) 8402 76112

Poison Center:
ORFILA (INRS)
FR: + 33 (0)1 45 42 59 59
24 hours all days

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification (REGULATION (EC) No 1272/2008)

Flammable gases, Category 1A	H220: Extremely flammable gas.
Gases under pressure, Liquefied gas	H280: Contains gas under pressure; may explode if heated.
Germ cell mutagenicity, Category 1B	H340: May cause genetic defects.
Carcinogenicity, Category 1A	H350: May cause cancer.

2.2 Label elements

Labelling (REGULATION (EC) No 1272/2008)

Hazard pictograms :



Signal word : Danger

Hazard statements :

H220	Extremely flammable gas.
H280	Contains gas under pressure; may explode if heated.
H340	May cause genetic defects.
H350	May cause cancer.

Precautionary statements :

Prevention:

P201	Obtain special instructions before use.
P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection/ hearing protection.

Response:

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:

P410 + P403	Protect from sunlight. Store in a well-ventilated place.

2.3 Other hazards

This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

Ecological information: 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.

Toxicological information: 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.

SECTION 3: Composition/information on ingredients

3.1 Substances

Substance name : 1,3-butadiene

EC-No. : 203-450-8

Components

Chemical name	CAS-No. EC-No.	Concentration (% w/w)	M-Factor, SCL, ATE
Substances with a workplace exposure limit :			
1,3-butadiene	106-99-0 203-450-8	>= 90 - <= 100	

SECTION 4: First aid measures

4.1 Description of first aid measures

General advice : This product is of low acute toxicity.
May cause cancer by inhalation.
Product is genotoxic.
Contact with liquid may cause frostbite.
Always observe self-protection methods
Move out of dangerous area.
Remove contaminated clothes except in the case of frostbite.
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
Show this material safety data sheet to the doctor in attendance.

If inhaled : Remove victim to fresh air and keep at rest in a position comfortable for breathing.
Do not leave the victim unattended.
Keep patient warm and at rest.
Immediately seek medical attention.
If breathing is difficult, give oxygen.
If unconscious, place in recovery position and seek medical advice.
In the event of unconsciousness, apnea or cardiac arrest (no pulse), apply cardiopulmonary resuscitation.

In case of skin contact	:	Dermal contact with rapidly evaporating liquid could result in freezing of the tissues or frostbite. If frostbite has occurred, seek medical attention immediately; do not rub the affected area or flush with water. To prevent further damage, do not attempt to remove frozen clothing from affected area.
In case of eye contact	:	If eye tissue is frozen, seek medical attention immediately. If tissue is not frozen, thoroughly flush the eyes with large amounts of clean low-pressure water for at least 15 minutes, occasionally lifting the upper and lower eyelids. If irritation persists seek medical attention.
If swallowed	:	Ingestion is not a route of exposure for gases.

4.2 Most important symptoms and effects, both acute and delayed

Symptoms	:	Inhalation of very high concentrations may cause asphyxia, anesthesia, CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe overexposure), and possible cardiac sensitization.
Risks	:	Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to this material. Skin or eye contact with rapidly evaporating liquid could result in freezing of the tissues or frostbite. May cause genetic defects. May cause cancer.

4.3 Indication of any immediate medical attention and special treatment needed

Treatment	:	Treat symptomatically. Treat frost-bitten areas as needed. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient.

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media	:	SMALL FIRE: Use dry chemical, CO2, water spray or regular foam. LARGE FIRE: Use water spray, water fog or regular foam. Do not use straight streams.
Unsuitable extinguishing media	:	Do not extinguish a leaking gas fire unless leak can be stopped.

5.2 Special hazards arising from the substance or mixture

Specific hazards during fire-fighting	:	May polymerize explosively when involved in a fire. Vapors may travel long distances along the ground before

reaching a source of ignition and flashing back.
Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
Cool containers with flooding quantities of water until well after fire is out.
Do not direct water at source of leak or safety devices; icing may occur.
Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
Always stay away from tanks engulfed in fire.
For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.
Move containers from fire area if it can be done without risk.
Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.
Thermal decomposition may produce oxides of carbon and other toxic gases and liberate heat and pressure.
Reacts with air to form peroxides.

5.3 Advice for firefighters

Special protective equipment for firefighters : Wear an approved positive pressure self-contained breathing apparatus and firefighter turnout gear.

Further information : Use water spray to cool unopened containers.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Personal precautions : Use personal protective equipment.
Eliminate all sources of ignition.
Beware of vapors accumulating to form explosive concentrations. Vapors can accumulate in low areas.
Spillages of liquid product will create a fire hazard and form an explosive atmosphere
Avoid direct contact with released material. Stay upwind.
Keep non-involved personnel away from the area of spillage.
See section 8 for additional PPE information.
See section 13 for disposal information.

6.2 Environmental precautions

Environmental precautions : An authoritative evaluation of environmental exposure and risk indicates that no special risk management practices are needed to control environmental release.

6.3 Methods and material for containment and cleaning up

Methods for cleaning up : Contain spillage, and then collect with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see section 13).

Eliminate all sources of ignition.
Let evaporate.
All equipment used when handling this product must be grounded.
Stop leak if you can do it without risk.
Isolate area until gas has dispersed.
Water spray may reduce vapor; but may not prevent ignition in closed spaces.
Prevent entry into waterways, sewers, basements or confined areas.
Caution: When in contact with refrigerated/cryogenic liquids, many materials become brittle and are likely to break without warning.

6.4 Reference to other sections

For personal protection see section 8., For disposal considerations see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling	:	Do not handle near heat, sparks, or open flame. Do not enter storage areas unless adequately ventilated. Metal containers involved in the transfer of this material should be grounded and bonded. Bonding and grounding measures may not be enough if non-conductive flammables are involved. Check atmosphere for explosiveness and oxygen deficiencies. Wear recommended personal protective equipment. Handle empty containers with care; vapor residue may be flammable/explosive. Isolate, vent, drain, wash and purge systems or equipment before maintenance or repair. All equipment must conform to applicable electrical code. Use only non-sparking tools. Do not pressurize, cut, weld, braze solder, drill, or grind on containers. While moving cylinder, always keep in place removable valve cover. Securely chain cylinders when in use and protect against physical damage. Do not pressurize or expose empty containers to open flame, sparks, or heat. Do not enter areas where used or stored until adequately ventilated. Ice formation in freezing conditions during transport and/or unloading may restrict the operation of the RTC bottom valve and shall be considered in operating procedures / risk analysis at unloading site by the customer.
Advice on protection against fire and explosion	:	Take precautionary measures against static discharge.
Hygiene measures	:	Selection of appropriate personal protective equipment should

be based on an evaluation of the performance characteristics of the protective equipment relative to the task(s) to be performed, conditions present, duration of use, and the hazards and/or potential hazards that may be encountered during use. Consult the appropriate European norm (EN) standard before deciding on the type of personal protective equipment that is appropriate for a particular set of circumstances.
Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Use good personal hygiene practices. Wash hands before eating, drinking, smoking, or using toilet facilities. Take off contaminated clothing and wash before reuse.

Fire-fighting class : Extremely flammable gas.

7.2 Conditions for safe storage, including any incompatibilities

Requirements for storage areas and containers : Keep storage containers clean, dry and free of oxygen. Store in accordance with the particular national regulations. Oxygen intrusion into the vessel headspace may support the formation of peroxides and promote popcorn polymer growth. Popcorn polymer may plug safety-venting devices, plug lines and foul equipment. Polymer formation may build sufficient mechanical force to rupture equipment. Store in tightly closed containers segregated from oxidizers and other combustible material. Provide electrical equipment with spark resistant construction.

7.3 Specific end use(s)

Specific use(s) : (Refer to exposure scenario section for specific information).

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Occupational Exposure Limits

Components	CAS-No.	Value type (Form of exposure)	Control parameters	Basis
1,3-butadiene	106-99-0	TWA	1 ppm 2.2 mg/m3	2004/37/EC
	Further information: Carcinogens or mutagens			
		VME	1 ppm 2.2 mg/m3	FR VLE
	Further information: Carcinogenic category 1A - Carcinogenic to humans, Mutagenic category 1B - Probably mutagenic to humans, Regulatory binding exposure limits			

8.2 Exposure controls

Appropriate engineering controls

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits.

Individual protection measures, such as personal protective equipment (PPE)

Eye/face protection	:	Safety glasses are the minimum requirements. Use chemical type goggles and face shield when handling liquefied gases. The selected goggles or glasses must satisfy the European norm standard EN 166.
Hand protection		
Remarks	:	Wear insulated gloves if contact with liquid is possible. The selected gloves must satisfy the European norm standard EN 511 for protection against the cold.
Skin and body protection	:	Clothing such as insulated impervious gloves to protect against exposure to cold liquid or gas should be worn. Choose body protection according to the amount and concentration of the dangerous substance at the work place. Use PPE that is chemical resistant to the product and prevents skin contact. Fire retardant clothing is appropriate for routine occupational use. The selected clothing must satisfy the European norm standard EN 533.
Respiratory protection	:	When workers are facing concentrations above the exposure limit they must use appropriate certified respirators. Use only approved supplied air or self-contained breathing apparatus operated in positive pressure mode. If needed, wear a supplied air respirator conforming to a European norm standard such as EN 139 or equivalent. Wear a respirator conforming to EN 371 with Type AX filter designed for low boiling compounds.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Physical state	:	gaseous (20 °C, 1,013 hPa)
Form	:	compressed liquefied gas
Colour	:	colorless
Odour	:	hydrocarbon-like
Odour Threshold	:	Not applicable
Melting point/range	:	-108.9 °C
Freezing point		no data available
Boiling point/boiling range	:	-4.41 °C
Upper explosion limit / Upper	:	12 vol%

flammability limit

Lower explosion limit / Lower flammability limit	:	2 vol%
Flash point	:	Not applicable (gas).
Decomposition temperature	:	Carbon dioxide, carbon monoxide, smoke, fumes and un-burned hydrocarbons.
pH	:	Not applicable.
Solubility(ies)		
Water solubility	:	0.735 g/l (20 °C)
Partition coefficient: n-octanol/water	:	log Pow: 1.99
Vapour pressure	:	2,170 hPa (16.85 °C)
		2,550 hPa (21.85 °C)
Density	:	Not applicable (gas).

9.2 Other information

Explosives	:	Not applicable.
		(No chemical groups associated with explosive properties.)
Oxidizing properties	:	The substance or mixture is not classified as oxidizing.
Self-ignition	:	420 °C
Molecular weight	:	54.09 g/mol

SECTION 10: Stability and reactivity

10.1 Reactivity

The product is normally supplied in a stabilized form. If the permissible storage period and/or storage temperature is noticeably exceeded, the product may polymerize with heat evolution. 1,3-butadiene may react with oxygen to form unstable butadiene peroxides. Butadiene peroxides are thermally unstable, shock sensitive and may lead to the formation of popcorn polymer.

10.2 Chemical stability

This product is stable with an appropriate level of TBC inhibitor (minimum 10 ppm), but reactive (unstable) without.

10.3 Possibility of hazardous reactions

Hazardous reactions : Polymerization may take place at elevated temperatures or in the presence of oxidizers. The formation of popcorn polymer can build sufficient mechanical force to rupture process equipment. Polymer may also plug safety venting devices. Not Available.

10.4 Conditions to avoid

Conditions to avoid : All sources of ignition, high temperature and oxygen intrusion into storage and transportation vessels. Elevated temperature or catalysis can cause violent rupture of containers.

10.5 Incompatible materials

Materials to avoid : Phenol, ethanol, chlorine dioxide, crotonaldehyde, nitric acid, oxygen and other strong oxidizers, and acetylide forming materials such as copper, magnesium, mercury, silver and monel. Contact may form violently explosive peroxides.

10.6 Hazardous decomposition products

Explosive peroxides.
4-Vinylcyclohexene-1

SECTION 11: Toxicological information

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

Acute toxicity

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

Components:

1,3-butadiene:

Acute oral toxicity : Assessment: The substance or mixture has no acute oral toxicity

Acute inhalation toxicity : LC50 (Rat): 285 mg/l
Exposure time: 4 HOURS
Test atmosphere: gas

Acute dermal toxicity : Assessment: The substance or mixture has no acute dermal toxicity

Skin corrosion/irritation

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

Components:

1,3-butadiene:

Assessment : No skin irritation

Serious eye damage/eye irritation

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

Components:

1,3-butadiene:

Assessment : No eye irritation

Respiratory or skin sensitisation

Skin sensitisation

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

Respiratory sensitisation

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

Components:

1,3-butadiene:

Assessment : Did not cause sensitization on laboratory animals.

Germ cell mutagenicity

May cause genetic defects.

Components:

1,3-butadiene:

Germ cell mutagenicity- Assessment : Presumed to induce heritable mutations in the germ cells of humans.

Carcinogenicity

May cause cancer.

Components:

1,3-butadiene:

Carcinogenicity - Assessment : Positive evidence from human epidemiological studies

Reproductive toxicity

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

Components:

1,3-butadiene:

Reproductive toxicity - Assessment : Based on available data, the classification criteria are not met.

STOT - single exposure

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

Components:

1,3-butadiene:

Assessment : The substance or mixture is not classified as specific target organ toxicant, single exposure.

STOT - repeated exposure

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

Components:

1,3-butadiene:

Assessment : The substance or mixture is not classified as specific target organ toxicant, repeated exposure.

Aspiration hazard

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

Components:

1,3-butadiene:

Not applicable

11.2 Information on other hazards

Endocrine disrupting properties

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

Product:

Assessment : 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.

SECTION 12: Ecological information

12.1 Toxicity

Components:

1,3-butadiene:

Toxicity to fish : LC50 (Pimephales promelas (fathead minnow)): 43 mg/l
Exposure time: 96 HOURS
Remarks: The value is given based on a SAR/AAR approach using OECD Toolbox, DEREK, VEGA QSAR models (CAESAR models), etc.

Toxicity to daphnia and other aquatic invertebrates : LC50 (Daphnia magna (Water flea)): 24 mg/l
Exposure time: 48 HOURS
Remarks: The value is given based on a SAR/AAR approach using OECD Toolbox, DEREK, VEGA QSAR models (CAESAR models), etc.

Toxicity to algae/aquatic plants : EC50 (green algae): 11 mg/l
Exposure time: 96 HOURS
Remarks: The value is given based on a SAR/AAR approach

using OECD Toolbox, DEREK, VEGA QSAR models (CAESAR models), etc.

Toxicity to fish (Chronic toxicity) : NOELR: 4.4 mg/l
Exposure time: 21 d
Species: Oncorhynchus mykiss (rainbow trout)
Remarks: The value is given based on a SAR/AAR approach using OECD Toolbox, DEREK, VEGA QSAR models (CAESAR models), etc.

Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity) : EC50: 2.2 mg/l
Exposure time: 16 d
Species: Daphnia (water flea)
Remarks: The value is given based on a SAR/AAR approach using OECD Toolbox, DEREK, VEGA QSAR models (CAESAR models), etc.

Ecotoxicology Assessment

Acute aquatic toxicity : Harmful to aquatic life.

Chronic aquatic toxicity : Not classified

12.2 Persistence and degradability

Components:

1,3-butadiene:

Biodegradability : Result: Readily biodegradable.

Stability in water : Remarks: no data available

Photodegradation : Remarks: no data available

12.3 Bioaccumulative potential

Components:

1,3-butadiene:

Bioaccumulation : Bioconcentration factor (BCF): 9.55
Method: Calculation method
Remarks: Bioaccumulation is unlikely.

Partition coefficient: n-octanol/water : log Pow: 1.99
Remarks: Based on data from similar materials

12.4 Mobility in soil

Components:

1,3-butadiene:

Stability in soil : Remarks: no data available

12.5 Results of PBT and vPvB assessment

Product:

Assessment : This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

12.6 Endocrine disrupting properties

Product:

Assessment : 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.

12.7 Other adverse effects

Components:

1,3-butadiene:

Additional ecological information : no data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product : Preferred disposal for this volatile, flammable product is through combustion.
Use flare if pressure warrants.
Assure emissions comply with applicable regulations.
Contaminated product, soil, water, and empty containers may be hazardous wastes due to possible presence of flammable gases.
Dispose of in accordance with local regulations.
Contaminated product, soil, water, container residues and spill cleanup materials may be hazardous wastes.
Proper grounding procedures to avoid static electricity should be followed.
The product should not be allowed to enter drains, water courses or the soil.

SECTION 14: Transport information

14.1 UN number or ID number

ADN : UN 1010

ADR : UN 1010

RID : UN 1010

IMDG : UN 1010

14.2 UN proper shipping name

ADN : BUTADIENES (1,3-BUTADIENE), STABILIZED

ADR : BUTADIENES, STABILIZED

RID : BUTADIENES, STABILIZED

IMDG : BUTADIENES, STABILIZED

14.3 Transport hazard class(es)

		Class	Subsidiary risks
ADN	:	2	2.1, Unst., CMR
ADR	:	2	2.1
RID	:	2	2.1, 13
IMDG	:	2.1	

14.4 Packing group

ADN

Packing group	:	Not assigned by regulation
Classification Code	:	2F
Labels	:	2.1 (Unst., CMR)

ADR

Packing group	:	Not assigned by regulation
Classification Code	:	2F
Hazard Identification Number	:	239
Labels	:	2.1
Tunnel restriction code	:	B/D

RID

Packing group	:	Not assigned by regulation
Classification Code	:	2F
Hazard Identification Number	:	239
Labels	:	2.1 (13)

IMDG

Packing group	:	Not assigned by regulation
Labels	:	2.1
EmS Code	:	F-D, S-U

14.5 Environmental hazards

ADN

Environmentally hazardous : no

ADR

Environmentally hazardous : no

RID

Environmentally hazardous : no

IMDG
Marine pollutant : no

14.6 Special precautions for user

The transport classification(s) provided herein are for informational purposes only, and solely based upon the properties of the unpackaged material as it is described within this Safety Data Sheet. Transportation classifications may vary by mode of transportation, package sizes, and variations in regional or country regulations.

14.7 Maritime transport in bulk according to IMO instruments

Regulatory basis	:	IGC Code
Product name	:	BUTADIENE (ALL ISOMERS)
Ship type	:	2G/2PG
Pollution category	:	N.A.

SECTION 15: Regulatory information

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

REACH - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles (Annex XVII)	:	Conditions of restriction for the following entries should be considered: Number on list 28: 1,3-butadiene Number on list 29: 1,3-butadiene Number on list 40 Number on list 75 If you intend to use this product as tattoo ink, please contact your vendor.
Regulation (EC) No 649/2012 of the European Parliament and the Council concerning the export and import of dangerous chemicals	:	Not applicable
REACH - Candidate List of Substances of Very High Concern for Authorization (Article 59).	:	Contains no REACH candidate substance above 0.1%
Regulation (EC) No 1005/2009 on substances that deplete the ozone layer	:	Not applicable
Regulation (EU) 2019/1021 on persistent organic pollutants (recast)	:	Not applicable
REACH - List of substances subject to authorisation (Annex XIV)	:	Contains no substance(s) listed on REACH XIV (Authorisation List)
Occupational Illnesses (R-461-3, France)	:	99
Reinforced medical supervision (R4624-18)	:	The product has no CMR properties

Installations classified for the protection of the environment (Environment Code R511-9)	:	4310
Volatile organic compounds	:	Directive 2010/75/EU of 24 November 2010 on industrial emissions (integrated pollution prevention and control) Volatile organic compounds (VOC) content: 99.71 %

Other regulations:

Take note of Directive 94/33/EC on the protection of young people at work or stricter national regulations, where applicable.

The components of this product are reported in the following inventories:

TCSI	:	On the inventory, or in compliance with the inventory
TSCA	:	All substances listed as active on the TSCA inventory
AIIC	:	On the inventory, or in compliance with the inventory
DSL	:	All components of this product are on the Canadian DSL
ENCS	:	On the inventory, or in compliance with the inventory
KECI	:	On the inventory, or in compliance with the inventory
PICCS	:	On the inventory, or in compliance with the inventory
IECSC	:	On the inventory, or in compliance with the inventory
REACH	:	If the product has been purchased from Rotterdam Olefins & Polyolefins B.V., we confirm that the chemical substances in this product have been registered under REACH, in accordance with the deadlines set forth in REACH. (Regulation (EU) No. 1907/2006).
NZIoC	:	On the inventory, or in compliance with the inventory
TECI	:	On the inventory, or in compliance with the inventory
CH BAGREG	:	On the inventory, or in compliance with the inventory
MXINSQ	:	On the inventory, or in compliance with the inventory
NCI	:	On the inventory, or in compliance with the inventory
UKREACH	:	If the product has been purchased from Rotterdam Olefins & Polyolefins B.V., we confirm that the chemical substances in this product have been notified with a DUIN or, where required under UK-REACH, registered, and that we have the intention to proceed with any required registration in accordance with the deadlines set forth in the regulation REACH etc. (Amendment etc.) (EU Exit) Regulations 2019.

KKDIK	:	If the product has been purchased from Rotterdam Olefins & Polyolefins B.V., we confirm that the chemical substances in this product have been pre-registered or, where required under KKDIK, registered, and that we have the intention to proceed with any required registration in accordance with the deadlines set forth in the regulation. For more information, please contact RegulatoryComplianceROP@velogy.com

15.2 Chemical safety assessment

A Chemical Safety Assessment has been carried out for this substance.

SECTION 16: Other information

Full text of H-Statements

Full text of other abbreviations

Carc.	:	Carcinogenicity
Flam. Gas	:	Flammable gases
Muta.	:	Germ cell mutagenicity
Press. Gas	:	Gases under pressure
2004/37/EC	:	Europe. Directive 2004/37/EC on the protection of workers from the risks related to exposure to carcinogens or mutagens at work
FR VLE	:	France. Occupational Exposure Limits
2004/37/EC / TWA	:	Long term exposure limit
FR VLE / VME	:	Time Weighted Average

ADN - European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways; ADR - Agreement concerning the International Carriage of Dangerous Goods by Road; AIIC - Australian Inventory of Industrial Chemicals; ASTM - American Society for the Testing of Materials; bw - Body weight; CLP - Classification Labelling Packaging Regulation; Regulation (EC) No 1272/2008; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DSL - Domestic Substances List (Canada); ECHA - European Chemicals Agency; EC-Number - European Community number; ECx - Concentration associated with x% response; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; GHS - Globally Harmonised System; GLP - Good Laboratory Practice; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organisation; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardisation; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; n.o.s. - Not Otherwise Specified; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NZIoC - New Zealand Inventory of Chemicals; OECD - Organisation for Economic Co-operation and Development; OPPTS - Office

of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RID - Regulations concerning the International Carriage of Dangerous Goods by Rail; SADT - Self-Accelerating Decomposition Temperature; SDS - Safety Data Sheet; SVHC - Substance of Very High Concern; TCSI - Taiwan Chemical Substance Inventory; TECI - Thailand Existing Chemicals Inventory; TRGS - Technical Rule for Hazardous Substances; TSCA - Toxic Substances Control Act (United States); UN - United Nations; vPvB - Very Persistent and Very Bioaccumulative

Further information

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

FR / EN

EXPOSURE SCENARIO FOR COMMUNICATION

1. ES 1: Manufacture

1.1. Title section

ES name: Manufacture of substance

Environment	
1: Manufacture of the substance	ERC 1
Worker	
2: General exposures (closed systems)	PROC 1
3: General exposures (closed systems); With sample collection	PROC 2
4: General exposures (closed systems); Batch process	PROC 3
5: General exposures	PROC 4
6: Process sampling	PROC 9
7: Laboratory activities	PROC 15
8: Bulk transfers; Closed systems	PROC 8b
9: Bulk transfers	PROC 8b
10: Bulk transfers	PROC 8b
11: Equipment cleaning and maintenance	PROC 8a, PROC 28
12: Storage	PROC 1

13: Storage	PROC 2

1.2. Conditions of use affecting exposure

1.2.1. Control of environmental exposure: Manufacture of the substance (ERC 1)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 696.6 tonnes/day
Annual amount per site <= 2.09E5 tonnes/year
Conditions and measures related to biological sewage treatment plant
No application of sewage sludge to soil
Provide onsite wastewater treatment.
Assumed domestic sewage treatment plant flow >= 2E3 m3/day
Other conditions affecting environmental exposure
Indoor use

1.2.2. Control of worker exposure: General exposures (closed systems) (PROC 1)

Product (article) characteristics
Liquefied gas
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to

authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

1.2.3. Control of worker exposure: General exposures (closed systems); With sample collection (PROC 2)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

1.2.4. Control of worker exposure: General exposures (closed systems); Batch process (PROC 3)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machi-

nes.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

1.2.5. Control of worker exposure: General exposures (PROC 4)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases.

Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

1.2.6. Control of worker exposure: Process sampling (PROC 9)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 0.25 h/day
Technical and organisational conditions and measures
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

1.2.7. Control of worker exposure: Laboratory activities (PROC 15)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure

Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

1.2.8. Control of worker exposure: Bulk transfers; Closed systems (PROC 8b)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Ensure material transfers are under containment or extract ventilation.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.

Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

1.2.9. Control of worker exposure: Bulk transfers (PROC 8b)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Ensure material transfers are under containment or extract ventilation.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

1.2.10. Control of worker exposure: Bulk transfers (PROC 8b)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Wear a respirator which reduces the air impurities by at least a factor of 10 (APF >= 10). For further specification, refer to section 8 of the SDS
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

1.2.11. Control of worker exposure: Equipment cleaning and maintenance (PROC 8a, PROC 28)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Drain down and flush system prior to equipment break-in or maintenance.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Wear a respirator which reduces the air impurities by at least a factor of 10 (APF >= 10). For further specification, refer to section 8 of the SDS
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

1.2.12. Control of worker exposure: Storage (PROC 1)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Store substance within a closed system.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply

Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

1.2.13. Control of worker exposure: Storage (PROC 2)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Store substance within a closed system.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

1.3. Exposure estimation and reference to its source

1.3.1. Environmental release and exposure: Manufacture of the substance (ERC 1)

Release route	Release rate	Release estimation method
Water	327.4 kg/day	Estimated release factor

Release route	Release rate	Release estimation method
Air	11.14 kg/day	Estimated release factor
Soil	6.967 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Man via environment - Inhalation (systemic effects)	0.047 mg/m³ (EUSES 2.1.2)	0.178

1.3.2. Worker exposure: General exposures (closed systems) (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.016 mg/m³ (TRA Workers 3.0)	< 0.01

1.3.3. Worker exposure: General exposures (closed systems); With sample collection (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.789 mg/m³ (TRA Workers 3.0)	0.357

1.3.4. Worker exposure: General exposures (closed systems); Batch process (PROC 3)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.578 mg/m³ (TRA Workers 3.0)	0.714

1.3.5. Worker exposure: General exposures (PROC 4)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.352 mg/m³ (TRA Workers 3.0)	0.612

1.3.6. Worker exposure: Process sampling (PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.352 mg/m³ (TRA Workers 3.0)	0.612

1.3.7. Worker exposure: Laboratory activities (PROC 15)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.578 mg/m³ (TRA Workers 3.0)	0.714

1.3.8. Worker exposure: Bulk transfers; Closed systems (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.014 mg/m³ (TRA Workers 3.0)	0.459

1.3.9. Worker exposure: Bulk transfers (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.014 mg/m³ (TRA Workers 3.0)	0.459

1.3.10. Worker exposure: Bulk transfers (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	2.028 mg/m³ (TRA Workers 3.0)	0.918

1.3.11. Worker exposure: Equipment cleaning and maintenance (PROC 8a, PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.789 mg/m³ (TRA Workers 3.0)	0.357

1.3.12. Worker exposure: Storage (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.016 mg/m³ (TRA Workers 3.0)	< 0.01

1.3.13. Worker exposure: Storage (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.789 mg/m³ (TRA Workers 3.0)	0.357

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

Guidance: 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.
Scaling tool: ECETOC TRA worker v3
Scaling instructions: If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required.

2. ES 2: Formulation or re-packing

2.1. Title section

ES name: Formulation & (re)packing of substances and mixtures

Environment	
1: Formulation into mixture	ERC 2
Worker	
2: General exposures (closed systems)	PROC 1
3: General exposures (closed systems); With sample collection	PROC 2
4: General exposures (closed systems); Batch process	PROC 3
5: General exposures	PROC 4
6: Batch process; Elevated temperature; Use in contained systems.	PROC 3
7: Process sampling	PROC 9
8: Laboratory activities	PROC 15
9: Bulk transfers; Dedicated facility	PROC 8b
10: Mixing operations	PROC 5
11: Manual; Transfer from/pouring from containers; Non-dedicated facility	PROC 8a
12: Drum/batch transfers; Dedicated facility	PROC 8b
13: Tabletting, compression, extrusion or pelletisation	PROC 14

14: Drum and small package filling	PROC 9
15: Equipment cleaning and maintenance	PROC 8a, PROC 28
16: Storage	PROC 1
17: Storage	PROC 2

2.2. Conditions of use affecting exposure

2.2.1. Control of environmental exposure: Formulation into mixture (ERC 2)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 600 tonnes/day
Annual amount per site <= 1.8E5 tonnes/year
Technical and organisational conditions and measures
Assumes no free product in wastewater stream; oil-water separation (e.g. via oil water separators, oil skimmers, dissolved air floatation) may be required under some circumstances.
Conditions and measures related to biological sewage treatment plant
Assumed domestic sewage treatment plant flow >= 2E3 m3/day
Provide onsite wastewater treatment.
No application of sewage sludge to soil
Other conditions affecting environmental exposure
Indoor use

2.2.2. Control of worker exposure: General exposures (closed systems) (PROC 1)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C

Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

2.2.3. Control of worker exposure: General exposures (closed systems); With sample collection (PROC 2)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

2.2.4. Control of worker exposure: General exposures (closed systems); Batch process (PROC 3)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day

Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

2.2.5. Control of worker exposure: General exposures (PROC 4)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide extract ventilation to points where emissions occur.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases.

Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

2.2.6. Control of worker exposure: Batch process; Elevated temperature; Use in contained systems. (PROC 3)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 4 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Formulate in enclosed or ventilated mixing vessels.; Ensure material transfers are under containment or extract ventilation.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Elevated temperature
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

2.2.7. Control of worker exposure: Process sampling (PROC 9)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 0.25 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machi-

nes.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

2.2.8. Control of worker exposure: Laboratory activities (PROC 15)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to

authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

2.2.9. Control of worker exposure: Bulk transfers; Dedicated facility (PROC 8b)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Ensure material transfers are under containment or extract ventilation.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

2.2.10. Control of worker exposure: Mixing operations (PROC 5)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal

operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide extract ventilation to points where emissions occur.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Wear a respirator which reduces the air impurities by at least a factor of 10 (APF >= 10). For further specification, refer to section 8 of the SDS
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

2.2.11. Control of worker exposure: Manual; Transfer from/pouring from containers; Non-dedicated facility (PROC 8a)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide extract ventilation to points where emissions occur.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Wear a respirator which reduces the air impurities by at least a factor of 10 (APF >= 10). For further spe-

cification, refer to section 8 of the SDS
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

2.2.12. Control of worker exposure: Drum/batch transfers; Dedicated facility (PROC 8b)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide extract ventilation to points where emissions occur.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

2.2.13. Control of worker exposure: Tabletting, compression, extrusion or pelletisation (PROC 14)

Product (article) characteristics
Covers concentrations up to 1 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Handle substance within a predominantly closed system provided with extract ventilation.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

2.2.14. Control of worker exposure: Drum and small package filling (PROC 9)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 0.25 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Fill containers/cans at dedicated fill points supplied with local extract ventilation.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).

Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

2.2.15. Control of worker exposure: Equipment cleaning and maintenance (PROC 8a, PROC 28)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 4 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Drain down and flush system prior to equipment break-in or maintenance.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Wear a respirator which reduces the air impurities by at least a factor of 20 (APF >= 20). For further specification, refer to section 8 of the SDS
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local

exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

2.2.16. Control of worker exposure: Storage (PROC 1)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Store substance within a closed system.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

2.2.17. Control of worker exposure: Storage (PROC 2)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 4 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal

operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Store substance within a closed system.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

2.3. Exposure estimation and reference to its source

2.3.1. Environmental release and exposure: Formulation into mixture (ERC 2)

Release route	Release rate	Release estimation method
Water	1.2E3 kg/day	Estimated release factor
Air	0.162 kg/day	Estimated release factor
Soil	180 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Man via environment - Inhalation (systemic effects)	0.173 mg/m³ (EUSES 2.1.2)	0.652

2.3.2. Worker exposure: General exposures (closed systems) (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.016 mg/m³ (TRA Workers 3.0)	< 0.01

2.3.3. Worker exposure: General exposures (closed systems); With sample collection (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.789 mg/m³ (TRA Workers 3.0)	0.357

2.3.4. Worker exposure: General exposures (closed systems); Batch process

(PROC 3)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.578 mg/m³ (TRA Workers 3.0)	0.714

2.3.5. Worker exposure: General exposures (PROC 4)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.352 mg/m³ (TRA Workers 3.0)	0.612

2.3.6. Worker exposure: Batch process; Elevated temperature; Use in contained systems. (PROC 3)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	2.028 mg/m³ (TRA Workers 3.0)	0.918

2.3.7. Worker exposure: Process sampling (PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.352 mg/m³ (TRA Workers 3.0)	0.612

2.3.8. Worker exposure: Laboratory activities (PROC 15)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.578 mg/m³ (TRA Workers 3.0)	0.714

2.3.9. Worker exposure: Bulk transfers; Dedicated facility (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.014 mg/m³ (TRA Workers 3.0)	0.459

2.3.10. Worker exposure: Mixing operations (PROC 5)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.789 mg/m³ (TRA Workers 3.0)	0.357

2.3.11. Worker exposure: Manual; Transfer from/pouring from containers; Non-dedicated facility (PROC 8a)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.789 mg/m³ (TRA Workers 3.0)	0.357

2.3.12. Worker exposure: Drum/batch transfers; Dedicated facility (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.014 mg/m³ (TRA Workers 3.0)	0.459

2.3.13. Worker exposure: Tabletting, compression, extrusion or pelletisation (PROC 14)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.69 mg/m³ (TRA Workers 3.0)	0.765

2.3.14. Worker exposure: Drum and small package filling (PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.352 mg/m³ (TRA Workers 3.0)	0.612

2.3.15. Worker exposure: Equipment cleaning and maintenance (PROC 8a, PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.183 mg/m³ (TRA Workers 3.0)	0.535

2.3.16. Worker exposure: Storage (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.016 mg/m³ (TRA Workers 3.0)	< 0.01

2.3.17. Worker exposure: Storage (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.014 mg/m³ (TRA Workers 3.0)	0.459

2.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Guidance: 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.
Scaling tool: ECETOC TRA worker v3
Scaling instructions: If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required.

3. ES 3: Use at industrial sites

3.1. Title section

ES name: Use as an intermediate

Environment	
1: Use as an intermediate	ERC 6a
Worker	
2: General exposures (closed systems)	PROC 1
3: General exposures (closed systems); With sample collection	PROC 2
4: General exposures (closed systems); Batch process	PROC 3
5: General exposures	PROC 4
6: Process sampling	PROC 9
7: Laboratory activities	PROC 15
8: Bulk transfers; Closed systems	PROC 8b
9: Bulk transfers	PROC 8b
10: Bulk transfers	PROC 8b
11: Equipment cleaning and maintenance	PROC 8a, PROC 28

12: Storage	PROC 1
13: Storage	PROC 2

3.2. Conditions of use affecting exposure

3.2.1. Control of environmental exposure: Use as an intermediate (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 733.3 tonnes/day
Annual amount per site <= 2.2E5 tonnes/year
Technical and organisational conditions and measures
Indoor use
Conditions and measures related to biological sewage treatment plant
Municipal sewage treatment plant is assumed.
Assumed domestic sewage treatment plant flow >= 2E3 m3/day
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
Local freshwater dilution factor 40

3.2.2. Control of worker exposure: General exposures (closed systems) (PROC 1)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases.

Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

3.2.3. Control of worker exposure: General exposures (closed systems); With sample collection (PROC 2)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

3.2.4. Control of worker exposure: General exposures (closed systems); Batch process (PROC 3)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 0.25 h/day

Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

3.2.5. Control of worker exposure: General exposures (PROC 4)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 0.25 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure

Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

3.2.6. Control of worker exposure: Process sampling (PROC 9)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 0.25 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

3.2.7. Control of worker exposure: Laboratory activities (PROC 15)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

3.2.8. Control of worker exposure: Bulk transfers; Closed systems (PROC 8b)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Ensure material transfers are under containment or extract ventilation.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification,

refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

3.2.9. Control of worker exposure: Bulk transfers (PROC 8b)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Ensure material transfers are under containment or extract ventilation.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work

or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

3.2.10. Control of worker exposure: Bulk transfers (PROC 8b)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Wear a respirator which reduces the air impurities by at least a factor of 10 (APF >= 10). For further specification, refer to section 8 of the SDS
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

3.2.11. Control of worker exposure: Equipment cleaning and maintenance (PROC 8a, PROC 28)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machi-

nes.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Drain down and flush system prior to equipment break-in or maintenance.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Wear a respirator which reduces the air impurities by at least a factor of 10 (APF >= 10). For further specification, refer to section 8 of the SDS
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

3.2.12. Control of worker exposure: Storage (PROC 1)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Store substance within a closed system.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.

Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

3.2.13. Control of worker exposure: Storage (PROC 2)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Store substance within a closed system.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

3.3. Exposure estimation and reference to its source

3.3.1. Environmental release and exposure: Use as an intermediate (ERC 6a)

Release route	Release rate	Release estimation method
Water	103.4 kg/day	Estimated release factor
Air	5.867 kg/day	Estimated release factor
Soil	733.3 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Man via environment - Inhalation (systemic effects)	0.015 mg/m³ (EUSES 2.1.2)	0.056

3.3.2. Worker exposure: General exposures (closed systems) (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.016 mg/m³ (TRA Workers 3.0)	< 0.01

3.3.3. Worker exposure: General exposures (closed systems); With sample collection (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.789 mg/m³ (TRA Workers 3.0)	0.357

3.3.4. Worker exposure: General exposures (closed systems); Batch process (PROC 3)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.789 mg/m³ (TRA Workers 3.0)	0.357

3.3.5. Worker exposure: General exposures (PROC 4)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.578 mg/m³ (TRA Workers 3.0)	0.714

3.3.6. Worker exposure: Process sampling (PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.352 mg/m³ (TRA Workers 3.0)	0.612

3.3.7. Worker exposure: Laboratory activities (PROC 15)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.578 mg/m³ (TRA Workers 3.0)	0.714

3.3.8. Worker exposure: Bulk transfers; Closed systems (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.014 mg/m³ (TRA Workers 3.0)	0.459

3.3.9. Worker exposure: Bulk transfers (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.014 mg/m³ (TRA Workers 3.0)	0.459

3.3.10. Worker exposure: Bulk transfers (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	2.028 mg/m³ (TRA Workers 3.0)	0.918

3.3.11. Worker exposure: Equipment cleaning and maintenance (PROC 8a, PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.789 mg/m³ (TRA Workers 3.0)	0.357

3.3.12. Worker exposure: Storage (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.016 mg/m³ (TRA Workers 3.0)	< 0.01

3.3.13. Worker exposure: Storage (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.789 mg/m³ (TRA Workers 3.0)	0.357

3.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Guidance: 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.
Scaling tool: ECETOC TRA worker v3
Scaling instructions: If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required.

4. ES 4: Use at industrial sites

4.1. Title section

ES name: *Use of substance as intermediate (under SCC)*

Environment	
1: *Use of substance as intermediate (under SCC)*	ERC 6a
Worker	
2: General exposures (closed systems)	PROC 1
3: General exposures (closed systems); With sample collection	PROC 2
4: General exposures (closed systems); Batch process	PROC 3
5: Process sampling	PROC 9
6: Laboratory activities	PROC 15
7: Bulk transfers; Closed systems	PROC 8b
8: Bulk transfers	PROC 8b
9: Bulk transfers	PROC 8b
10: Equipment cleaning and maintenance	PROC 8a, PROC 28
11: Storage	PROC 1
12: Storage	PROC 2

4.2. Conditions of use affecting exposure

4.2.1. Control of environmental exposure: *Use of substance as intermediate (under SCC)* (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 58.33 tonnes/day
Annual amount per site <= 1.75E4 tonnes/year
Technical and organisational conditions and measures
Indoor use
Conditions and measures related to biological sewage treatment plant
Municipal sewage treatment plant is assumed.
Assumed domestic sewage treatment plant flow >= 2E3 m3/day
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
Local freshwater dilution factor 40

4.2.2. Control of worker exposure: General exposures (closed systems) (PROC 1)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush

equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

4.2.3. Control of worker exposure: General exposures (closed systems); With sample collection (PROC 2)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

4.2.4. Control of worker exposure: General exposures (closed systems); Batch process (PROC 3)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 0.25 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal

operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

4.2.5. Control of worker exposure: Process sampling (PROC 9)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 0.25 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply

Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

4.2.6. Control of worker exposure: Laboratory activities (PROC 15)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

4.2.7. Control of worker exposure: Bulk transfers; Closed systems (PROC 8b)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures

Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Ensure material transfers are under containment or extract ventilation.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

4.2.8. Control of worker exposure: Bulk transfers (PROC 8b)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Ensure material transfers are under containment or extract ventilation.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure

Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

4.2.9. Control of worker exposure: Bulk transfers (PROC 8b)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Wear a respirator which reduces the air impurities by at least a factor of 10 (APF >= 10). For further specification, refer to section 8 of the SDS
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

4.2.10. Control of worker exposure: Equipment cleaning and maintenance (PROC 8a, PROC 28)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Drain down and flush system prior to equipment break-in or maintenance.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Wear a respirator which reduces the air impurities by at least a factor of 10 (APF >= 10). For further specification, refer to section 8 of the SDS
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

4.2.11. Control of worker exposure: Storage (PROC 1)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Store substance within a closed system.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

4.2.12. Control of worker exposure: Storage (PROC 2)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Store substance within a closed system.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves

and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

4.3. Exposure estimation and reference to its source

4.3.1. Environmental release and exposure: *Use of substance as intermediate (under SCC)* (ERC 6a)

Release route	Release rate	Release estimation method
Water	8.225 kg/day	Estimated release factor
Air	0.467 kg/day	Estimated release factor
Soil	58.33 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Man via environment - Inhalation (systemic effects)	1.21E-3 mg/m³ (EUSES 2.1.2)	< 0.01

4.3.2. Worker exposure: General exposures (closed systems) (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.016 mg/m³ (TRA Workers 3.0)	< 0.01

4.3.3. Worker exposure: General exposures (closed systems); With sample collection (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.789 mg/m³ (TRA Workers 3.0)	0.357

4.3.4. Worker exposure: General exposures (closed systems); Batch process (PROC 3)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.789 mg/m³ (TRA Workers 3.0)	0.357

4.3.5. Worker exposure: Process sampling (PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.352 mg/m³ (TRA Workers 3.0)	0.612

4.3.6. Worker exposure: Laboratory activities (PROC 15)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.578 mg/m³ (TRA Workers 3.0)	0.714

4.3.7. Worker exposure: Bulk transfers; Closed systems (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.014 mg/m³ (TRA Workers 3.0)	0.459

4.3.8. Worker exposure: Bulk transfers (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.014 mg/m³ (TRA Workers 3.0)	0.459

4.3.9. Worker exposure: Bulk transfers (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	2.028 mg/m³ (TRA Workers 3.0)	0.918

4.3.10. Worker exposure: Equipment cleaning and maintenance (PROC 8a, PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.789 mg/m³ (TRA Workers 3.0)	0.357

4.3.11. Worker exposure: Storage (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.016 mg/m³ (TRA Workers 3.0)	< 0.01

4.3.12. Worker exposure: Storage (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.789 mg/m³ (TRA Workers 3.0)	0.357

4.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Guidance: 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.
Scaling tool: ECETOC TRA worker v3
Scaling instructions: If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required.

5. ES 5: Use at industrial sites; Lubricants, Greases, Release Products (PC 24)

5.1. Title section

ES name: Use in binder and release agents
Product category: Lubricants, Greases, Release Products (PC 24)

Environment		SPERC
1: Use of non-reactive processing aid at industrial site (no inclusion into or onto article)	ERC 4	*ESVOC SPERC 4.10a.v4*
Worker		SWED
2: Material transfers; Closed systems	PROC 1	
3: Material transfers; Closed systems	PROC 2	
4: Material transfers; Closed systems	PROC 3	
5: Drum/batch transfers; Dedicated facility	PROC 8b	
6: Mixing operations; Closed systems	PROC 3	

7: Mixing operations	PROC 4
8: Mold forming	PROC 14
9: Casting operations; Elevated temperature	PROC 6
10: Spraying; Machines	PROC 7
11: Spraying; Manual	PROC 7
12: Rolling, Brushing; Manual	PROC 10
13: Treatment by dipping and pouring	PROC 13
14: Equipment cleaning and maintenance	PROC 8a, PROC 28
15: Storage	PROC 1
16: Storage	PROC 2

5.2. Conditions of use affecting exposure

5.2.1. Control of environmental exposure: Use of non-reactive processing aid at industrial site (no inclusion into or onto article) (ERC 4)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 0.083 tonnes/day
Annual amount per site <= 25 tonnes/year
Technical and organisational conditions and measures
Assumes no free product in wastewater stream; oil-water separation (e.g. via oil water separators, oil skimmers, dissolved air floatation) may be required under some circumstances.
Conditions and measures related to biological sewage treatment plant
Assumed domestic sewage treatment plant flow >= 2E3 m3/day
Aerobic biological treatment
No application of sewage sludge to soil
Other conditions affecting environmental exposure
Indoor use

5.2.2. Control of worker exposure: Material transfers; Closed systems (PROC 1)

Product (article) characteristics
Liquefied gas
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

5.2.3. Control of worker exposure: Material transfers; Closed systems (PROC 2)

Product (article) characteristics
Liquefied gas
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Ensure material transfers are under containment or extract ventilation.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to

authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

5.2.4. Control of worker exposure: Material transfers; Closed systems (PROC 3)

Product (article) characteristics
Liquefied gas
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Ensure material transfers are under containment or extract ventilation.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

5.2.5. Control of worker exposure: Drum/batch transfers; Dedicated facility (PROC 8b)

Product (article) characteristics
Liquefied gas
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures

Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide extract ventilation to points where emissions occur.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

5.2.6. Control of worker exposure: Mixing operations; Closed systems (PROC 3)

Product (article) characteristics
Liquefied gas
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide extract ventilation to points where emissions occur.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C

Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

5.2.7. Control of worker exposure: Mixing operations (PROC 4)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 0.25 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide extract ventilation to points where emissions occur.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

5.2.8. Control of worker exposure: Mold forming (PROC 14)

Product (article) characteristics
Covers concentrations up to 100 %

Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide extract ventilation to points where emissions occur.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Wear a respirator which reduces the air impurities by at least a factor of 10 (APF >= 10). For further specification, refer to section 8 of the SDS
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

5.2.9. Control of worker exposure: Casting operations; Elevated temperature (PROC 6)

Product (article) characteristics
Covers concentrations up to 25 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).

Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Elevated temperature
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

5.2.10. Control of worker exposure: Spraying; Machines (PROC 7)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 4 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Wear a respirator which reduces the air impurities by at least a factor of 10 (APF >= 10). For further specification, refer to section 8 of the SDS
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply

Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

5.2.11. Control of worker exposure: Spraying; Manual (PROC 7)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 4 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide enclosing hood with very high effectiveness (such as fume cupboard) or effective ventilation by spray booth according to EN 16985. Ensure effectiveness is at least 95%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Wear a respirator which reduces the air impurities by at least a factor of 10 (APF >= 10). For further specification, refer to section 8 of the SDS
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

5.2.12. Control of worker exposure: Rolling, Brushing; Manual (PROC 10)

Product (article) characteristics

Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 4 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide extract ventilation to points where emissions occur.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Wear a respirator which reduces the air impurities by at least a factor of 10 (APF >= 10). For further specification, refer to section 8 of the SDS
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

5.2.13. Control of worker exposure: Treatment by dipping and pouring (PROC 13)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 4 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide extract ventilation to points where emissions occur.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).

Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Wear a respirator which reduces the air impurities by at least a factor of 10 (APF >= 10). For further specification, refer to section 8 of the SDS
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

5.2.14. Control of worker exposure: Equipment cleaning and maintenance (PROC 8a, PROC 28)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Drain down and flush system prior to equipment break-in or maintenance.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Wear a respirator which reduces the air impurities by at least a factor of 10 (APF >= 10). For further specification, refer to section 8 of the SDS
Other conditions affecting workers exposure

Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

5.2.15. Control of worker exposure: Storage (PROC 1)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Store substance within a closed system.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Use suitable eye protection.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

5.2.16. Control of worker exposure: Storage (PROC 2)

Product (article) characteristics

Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Store substance within a closed system.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

5.3. Exposure estimation and reference to its source

5.3.1. Environmental release and exposure: Use of non-reactive processing aid at industrial site (no inclusion into or onto article) (ERC 4)

Release route	Release rate	Release estimation method
Water	2.49 kg/day	SPERC
Air	41.5 kg/day	SPERC
Soil	0.83 kg/day	SPERC

Protection target	Exposure estimate	RCR
Man via environment - Inhalation (systemic effects)	9.55E-3 mg/m³ (EUSES 2.1.2)	0.036

5.3.2. Worker exposure: Material transfers; Closed systems (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.016 mg/m³ (TRA Workers 3.0)	< 0.01

5.3.3. Worker exposure: Material transfers; Closed systems (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.789 mg/m³ (TRA Workers 3.0)	0.357

5.3.4. Worker exposure: Material transfers; Closed systems (PROC 3)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.578 mg/m³ (TRA Workers 3.0)	0.714

5.3.5. Worker exposure: Drum/batch transfers; Dedicated facility (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.014 mg/m³ (TRA Workers 3.0)	0.459

5.3.6. Worker exposure: Mixing operations; Closed systems (PROC 3)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.578 mg/m³ (TRA Workers 3.0)	0.714

5.3.7. Worker exposure: Mixing operations (PROC 4)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.578 mg/m³ (TRA Workers 3.0)	0.714

5.3.8. Worker exposure: Mold forming (PROC 14)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.789 mg/m³ (TRA Workers 3.0)	0.357

5.3.9. Worker exposure: Casting operations; Elevated temperature (PROC 6)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	2.028 mg/m³ (TRA Workers 3.0)	0.918

5.3.10. Worker exposure: Spraying; Machines (PROC 7)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.014 mg/m³ (TRA Workers 3.0)	0.459

5.3.11. Worker exposure: Spraying; Manual (PROC 7)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.014 mg/m³ (TRA Workers 3.0)	0.459

5.3.12. Worker exposure: Rolling, Brushing; Manual (PROC 10)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.014 mg/m³ (TRA Workers 3.0)	0.459

5.3.13. Worker exposure: Treatment by dipping and pouring (PROC 13)

Route of exposure and type of effects	Exposure estimate	RCR

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.014 mg/m³ (TRA Workers 3.0)	0.459

5.3.14. Worker exposure: Equipment cleaning and maintenance (PROC 8a, PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.789 mg/m³ (TRA Workers 3.0)	0.357

5.3.15. Worker exposure: Storage (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.016 mg/m³ (TRA Workers 3.0)	< 0.01

5.3.16. Worker exposure: Storage (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.789 mg/m³ (TRA Workers 3.0)	0.357

5.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Guidance: 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.
Scaling tool: ECETOC TRA worker v3
Scaling instructions: If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required.

6. ES 6: Use at industrial sites; Fuels (PC 13)

6.1. Title section

ES name: Use in fuel
Product category: Fuels (PC 13)

Environment		SPERC
1: Use of functional fluid at industrial site	ERC 7	*ESVOC SPERC 7.12a.v4*
Worker		SWED
2: Bulk transfers; Dedicated facility	PROC 8b	
3: Drum/batch transfers; Dedicated facility	PROC 8b	
4: General exposures (closed systems)	PROC 1	
5: General exposures (closed systems); With sample collection	PROC 2	
6: Use of fuels; Closed systems	PROC 16	
7: Equipment cleaning and maintenance	PROC 8a, PROC 28	
8: Storage	PROC 1	
9: Storage	PROC 2	

6.2. Conditions of use affecting exposure

6.2.1. Control of environmental exposure: Use of functional fluid at industrial site (ERC 7)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 13.33 tonnes/day
Annual amount per site <= 4E3 tonnes/year
Technical and organisational conditions and measures
Assumes no free product in wastewater stream; oil-water separation (e.g. via oil water separators, oil skimmers, dissolved air floatation) may be required under some circumstances.
Conditions and measures related to biological sewage treatment plant
Assumed domestic sewage treatment plant flow >= 2E3 m3/day
Aerobic biological treatment
No application of sewage sludge to soil
Other conditions affecting environmental exposure
Indoor use

6.2.2. Control of worker exposure: Bulk transfers; Dedicated facility (PROC 8b)

Product (article) characteristics
Covers concentrations up to 25 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 4 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide enclosing hood with very high effectiveness (such as fume cupboard) or effective ventilation by spray booth according to EN 16985. Ensure effectiveness is at least 95%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local

exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

6.2.3. Control of worker exposure: Drum/batch transfers; Dedicated facility (PROC 8b)

Product (article) characteristics
Covers concentrations up to 25 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 4 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide enclosing hood with very high effectiveness (such as fume cupboard) or effective ventilation by spray booth according to EN 16985. Ensure effectiveness is at least 95%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

6.2.4. Control of worker exposure: General exposures (closed systems) (PROC 1)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure

Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

6.2.5. Control of worker exposure: General exposures (closed systems); With sample collection (PROC 2)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply

Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

6.2.6. Control of worker exposure: Use of fuels; Closed systems (PROC 16)

Product (article) characteristics
Covers concentrations up to 25 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

6.2.7. Control of worker exposure: Equipment cleaning and maintenance (PROC 8a, PROC 28)

Product (article) characteristics
Covers concentrations up to 25 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 4 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal

operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Drain down and flush system prior to equipment break-in or maintenance.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Wear a respirator which reduces the air impurities by at least a factor of 10 (APF >= 10). For further specification, refer to section 8 of the SDS
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

6.2.8. Control of worker exposure: Storage (PROC 1)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Store substance within a closed system.
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C

Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

6.2.9. Control of worker exposure: Storage (PROC 2)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Store substance within a closed system.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

6.3. Exposure estimation and reference to its source

6.3.1. Environmental release and exposure: Use of functional fluid at industrial site (ERC 7)

Release route	**Release rate**	**Release estimation method**
Water	0.267 kg/day	SPERC

Release route	Release rate	Release estimation method
Air	133.3 kg/day	SPERC
Soil	0.133 kg/day	SPERC

Protection target	Exposure estimate	RCR
Man via environment - Inhalation (systemic effects)	0.03 mg/m³ (EUSES 2.1.2)	0.115

6.3.2. Worker exposure: Bulk transfers; Dedicated facility (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.826 mg/m³ (TRA Workers 3.0)	0.826

6.3.3. Worker exposure: Drum/batch transfers; Dedicated facility (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.826 mg/m³ (TRA Workers 3.0)	0.826

6.3.4. Worker exposure: General exposures (closed systems) (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.016 mg/m³ (TRA Workers 3.0)	< 0.01

6.3.5. Worker exposure: General exposures (closed systems); With sample collection (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.69 mg/m³ (TRA Workers 3.0)	0.765

6.3.6. Worker exposure: Use of fuels; Closed systems (PROC 16)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.473 mg/m³ (TRA Workers 3.0)	0.214

6.3.7. Worker exposure: Equipment cleaning and maintenance (PROC 8a, PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.42 mg/m³ (TRA Workers 3.0)	0.642

6.3.8. Worker exposure: Storage (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.016 mg/m³ (TRA Workers 3.0)	< 0.01

6.3.9. Worker exposure: Storage (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.69 mg/m³ (TRA Workers 3.0)	0.765

6.4. Guidance to DU to evaluate whether he works inside the

boundaries set by the ES

Guidance: 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.
Scaling tool: ECETOC TRA worker v3
Scaling instructions: If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required.

ES 7: Use at industrial sites; Laboratory Chemicals (PC 21)

7.1. Title section

ES name: Use in laboratories
Product category: Laboratory Chemicals (PC 21)

Environment		SPERC
1: Use of non-reactive processing aid at industrial site (no inclusion into or onto article)	ERC 4	*ESVOC SPERC 4.1.v2*
Worker		SWED
2: Laboratory activities	PROC 15	
3: Laboratory activities	PROC 15	

7.2. Conditions of use affecting exposure

7.2.1. Control of environmental exposure: Use of non-reactive processing aid at industrial site (no inclusion into or onto article) (ERC 4)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 0.33 tonnes/day
Annual amount per site <= 100 tonnes/year
Technical and organisational conditions and measures
Assumes no free product in wastewater stream; oil-water separation (e.g. via oil water separators, oil skimmers, dissolved air floatation) may be required under some circumstances.
Conditions and measures related to biological sewage treatment plant
No application of sewage sludge to soil
Aerobic biological treatment
Assumed domestic sewage treatment plant flow >= 2E3 m3/day
Other conditions affecting environmental exposure
Indoor use

7.2.2. Control of worker exposure: Laboratory activities (PROC 15)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure

Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Handle in a fume cupboard or under extract ventilation.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

7.2.3. Control of worker exposure: Laboratory activities (PROC 15)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Wear a respirator which reduces the air impurities by at least a factor of 10 (APF >= 10). For further specification, refer to section 8 of the SDS
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local

exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

7.3. Exposure estimation and reference to its source

7.3.1. Environmental release and exposure: Use of non-reactive processing aid at industrial site (no inclusion into or onto article) (ERC 4)

Release route	Release rate	Release estimation method
Water	0.99 kg/day	SPERC
Air	16.5 kg/day	SPERC
Soil	0.033 kg/day	SPERC

Protection target	Exposure estimate	RCR
Man via environment - Inhalation (systemic effects)	3.84E-3 mg/m³ (EUSES 2.1.2)	0.014

7.3.2. Worker exposure: Laboratory activities (PROC 15)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.578 mg/m³ (TRA Workers 3.0)	0.714

7.3.3. Worker exposure: Laboratory activities (PROC 15)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.578 mg/m³ (TRA Workers 3.0)	0.714

7.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Guidance: 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.
Scaling tool: ECETOC TRA worker v3
Scaling instructions: If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required.

ES 8: Use at industrial sites; Products such as ph-regulators, flocculants, precipitants, neutralization agents (PC 20)

8.1. Title section

ES name: Use in rubber production and processing
Product category: Products such as ph-regulators, flocculants, precipitants, neutralization agents (PC 20)

Environment	
1: Use in rubber production and processing	ERC 4
Worker	
2: Material transfers; Closed systems	PROC 1
3: Material transfers; Closed systems	PROC 2
4: Material transfers; Dedicated facility	PROC 8b
5: Bulk weighing; Use in contained systems.	PROC 1
6: Bulk weighing; Use in contained systems.	PROC 2
7: Small scale weighing	PROC 9
8: Additive premixing	PROC 3
9: Additive premixing	PROC 4
10: Additive premixing	PROC 5
11: Calendering (including Banburys); Elevated temperature	PROC 6
12: Pressing uncured rubber blanks	PROC 14
13: Tyre build up	PROC 7
14: Vulcanisation; Elevated temperature	PROC 6
15: *Cooling cured articles. Elevated temperature.*	PROC 6
16: Production of articles by dipping and pouring	PROC 13
17: Laboratory activities	PROC 15
18: Equipment cleaning and maintenance	PROC 8a, PROC 28
19: Storage	PROC 1
20: Storage	PROC 2

8.2. Conditions of use affecting exposure

8.2.1. Control of environmental exposure: Use in rubber production and processing (ERC 4)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 503.3 tonnes/day
Annual amount per site <= 1.51E5 tonnes/year
Technical and organisational conditions and measures
Assumes no free product in wastewater stream; oil-water separation (e.g. via oil water separators, oil skimmers, dissolved air floatation) may be required under some circumstances.
Conditions and measures related to biological sewage treatment plant
Assumed domestic sewage treatment plant flow >= 2E3 m3/day
Aerobic biological treatment
No application of sewage sludge to soil
Other conditions affecting environmental exposure
Indoor use

8.2.2. Control of worker exposure: Material transfers; Closed systems (PROC 1)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

8.2.3. Control of worker exposure: Material transfers; Closed systems (PROC 2)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).

Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

8.2.4. Control of worker exposure: Material transfers; Dedicated facility (PROC 8b)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide enclosing hood with very high effectiveness (such as fume cupboard) or effective ventilation by spray booth according to EN 16985. Ensure effectiveness is at least 95%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control

measures. Consider the need for risk based health surveillance. [G20].

8.2.5. Control of worker exposure: Bulk weighing; Use in contained systems. (PROC 1)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

8.2.6. Control of worker exposure: Bulk weighing; Use in contained systems. (PROC 2)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.

Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

8.2.7. Control of worker exposure: Small scale weighing (PROC 9)

Product (article) characteristics
Covers concentrations up to 5 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 4 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control

measures. Consider the need for risk based health surveillance. [G20].

8.2.8. Control of worker exposure: Additive premixing (PROC 3)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 4 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Ensure material transfers are under containment or extract ventilation.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

8.2.9. Control of worker exposure: Additive premixing (PROC 4)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Ensure material transfers are under containment or extract ventilation.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification,

refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

8.2.10. Control of worker exposure: Additive premixing (PROC 5)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 0.25 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Ensure material transfers are under containment or extract ventilation.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

8.2.11. Control of worker exposure: Calendering (including Banburys); Elevated temperature (PROC 6)

Product (article) characteristics
Covers concentrations up to 1 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 4 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Elevated temperature
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

8.2.12. Control of worker exposure: Pressing uncured rubber blanks (PROC 14)

Product (article) characteristics
Covers concentrations up to 1 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 4 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing

hood type). Ensure effectiveness is at least 90%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

8.2.13. Control of worker exposure: Tyre build up (PROC 7)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 4 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Wear a respirator which reduces the air impurities by at least a factor of 10 (APF >= 10). For further specification, refer to section 8 of the SDS
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply

Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

8.2.14. Control of worker exposure: Vulcanisation; Elevated temperature (PROC 6)

Product (article) characteristics
Covers concentrations up to 1 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Elevated temperature
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

8.2.15. Control of worker exposure: *Cooling cured articles. Elevated temperature.* (PROC 6)

Product (article) characteristics

Covers concentrations up to 1 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Elevated temperature
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

8.2.16. Control of worker exposure: Production of articles by dipping and pouring (PROC 13)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 4 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation

Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Wear a respirator which reduces the air impurities by at least a factor of 10 (APF >= 10). For further specification, refer to section 8 of the SDS
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

8.2.17. Control of worker exposure: Laboratory activities (PROC 15)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control

measures. Consider the need for risk based health surveillance. [G20].

8.2.18. Control of worker exposure: Equipment cleaning and maintenance (PROC 8a, PROC 28)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 4 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Drain down and flush system prior to equipment break-in or maintenance.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Wear a respirator which reduces the air impurities by at least a factor of 10 (APF >= 10). For further specification, refer to section 8 of the SDS
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

8.2.19. Control of worker exposure: Storage (PROC 1)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Store substance within a closed system.
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal

operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

8.2.20. Control of worker exposure: Storage (PROC 2)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Store substance within a closed system.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to

authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

8.3. Exposure estimation and reference to its source

8.3.1. Environmental release and exposure: Use in rubber production and processing (ERC 4)

Release route	Release rate	Release estimation method
Water	1.51E3 kg/day	Estimated release factor
Air	0.136 kg/day	Estimated release factor
Soil	50.33 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Man via environment - Inhalation (systemic effects)	0.218 mg/m³ (EUSES 2.1.2)	0.821

8.3.2. Worker exposure: Material transfers; Closed systems (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.016 mg/m³ (TRA Workers 3.0)	< 0.01

8.3.3. Worker exposure: Material transfers; Closed systems (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.69 mg/m³ (TRA Workers 3.0)	0.765

8.3.4. Worker exposure: Material transfers; Dedicated facility (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.014 mg/m³ (TRA Workers 3.0)	0.459

8.3.5. Worker exposure: Bulk weighing; Use in contained systems. (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.016 mg/m³ (TRA Workers 3.0)	< 0.01

8.3.6. Worker exposure: Bulk weighing; Use in contained systems. (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.69 mg/m³ (TRA Workers 3.0)	0.765

8.3.7. Worker exposure: Small scale weighing (PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.623 mg/m³ (TRA Workers 3.0)	0.734

8.3.8. Worker exposure: Additive premixing (PROC 3)

Route of exposure and type of effects	Exposure estimate	RCR

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	2.028 mg/m³ (TRA Workers 3.0)	0.918

8.3.9. Worker exposure: Additive premixing (PROC 4)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.352 mg/m³ (TRA Workers 3.0)	0.612

8.3.10. Worker exposure: Additive premixing (PROC 5)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.69 mg/m³ (TRA Workers 3.0)	0.765

8.3.11. Worker exposure: Calendering (including Banburys); Elevated temperature (PROC 6)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.014 mg/m³ (TRA Workers 3.0)	0.459

8.3.12. Worker exposure: Pressing uncured rubber blanks (PROC 14)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.014 mg/m³ (TRA Workers 3.0)	0.459

8.3.13. Worker exposure: Tyre build up (PROC 7)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.014 mg/m³ (TRA Workers 3.0)	0.459

8.3.14. Worker exposure: Vulcanisation; Elevated temperature (PROC 6)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.69 mg/m³ (TRA Workers 3.0)	0.765

8.3.15. Worker exposure: *Cooling cured articles. Elevated temperature.* (PROC 6)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.69 mg/m³ (TRA Workers 3.0)	0.765

8.3.16. Worker exposure: Production of articles by dipping and pouring (PROC 13)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.014 mg/m³ (TRA Workers 3.0)	0.459

8.3.17. Worker exposure: Laboratory activities (PROC 15)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.578 mg/m³ (TRA Workers 3.0)	0.714

8.3.18. Worker exposure: Equipment cleaning and maintenance (PROC 8a, PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.014 mg/m³ (TRA Workers 3.0)	0.459

8.3.19. Worker exposure: Storage (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.016 mg/m³ (TRA Workers 3.0)	< 0.01

8.3.20. Worker exposure: Storage (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.69 mg/m³ (TRA Workers 3.0)	0.765

8.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Guidance: 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.
Scaling tool: ECETOC TRA worker v3
Scaling instructions: If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required.

ES 9: Use at industrial sites; Polymer Preparations and Compounds (PC 32)

9.1. Title section

ES name: Use in polymer processing
Product category: Polymer Preparations and Compounds (PC 32)

Environment	
1: Use of non-reactive processing aid at industrial site (no inclusion into or onto article)	ERC 4
Worker	
2: Bulk transfers; Closed systems	PROC 1
3: Bulk transfers; Closed systems	PROC 2
4: Bulk transfers; Dedicated facility	PROC 8b
5: Bulk weighing; Closed systems	PROC 1
6: Bulk weighing; Closed systems	PROC 2
7: Small scale weighing	PROC 9
8: Additive premixing	PROC 3
9: Additive premixing	PROC 4
10: Additive premixing	PROC 5
11: Calendering (including Banburys); Elevated temperature	PROC 6
12: Production of articles by dipping and pouring	PROC 13
13: Masterbatches	PROC 14

14: Injection moulding of articles	PROC 14
15: Equipment maintenance	PROC 8a, PROC 28
16: Storage	PROC 1
17: Storage	PROC 2

9.2. Conditions of use affecting exposure

9.2.1. Control of environmental exposure: Use of non-reactive processing aid at industrial site (no inclusion into or onto article) (ERC 4)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 166.6 tonnes/day
Annual amount per site <= 5E4 tonnes/year
Technical and organisational conditions and measures
Assumes no free product in wastewater stream; oil-water separation (e.g. via oil water separators, oil skimmers, dissolved air floatation) may be required under some circumstances.
Conditions and measures related to biological sewage treatment plant
Assumed domestic sewage treatment plant flow >= 2E3 m3/day
Aerobic biological treatment
No application of sewage sludge to soil
Other conditions affecting environmental exposure
Indoor use

9.2.2. Control of worker exposure: Bulk transfers; Closed systems (PROC 1)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases.

Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

9.2.3. Control of worker exposure: Bulk transfers; Closed systems (PROC 2)

Product (article) characteristics
Covers concentrations up to 1 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

9.2.4. Control of worker exposure: Bulk transfers; Dedicated facility (PROC 8b)

Product (article) characteristics
Covers concentrations up to 1 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machi-

nes.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide enclosing hood with very high effectiveness (such as fume cupboard) or effective ventilation by spray booth according to EN 16985. Ensure effectiveness is at least 95%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

9.2.5. Control of worker exposure: Bulk weighing; Closed systems (PROC 1)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local

exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

9.2.6. Control of worker exposure: Bulk weighing; Closed systems (PROC 2)

Product (article) characteristics
Covers concentrations up to 1 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

9.2.7. Control of worker exposure: Small scale weighing (PROC 9)

Product (article) characteristics
Covers concentrations up to 1 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing

hood type). Ensure effectiveness is at least 90%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

9.2.8. Control of worker exposure: Additive premixing (PROC 3)

Product (article) characteristics
Covers concentrations up to 1 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain

contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

9.2.9. Control of worker exposure: Additive premixing (PROC 4)

Product (article) characteristics
Covers concentrations up to 1 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

9.2.10. Control of worker exposure: Additive premixing (PROC 5)

Product (article) characteristics
Covers concentrations up to 1 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.

Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

9.2.11. Control of worker exposure: Calendering (including Banburys); Elevated temperature (PROC 6)

Product (article) characteristics
Covers concentrations up to 1 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Elevated temperature
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply

Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

9.2.12. Control of worker exposure: Production of articles by dipping and pouring (PROC 13)

Product (article) characteristics
Covers concentrations up to 1 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

9.2.13. Control of worker exposure: Masterbatches (PROC 14)

Product (article) characteristics
Covers concentrations up to 1 %

Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

9.2.14. Control of worker exposure: Injection moulding of articles (PROC 14)

Product (article) characteristics
Covers concentrations up to 1 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected

with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

9.2.15. Control of worker exposure: Equipment maintenance (PROC 8a, PROC 28)

Product (article) characteristics
Covers concentrations up to 1 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Drain or remove substance from equipment prior to break-in or maintenance.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control

measures. Consider the need for risk based health surveillance. [G20].

9.2.16. Control of worker exposure: Storage (PROC 1)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Store substance within a closed system.
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

9.2.17. Control of worker exposure: Storage (PROC 2)

Product (article) characteristics
Covers concentrations up to 1 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Store substance within a closed system.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

9.3. Exposure estimation and reference to its source

9.3.1. Environmental release and exposure: Use of non-reactive processing aid at industrial site (no inclusion into or onto article) (ERC 4)

Release route	Release rate	Release estimation method
Water	333.3 kg/day	Estimated release factor
Air	0.045 kg/day	Estimated release factor
Soil	166.6 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Man via environment - Inhalation (systemic effects)	0.048 mg/m³ (EUSES 2.1.2)	0.181

9.3.2. Worker exposure: Bulk transfers; Closed systems (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	6.76E-3 mg/m³ (TRA Workers 3.0)	< 0.01

9.3.3. Worker exposure: Bulk transfers; Closed systems (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.394 mg/m³ (TRA Workers 3.0)	0.178

9.3.4. Worker exposure: Bulk transfers; Dedicated facility (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.183 mg/m³ (TRA Workers 3.0)	0.535

9.3.5. Worker exposure: Bulk weighing; Closed systems (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.016 mg/m³ (TRA Workers 3.0)	< 0.01

9.3.6. Worker exposure: Bulk weighing; Closed systems (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.394 mg/m³ (TRA Workers 3.0)	0.178

9.3.7. Worker exposure: Small scale weighing (PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.352 mg/m³ (TRA Workers 3.0)	0.612

9.3.8. Worker exposure: Additive premixing (PROC 3)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.789 mg/m³ (TRA Workers 3.0)	0.357

9.3.9. Worker exposure: Additive premixing (PROC 4)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.578 mg/m³ (TRA Workers 3.0)	0.714

9.3.10. Worker exposure: Additive premixing (PROC 5)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.69 mg/m³ (TRA Workers 3.0)	0.765

9.3.11. Worker exposure: Calendering (including Banburys); Elevated temperature (PROC 6)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.69 mg/m³ (TRA Workers 3.0)	0.765

9.3.12. Worker exposure: Production of articles by dipping and pouring (PROC 13)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.69 mg/m³ (TRA Workers 3.0)	0.765

9.3.13. Worker exposure: Masterbatches (PROC 14)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.69 mg/m³ (TRA Workers 3.0)	0.765

9.3.14. Worker exposure: Injection moulding of articles (PROC 14)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.69 mg/m³ (TRA Workers 3.0)	0.765

9.3.15. Worker exposure: Equipment maintenance (PROC 8a, PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.69 mg/m³ (TRA Workers 3.0)	0.765

9.3.16. Worker exposure: Storage (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.016 mg/m³ (TRA Workers 3.0)	< 0.01

9.3.17. Worker exposure: Storage (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.789 mg/m³ (TRA Workers 3.0)	0.357

9.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Guidance: 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.
Scaling tool: ECETOC TRA worker v3
Scaling instructions: If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required.

10. ES 10: Use at industrial sites; Polymer Preparations and Compounds (PC 32)

10.1. Title section

ES name: Use in polymer production
Product category: Polymer Preparations and Compounds (PC 32)

Environment	
1: *Polymer Production*	ERC 6c
Worker	
2: General exposures (closed systems); Continuous process	PROC 1
3: General exposures; Closed systems; Continuous process	PROC 8b
4: Polymerisation; Continuous process; With sample collection	PROC 2
5: Polymerisation; Batch process; With sample collection	PROC 3
6: Polymerisation; Batch process; Elevated temperature; With sample collection	PROC 3
7: Finishing operations; Batch process; With sample collection	PROC 3
8: Intermediate Bulk Container; Storage	PROC 4
9: Additivation; Stabilisation; Batch process; With sample collection	PROC 3
10: Mixing or blending in batch processes; Vessel / container	PROC 5
11: Tabletting, compression, extrusion or pelletisation	PROC 6
12: Bulk transfers; Closed systems	PROC 8b
13: Tabletting, compression, extrusion or pelletisation	PROC 14
14: Equipment cleaning and maintenance	PROC 8a, PROC 28
15: Storage	PROC 1
16: Storage	PROC 2

10.2. Conditions of use affecting exposure

10.2.1. Control of environmental exposure: *Polymer Production* (ERC 6c)

Amount used, frequency and duration of use (or from service life)

Daily amount per site <= 300 tonnes/day
Annual amount per site <= 9E4 tonnes/year
Conditions and measures related to biological sewage treatment plant
Assumed domestic sewage treatment plant flow >= 2E3 m3/day
Provide onsite wastewater treatment.
No application of sewage sludge to soil
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.

10.2.2. Control of worker exposure: General exposures (closed systems); Continuous process (PROC 1)

Product (article) characteristics
Covers concentrations up to 100 %
Liquefied gas
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

10.2.3. Control of worker exposure: General exposures; Closed systems;

Continuous process (PROC 8b)

Product (article) characteristics
Covers concentrations up to 100 %
Liquefied gas
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide enclosing hood with very high effectiveness (such as fume cupboard) or effective ventilation by spray booth according to EN 16985. Ensure effectiveness is at least 95%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

10.2.4. Control of worker exposure: Polymerisation; Continuous process; With sample collection (PROC 2)

Product (article) characteristics
Covers concentrations up to 100 %
Liquefied gas
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures

Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

10.2.5. Control of worker exposure: Polymerisation; Batch process; With sample collection (PROC 3)

Product (article) characteristics
Covers concentrations up to 100 %
Liquefied gas
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected

with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

10.2.6. Control of worker exposure: Polymerisation; Batch process; Elevated temperature; With sample collection (PROC 3)

Product (article) characteristics
Covers concentrations up to 25 %
Liquefied gas
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 60 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply

Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

10.2.7. Control of worker exposure: Finishing operations; Batch process; With sample collection (PROC 3)

Product (article) characteristics
Covers concentrations up to 5 %
Liquefied gas
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

10.2.8. Control of worker exposure: Intermediate Bulk Container; Storage

(PROC 4)

Product (article) characteristics
Covers concentrations up to 5 %
Liquefied gas
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

10.2.9. Control of worker exposure: Additivation; Stabilisation; Batch process; With sample collection (PROC 3)

Product (article) characteristics
Covers concentrations up to 5 %
Liquefied gas
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures

Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

10.2.10. Control of worker exposure: Mixing or blending in batch processes; Vessel / container (PROC 5)

Product (article) characteristics
Covers concentrations up to 5 %
Liquefied gas
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected

with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

10.2.11. Control of worker exposure: Tabletting, compression, extrusion or pelletisation (PROC 6)

Product (article) characteristics
Covers concentrations up to 1 %
Liquefied gas
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 60 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply

Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

10.2.12. Control of worker exposure: Bulk transfers; Closed systems (PROC 8b)

Product (article) characteristics
Covers concentrations up to 100 %
Liquefied gas
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide enclosing hood with very high effectiveness (such as fume cupboard) or effective ventilation by spray booth according to EN 16985. Ensure effectiveness is at least 95%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

10.2.13. Control of worker exposure: Tabletting, compression, extrusion or

pelletisation (PROC 14)

Product (article) characteristics
Covers concentrations up to 1 %
Liquefied gas
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

10.2.14. Control of worker exposure: Equipment cleaning and maintenance (PROC 8a, PROC 28)

Product (article) characteristics
Covers concentrations up to 100 %
Liquefied gas
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 4 h/day
Technical and organisational conditions and measures

Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of controlled ventilation (5 to 10 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Wear a respirator which reduces the air impurities by at least a factor of 10 (APF >= 10). For further specification, refer to section 8 of the SDS
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

10.2.15. Control of worker exposure: Storage (PROC 1)

Product (article) characteristics
Covers concentrations up to 100 %
Liquefied gas
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification,

refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

10.2.16. Control of worker exposure: Storage (PROC 2)

Product (article) characteristics
Covers concentrations up to 100 %
Liquefied gas
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personal operating under supervision.; Ensure regular inspection, cleaning and maintenance of equipment and machines.; Clear spills immediately.; Ensure daily cleaning of the equipment.
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Cryogenic Gloves to EN388 and EN 511
Use suitable eye protection.
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local

exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

10.3. Exposure estimation and reference to its source

10.3.1. Environmental release and exposure: *Polymer Production* (ERC 6c)

Release route	Release rate	Release estimation method
Water	45 kg/day	Estimated release factor
Air	0.081 kg/day	Estimated release factor
Soil	3 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Man via environment - Inhalation (systemic effects)	6.62E-3 mg/m³ (EUSES 2.1.2)	0.025

10.3.2. Worker exposure: General exposures (closed systems); Continuous process (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.016 mg/m³ (TRA Workers 3.0)	< 0.01

10.3.3. Worker exposure: General exposures; Closed systems; Continuous process (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.014 mg/m³ (TRA Workers 3.0)	0.459

10.3.4. Worker exposure: Polymerisation; Continuous process; With sample collection (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.789 mg/m³ (TRA Workers 3.0)	0.357

10.3.5. Worker exposure: Polymerisation; Batch process; With sample collection (PROC 3)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.578 mg/m³ (TRA Workers 3.0)	0.714

10.3.6. Worker exposure: Polymerisation; Batch process; Elevated temperature; With sample collection (PROC 3)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.947 mg/m³ (TRA Workers 3.0)	0.428

10.3.7. Worker exposure: Finishing operations; Batch process; With sample collection (PROC 3)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.578 mg/m³ (TRA Workers 3.0)	0.714

10.3.8. Worker exposure: Intermediate Bulk Container; Storage (PROC 4)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.352 mg/m³ (TRA Workers 3.0)	0.612

10.3.9. Worker exposure: Additivation; Stabilisation; Batch process; With sample collection (PROC 3)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.578 mg/m³ (TRA Workers 3.0)	0.714

10.3.10. Worker exposure: Mixing or blending in batch processes; Vessel / container (PROC 5)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.578 mg/m³ (TRA Workers 3.0)	0.714

10.3.11. Worker exposure: Tabletting, compression, extrusion or pelletisation (PROC 6)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.69 mg/m³ (TRA Workers 3.0)	0.765

10.3.12. Worker exposure: Bulk transfers; Closed systems (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.014 mg/m³ (TRA Workers 3.0)	0.459

10.3.13. Worker exposure: Tabletting, compression, extrusion or pelletisation (PROC 14)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.69 mg/m³ (TRA Workers 3.0)	0.765

10.3.14. Worker exposure: Equipment cleaning and maintenance (PROC 8a, PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.014 mg/m³ (TRA Workers 3.0)	0.459

10.3.15. Worker exposure: Storage (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.016 mg/m³ (TRA Workers 3.0)	< 0.01

10.3.16. Worker exposure: Storage (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.789 mg/m³ (TRA Workers 3.0)	0.357

10.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

11. ES 11: Widespread use by professional workers; Polymer Preparations and Compounds (PC 32)

11.1. Title section

ES name: Use in polymer processing
Product category: Polymer Preparations and Compounds (PC 32)

Environment		SPERC
1: Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor)	ERC 8d, ERC 9a, ERC 8a	*ESVOC SPERC 8.21b.v3*
Worker		SWED
2: Bulk transfers; Closed systems	PROC 1	
3: Bulk transfers; Closed systems	PROC 2	
4: Material transfers; Dedicated facility	PROC 8b	
5: Injection moulding of articles	PROC 6	
6: Injection moulding of articles	PROC 14	
7: Equipment maintenance	PROC 8a, PROC 28	
8: Storage	PROC 1	
9: Storage	PROC 2	

11.2. Conditions of use affecting exposure

11.2.1. Control of environmental exposure: Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor) (ERC 8d, ERC 9a, ERC 8a)

Conditions and measures related to biological sewage treatment plant
Municipal sewage treatment plant is assumed.
Other conditions affecting environmental exposure
Indoor or outdoor use

11.2.2. Control of worker exposure: Bulk transfers; Closed systems (PROC 1)

Product (article) characteristics

Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

11.2.3. Control of worker exposure: Bulk transfers; Closed systems (PROC 2)

Product (article) characteristics
Covers concentrations up to 1 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Provide specifically designed and maintained LEV (receiving hood type). Ensure effectiveness is at least 80%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

11.2.4. Control of worker exposure: Material transfers; Dedicated facility (PROC 8b)

Product (article) characteristics
Covers concentrations up to 1 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 1 h/day
Technical and organisational conditions and measures
Provide specifically designed and maintained LEV (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

11.2.5. Control of worker exposure: Injection moulding of articles (PROC 6)

Product (article) characteristics
Covers concentrations up to 1 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 4 h/day
Technical and organisational conditions and measures
Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Wear a respirator which reduces the air impurities by at least a factor of 10 (APF >= 10). For further specification, refer to section 8 of the SDS
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to

authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

11.2.6. Control of worker exposure: Injection moulding of articles (PROC 14)

Product (article) characteristics
Covers concentrations up to 1 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 4 h/day
Technical and organisational conditions and measures
Provide specifically designed and maintained LEV (receiving hood type). Ensure effectiveness is at least 80%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Wear a respirator which reduces the air impurities by at least a factor of 10 (APF >= 10). For further specification, refer to section 8 of the SDS
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

11.2.7. Control of worker exposure: Equipment maintenance (PROC 8a, PROC 28)

Product (article) characteristics
Covers concentrations up to 1 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 4 h/day
Technical and organisational conditions and measures
Drain or remove substance from equipment prior to break-in or maintenance.
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Wear a respirator which reduces the air impurities by at least a factor of 10 (APF >= 10). For further spe-

cification, refer to section 8 of the SDS
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

11.2.8. Control of worker exposure: Storage (PROC 1)

Product (article) characteristics
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Store substance within a closed system.
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

11.2.9. Control of worker exposure: Storage (PROC 2)

Product (article) characteristics
Covers concentrations up to 1 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Store substance within a closed system.
Provide specifically designed and maintained LEV (receiving hood type). Ensure effectiveness is at least 80%.

Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Cryogenic Gloves to EN388 and EN 511
Other conditions affecting workers exposure
Assumes process temperature up to 20 °C
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].

11.3. Exposure estimation and reference to its source

11.3.1. Environmental release and exposure: Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor) (ERC 8d)

Release route	Release rate	Release estimation method
Water	0.057 kg/day	SPERC
Air	0.057 kg/day	SPERC
Soil	5.67E-5 kg/day	SPERC

Protection target	Exposure estimate	RCR
Man via environment - Inhalation (systemic effects)	3.94E-5 mg/m³ (EUSES 2.1.2)	< 0.01

11.3.2. Worker exposure: Bulk transfers; Closed systems (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.225 mg/m³ (TRA Workers 3.0)	0.102

11.3.3. Worker exposure: Bulk transfers; Closed systems (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.578 mg/m³ (TRA Workers 3.0)	0.714

11.3.4. Worker exposure: Material transfers; Dedicated facility (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.789 mg/m³ (TRA Workers 3.0)	0.357

11.3.5. Worker exposure: Injection moulding of articles (PROC 6)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.947 mg/m³ (TRA Workers 3.0)	0.428

11.3.6. Worker exposure: Injection moulding of articles (PROC 14)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.947 mg/m³ (TRA Workers 3.0)	0.428

11.3.7. Worker exposure: Equipment maintenance (PROC 8a, PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.352 mg/m³ (TRA Workers 3.0)	0.612

11.3.8. Worker exposure: Storage (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.225 mg/m³ (TRA Workers 3.0)	0.102

11.3.9. Worker exposure: Storage (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.578 mg/m³ (TRA Workers 3.0)	0.714

11.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Guidance: 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.
Scaling tool: ECETOC TRA worker v3
Scaling instructions: If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required.