SECTION 1: IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1. Product identifier

- Trade name: **C10 FRACTION NON-HYDROGENATED**
- Chemical name: Distillates (petroleum), cracked, ethylene manuf. by-product, C9-10 fraction
- Registration number REACH: 01-2119487291-35-0001
- UFI code: irrelevant for substances
- Index number: Substance is not in the list of harmonized classifications (Annex VI of CLP)
- CAS number: 94733-07-0
- EC number: 305-586-4

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

1.2.1. Identified uses

Monomer for the industrial production of hydrocarbon resin.

1.2.2. Non-recommended uses

There are no non-recommended uses stated in the registration. The product may not be used in any way other than that specified in point 1.2.1 or subsection 7.3.

1.3. Details of the supplier of the safety data sheet

producer: ORLEN Unipetrol RPA s.r.o. Záluží 1, 436 70 Litvínov, Czech Republic

ID No.: 27597075
☎: +420 476 161 111
fax: +420 476 709 553
info@orlenunipetrol.cz
www.orlenunipetrolrpa.cz

Other contacts:

- Director of the Monomers and Chemicals Unit: ☎: +48 242 566 615, email: Dorota.Smolarek@orlen.pl
- Key Account Manager: ☎: +420 226 841 474, email: Beata.Zajicova@orlenunipetrol.cz
- Head of Customer Service Department: ☎: +420 476 162 006, email: Lucie.Markova@orlenunipetrol.cz
- Person professionally qualified to compile a SDS: email: reach.unirpa@orlenunipetrol.cz

1.4. Emergency telephone number

- ORLEN Unipetrol RPA s.r.o. ☎:+420 476 163 111 (NON STOP)
- Toxicological Information Center (TIS) ☎:+420 224 919 293 (NON STOP)
  Na bojišti 1, 120 00 Prague 2, Czech Republic ☎:+420 224 915 402 (NON STOP)
  e-mail: tis@vfn.cz
- Transport Information & Accident System (TRINS) ☎:+420 476 163 111 (NON STOP)

Note: Emergency telephone numbers for EU countries are listed in section 16.

SECTION 2: HAZARDS IDENTIFICATION

2.1. Classification of the substance or mixture

The product is classified as hazardous pursuant to CLP Regulation (EC) No. 1272/2008 CLP:

FLAMMABLE LIQUID, CATEGORY 3	**Flam. Liq. 3, H 226**
ACUTE TOXICITY, CATEGORY 4 (ORAL)	**Acute Tox. 4, H 302**
ACUTE TOXICITY, CATEGORY 4 (INHAL)	**Acute Tox. 4, H 332**
CARCINOGENIC, CATEGORY 1A	**Carc. 1A, H 350**
MUTAGENIC, CATEGORY 1B	**Muta. 1B, H 340**

ASPIRATION HAZARD, CATEGORY 1	**Asp. Tox. 1, H 304**
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPLOSURE), CATEGORY 3 (AFFECTED ORGANS: RESPIRATORY SYSTEM, LUNGS)	**STOT SE 3, H 335**
SERIOUS EYE DAMAGE / EYE IRRITATION, CATEGORY 2	**Eye Irrit. 2, H 319**
SKIN CORROSION/IRRITATION, CATEGORY 2	**Skin Irrit. 2, H 315**
HAZARDS TO THE AQUATIC ENVIRONMENT (ACUTE/SHORT-TERM), CATEGORY 1	**Aquatic Acute 1, H 400**
HAZARDS TO THE AQUATIC ENVIRONMENT (CHRONIC/LONG-TERM, CATEGORY CHRONIC 2	**Aquatic Chronic 1, H 410**

Note: The full text of the H-sentence and / or EUH-sentences is stated in Section 16.

2.2. Label elements

Product identifiers		**C10 FRACTION NON-HYDROGENATED** DISTILLATES (PETROLEUM), CRACKED, ETHYLENE MANUF. BY-PRODUCT, C9-10 FRACTION CAS number.: 94733-07-0
Warning hazard symbol		
Signal word		**DANGER**
H-phrases (standard hazard phrases)	H226 H302 H304 H315 H319 H332 H335 H340 H350 H410	Flammable liquid and vapour. Harmful if swallowed. May be fatal if swallowed and enters airways. Causes skin irritation. Causes serious eye irritation. Harmful if inhaled. May cause respiratory irritation. May cause genetic defects. May cause cancer. Very toxic to aquatic life with long lasting effects.
P-statements (precautionary statements)	P202 P210 P243 P273 P280 P301+P310 P305+P351+P338 P331 P391	Do not handle until all safety precautions have been read and understood. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Take action to prevent static discharges. Avoid release to the environment. Wear protective gloves/protective clothing/eye protection/face protection. IF SWALLOWED: Immediately call a POISON CENTER/doctor. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. DO NOT INDUCE vomiting. Collect spillage
Additional information		Only for professional users.
		ORLEN Unipetrol RPA s.r.o. Záluží 1, 436 70 Litvínov, Czech Republic ☎: +420 476 161 111

2.3. Other hazards

Vapours with oxygen create explosive mixtures that are heavier than air, and so they amass and spread near the ground, and in case of a random leak may initiate a fire or explosion even far from the source. The product does not dissolve in water, it floats on and above the water surface and thus explosive mixtures with air may be created. There is a danger of explosion and subsequent fire if the product leaks in the sewage.
The product is classified as hazardous if inhaled. This means that in case of consumption and subsequent vomiting, there is a risk of aspiration (entering the lungs) and a risk of chemical pneumonia (lung swelling), which may lead to death.
Product is not identified as a PBT substance (Persistent, Bioaccumulative, Toxic) or a vPvB (very Persistent, very Bioaccumulative) substance. Product assessments for PBT / vPvB criteria see Subsection 12.4. ("Results of PBT and vPvB assessment").
The substance is not included in the candidate list pursuant to Article 59 (Paragraph 1) of the REACH Directive.

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.1. Substances

Name of the substance:	C10 FRACTION NON-HYDROGENATED	
Index number (index):	none	
CAS number:	94733-07-0	
EC number:	305-586-4	
this UVCB substance contains the following components • *in a concentration of ≥ 10% or* • *influencing the classification of this substance:*	*NAME:*	*IDENTIFIER:*
	benzene	*benzene (index 601-020-00-8, CAS 71-43-2, ES 200-753-7)*
	ethylbenzene	*ethylbenzene (index 601-023-00-4, CAS 100-41-4, ES 202-849-4)*
	xylenes	*xylene (index 601-022-00-9, CAS 1330-20-7, ES 215-535-7)*
	naphthalene	*naphthalene (index 601-052-00-2, CAS 91-20-3, ES 202-049-5)*
	indene	*indene (CAS 95-13-6, ES 202-393-6)*
	methylstyrenes	*methylstyrenes (CAS 25013-15-4, ES 246-562-2)*
	methylindenes	*2-methylindene (CAS 2177-47-1)*
	1,2-dihydronaphthtalene	*1,2-dihydronahthalene (CAS 447-53-0, ES 207-183-8)*
	tetrahydronaphthalene	*1,2,3,4-tetrahydrnaphthalehe (index 601-045-00-4, CAS 119-64-2, ES 204-340-2)*

Note: The UVCB substance does not contain a nanoform.

3.2. Mixtures

Not applicable, the product is a substance.

SECTION 4: FIRST AID MEASURES

4.1. Description of first aid measures

4.1.1. General instructions

When providing first aid pay attention to self-protection.
Call emergency medical services (☎120 EU) and follow their instructions until their arrival.
First aid must be always administered with the objective to preserve the basic bodily functions - should the victim become unconscious or should he/she stop breathing, start resuscitation immediately (chest compression and mouth-to-mouth resuscitation with the 30:2 ratio). When the victim is unconscious but

is breathing NORMALLY, put him/her in the recovery position. The condition of the patient can change very quickly, so you need to watch him/her constantly and continuously monitor his/her consciousness status and breathing.

4.1.2. When inhaled
Transport the patient to fresh air, do not let them get cold and ensure specialized medical help.

4.1.3. Skin contact
Remove contaminated clothing and shoes. Thoroughly wash the affected areas with water (ideally tepid) and soap - continue for at least 15 minutes.. If symptoms persist, secure professional medical help.

4.1.4. Contact with eyes
Immediately start washing wide open eyes under flowing tepid water and continue for at least 15 minutes. If the patient has contact lenses, remove them before washing his/her eyes. Secure professional medical help.

4.1.5. When ingested
DO NOT INDUCE VOMITING! If the patient is vomiting on his/her own, keep his/her head below his/her hips to prevent him/her from inhaling his/her own vomit. Secure professional medical help as soon as possible.

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

Based on the size of exposure, the substance may cause headaches, sore throat, coughing, breathing difficulties, chest pressure, disruptions of the central nervous system, nausea, sleepiness and dizziness. Consumption may lead to abdomen spasms, spontaneous vomiting with a risk of aspiration and of chemical pneumonia, which may cause death. Direct contact with eyes or skin may cause their irritation and cause the affected area to turn red, swell and produce tears. Prolonged exposure of the skin to the substance may lead to ungreasing and crackles.

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

Immediate medical help is necessary in case of consumption or if the substance enters the lungs. If a gastric lavage is necessary, it may be performed only by a qualified doctor via endotracheal intubation.
We recommend the workplace to be equipped with a safety shower and a device for washing eyes.

SECTION 5: FIREFIGHTING MEASURES

5.1. Extinguishing media

Appropriate extinguishing media: low expansion foam, spray or water fog.
Inappropriate extinguishing media: direct water stream.
Extinguishing small fire: dry-powder or carbon dioxide (CO2) extinguisher, dry sand or extinguishing foam.

5.2. Special hazards arising from the substance or mixture

The vapors are heavier than air. They accumulate and spread near the ground to significant distances and in contact with a source of ignition may cause back-up with subsequent explosion and / or fire. This danger is imminent especially in places below the ground or in enclosed places. Toxic or irritating fuels containing monoxide, carbon dioxide or unburned hydrocarbon might be produced during burning.

5.3. Advice for firefighters

Minimize the penetration of extinguishing medium contaminated by the substance into the sewage, surface or underground waters or into the soil. There is a danger of explosion and subsequent fire in case of a leak into the sewage.
Use water spray to keep the containers cool in order to prevent an explosion caused by the heat.
Do not use foam and water at the same time because water dissolves the foam.
Protective equipment for fire fighters: full protective gear and self-contained close-circuit breathing apparatus.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1. Personal precautions, protective equipment and emergency procedures

Close the accident location and prevent access to the endangered area by persons who do not participate in the liquidation of the given incidental leak. Remain on the windward side. There is a danger of fire in case of

accidental release of this substance, therefore remove all possible ignition sources, do not smoke and do not manipulate with open fire. If possible, ensure a sufficient ventilation of enclosed spaces.
Prevent direckt contact with the substance and its vapors. Use proper personal protective equipment (as indicated in Subsection 8.2) when removing the effects of the emergency event/accident. Evacuate people from the whole area in danger for large accidents. There is a danger of vapors explosion in case of substance initiation in places below the ground or in enclosed places (including sewage).

6.2. Environmental precautions

If it safety, prevent further leaking and enclose the leaking place. Prevent leakage of the substance into the sewage, surface and underground waters by covering sewage inlets. Inform the relevant authorities if rivers, lakes or sewage systems have been contaminated during the leak. Do not allow the substance to enter into soil/subsoil. Should the leak contaminate surface water, soil or public sewerage systems, notify the appropriate authorities.

6.3. Methods and material for containment and cleaning up

Safely drain the leaked substance. There is a danger of fire during a leak; therefore only explosion-proof luminaries and electrical equipment and non-sparking tools must be used. Absorb the remains into an appropriate non-flammable porous/absorbent material (e.g. sand, dirt, siliceous earth, vermiculit) and transport for disposal in sealed containers. Dispose of in accordance with valid legal regulations for waste (see Section 13).
For large leaks into water use floating barrage and collect the substance from surface using surface skimmers (separators) or cover the leaked substance with sorbent and remove saturated sorbent from the surface by scraping or draining. Consult a professional before using dispersing agents. The product will flow in water and can flare on its surface.

6.4. Reference to other

For recommended personal protective aids – see Subsection 8.2. (“Exposure controls”).
For recommended manner of removing waste – see Section 13 (“Disposal considerations”).

SECTION 7: HANDLING AND STORAGE

7.1 Precautions for safe handling

Adhere to all fire safety precautions (no smoking, no open fire, removal of all possible combustion sources and oxidizing agents) and stay in well-ventilated areas when manipulating with the substance and with empty tanks (may contain residue). Do not perform activities such as welding, cutting, grinding etc. near containers (even empty ones). Only open containers where protection against leaks is ensured and appropriate suction. Keep in mind that the gases of the product are heavier than air, and so perform necessary precautions to prevent their accumulation underground. Do not use compressed air for emptying, filling or any other handling. Prevent bolts of static electricity. Handle empty containers with care; vapor residues can be flammable.
Cleaning, inspections and maintenance of the inner structure of the storage tanks can be only conducted by properly equipped and qualified personnel.
Please keep the rules of personal hygiene. Take off contaminated pieces of clothing. Do not eat, drink or smoke during work! Wash your hands and exposed parts of body thoroughly with soap and water after work and before meal and possibly treat with suitable reparation lotion. Do not wear contaminated clothing, shoes or protective equipment in the catering area.

7.2 Conditions for safe storage, including any incompatibilities

Storage must adhere to the fire safety requirements on buildings and electric equipment must adhere to valid regulations. Store in cool, well-ventilated places with efficient suction from all heat and combustion sources. Storage containers must be closed, properly labeled and grounded. Recommended material suitable for containers is soft or stainless steel. Do not store near incompatible materials, such as oxidizers (oxygen, air etc.) or other flammable materials. Vapors above the stored liquid can be flammable / explosive if they are not covered with an inert gas.
Open containers must be carefully closed, permanently marked and maintained in a vertical position, thus preventing leaks.

7.3 Specific end use(s)

The substance is intended for specific use as a monomer to which the recommendations given in exposure

scenario ES6 (IS) "Use of C10 non-hydrogenated monomer fraction for the industrial manufacture of polymers", which is included in the annex to this Safety Data Sheet.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Control parameters

8.1.1. Occupational exposure limit values

The following Permissible Exposure Limits (PELs) and Maximum Allowable Concentrations (NPK-P) of Chemicals in the Atmosphere of Workplaces within the Czech Republic are set by the Government Regulation No. 361/2007 Coll., determining conditions of occupational health protection, as amended:

Name	CAS number	PEL [mg.m^{-3}]	NPK-P [mg.m^{-3}]	Note
Distillates (petroleum), cracked, ethylene manuf. by-product, C9-10 fraction	94733-07-0	Limit values for the substance have not been determine. *It is recommended to comply with the limits specified for individual components, present in this substance:*		
Substance components :	*NAME / CAS NUMBER:*	*PEL [mg.m^{-3}]*	*NPK-P [mg.m^{-3}]*	
	benzene / 71-43-2	*1,65 / 0,66**	*10*	
	ethylbenzene/100-41-4	*200*	*500*	
	xylenes / 1330-20-7	*200*	*400*	
	naphthtalene / 91-20-3	*50*	*100*	

Note 1: An explanation of the meaning of the PEL and NPK-P abbreviations is in section 16.
Note 2: Occupational exposure limit values for EU countries are listed in section 16.
*Note *: Limit value of 1.65 mg/m^3 valid until 05.04.2026. Limit value 0.66 mg/m^3 from 05.04.2026.*

8.1.2. DNEL/DMEL values

EXPOSURE OF WORKERS / EMPLOYEES			
EXPOSURE	IMPACTS	POINT OF ENTRY	DNEL/DMEL
acute	system	skin	non-threshold effect and/or no data on reaction to a dose
acute	system	inhaling	
acute	local	skin	non-threshold effect and/or no data on reaction to a dose
acute	local	inhaling	
acute	local	eye	Medium hazard (without a derived threshold value)
long-term	system	skin	DMEL 0,34 mg/kg.bw/d
long-term	system	inhaling	DMEL 1,91 mg.m^{-3}
long-term	local	skin	non-threshold effect and/or no data on reaction to a dose
long-term	local	inhaling	

Note 1: There isn´t insufficient information to determine the dermal, inhalation (or oral) DNEL / DMEL value for acute systemic and local effects and long-term local effects. The risk characterization focused on the possibility of causing serious long-term systemic effects.
Note 2: An explanation of the meaning of the DNEL/DMEL abbreviations is in section 16.

8.1.3. PNEC values

Determination of concrete PNEC values based on experimental data obtained by testing modified water fractions containing dissolved/emulsified/suspended shares of the tested substance (WAF – "Water accommodated Fraction") is not suitable for UVCB substances of the hydrocarbon type. The risk characterization of the product for the environment was thus determined statistically, using the hydrocarbon block method of extrapolating HC5 with the PETROTOX model, v.3.05.

8.1.4. Recommended monitoring of the concentration in the workplace

Gas chromatography (GC) with a flame ionizing detector (FID) or a mass spectrometer (MS) in accordance with technical norms ČSN EN 689 and ČSN EN 482.

8.2. Exposure control

8.2.1. Technical protective measures for limiting the exposure of people and the environment

Exposure control of unwanted exposure of humans and the environment must be ensured by strictly keeping the substance under control by using process and control technologies, which reduce emissions and subsequent exposure with the goal of preventing the substance from entering the air and water systems as well as the soil, and of preventing possible human exposure. The areas where the substance is stored and manipulated must be equipped with impermeable floors and retaining tanks in case of emergency leaks. It is necessary to ensure global as well as local ventilation and efficient suction.

8.2.2. Individual protective measures

If an accident or extraordinary event causes increased exposure, employees must have access to personal protective measures (PPM) for the protection of airways, eyes, hands and skin, depending on the nature of the performed activities. Suitable protection for airways must also be available where it is not technically possible to ensure the adherence of exposition limits identified for the work environment or ensure that exposure via airways will not affect the health of people. During non-stop use of these measures during permanent work, it is necessary to include safety breaks if the nature of the PPM requires them. All PPM need to be kept in usable condition and damaged or contaminated ones need to be immediately replaced**.**

RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT (PPE):

*(*the specific type of protective equipment must be chosen according to the type of activity being carried out and the quantity and concentration of the dangerous substance / mixture at the workplace)

- *Respiratory protection:* Protective mask compliant with EN 140 with a filter that is suitable against organic gases, insulation breathing apparatus (use the mask in case of insufficient ventilation and / or local exhaustion and product leakage);
- *Eye/face protection:* Protective chemical goggles compliant with EN 166;
- *Hand protection:* chemically resistant gloves tested according to EN 374, e.g. the following materials are suitable:

	Glove material	*Material thickness*	*Penetration time*
Regular work activities (staining risk)	nitrile	0.4 mm	30 minutes
Leak / accident liquidation	Viton	0.7 mm	480 minutes

- *Protection of other body parts:* Antistatic, inflammable protective clothes, antistatic shoes;
- *Thermal risk:* Not relevant for the given manner of the use.
- *Other measures:* We recommend that the workplace is equipped with a safety shower and eye rinse facilities.

8.2.3. Environmental exposure controls

Avoid product leakage to the environment with all available means. See section 6.2.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1. Information on basic physical and chemical properties

The information is taken from the substance`s registration dossier (CSR) unless otherwise stated.

CHARACTERISTIC	UNIT	VALUE	SOURCE	NOTE
Physical state		Liquid		at 20°C, 101,3 kPa
Colour		Colorless or yellowish		
Odour		Characteristic, aromatic		
Odour threshold	[mg.m^{-3}]	*data for the components:* *4.68(benzene)* *140 (ethylbenzene)* *4.5 (xylenes)* *0.084 (naphthalene)* *240 (methylstyrenes)*	search data	CSR does not specify

CHARACTERISTIC	UNIT	VALUE	SOURCE	NOTE
Melting point/freezing point	[°C]	< -30 to +45		
Boiling point or Initial boiling point / boiling range	[°C]	167 - 225		CSR- DW
Flammability (solid, gas, liquid)		Irrelevant		
Upper flammability / explosive limits	[%]	*data for the components:* *7.8 (benzene)* *6.8 (ethylbenzene)* *7.5 (xylenes)* *5.9 (naphthalene)* *7.2 (indene)* *11 (methylstyrenes)* *6.4 (2-methylindene)*	search data	CSR does not specify
Lower flammability / explosive limits	[%]	*data for the components:* *1.2 (benzene)* *0.8 (ethylbenzene)* *1.7 (xylenes)* *0.9 (naphthalene)* *1.0 (indene)* *0.8 (methylstyrenes)* *0.9 (2-methylindene)*	rešeršní údaje	CSR neuvádí
Flash point	[°C]	36,5 – 76 (44,5) 53,5	CSR own tests	ISO 3679
Auto-ignition temperature	[°C]	409-505		
Decomposition temperature	[°C]	Does not decompose at normal usage temperatures		CSR does not specify
pH		Irrelevant		CSR does not specify
Kinematic viscosity	[mm^2/s]	1.1-1.9		at 20°C
Solubility in water	[$mg.l^{-1}$]	62-130		at 20°C
Partition coefficient: n-octanol/water	[log Kow]	2,8 – 6,5		at 20°C
Vapour pressure	[hPa]	2-41		at 20-25°C
Relative density	Water=1	0,894-1,000		at 20°C
Relative vapour density	Air=1	*data for the components:* *2.8 (benzene)* *3.66 (ethylbenzene)* *4.5 (xylenes)* *4.42 (naphthalene)* *4.0 (indene)* *4.08 (methylstyrenes)* *4.5 (1,2-dihydroaphthalene)*	search data	CSR does not specify
Particle characteristics		Irrelevant		Not applicable - this is a liquid.

9.2. Other information

9.2.1. Information with regard to physical hazard classes

Flammable liquids and gases

CHARACTERISTIC	UNIT	VALUE	SOURCE	NOTE
Explosive properties		Substance is not explosive		CSR – DW
Oxidising properties		None	own tests	CSR - DW

9.2.2. Other safety characteristics

CHARACTERISTIC	UNIT	VALUE	SOURCE	NOTE
Evaporation rate	diethylether=1 butylacetate=1 diethylether=1 diethylether=1 butylacetate=1	*data for the components:* *2.8 (benzene)* *0.84 (ethylbenzene)* *8.8 (ethylbenzene)* *13.5 (xylenes)* *< 1 (naphthalene)*	search data	CSR does not specify
Dynamic viscosity	[mP.s]	2.39	CSR	

SECTION 10: STABILITY AND REACTIVITY

10.1. Reactivity
No threat of reactivity during storage and handling under the conditions listed in Section 7.

10.2. Chemical stability
The product is chemically stable when handled and stored under the conditions listed in Section 7.

10.3. Possibility of hazardous reactions
No threat of dangerous reactions during storage and handling under the conditions listed in Section 7.

10.4. Conditions to avoid
Sources of ignition (including static electricity), high temperature, creation of an explosive mixture with air.

10.5. Incompatible materials
Oxidizers.

10.6. Hazardous decomposition products
Heat decomposition at high temperatures, e.g. during fires, may cause the creation of carbon monoxide, carbon dioxide and unburned hydrocarbons (smoke).

SECTION 11: TOXIKOLOGICAL INFORMATION

11.1. Information on hazard classes as defined in Regulation (EC) No 1272/2008
11.1.1. Toxicological effects of the substance

HAZARD CLASS	DATA FROM REGISTRATION DOCUMENTATION		EVALUATION
	DESCRIPTION	RESULT	
Acute toxicity	1/ oral: 2/ dermal: 3/ inhalation: (OECD 403)	1/ LD_{50} (rat) = 2000-5000 mg/kg 2/ LD_{50} (rat) > 2000 mg/kg 3/ LC50 (rat)= >4,74 mg/l air (no mortality and no unwanted clinical symptoms upon exposure to the highest achievable tested concentration)	Meets the classification criteria (H302 a H332)
Skin corrosion/irritation		Product irritates skin	Meets the classification criteria (H315)
Serious eye damage/irritation		Product irritates/does not irritate eyes depending on the composition	Meets the classification criteria (H319)
Sensitisation		Product, or its components do not cause allergic reactions	Does not meet the classification criteria
Germ cell mutagenicity		Product containing ≥0.1% of benzene may induce detrimental genotoxic effects	Meets the classification criteria

HAZARD CLASS	DATA FROM REGISTRATION DOCUMENTATION		EVALUATION
	DESCRIPTION	RESULT	
			(H340)
Carcinogenicity	1/ oral (chronic): 2/ dermal: 3/ inhalation (subchronic):	1/ LOAEL (mouse) = 25 mg/kg dw/day 2/ No studies are available. 3/ LOAEC(mouse) = 960 mg/m^3 Conclusion: The product that contains .≥0,1% of benzene can cause cancer.	splňuje kritéria pro klasifikaci (H350)
Reproductive toxicity	1/ inhalation:	1/ NOAEC(rat) = 32 mg/m^3 Conclusion: No harmful reproduction or development effects have been recorded when the substance contains < 3% of toulene	nesplňuje kritéria pro klasifikaci
STOT-single exposure		H335 classification is not required if the combined concentration of dicyclopentadiene and xylenes (irritant substances for the airways) < 10% H336 classification is not required if the UVCB substance contains < 20% of toluene	H335 classification within Category L. fractions C9-C10 (CAS 94733-07-0)
STOT-repeated exposure	1/ oral – systematic effects: 2/ inhalation – systematic effects: 3/ inhalation – local effects: 4/ dermal: – systematic and local effects:	1/ NOAEL(rat)=25 mg/kg bw/day 2/LOAEC (human, epidemiological findings)=11,2 mg/m^3 4/ Scientifically unjustified.(DW/su) Conclusion: No harmful effects have been recorded when the UVCB substance contains <1% of benzene and <10% of toluene	nesplňuje kritéria pro klasifikaci
Aspiration hazard		The product is hydrocarbon with a kinematic viscosity ≤ 20.5 mm^2.s^{-1} at 40°C	Meets the classification criteria (H304)

11.1.2. Information on likely routes of exposure
Exposure may occur via inhalation, random consumption or by penetrating through skin.

11.1.3. Delayed and immediate effects as well as chronic effects from short and long-term exposure
Based on the size of exposure, the substance may cause headaches, sore throat, coughing, breathing difficulties, chest pressure, disruptions of the central nervous system, nausea, sleepiness and dizziness. Consumption may lead to abdomen spasms, spontaneous vomiting with a risk of aspiration and of chemical pneumonia, which may cause death. Direct contact with eyes or skin may cause their irritation and cause the affected area to turn red, swell and produce tears. Prolonged exposure of the skin to the substance may lead to ungreasing and crackles. The substance can trigger heritable genetic changes and cause or help cause cancer.

11.1.4. Interactive effects
There are no interactions for identified use.

11.2. Information on other hazards

The substance is not included in the candidate list pursuant to Article 59 (Paragraph 1) of the REACH Directive (due to the characteristics that can compromise endocrine activities or due to any other reason).

SECTION 12: ECOLOGICAL INFORMATION

12.1. Toxicity

Water environment	Fish	LC_{50} (96 h, fish) = 0,58-13,5 mg/l	OECD 203
	Invertebrates	EC_{50} (48 h, invertebrates) = 0,76-2,9 mg/l EC/LC50 (freshwater invertebrates) = 0,91 mg/l EC/LC50 (marine, invertebrates) = 1,4 mg/l	OECD 202
	Algae	ErL_{50} (72 h, algae) = 1,3 – 1,5 mg/l (WAF) EC50 (freshwater algae) = 1,3 mg/l EC10/LC10 nebo NOEC (freshwater algae) = 0,46 mg/l	OECD 201

Note: An explanation of the meaning of the LC_{50}, EC_{50} a ErC_{50} abbreviations is in section 16.

12.2. Persistence and degradability

Biological decomposability: it is not assumed that the product is easily biologically decomposable.

Abiotic degradability:

- hydrolysis as a function of pH: the product is unaffected by hydrolysis,
- photolysis: the product is unaffected by photolysis,
- atmospheric oxidation: quick decomposition through indirect photolysis in the air is assumed.

12.3. Bioaccumulative potential

Since the value of the n-octanol/water distribution coefficient (log Kow) specified for individual components falls within the range of 2.68 and 6.96, the values of the BCF (QSAR) bioconcentration factor were calculated. When using the US EPA model (2008), the calculated BCF values for the representative current components in this category fall within the range of 4 - 2010. When the Veith et al method is used (1979), the calculated BCF value for the representative current components in this category falls within the range of 4.9 – 552. The key value for assessing chemical safety is the median of the derived BCF (162 dimensionless). Based on the available information, there are no indications of a bioaccumulation potential. Secondary poisoning is thus considered irrelevant.

12.4. Mobility in soil

Determining this parameter with the use of standard method designed for simple substances is not suitable for a UVCB substance of the hydrocarbon. The PETRORISK model using relations between the hydrocarbon groups and their properties was used to assess the hazard to the environment.

12.5. Results of PBT and vPvB assessment

This UVCB hydrocarbon substance should not be compared according to the criteria in Annex XIII of EC regulation No 1907/2006 REACH as a whole. Thus an assessment of the contained components was carried out with a conclusion that the product does not fulfill the criteria for persistent, bioaccumulating and toxic substances or the criteria for very persistent and very bioaccumulating substances in accordance with Annex XIII of EC regulation No 1907/2006 REACH, and so is not identified as a PBT substance (Persistent, Bioaccumulative, Toxic) or a vPvB (very Persistent, very Bioaccumulative) substance.

12.6. Endocrine disrupting properties

The substance is not included in the candidate list pursuant to Article 59 (Paragraph 1) of the REACH Directive due to the characteristics that can compromise endocrine activities.

12.7. Other adverse effects

Pursuant to Appendix 1 of Act No. 254/2001Coll. (the Water Act), the product is considered a hazardous harmful substance.

SECTION 13: DISPOSAL CONSIDERATIONS

13.1. Waste treatment methods

If the remainder of the product is to be disposed (eg unused or leaked product), the valid European Union and national legislature as well as locally valid regulations have to be complied with. Deliver the waste for disposal

to a professionally qualified person /to facility with the appropriate authorization to manage waste.

Recommended waste classification pursuant to Regulation No. 8/2021 Coll., on the Waste Catalogue and on Assessing Waste Characteristics.

13.1.1. Catalogue number

Catalogue number for products that have become waste:

07 01 04* Other organic solvents, washing liquids and mother liquors.

16 03 05* Organic waste containing dangerous substances.

Catalogue number for leaked product absorbed into an absorption agent (e.g. vapex):

15 02 02* Absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances.

Catalogue number for soil contaminated by leaked product:

17 05 03* Soil and stones containing dangerous substances.

13.1.2. Recommended waste removal method

Deliver the unusable remainder of the product for disposal to a professionally qualified person with the appropriate authorization.

Recommended removal method: Energy utilization (burning)

13.1.3. Recommended methods of contaminated containers disposal

Not relevant. Product is not packed, it is transported through railroad cisterns.

13.1.4. Measures for limiting exposure when handling waste

Do not flush leaked product during an emergency event or accident into sewage. Proceed in accordance with instructions provided in Section 6 („Accidental release measures“) and in Subsection 8.2 („Limiting exposure“) and adhere to all valid legal regulations for the protection of people, air and water.

WARNING: *The stated information is of a recommendation character. It is related to the delivered, still unused material. Pursuant to the Waste Act, all responsibilities for managing the waste, including its assignment based on its type and category, are responsibilities of the waste originator.*

SECTION 14: TRANSPORT INFORMATION

The listed information applies to road transport (ADR) and rail (RID) transport of dangerous goods:

14.1. UN number or ID number: 3295

14.2. UN proper shipping name: HYDROCARBONS, LIQUID, N.O.S.

14.3. Transport hazard class(es): 3

14.4. Packing group: III

14.5. Environmental hazards: based on the criteria of the UN sample regulations, the product is harmful to the environment

14.6. Special precautions for user: none

14.7. Maritime transport in bulk according to IMO instruments: the product is not designated for bulk transport pursuant to the International Maritime Organization (IMO) documents

14.8. Other information

Hazard identification number: 30

Classification code: F1

Labels: 3 + label for substances endangering the environment (symbol: fish and tree)

SECTION 15: REGULATORY INFORMATION

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

15.1.1. European Union

Regulation of the European Parliament and Council (EC) No. 1907/2006 (REACH), as amended

REGISTRATION (TITLE II OF THE REACH REGULATION)

the product was fully registered as a substance

AUTORISATION (TITLE VII OF THE REACH REGULATION)

the product is not listed in the list of substances in Annex XIV of EC Regulation No 1907/2006 REACH, and so no licensing obligation applies

RESTRICTION (TITLE VIII OF THE REACH REGULATION)

annex XVII – point 3., point 5., point 28. and point 40. (the product shall not be used in aerosol dispensers for amusement and decorative purposes intended for sale to the public) - restrictions are met by determining identified uses

Regulation of the European Parliament and Council (EC) No. 1272/2008 (CLP), as amended

the product has been classified in compliance with the stated regulation, packaging and labeling obligations of dangerous chemicals only apply to the product if it is marketed in packaging subject to its labelling according to CLP regulation

Regulation of the European Parliament and Council (EC) No. 649/2012 on the export and import of dangerous chemicals, as amended

the product is not subject to special import or export restrictions

15.1.2. Czech Republic

Act No. 350/2011 Coll. on Chemical Substances and Chemical Mixtures, as amended

the product is not subject to the obligation of notification to the information system PCN (Poison centres notification)

Act No. 258/2000 Coll. on the Protection of Public Health, as amended

Act No. 254/2001 Coll., on Water, as amended

Act No. 201/2012 Coll., on Air Protection, as amended

Act No. 541/2020 Coll., on Waste, as amended

Decree of Ministry of Environment no. 8/2021 Coll. laying down Waste Catalogue, as amended

Governmental decree no. 361/2007 Coll., laying down occupational health and safety conditions

product components have exposure limits; the product is subject to the obligation to establish a controlled zone

Act no. 224/2015 Coll., on prevention of serious accidents caused by selected dangerous chemical substances or mixtures

15.2. Chemical safety assessment

Chemical safety assessment was performed. The substance fulfils the criteria for being classified as dangerous in accordance with EC Regulation No. 1272/2008 CLP. Exposure assessment and following risk characterization have been performed. Exposure scenarios pursuant to Article 31 of Directive of the European Parliament and Council (EC) No. 1907/2006 (REACH) form an appendix to the corresponding safety data sheet.

SECTION 16: OTHER INFORMATION

Changes adopted as a part of the revision process

12/01/2009:	Revision (2):	Editing information in the sections 1, 2, 3, 9, 11, 12, 14, 15 and 16
12/01/2010:	Revision (3):	Editing information in the sections 1 (registration number), 2 (classification and labeling according to CLP), 3, 9 and 16
08/01/2011:	Revision (4):	Complete revision of the document in relation to the updating of Annex II of Regulation (EC) No 1907/2006 REACH in accordance with Annex I of Commission Regulation (EU) No 453/2010
	01/01/2012 / 4(1):	Section 15.1.2 – updating legislation
	01/06/2012 / 4(2):	Section 1.1 - identifiers, Section 1.3 – update contact and Section 16 – abbreviations
	05/31/2015 / 4(3):	Section 1 (contact information), Section 2, Section 15.1 (update of legal regulations) and 16 (text deletion)

11/01/2016 / 4(4): Section 1 (contact information), Section 14 and 15 (editing in accordance with Regulation (EC) no. 830/2015), Section 15 (legislation update)
02/01/2018 / 4(5): Unification of SDS format after the ČeR merger into UNIPETROL RPA, including the editing of data in sections 1, 8, 9, 11, 12, 13 15 and 16
02/01/2021: Revision (5) – Overall modification of the document in relation to the update of Appendix II of Directive (EC) No. 1907/2006 REACH, by Directive of the Council (EC) No. 2020/878;
Data modifications in Sections 2, 4, 6, 7, 8.1.2, 9.1, 11 and 12, and of the exposure scenarios included in the appendix in relation to the CSR update;
Data modification in Sections 13 and 15 - update of the legal regulations;
Data modification in Section 1 – change of the business company name;
05/08/2024 / 5(1): Section 8.1. – workplace exposure limit values (updated according to legal regulations),

Acronyms and abbreviations used in the text

ADR	Agreement concerning the International Carriage of Dangerous Goods by Road
CAS	Registration number assigned to the substance by the Chemical Abstracts Service of the American Chemical Society
CLP	EU Directive No. 1272/2008 on Classification, Labeling and Packaging of chemical substances and mixtures, which is implemented into the European legislature by the means of GHS (United Nations´ Globally harmonized System) for classifying and labeling chemical substances
CMR	Carcinogenic, mutagenic or toxic for reproduction
ČSN EN (ISO)	European standard incorporated into the Czech technical standards
CSR	Chemical Safety Report
DMEL	Derived minimal effect level - an exposure level that corresponds to a low and possibly theoretical risk, which should be considered as an acceptable risk (for threshholdless effects, i.e. there is no exposure level without effect))
DNEL	Derived no-effect level - level of exposure derived from toxicological data that does not produce any adverse effects on human health
DW	Data waiving
EC_{50}	Effective concentration EC_{50} is the concentration of substance that causes immobilization of 50% of individuals
ErC_{50}	Effective concentration EC_{50} is the concentration of substance that causes 50 % decrease of Algea growth
ECHA	European Chemicals Agency
ES	Official number of the chemical substance in the European Union: EINECS from the European Inventory of Existing Commercial Substances, or ELINCS from the European List of Notified Chemical Substances, or NLP from the No Longer Polymer list
HSDB	Hazardous Substances Data Bank
IATA	International Air Transport Association
IBC	Intermediate Bulk Container
IC_{50}	Inhibition concentration IC_{50} that causes inhibition of 50% of individuals
ICAO	International Civil Aviation Organization
ICE	"Intervention in Chemical Transport Emergencies" system providing both professional and practical assistance in dealing with emergency situations related to the transport and storage of hazardous chemicals
IMDG	International Maritime Dangerous Goods
IMO	International Maritime Organisation
ISO	International Organization for Standardization
LC_{50}/LD_{50}	Lethal concentration/level is the concentration/level of substance that causes mortality of 50 % individuals
LOEC/LOEL	Lowest Observed Effect Concentration/Level
log Kow	Logarithm of distribution coefficient n-octanol/water
nf	Not feasible
NOAEC/NOAEL	No Observed Adverse Effect Concentration/No Observed Adverse Effect Level

NOEC/NOEL	No Observed Effect Concentration/No Observed Effect Level
NPK-P	The highest permitted concentration of the chemical substance in the air (the concentration of the substance that a worker may be exposed to for a maximum of 15 minutes but which must never be exceeded)
OECD	Organization for Economic Co-operation and Development
OOP	Recommended personal protective aids
OSN	United Nations
(Q)SAR	Quantitative Structure-Activity Relationship
PBT, vPvB	Persistent, bioaccumulative and toxic; high persistent and high bioaccumulative
PEL	Permitted exposure limit of the chemical substance in the air (the exposure value that an employee may be exposed to during the entire working shift (8 hours), without endangering his health during lifetime occupational exposure)
PNEC	Predicted No Effect Concentration
REACH	EU Directive No. 1907/2006 on Registration, Evaluation and Authorization of Chemicals
RID	Regulations concerning the International Carriage of Dangerous Goods by Rail
SDS	Safety Data Sheet
STOT	Specific Target Organ Toxicity
STP	Sewage treatment plant
su	Scientifically Unjustified
TRINS	Transport Information and Accident System of the Czech Republic, providing professional and practical assistance in dealing with emergency situations related to transport and storage of hazardous chemical substances, included in ICE
UACRON	Chemical database (The University of Akron).
UN	The four-digit identification number of the substance or object identifying hazardous material in international transport
UVCB	Substances of Unknown or Variable composition, Complex reaction products or Biological materials

Data sources used for preparing the material safety sheet

Annexes I, IV, VI and VII to Regulation (EC) No. 1272/2008 CLP, as amended;
Principles for providing first aid upon being exposed to chemical substances ;
Substance registration documentation pursuant to Regulation (EC) No. 1907/2006 REACH;
Decision of ECHA No SUB-D-2114147706-45-01/F on registration in accordance with EC Regulation No 1907/2006 REACH;
Research data sources (Hazardous Substances Data Bank HSDB, Sicherheitstechnische Kenndaten chemischer Stoffe SORBE, MedisAlarm, University of Akron Chemical UAKRON, Gestis sanitary limits);

Full text of H-/ EUH-sentences and abbreviations of hazard classes stated in Section 2 and/or 3

H 226	Flammable liquid and vapor.
H 302	Harmful if swallowed.
H 304	May be fatal if swallowed and enters airways.
H 315	Causes skin irritation.
H 319	Causes serious eye irritation.
H 332	Harmful if inhaled.
H 335	May cause respiratory irritation.
H 340	May cause genetic defects.
H 350	May cause cancer.
H 400	Very toxic to aquatic life.
H 410	Very toxic to aquatic life with long lasting effects.
H 411	Toxic to aquatic life with long lasting effects.

Acute Tox.	Acute toxicity
Aqauatic Chronic	Hazards to the aquatic environment, category Chronic toxicity
Aquatic Acute	Hazards to the aquatic environment, category Acute toxicity
Asp. Tox.	Aspiration hazard
Carc.	Carcinogenicity

Eye Irrit.	Eye irritation
Flam. Liq.	Flammable liquid
Muta	Germ cell mutagenicity
Skin Irrit.	Skin irritation
STOT SE	Specific target organ toxicity (single explosure)

Training instructions

Persons handling the product must be advised of the risks involved in handling the product and the health and environmental protection requirements (see applicable provisions of the Labor Code).

Access to information

Pursuant to Article 35 of Directive (EC) No. 1907/2006 REACH, every employer is obliged to allow access to the information stated on the given material safety sheet to all workers who use this product or are exposed to its impacts while working, and also to representatives of these workers.

Occupational exposure limit values for EU countries (see point 8.1.1)

data for Distillates (petroleum), cracked, ethylene manuf. by-product, C9-10 fraction (number CAS 94733-07-0)

Name	Country	8-hour limit [mg.m^{-3}]	Short-term limit [mg.m^{-3}]
Residues (petroleum), steam-cracked	European Union (Regulation No. 2000/39/EC as amended)	**Limit values for the substance itself have not been determine** *it is recommended to adhere to the limits determined for the components contained in the substance:*	
	Germany		
	Netherlands		
	Poland		
benzene / CAS 71-43-2	*European Union*	*1,65 / 0,66 [1] (skin)*	*not specified*
	Germany (AGS)	*1,9*	*15,2*
	Poland	*1.6*	*not specified*
	France	*3,25*	*not specified*
	Italy	*3,25*	*not specified*
	Sweden	*1,5*	*9*
ethylbenzene / CAS 100-41-4	*European Union*	*442 (skin)*	*884 (skin)*
	Germany (AGS)	*88 (skin)*	*176 (skin)*
	Poland	*200 (skin)*	*400 (skin)*
	France	*88,4*	*442*
	Italy	*442 (skin)*	*884 (skin)*
	Sweden	*220*	*884*
xylenes / CAS 1330-20-7	*European Union*	*221 (skin)*	*442 (skin)*
	Germany (AGS)	*220 (skin)*	*440 (skin)*
	Poland	*100 (skin)*	*200 (skin)*
	France	*221 (skin)*	*442 (skin)*
	Italy	*221 (skin)*	*442 (skin)*
	Sweden	*221*	*442*
naphthtalene / CAS 91-20-3	*European Union*	*not specified*	*not specified*
	Germany (AGS)	*2 (Inhalable fraction and vapour / skin)*	*8 (Inhalable fraction and vapour / skin)*
	Poland	*20*	*50*
	France	*50*	*not specified*
	Italy	*50*	*not specified*
	Sweden	*50*	*80*
methylstyrenes / CAS 25013-15-4	*European Union*	*not specified*	*not specified*
	Germany (AGC)	*490*	*980*
	France	*240*	*nestanoveno*
	Sweden	*50*	*150*
tetrahydronaphthtalene / CAS 119-64-2	*European Union*	*not specified*	*not specified*
	Germany (DFG)	*11 (Inhalable fraction and vapour)*	*11 (Inhalable fraction and vapour*

Name	Country	8-hour limit [mg.m^{-3}]	Short-term limit [mg.m^{-3}]
	Poland	*100*	*300*

8-hour limit: *Measured or calculated in relation to the 8-hour reference period as a timely weighted average*
Short-term limit: *Exposure limit value, which shall not be exceeded and which corresponds to a 15-minute period*

1) Limit value of 0.5 ppm (1.65 mg/m^3) from 5 April 2024 to 5 April 2026. Thereafter limit value of 0.2 ppm (0.66 mg/m^3).

Emergency telephone number for EU countries (see subsection 1.4)

National Centers	TELEFONE	LANGUAGE	Institution / website / email
Belgium	☎+070245245	German	http://www.poisoncentre.be Centre Antipoisons, c/o Hôpital Militaire Reine Astrid Rue Bruyn 1, 1120 Bruxelles
Czech Republic	☎+420/224-919293; 915402	Czech	http://www.tis-cz.cz Toxikologické informační středisko (TIS) Na bojišti 1, 120 00 Praha 2 e-mail: tis@vfn.cz
France – Orfila (INRS)	☎+33/0145425959	French	"Centres Antipoison et de Toxicovigilance (CapTv) Hôpital Fernand Widal" 200 rue du Faubourg Saint Denis 75010 PARIS viviane.damboise@lrb.aphp.fr
France - Angers	☎+33/241482121	French	http://www.centres-antipoison.net/angers/index.html
France - Bordeaux	☎+33/556964080	French	http://www.centres-antipoison.net/bordeaux/index.html
France - Lille	☎+33/0800595959	French	http://www.centres-antipoison.net/lille/index.html
France - Lyon	☎+33/472116911	French	http://www.centres-antipoison.net/lyon/index.html
France - Marseille	☎+33/491752525	French	http://www.centres-antipoison.net/marseille/index.html
France - Nancy	☎+33/383225050	French	http://www.centres-antipoison.net/nancy/index.html
France - Paris	☎+33/140054848	French	http://www.centres-antipoison.net/paris/index.html
France - Strasbourg	☎+33/388373737	French	http://www.centres-antipoison.net/strasbourg/index.html
France - Toulouse	☎+33/561777447	French	http://www.centres-antipoison.net/toulouse/index.html
Italy - Bergamo	☎+39/800883300	Italian	Istituto Superiore di sanitá – Preparati Pericolosi
Italy - Firenze	☎+39/0557947819	Italian	
Italy - Milano	☎+39/02-66101029	Italian	
Italy - Pavia	☎+39/0382-24444	Italian	
Italy - Napoli	☎+39/081-5453333	Italian	
Italy - Foggia	☎+39/800183459	Italian	
Italy - Verona	☎+39/800011858	Italian	
Italy - Roma	☎+39/06-49978000, ☎+39/06-3054343	Italian	
Hungary	☎+36/680201199, 36/0614766464	Hungarian	http://www.okbi.hu/page.php?trid=1&dz=103
Germany	☎+49/112, ☎+49/116117	German	
Germany - Berlin	☎+49/3019240	German	https://giftnotruf.charite.de
Germany - Bonn	☎+49/22819240	German	http://www.gizbonn.de/index.php?id=272
Germany - Erfurt	☎+49/361730730	German	https://www.ggiz-erfurt.de/home.html
Germany - Freiburg	☎+49/076119240	German	https://www.uniklinik-freiburg.de/giftberatung.html
Germany - Göttingen	☎+49/55119240	German	https://www.giz-nord.de/cms/index.php
Germany – Homburg/Saar	☎+49/684119240	German	http://www.uniklinikum-saarland.de/de/einrichtungen/kliniken_institute/kinder_und_jugendmedizin/informations_und_behandlungszentrum_fuer_vergiftungen_des_saarlandes
Germany – Mainz	☎+49/613119240	German	http://www.giftinfo.uni-mainz.de/index.php?id=24807
Germany - München	☎+49/8919240	German	http://www.toxinfo.med.tum.de
Netherlands	☎+31/302748888	Dutch	http://www.productnotification.nl/
Poland - Kraków	☎+48/124119999	Polish	http://www.oit.cm.uj.edu.pl
Poland – Gdansk	☎+48/586820404	Polish	http://www.pctox.pl/news.php
Poland – Poznaň	☎+48/618476946	Polish	http://www.raszeja.poznan.pl/oddzialy/oddzialtoksykologiczny

National Centers		TELEFONE	LANGUAGE	Institution / website / email
Poland - Warszawa		☎+48/607218174	Polish	okzit@burdpi.pol.pl
Austria		☎+43/14064343	German	Austrian Poison Information Centre (Vergiftungsinformationszentrale-VIZ)
Slovakia		☎+421/254652307	Slovak	http://www.ntic.sk
Spain		☎+34/915620420	Spanish	Servicio de Información Toxicológica (SIT) Instituto Nacional de Toxicología y Ciencias Forenses (INTCF) C/José Echegaray nº4, 28232 Las Rozas de Madrid Madrid sit@mju.es / intcf@justicia.es

Statement: *The material safety sheet has been prepared in compliance with Directive (EC) No. 1907/2006 REACH. It includes data that are necessary for securing occupational health and safety and the protection of the environment. These data have been provided in good faith, correspond to the current state of knowledge and experience and are in accordance with our valid legal regulations The data provided does not replace the quality specification and can not be considered as a guarantee of the suitability and usability of this product for a specific application. It is the responsibility of the product user to assess the accuracy of the information in a particular application where the product's properties can influence different factors. The consumer is responsible for compliance with the appropriate, regionally valid legal regulations.*

ANNEX OF MATERIAL SAFETY DATA SHEET

EXPOSURE SCENARIOS ACCORDING TO ARTICLE 31 OF REGULATION (EC) NO 1907/2006 (REACH) OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

The Annex contains exposure scenarios contained in **Chapter 9** of the chemical safety report dated 11/06/2019 (**numbering from it is maintained here below**) for identified uses of the substance processed by Chesar v3.4

Exposure scenario	**Title**	**pages**
ES1 (M)	Manufacture – Manufacture of substance (ECR 1)	26 - 38
ES2 (F)	Formulation or re-packing – Formulation (ECR 2)	39 - 52
ES6 (IS)	Use at industrial sites - Polymer Production (ECR 6c)	53 - 65
M - Manufacture, F - Formulation, IS - Industrial end use at site		

9.0.3. Introduction to the assessment for the environment

Table 9.2. Tonnage for assessment

Exposure scenario	**Title**	
ES1 (M)	Manufacture – Manufacture of substance	1.3E6
ES2 (F)	Formulation or re-packing – Formulation	3.3E5
ES6 (IS)	Use at industrial sites - Polymer Production (ECR 6c)	6.1E5
M - Manufacture, F - Formulation, IS - Industrial end use at site		

General section for environmental contributing scenarios ENV CS (for ES 1, 2, 6)

Assessments were performed by using the Petrorisk model based on the composition of the substance.
Assessment entity group (AEG) name: >0.1% Benzene and >0.1% DCPD (dicyclopentadiene)

Local Exposure and Risk Characterisation Results from PETRORISK

	local output Manufacture #1	local output Formulation #2	local output Polymer Production #6
Section 9 - Exposure Assessment	**9.1**	**9.2**	**9.6**
Regional Tonnage (T/yr)	1.3E+05	3.3E+04	6.1E+04
Fraction of regional tonnage used locally	1.0E+00	9.1E-01	2.5E-01
Local Site Tonnage (T/y)	1.3E+05	3.0E+04	1.5E+04
Site Tonnage (kg/d)	4.3E+05	1.0E+05	5.0E+04
Emission days (d/yr)	300	300	300
Release fraction (prior to RMM) - wastewater	4.4E-05	3.8E-05	1.9E-05
Release fraction (prior to RMM) - air	5.0E-02	2.5E-02	1.0E-02
Dilution Factor - Freshwater	40	40	10
Dilution Factor - Marine	100	100	100

On-site removal eff iciency - Air (%)	90	0	80
Risk-driving Compartment	oral/freshwater fish	oral/freshwater fish	oral/freshwater fish
Wastewater Treatment Required (Yes/No)	Yes	Yes	Yes
Required Removal Efficiency - wastewater (%)	94.6	94.6	94.6
Onsite Removal Efficiency - wastewater (%)	0.0	0.0	0.0
Offsite Removal Efficiency - wastewater (%)	95.1	95.1	95.1
Total Removal Efficiency - wastewater r (%)	95.1	95.1	95.1
Msafe (kg/d)	4.8E+05	1.1E+05	5.5E+04
Aquatic without Treatment (kg/d)	1.6E+01	3.4E+00	3.2E+00
Aquatic (with onsite and offsite treatment) (kg/d)	1.2E+01	2.6E+00	2.4E+00
Air (direct after on-site treatment) (kg/d)	1.8E+03	2.3E+03	3.4E+02
Environmental Exposure			
PEC effluent (mg/L)	7.9E-02	7.9E-02	2.0E-02
PEC sludge (mg/kg dw)	1.0E+02	1.0E+02	2.5E+01
PEC air (mg/m3)	5.1E-01	5.7E-01	2.3E-02
C air (mg/m3)	5.1E-01	5.7E-01	2.3E-02
PEC freshwater (mg/L)	2.0E-03	2.0E-03	2.0E-03
C freshwater (mg/L)	2.0E-03	2.0E-03	2.0E-03
PEC marine (mg/L)	7.9E-04	7.9E-04	2.0E-04
C marine (mg/L)	7.9E-04	7.9E-04	2.0E-04
PEC freshwater sediment (mg/kg w w)	1.4E-02	1.4E-02	1.4E-02
C freshwater sediment (mg/kg w w)	1.4E-02	1.4E-02	1.4E-02
PEC marine sediment (mg/kg w w)	5.6E-03	5.6E-03	1.4E-03
C marine sediment (mg/kg w w)	5.6E-03	5.6E-03	1.4E-03
PEC agricultural soil (mg/kg w w)	1.6E-03	1.9E-03	7.6E-05
C agricultural soil (mg/kg w w)	1.6E-03	1.9E-03	7.6E-05
PEC groundwater (mg/L)	3.7E-04	4.2E-04	1.7E-05
C groundwater (mg/L)	4.0E-08	4.0E-08	4.0E-08
PEC oral freshwater fish (mg/kg w w)	2.7E-02	2.7E-02	2.7E-02
PEC oral marine top predator (mg/kg w w)	8.0E-03	8.0E-03	8.0E-03
PEC oral worm (mg/kg w w)	1.3E-03	1.5E-03	6.2E-05
PEC oral Top Predator (mg/kg w w)	8.0E-03	8.0E-03	8.0E-03
Indirect Human Exposure			
PEC fish (mg/kg w w)	5.2E-02	5.2E-02	5.2E-02
C fish (mg/kg w w)	5.2E-02	5.2E-02	5.2E-02
PEC drinking water (mg/L)	1.2E-03	1.3E-03	8.5E-04
C drinking water (mg/L)	1.2E-03	1.3E-03	8.5E-04
PEC meat (mg/kg w w)	3.4E-03	4.0E-03	1.6E-04
C meat (mg/kg w w)	3.4E-03	4.0E-03	1.6E-04
PEC milk (mg/kg w w)	1.3E-03	1.5E-03	6.2E-05
C milk (mg/kg w w)	1.3E-03	1.5E-03	6.2E-05
PEC leaf (mg/kg w w)	1.5E-03	1.7E-03	7.1E-05
C leaf (mg/kg w w)	1.5E-03	1.7E-03	7.0E-05
PEC root (mg/kg w w)	2.4E-03	2.8E-03	1.1E-04
C root (mg/kg w w)	2.4E-03	2.8E-03	1.1E-04
Dose inhalation (ug/kg/d)	1.4E+02	1.6E+02	6.6E+00
Dose oral exposure - excl. inhalation (ug/kg/d)	5.1E-01	5.2E-01	1.1E-01
Fraction from water pathways	3.2E-03	2.7E-03	1.6E-02

	local output Manufacture #1	local output Formulation #2	local output Polymer Production #6
Section 10 - Risk Characterisation	**10.1**	**10.2**	**10.6**
PNEC oral (mg/kg w w)	3.0E-02	3.0E-02	3.0E-02
DNEL inhalation (ug/kg/d)	2.0E+02	2.0E+02	2.0E+02
DNEL oral exposure (ug/kg/d)	1.5E+04	1.5E+04	1.5E+04
Environmental Risk			
RCR effluent	1.1E-02	1.1E-02	2.7E-03
RCR freshwater	1.2E-02	1.2E-02	1.2E-02
RCR marine	4.6E-03	4.6E-03	1.2E-03
RCR freshwater sediment	1.5E-02	1.5E-02	1.5E-02
RCR marine sediment	6.0E-03	6.0E-03	1.5E-03
RCR oral freshwater fish	9.1E-01	9.1E-01	9.1E-01
RCR oral marine top predator	1.1E-01	1.1E-01	2.7E-02
RCR agricultural soil	4.8E-03	5.5E-03	2.2E-04
RCR worm oral	4.4E-02	5.1E-02	2.1E-03
RCR Top Predator	1.1E-01	1.1E-01	2.7E-02
Indirect Human Risk			
RCR inhalation	7.2E-01	8.3E-01	3.3E-02
RCR oral exposure - excluding inhalation	3.4E-05	3.5E-05	7.5E-06
RCR combined HI	7.2E-01	8.3E-01	3.3E-02
MaxRCR - Water-related compartments	9.1E-01	9.1E-01	9.1E-01
MaxRCR - Air-related compartments	7.2E-01	8.3E-01	3.3E-02
Max RCR - all compartments	9.1E-01	9.1E-01	9.1E-01

RMM *Risk Management Measure*
PEC *Predicted Environmental Concentration*
C *Concentration*
PNEC *Predicted no-effect concentrations*
DNEL *Derived No-Effect Level*
RCR *Risk Characterization Ratio*

The risk and exposure assessment was performed on the basis of the content of selected components benzene and DCPD (so-called hazard drivers) and their maximum possible content in the registered substance to cover the composition of all registrants of the substance. The content of benzene in the substance produced by ORLEN Unipetrol RPA is <0.5% and the content of DCPD in the substance produced by ORLEN Unipetrol RPA is <2%.

Regional Exposure and Risk Characterisation Results from PETRORISK

Compartment	Value
Emissions	
Aquatic with STP (kg/d)	2.6E+01
Air (direct + STP) (kg/d)	5.4E+03
Soil (direct only) (kg/d)	9.1E+01
Environmental Exposure	
PEC air (mg/m3)	3.3E-05
PECregional,FW (mg/L)	1.3E-06
PECregional,Fw sediment (mg/kg ww)	4.4E-06
PECregional,Marine (mg/L)	9.1E-09
PECregional,msd (mg/kg ww)	2.4E-08
PECregional,Agsoil (mg/kg ww)	1.8E-07
PECgrassland (Natural) (mg/kg ww)	9.9E-08
Indirect Human Exposure	
PECfish (mg/kg ww)	5.0E-05
PECdrinking water (mg/kg ww)	6.8E-07
PECroot (mg/kg ww)	3.9E-07
PECleaf (mg/kg ww)	7.8E-07
PECmeat (mg/kg ww)	2.3E-06
PECmilk (mg/kg ww)	7.3E-07
Dose inhalation (ug/kg/d)	9.5E-03
Dose oral exposure - excluding inhalation (ug/kg/d)	3.7E-04
Environmental Risk Characterisation	
RCR freshwater	1.1E-05
RCR freshwater sediment	4.8E-06
RCR marine	8.5E-08
RCR marine sediment	2.7E-08
RCR agricultural soil	7.5E-08
RCR grassland (Natural)	4.1E-08
Indirect Human Risk	
RCR inhalation	4.8E-05
RCR oral exposure - excluding inhalation	2.4E-08
combined RCR	4.8E-05

9.0.4. Introduction to the assessment for workers

9.0.4.1. Scope and type of assessment for workers

The scope of exposure assessment and type of risk characterisation required for workers are described in the following table based on the hazard conclusions presented in CSR section 5.11.

Table 9.3. Type of risk characterisation required for workers

Route	Type of effect	Assessment entity	Risk characterisation type	Hazard conclusion (CSR section 5.11)
Inhalation	Systemic effects - long term	Benzene	Semi-quantitative	Other toxicological threshold = 1.9 mg/m³
		DCPD	Quantitative	DNEL (Derived No Effect Level) = 2.31 mg/m³
	Systemic effects - acute	Benzene	Qualitative	High hazard (no threshold derived)
		DCPD	Not needed	No hazard identified
	Local effects - long term	Benzene	Not needed	No hazard identified
		DCPD	Quantitative	DNEL (Derived No Effect Level) = 2.31 mg/m³
	Local effects - acute	Benzene	Not needed	No hazard identified
		DCPD	Quantitative	DNEL (Derived No Effect Level) = 160.2 mg/m³
Dermal	Systemic effects - long term	Benzene	Qualitative	High hazard (no threshold derived)
		DCPD	Quantitative	DNEL (Derived No Effect Level) = 0.95 mg/kg bw/day
	Systemic effects - acute	Benzene	Qualitative	High hazard (no threshold derived)
		DCPD	Not needed	No hazard identified
	Local effects - long term	Benzene	Qualitative	Low hazard (no threshold derived)
		DCPD	Not needed	No hazard identified
	Local effects - acute	Benzene	Qualitative	Low hazard (no threshold derived)
		DCPD	Not needed	No hazard identified
Eye	Local effects	Benzene	Qualitative	Low hazard (no threshold derived)
		DCPD	Qualitative	Low hazard (no threshold derived)

General section for worker contributing scenarios Worker CS (for ES 1, 2, 6)

Assessment entity group (AEG) name: >0.1% Benzene and >0.1% DCPD (dicyclopentadiene)

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (20°C) used for the calculation is 1E4 Pa for Benzene.
The vapour pressure at operating temperature (20°C) used for the calculation is 186 Pa for DCPD.

Risk characterisation

Qualitative risk characterisation (Inhalation, systemic, long term, Inhalation, systemic, acute, Dermal, systemic, long term, Dermal, systemic, acute, Dermal, local, long-term, Dermal, local, acute, Eye, local):

If conditions of use stipulated for each activity are adhered to then safe use has been achieved.

The risk and exposure assessment was performed on the basis of the content of selected components benzene and DCPD (so-called hazard drivers) and their maximum possible content in the registered substance to cover the composition of all registrants of the substance. The content of benzene in the substance produced by ORLEN Unipetrol RPA is <0.5% and the content of DCPD in the substance produced by ORLEN Unipetrol RPA is <2%.

Operational conditions and Risk Management measures (conditions of use) common for all contribution scenarios CS	**Method**
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: *see specific ´Conditions of use´ for a particular CS*	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: *see specific ´Conditions of use´ for a particular CS*	TRA Workers 3.0
• Local exhaust ventilation: *see specific ´Conditions of use´ for a particular CS*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
General measures (eye irritants) [G44] Use suitable eye protection [PPE26]. Avoid direct eye contact with product, also via contamination on hands [E73].	
• Respiratory Protection: *see specific ´Conditions of use´ for a particular CS*	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *The condition is valid for most CSs, unless exceptionally otherwise stated in specific ´Conditions of use´ for a particular CS.*	TRA Workers 3.0
General measures (skin irritants) [G19]: Avoid direct skin contact with product. Identify potential areas for indirect skin contact. Wear gloves (tested to EN374) if hand contact with substance likely. Clean up contamination/spills as soon as they occur. Wash off any skin contamination immediately. Provide basic employee training to prevent / minimise exposures and to report any skin effects that may develop [E3].	
Other conditions affecting workers exposure	
• Operating temperature: <= 20.0 °C	TRA Workers 3.0
• Place of use: *see specific ´Conditions of use´ for a particular CS*	TRA Workers 3.0
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply	
General measures (carcinogens) [G18]: 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	

Operational conditions and Risk Management measures (conditions of use) common for all contribution scenarios CS	**Method**
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].	

INSTRUCTIONS FOR COMPLIANCE CHECK WITH THE EXPOSURE SCENARIO

Exposure estimates were conducted using the ECETOC TRA assessment method. If complying with the recommended risk management measures under the listed operating conditions, it is not expected that exposure could exceed the established DNEL/DMEL values.

Manufacturing processes do not present an unacceptable risk to the health of industrial workers if the exposures are controlled by appropriate operating conditions (eg task duration, use of ventilation) and risk management measures (eg personal protective equipment) of such a type, that the exposures do not exceed the established DNELs / DMELs. Where risk management measures / operational conditions have been modified, users must make sure that risks are controlled at least at equivalent levels.

9.1. Exposure scenario 1: Manufacture - Manufacture of substance

Environment contributing scenario(s):	
CS 1 Manufacture	ERC 1
Worker contributing scenario(s):	
CS 2 General exposures (closed systems) [CS15]; Indoor	PROC 1
CS 3 General exposures (closed systems) [CS15]; Outdoor	PROC 1
CS 4 General exposures (closed systems) [CS15]; LEV, Indoor	PROC 2
CS 5 General exposures (closed systems) [CS15]; LEV, Indoor	PROC 3
CS 6 General exposures (open systems) [CS16]; LEV, Indoor	PROC 4
CS 7 General exposures (open systems) [CS16]; RPE (APF 10), Indoor, 4hrs	PROC 4
CS 8 General exposures (open systems) [CS16]; RPE (APF 10), Outdoor, 1hr	PROC 4
CS 9 Process sampling [CS2]; LEV, Indoor	PROC 9
CS 10 Process sampling [CS2]; RPE (APF 10), Indoor, 1hr	PROC 9
CS 11 Process sampling [CS2]; RPE (APF 10), Outdoor, 1hr	PROC 9
CS 12 Laboratory activities [CS36]; LEV, Indoor	PROC 15
CS 13 Bulk transfers [CS14]. (closed systems) [CS107]; LEV, Indoor	PROC 8b
CS 14 Bulk transfers [CS14]. (open systems) [CS108]: LEV, Indoor	PROC 8b
CS 15 Bulk transfers [CS14]. (open systems) [CS108]; RPE (APF 10), Outdoor, 1hr	PROC 8b
CS 16 Equipment cleaning and maintenance [CS39]; LEV, Indoor	PROC 8a, PROC 28
CS 17 Storage [CS67]; Outdoor	PROC 1, PROC 2
CS 18 Storage [CS67]; Indoor	PROC 2, PROC 1

CS *Contribution scenario*
RPE *Respiratory Protection Equipment*
LEV *Local exhaust ventilation*

9.1.1. Environmental contributing scenario ENV CS 1: Manufacture (ERC1)

See Petrorisk modelling for the environmental compartment stated from page 19.

9.1.2. Worker CS 2: General exposures (closed systems) [CS15]; Indoor (PROC 1)

9.1.2.1. Conditions of use – specific to CS

	Method
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
• Closed process without likelihood of exposure *No specific measures identified [EI20]*.	
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.1.2.2. Exposure and risks for workers

Table 9.5. Exposure concentrations and risks for workers

Route of exposure and type of effects		Exposure concentration	Risk quantification
Inhalation, systemic, long term	Benzene	4.56E-3 mg/m³ (TRA Workers) Exposure/DMEL = 2.4E-3	Final RCR = 0.017 Exposure/DMEL = 0.017
	DCPD	0.039 mg/m³ (TRA Workers) RCR = 0.017	
Inhalation, systemic, acute	Benzene	0.018 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	0.039 mg/m³ (TRA Workers) RCR = 0.017	Final RCR = 0.017
Inhalation, local, acute	DCPD	0.154 mg/m³ (TRA Workers) RCR = 9.63E-4	Final RCR < 0.01
Dermal, systemic, long term	Benzene	6.8E-4 mg/kg bw/day (TRA Workers)	Final RCR < 0.01 Qualitative risk
	DCPD	3.4E-3 mg/kg bw/day (TRA Workers) RCR = 3.58E-3	
Dermal, local, long term	Benzene	1.98E-4 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	1.98E-4 mg/cm² (TRA Workers)	Qualitative risk
Combined routes, systemic, long-term			Final RCR = 0.02

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.1.3. Worker CS 3: General exposures (closed systems) [CS15]; Outdoor (PROC 1)

9.1.3.1. Conditions of use – specific to CS

	Method
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
• Closed process without likelihood of exposure *No specific measures identified [EI20]*.	
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Outdoor (this eliminates the General Ventilation condition)	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.1.3.2. Exposure and risks for workers

Table 9.6. Exposure concentrations and risks for workers

see Table 9.5. Exposure concentrations and risks for workers in Section 9.1.2.2

9.1.4. Worker CS 4: General exposures (closed systems) [CS15]; LEV, Indoor (PROC 2)

9.1.4.1. Conditions of use – specific to CS

	Method
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0

	Method
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Handle substance within a predominantly closed system provided with extract ventilation [E49].*	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.1.4.2. Exposure and risks for workers

Table 9.7. Exposure concentrations and risks for workers

Route of exposure and type of effects		**Exposure concentration**	**Risk quantification**
Inhalation, systemic, long term	Benzene	1.139 mg/m³ (TRA Workers) Exposure/DMEL = 0.6	Final RCR = 0.6 Exposure/DMEL = 0.6
	DCPD	0.386 mg/m³ (TRA Workers) RCR = 0.167	
Inhalation, systemic, acute	Benzene	4.556 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	0.386 mg/m³ (TRA Workers) RCR = 0.167	Final RCR = 0.167
Inhalation, local, acute	DCPD	1.542 mg/m³ (TRA Workers) RCR = 9.63E-3	Final RCR < 0.01
Dermal, systemic, long term	Benzene	0.027 mg/kg bw/day (TRA Workers)	Final RCR = 0.144 Qualitative risk
	DCPD	0.137 mg/kg bw/day (TRA Workers) RCR = 0.144	
Dermal, local, long term	Benzene	4E-3 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	4E-3 mg/cm² (TRA Workers)	Qualitative risk
Combined routes, systemic, long-term			Final RCR = 0.311

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.1.5. Worker CS 5: General exposures (closed systems) [CS15]; LEV, Indoor (PROC 3)

9.1.5.1. Conditions of use – specific to CS

	Method
• Duration of activity: <=4.0 h/day	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Handle substance within a predominantly closed system provided with extract ventilation [E49].*	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see "General part (for ESs 1,2,6)" from p. 23.

9.1.5.2. Exposure and risks for workers

Table 9.8. Exposure concentrations and risks for workers

Route of exposure and type of effects		Exposure concentration	Risk quantification
Inhalation, systemic, long term	Benzene	1.367 mg/m³ (TRA Workers) Exposure/DMEL = 0.719	Final RCR = 0.719 Exposure/DMEL = 0.719
	DCPD	0.694 mg/m³ (TRA Workers) RCR = 0.3	
Inhalation, systemic, acute	Benzene	9.113 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	0.694 mg/m³ (TRA Workers) RCR = 0.3	Final RCR = 0.3
Inhalation, local, acute	DCPD	4.627 mg/m³ (TRA Workers) RCR = 0.029	Final RCR = 0.029
Dermal, systemic, long term	Benzene	8.28E-3 mg/kg bw/day (TRA Workers)	Final RCR = 0.073 Qualitative risk
	DCPD	0.069 mg/kg bw/day (TRA Workers) RCR = 0.073	
Dermal, local, long term	Benzene	2.42E-3 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	2.42E-3 mg/cm² (TRA Workers)	Qualitative risk
Combined routes, systemic, long-term			Final RCR = 0.373

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.1.6. Worker CS 6: General exposures (open systems) [CS16]; LEV, Indoor (PROC 4)

9.1.6.1. Conditions of use – specific to CS

	Method
• Duration of activity: <= 1 h/day	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Provide extract ventilation to points where emissions occur [E54].*	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see "General part (for ESs 1,2,6)" from p. 23.

9.1.6.2. Exposure and risks for workers

Table 9.9. Exposure concentrations and risks for workers

Route of exposure and type of effects		Exposure concentration	Risk quantification
Inhalation, systemic, long term	Benzene	0.911 mg/m³ (TRA Workers) Exposure/DMEL = 0.48	Final RCR = 0.48 Exposure/DMEL =

Route of exposure and type of effects		Exposure concentration	Risk quantification
	DCPD	0.386 mg/m³ (TRA Workers) RCR = 0.167	0.48
Inhalation, systemic, acute	Benzene	18.22 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	0.386 mg/m³ (TRA Workers) RCR = 0.167	Final RCR = 0.167
Inhalation, local, acute	DCPD	7.712 mg/m³ (TRA Workers) RCR = 0.048	Final RCR = 0.048
Dermal, systemic, long term	Benzene	0.027 mg/kg bw/day (TRA Workers)	Final RCR = 0.722 Qualitative risk
	DCPD	0.686 mg/kg bw/day (TRA Workers) RCR = 0.722	
Dermal, local, long term	Benzene	4E-3 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	4E-3 mg/cm² (TRA Workers)	Qualitative risk
Combined routes, systemic, long-term			Final RCR = 0.889

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.1.7. Worker CS 7: General exposures (open systems) [CS16]; RPE (APF 10), Indoor, 4 hrs (PROC 4)

9.1.7.1. Conditions of use – specific to CS

	Method
• Duration of activity: <= 4 h/day	TRA Workers 3.0
• General ventilation: Enhanced general ventilation (5-10 air changes per hour) [Effectiveness Inhalation: 70%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
• Respiratory Protection: Yes (Respirator with APF of **10**) [Effectiveness Inhalation: 90%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.1.7.2. Exposure and risks for workers

Table 9.10. Exposure concentrations and risks for workers

Route of exposure and type of effects		Exposure concentration	Risk quantification
Inhalation, systemic, long term	Benzene	1.172 mg/m³ (TRA Workers) Exposure/DMEL = 0.617	Final RCR = 0.617 Exposure/DMEL = 0.617
	DCPD	0.496 mg/m³ (TRA Workers) RCR = 0.215	
Inhalation, systemic, acute	Benzene	7.811 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long	DCPD	0.496 mg/m³ (TRA Workers)	Final RCR = 0.215

Route of exposure and type of effects		Exposure concentration	Risk quantification
term		RCR = 0.215	
Inhalation, local, acute	DCPD	3.305 mg/m³ (TRA Workers) RCR = 0.021	Final RCR = 0.021
Dermal, systemic, long term	Benzene	0.082 mg/kg bw/day (TRA Workers)	Final RCR = 0.722 Qualitative risk
	DCPD	0.686 mg/kg bw/day (TRA Workers) RCR = 0.722	
Dermal, local, long term	Benzene	0.012 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	0.012 mg/cm² (TRA Workers)	Qualitative risk
Combined routes, systemic, long-term			Final RCR = 0.937

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.1.8. Worker CS 8: General exposures (open systems) [CS16]; RPE (APF 10), Outdoor, 1hr (PROC 4)

9.1.8.1. Conditions of use – specific to CS

	Method
• Duration of activity: <= 1 h/day	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
• Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%]	TRA Workers 3.0
• Place of use: Outdoor (this eliminates the General Ventilation condition)	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.1.8.2. Exposure and risks for workers

Table 9.11. Exposure concentrations and risks for workers

see Table 9.9. Exposure concentrations and risks for workers in Section 9.1.6.2

9.1.9. Worker CS 9: Process sampling [CS2]; LEV, Indoor (PROC 9)

9.1.9.1. Conditions of use – specific to CS

	Method
• Duration of activity: <= 1 h/day	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Ensure samples are under containment or extract ventilation [E76] or sample via a closed loop or other system to avoid exposure [E8]*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.1.9.2. Exposure and risks for workers

Table 9.12. Exposure concentrations and risks for workers

Route of exposure and type of effects		Exposure concentration	Risk quantification
Inhalation, systemic, long term	Benzene	1.823 mg/m³ (TRA Workers) Exposure/DMEL = 0.959	Final RCR = 0.959 Exposure/DMEL = 0.959
	DCPD	0.386 mg/m³ (TRA Workers) RCR = 0.167	
Inhalation, systemic, acute	Benzene	36.45 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	0.386 mg/m³ (TRA Workers) RCR = 0.167	Final RCR = 0.167
Inhalation, local, acute	DCPD	7.712 mg/m³ (TRA Workers) RCR = 0.048	Final RCR = 0.048
Dermal, systemic, long term	Benzene	0.027 mg/kg bw/day (TRA Workers)	Final RCR = 0.722 Qualitative risk
	DCPD	0.686 mg/kg bw/day (TRA Workers) RCR = 0.722	
Dermal, local, long term	Benzene	4E-3 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	4E-3 mg/cm² (TRA Workers)	Qualitative risk
Combined routes, systemic, long-term			Final RCR = 0.889

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.1.10. Worker CS 10: Process sampling [CS2]; RPE (APF 10), Indoor, 1hr (PROC 9)

9.1.10.1. Conditions of use – specific to CS

	Method
• Duration of activity: <= 1 h/day	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
• Respiratory protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.1.10.2. Exposure and risks for workers

Table 9.13. Exposure concentrations and risks for workers

see Table 9.12. Exposure concentrations and risks for workers in Section 9.1.9.2

9.1.11. Worker CS 11: Process sampling [CS2]; RPE (APF 10), Outdoor, 1hr (PROC 9)

9.1.11.1. Conditions of use – specific to CS

	Method
• Duration of activity: <= 1 h/day	TRA Workers 3.0

	Method
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
• Respiratory protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%]	TRA Workers 3.0
• Place of use: Outdoor (this eliminates the General ventilation condition)	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see "General part (for ESs 1,2,6)" from p. 23.

9.1.11.2. Exposure and risks for workers

Table 9.14. Exposure concentrations and risks for workers

see Table 9.12. Exposure concentrations and risks for workers in Section 9.1.9.2

9.1.12. Worker CS 12: Laboratory activities [CS36]; LEV, Indoor (PROC 15)

9.1.12.1. Conditions of use – specific to CS

	Method
• Duration of activity: <=4 h/day	TRA Workers 3.0
• Effectiveness of laboratory fume cupboards: Handle in a fume cupboard or under extract ventilation [E83] [Effectiveness Inhalation: 90%] Inhalation explanation: *Standards governing the safety and performance requirements for general purpose fume cupboards have been available since the 1980s (CEN, 2003). In essence, fume cupboards should be capable of providing capture effectiveness of 97+% provided that they are properly designed, manufactured, installed and maintained (Ahn et al, 2008).* *The phrase is consistent with the TRA ventilation effectiveness associated with PROC15 'with LEV': in practice, control effectiveness is likely to be higher. A value of 95% is applied for high volatility materials and gases reflecting the improved efficiencies experienced when handling these types of substance (Tseng et al, 2007).* ** 95% is applied for high volatility materials and gases*	
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%]	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see "General part (for ESs 1,2,6)" from p. 23.

9.1.12.2. Exposure and risks for workers

Table 9.15. Exposure concentrations and risks for workers

Route of exposure and type of effects		**Exposure concentration**	**Risk quantification**
Inhalation, systemic, long term	Benzene	1.367 mg/m³ (TRA Workers) Exposure/DMEL = 0.719	Final RCR = 0.719 Exposure/DMEL = 0.719
	DCPD	1.157 mg/m³ (TRA Workers) RCR = 0.501	
Inhalation, systemic, acute	Benzene	9.113 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	1.157 mg/m³ (TRA Workers) RCR = 0.501	Final RCR = 0.501

Route of exposure and type of effects		Exposure concentration	Risk quantification
Inhalation, local, acute	DCPD	7.712 mg/m³ (TRA Workers) RCR = 0.048	Final RCR = 0.048
Dermal, systemic, long term	Benzene	4.08E-3 mg/kg bw/day (TRA Workers)	Final RCR = 0.036 Qualitative risk
	DCPD	0.34 mg/kg bw/day (TRA Workers) RCR = 0.036	
Dermal, local, long term	Benzene	1.19E-3 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	1.19E-3 mg/cm² (TRA Workers)	Qualitative risk
Combined routes, systemic, long-term			Final RCR = 0.537

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.1.13. Worker CS 13: Bulk transfers [CS14]. (closed systems) [CS107]; LEV, Indoor (PROC 8b)

9.1.13.1. Conditions of use – specific to CS

	Method
• Duration of activity: <=1 h/day	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 95%, Dermal: 0%] *Ensure material transfers are under containment or extract ventilation [E66].*	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) with specific activity training) and (other) appropriate dermal protection [Effectiveness Dermal: 95%]	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.1.13.2. Exposure and risks for workers

Table 9.16. Exposure concentrations and risks for workers

Route of exposure and type of effects		Exposure concentration	Risk quantification
Inhalation, systemic, long term	Benzene	0.683 mg/m³ (TRA Workers) Exposure/DMEL = 0.36	Final RCR = 0.36 Exposure/DMEL = 0.36
	DCPD	0.193 mg/m³ (TRA Workers) RCR = 0.083	
Inhalation, systemic, acute	Benzene	13.66 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	0.193 mg/m³ (TRA Workers) RCR = 0.083	Final RCR = 0.083
Inhalation, local, acute	DCPD	3.856 mg/m³ (TRA Workers) RCR = 0.024	Final RCR = 0.024

Route of exposure and type of effects		Exposure concentration	Risk quantification
Dermal, systemic, long term	Benzene	0.027 mg/kg bw/day (TRA Workers)	Final RCR = 0.722 Qualitative risk
	DCPD	0.686 mg/kg bw/day (TRA Workers) RCR = 0.722	
Dermal, local, long term	Benzene	2E-3 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	2E-3 mg/cm² (TRA Workers)	Qualitative risk
Combined routes, systemic, long-term			Final RCR = 0.805

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.1.14. Worker CS 14: Bulk transfers [CS14]. (open systems) [CS108]; LEV, Indoor (PROC 8b)

9.1.14.1. Conditions of use – specific to CS

	Method
• Duration of activity: <=1 h/day	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 95%, Dermal: 0%] *Ensure material transfers are under containment or extract ventilation [E66].*	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) with specific activity training) and (other) appropriate dermal protection [Effectiveness Dermal: 95%]	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.1.14.2. Exposure and risks for workers

Table 9.17. Exposure concentrations and risks for workers

see Table 9.16. Exposure concentrations and risks for workers in Section 9.1.13.2.

9.1.15. Worker CS 15: Bulk transfers [CS14]. (open systems) [CS108]; RPE (APF 10), Outdoor, 1hr (PROC 8b)

9.1.15.1. Conditions of use – specific to CS

	Method
• Duration of activity: <=1 h/day	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) with specific activity training) and (other) appropriate dermal protection [Effectiveness Dermal: 95%]	TRA Workers 3.0
• Respiratory protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%]	TRA Workers 3.0
• Place of use: Outdoor (this eliminates the General ventilation condition)	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see "General part (for ESs 1,2,6)" from p. 23.

9.1.15.2. Exposure and risks for workers

Table 9.18. Exposure concentrations and risks for workers

Route of exposure and type of effects		Exposure concentration	Risk quantification
Inhalation, systemic, long term	Benzene	1.367 mg/m³ (TRA Workers) Exposure/DMEL = 0.719	Final RCR = 0.719 Exposure/DMEL = 0.719
	DCPD	0.386 mg/m³ (TRA Workers) RCR = 0.167	
Inhalation, systemic, acute	Benzene	27.33 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	0.386 mg/m³ (TRA Workers) RCR = 0.167	Final RCR = 0.167
Inhalation, local, acute	DCPD	7.712 mg/m³ (TRA Workers) RCR = 0.048	Final RCR = 0.048
Dermal, systemic, long term	Benzene	0.027 mg/kg bw/day (TRA Workers)	Final RCR = 0.722 Qualitative risk
	DCPD	0.686 mg/kg bw/day (TRA Workers) RCR = 0.722	
Dermal, local, long term	Benzene	2E-3 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	2E-3 mg/cm² (TRA Workers)	Qualitative risk
Combined routes, systemic, long-term			Final RCR = 0.888

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.1.16. Worker CS 16: Equipment cleaning and maintenance [CS39]; LEV, Indoor (PROC 8a, PROC 28)

9.1.16.1. Conditions of use – specific to CS

	Method
• Duration of activity: <=4 h/day	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *LEV has been added to equate to the SOP. Drain down and flush system prior to equipment break-in or maintenance [E55]*	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) with specific activity training) and (other) appropriate dermal protection [Effectiveness Dermal: 95%]	TRA Workers 3.0
• Respiratory protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see "General part (for ESs 1,2,6)" from p. 23.

9.1.16.2. Exposure and risks for workers

Table 9.19. Exposure concentrations and risks for workers

Route of exposure and type of effects		Exposure concentration	Risk quantification
Inhalation, systemic, long term	Benzene	0.683 mg/m³ (TRA Workers) Exposure/DMEL = 0.36	Final RCR = 0.36 Exposure/DMEL = 0.36
	DCPD	0.231 mg/m³ (TRA Workers) RCR = 0.1	
Inhalation, systemic, acute	Benzene	4.556 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	0.231 mg/m³ (TRA Workers) RCR = 0.1	Final RCR = 0.1
Inhalation, local, acute	DCPD	1.542 mg/m³ (TRA Workers) RCR = 9.63E-3	Final RCR < 0.01
Dermal, systemic, long term	Benzene	0.082 mg/kg bw/day (TRA Workers)	Final RCR = 0.722 Qualitative risk
	DCPD	0.686 mg/kg bw/day (TRA Workers) RCR = 0.722	
Dermal, local, long term	Benzene	6E-3 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	6E-3 mg/cm² (TRA Workers)	Qualitative risk
Combined routes, systemic, long-term			Final RCR = 0.822

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.1.17. Worker CS 17: Storage [CS67]; Outdoor (PROC 1, PROC 2)

9.1.17.1. Conditions of use – specific to CS

	Method
• Duration of activity: <=8 h/day	TRA Workers 3.0
• Closed process without likelihood of exposure *Store substance within a closed system [E84].*	
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Outdoor (this eliminates the General ventilation condition)	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.1.17.2. Exposure and risks for workers

Table 9.20. Exposure concentrations and risks for workers

see Table 9.5. Exposure concentrations and risks for workers in Section 9.1.2.2

9.1.18. Worker CS 18: Storage [CS67]; Indoor (PROC 2, PROC 1)

9.1.18.1. Conditions of use – specific to CS

	Method
• Duration of activity: <=1 h/day	TRA Workers 3.0
• Closed continuous process with occasional controlled exposure	

	Method
Store substance within a closed system [E84].	
• General ventilation: Enhanced general ventilation (5-10 air changes per hour) [Effectiveness Inhalation: 70%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.1.18.2. Exposure and risks for workers

Table 9.21. Exposure concentrations and risks for workers

Route of exposure and type of effects		**Exposure concentration**	**Risk quantification**
Inhalation, systemic, long term	Benzene	0.976 mg/m³ (TRA Workers) Exposure/DMEL = 0.514	Final RCR = 0.514 Exposure/DMEL = 0.514
	DCPD	0.331 mg/m³ (TRA Workers) RCR = 0.143	
Inhalation, systemic, acute	Benzene	19.52 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	0.331 mg/m³ (TRA Workers) RCR = 0.143	Final RCR = 0.143
Inhalation, local, acute	DCPD	6.61 mg/m³ (TRA Workers) RCR = 0.041	Final RCR = 0.041
Dermal, systemic, long term	Benzene	5.48E-3 mg/kg bw/day (TRA Workers)	Final RCR = 0.144 Qualitative risk
	DCPD	0.137 mg/kg bw/day (TRA Workers) RCR = 0.144	
Dermal, local, long term	Benzene	7.99E-4 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	7.99E-4 mg/cm² (TRA Workers)	Qualitative risk
Combined routes, systemic, long-term			Final RCR = 0.287

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.2. Exposure scenario 2: Formulation or re-packing - Formulation

Environment contributing scenario(s):	
CS 1 Formulation	ERC 2
Worker contributing scenario(s):	
CS 2 General exposures (closed systems) [CS15]; Indoor	PROC 1
CS 3 General exposures (closed systems) [CS15]; Outdoor	PROC 1
CS 4 General exposures (closed systems) [CS15]; Use in contained systems. With sample collection [CS56]; LEV, Indoor	PROC 2
CS 5 General exposures (closed systems) [CS15]; LEV, Indoor	PROC 3
CS 6 General exposures (open systems) [CS16]; LEV, Indoor , 1hr	PROC 4
CS 7 General exposures (open systems) [CS16]; RPE (APF 10), Indoor, 1hr	PROC 4
CS 8 Batch processes at elevated temperatures [CS136]. Use in contained batch processes [CS37]; LEV, Indoor	PROC 3
CS 9 Batch processes at elevated temperatures [CS136]. Use in contained batch processes [CS37]; RPE (APF 10), Indoor, 4hrs	PROC 3
CS 10 Process sampling [CS2]; Indoor, 0.25hr	PROC 9
CS 11 Laboratory activities [CS36]; LEV, Indoor	PROC 15
CS 12 Bulk transfers [CS14]. Dedicated facility [CS81]; LEV, Indoor	PROC 8b
CS 13 Bulk transfers [CS14]. Dedicated facility [CS81]; RPE (APF 10), Indoor, 1hr	PROC 8b
CS 14 Mixing operations (open systems) [CS30]; LEV, Indoor , 4hrs	PROC 5
CS 15 Manual [CS34]. Transfer from/pouring from containers [CS22]. Non-dedicated facility [CS82]; RPE (APF 10), Indoor, 4hrs	PROC 8a
CS 16 Drum/batch transfers [CS8]. Dedicated facility [CS81]; LEV, Indoor	PROC 8b
CS 17 Drum/batch transfers [CS8]. Dedicated facility [CS81]; RPE (APF 10), Indoor, 1hr	PROC 8b
CS 18 Production or preparation or articles by tabletting, compression, extrusion or pelletisation [CS100]; LEV, Indoor, 4hrs	PROC 14
CS 19 Drum and small package filling [CS6]; Enhanced General Ventilation (5-10 ACH), Indoor	PROC 9
CS 20 Drum and small package filling [CS6]; RPE (APF 10), Indoor, 1hr	PROC 9
CS 21 Equipment cleaning and maintenance [CS39]; RPE (APF 10), Indoor, 4hrs	PROC 8a, PROC 28
CS 22 Storage [CS67]; Outdoor	PROC 1, PROC 2
CS 23 Storage [CS67]; Indoor, 0.25hrs	PROC 2, PROC 1

9.2.1. Environmental contributing scenario ENV CS 1: Formulation (ERC 2)

See Petrorisk modelling for the environmental compartment stated from page 19.

9.2.2. Worker CS 2: General exposures (closed systems) [CS15]; Indoor (PROC 1)

9.2.2.1. Conditions of use – specific to CS

	Method
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
• Closed process without likelihood of exposure *No specific measures identified [EI20].*	
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.2.2.2. Exposure and risks for workers

Table 9.22. Exposure concentrations and risks for workers

see Table 9.5. Exposure concentrations and risks for workers in Section 9.1.2.2

9.2.3. Worker CS 3: General exposures (closed systems) [CS15]; Outdoor (PROC 1)

9.2.3.1. Conditions of use – specific to CS

	Method
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
• Closed process without likelihood of exposure *No specific measures identified [EI20].*	
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Outdoor (this eliminates the General Ventilation condition)	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.2.3.2. Exposure and risks for workers

Table 9.23. Exposure concentrations and risks for workers

see Table 9.5. Exposure concentrations and risks for workers in Section 9.1.2.2

9.2.4. Worker CS 4: General exposures (closed systems) [CS15]; Use in contained systems. With sample collection [CS56]; LEV, Indoor

9.2.4.1. Conditions of use – specific to CS

	Method
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Handle substance within a predominantly closed system provided with extract ventilation [E49].*	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.2.4.2. Exposure and risks for workers

Table 9.24. Exposure concentrations and risks for workers

see Table 9.7. Exposure concentrations and risks for workers in Section 9.1.4.2

9.2.5. Worker CS 5: General exposures (closed systems) [CS15]; LEV, Indoor (PROC 3)

9.2.5.1. Conditions of use – specific to CS

	Method
• Duration of activity: <=4.0 h/day	TRA Workers 3.0
• Closed batch process with occasional controlled exposure	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Handle substance within a predominantly closed system provided with extract ventilation [E49].*	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.2.5.2. Exposure and risks for workers

Table 9.25. Exposure concentrations and risks for workers

see Table 9.8. Exposure concentrations and risks for workers in Section 9.1.5.2

9.2.6. Worker CS 6: General exposures (open systems) [CS16]; LEV, Indoor 1h (PROC 4)

9.2.6.1. Conditions of use – specific to CS

	Method
• Duration of activity: <= 1 h/day	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Provide extract ventilation to points where emissions occur [E54].*	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.2.6.2. Exposure and risks for workers

Table 9.26. Exposure concentrations and risks for workers

see Table 9.9. Exposure concentrations and risks for workers in Section 9.1.6.2

9.2.7. Worker CS 7: General exposures (open systems) [CS16]; RPE (APF 10), Indoor 1h (PROC 4)

9.2.7.1. Conditions of use – specific to CS

	Method
• Duration of activity: <= 1 h/day	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
• Respiratory protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.2.7.2. Exposure and risks for workers

Table 9.27. Exposure concentrations and risks for workers

see Table 9.9. Exposure concentrations and risks for workers in Section 9.1.6.2

9.2.8. Worker CS 8: Batch processes at elevated temperatures [CS136]. Use in contained batch processes [CS37]; LEV, Indoor (PROC 3)

9.2.8.1. Conditions of use – specific to CS

	Method
• Duration of activity: <=4.0 h/day	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Formulate in enclosed or ventilated mixing vessels [E46]; Ensure material transfers are under containment or extract ventilation [E66].*	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.2.8.2. Exposure and risks for workers

Table 9.28. Exposure concentrations and risks for workers

see Table 9.8. Exposure concentrations and risks for workers in Section 9.1.5.2

9.2.9. Worker CS 9: Batch processes at elevated temperatures [CS136]. Use in contained batch processes [CS37]; RPE (APF 10), Indoor 4hrs (PROC 3)

9.2.9.1. Conditions of use – specific to CS

	Method
• Duration of activity: <=4.0 h/day	TRA Workers 3.0
• Closed batch process with occasional controlled exposure	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0

	Method
• Respiratory protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see "General part (for ESs 1,2,6)" from p. 23.

9.2.9.2. Exposure and risks for workers

Table 9.29. Exposure concentrations and risks for workers

see Table 9.8. Exposure concentrations and risks for workers in Section 9.1.5.2

9.2.10. Worker CS 10: Process sampling [CS2]; Indoor, 0.25hr (PROC 9)

9.2.10.1. Conditions of use – specific to CS

	Method
• Duration of activity: <= 0.25 h/day	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Ensure samples are under containment or extract ventilation [E76] or sample via a closed loop or other system to avoid exposure [E8]*	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see "General part (for ESs 1,2,6)" from p. 23.

9.2.10.2. Exposure and risks for workers

Table 9.30. Exposure concentrations and risks for workers

Route of exposure and type of effects		**Exposure concentration**	**Risk quantification**
Inhalation, systemic, long term	Benzene	0.911 mg/m³ (TRA Workers) Exposure/DMEL = 0.48	Final RCR = 0.48 Exposure/DMEL = 0.48
	DCPD	0.193 mg/m³ (TRA Workers) RCR = 0.083	
Inhalation, systemic, acute	Benzene	36.45 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	0.193 mg/m³ (TRA Workers) RCR = 0.083	Final RCR = 0.083
Inhalation, local, acute	DCPD	7.712 mg/m³ (TRA Workers) RCR = 0.048	Final RCR = 0.048
Dermal, systemic, long term	Benzene	0.014 mg/kg bw/day (TRA Workers)	Final RCR = 0.722 Qualitative risk
	DCPD	0.686 mg/kg bw/day (TRA Workers) RCR = 0.722	
Dermal, local, long term	Benzene	2E-3 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	2E-3 mg/cm² (TRA Workers)	Qualitative risk

Route of exposure and type of effects		**Exposure concentration**	**Risk quantification**
Combined routes, systemic, long-term			Final RCR = 0.806

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.2.11. Worker CS 11: Laboratory activities [CS36]; LEV, Indoor (PROC 15)

9.2.11.1. Conditions of use – specific to CS

	Method
• Duration of activity: <=4 h/day	TRA Workers 3.0
• Effectiveness of laboratory fume cupboards: Handle in a fume cupboard or under extract ventilation [E83] [Effectiveness Inhalation: 90%] Inhalation explanation: *Standards governing the safety and performance requirements for general purpose fume cupboards have been available since the 1980s (CEN, 2003). In essence, fume cupboards should be capable of providing capture effectiveness of 97+% provided that they are properly designed, manufactured, installed and maintained (Ahn et al, 2008).* *The phrase is consistent with the TRA ventilation effectiveness associated with PROC15 'with LEV': in practice, control effectiveness is likely to be higher. A value of 95% is applied for high volatility materials and gases reflecting the improved efficiencies experienced when handling these types of substance (Tseng et al, 2007).* ** 95% is applied for high volatility materials and gases*	
• General ventilation: Enhanced general ventilation (5-10 air changes per hour) [Effectiveness Inhalation: 70%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%]	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see "General part (for ESs 1,2,6)" from p. 23.

9.2.11.2. Exposure and risks for workers

Table 9.31. Exposure concentrations and risks for workers

Route of exposure and type of effects		**Exposure concentration**	**Risk quantification**
Inhalation, systemic, long term	Benzene	0.586 mg/m³ (TRA Workers) Exposure/DMEL = 0.308	Final RCR = 0.308 Exposure/DMEL = 0.308
	DCPD	0.496 mg/m³ (TRA Workers) RCR = 0.215	
Inhalation, systemic, acute	Benzene	3.905 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	0.496 mg/m³ (TRA Workers) RCR = 0.215	Final RCR = 0.215
Inhalation, local, acute	DCPD	3.305 mg/m³ (TRA Workers) RCR = 0.021	Final RCR = 0.021
Dermal, systemic, long term	Benzene	4.08E-3 mg/kg bw/day (TRA Workers)	Final RCR = 0.036 Qualitative risk

Route of exposure and type of effects		Exposure concentration	Risk quantification
	DCPD	0.34 mg/kg bw/day (TRA Workers) RCR = 0.036	
Dermal, local, long term	Benzene	1.19E-3 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	1.19E-3 mg/cm² (TRA Workers)	Qualitative risk
Combined routes, systemic, long-term			Final RCR = 0.25

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.2.12. Worker CS 12: Bulk transfers [CS14]. Dedicated facility [CS81]; LEV, Indoor (PROC 8b)

9.2.12.1. Conditions of use – specific to CS

	Method
• Duration of activity: <=1 h/day	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 95%, Dermal: 0%] Ensure material transfers are under containment or extract ventilation [E66].	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) with specific activity training) and (other) appropriate dermal protection [Effectiveness Dermal: 95%]	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.2.12.2. Exposure and risks for workers

Table 9.32. Exposure concentrations and risks for workers

see Table 9.16. Exposure concentrations and risks for workers in Section 9.1.13.2

9.2.13. Worker CS 13: Bulk transfers [CS14]. Dedicated facility [CS81]; RPE (APF 10), Indoor, 1h (PROC 8b)

9.2.13.1. Conditions of use – specific to CS

	Method
• Duration of activity: <=1 h/day	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) with specific activity training) and (other) appropriate dermal protection [Effectiveness Dermal: 95%]	TRA Workers 3.0
• Respiratory protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%]	TRA Workers 3.0

	Method
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see "General part (for ESs 1,2,6)" from p. 23.

9.2.13.2. Exposure and risks for workers

Table 9.33. Exposure concentrations and risks for workers

see Table 9.18. Exposure concentrations and risks for workers in Section 9.1.15.2

9.2.14. Worker CS 14: Mixing operations (open systems) [CS30]; LEV, Indoor, 4hrs (PROC 5)

9.2.14.1. Conditions of use – specific to CS

	Method
• Duration of activity: <=4 h/day	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Provide extract ventilation to points where emissions occur [E54].*	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Respiratory protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) with specific activity training) and (other) appropriate dermal protection [Effectiveness Dermal: 95%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see "General part (for ESs 1,2,6)" from p. 23.

9.2.14.2. Exposure and risks for workers

Table 9.34. Exposure concentrations and risks for workers

Route of exposure and type of effects		**Exposure concentration**	**Risk quantification**
Inhalation, systemic, long term	Benzene	0.683 mg/m³ (TRA Workers) Exposure/DMEL = 0.36	Final RCR = 0.36 Exposure/DMEL = 0.36
	DCPD	0.116 mg/m³ (TRA Workers) RCR = 0.05	
Inhalation, systemic, acute	Benzene	4.556 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	0.116 mg/m³ (TRA Workers) RCR = 0.05	Final RCR = 0.05
Inhalation, local, acute	DCPD	0.771 mg/m³ (TRA Workers) RCR = 4.81E-3	Final RCR < 0.01
Dermal, systemic, long term	Benzene	0.082 mg/kg bw/day (TRA Workers)	Final RCR = 0.722 Qualitative risk
	DCPD	0.686 mg/kg bw/day (TRA Workers) RCR = 0.722	
Dermal, local, long term	Benzene	0.012 mg/cm² (TRA Workers)	Qualitative risk

Route of exposure and type of effects		**Exposure concentration**	**Risk quantification**
Dermal, local, acute	Benzene	0.012 mg/cm² (TRA Workers)	Qualitative risk
Combined routes, systemic, long-term			Final RCR = 0.772

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.2.15. Worker CS 15: Manual [CS34]. Transfer from/pouring from containers [CS22]. Non-dedicated facility [CS82]; RPE (APF 10), Indoor, 4hrs (PROC 8a)

9.2.15.1. Conditions of use – specific to CS

	Method
• Duration of activity: <=4 h/day	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Provide extract ventilation to points where emissions occur [E54].*	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) with specific activity training) and (other) appropriate dermal protection [Effectiveness Dermal: 95%]	TRA Workers 3.0
• Respiratory protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.2.15.2. Exposure and risks for workers

Table 9.35. Exposure concentrations and risks for workers

see Table 9.19. Exposure concentrations and risks for workers in Section 9.1.16.2

9.2.16. Worker CS 16: Drum/batch transfers [CS8]. Dedicated facility [CS81]; LEV, Indoor (PROC 8b)

9.2.16.1. Conditions of use – specific to CS

	Method
• Duration of activity: <=1 h/day	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 95%, Dermal: 0%] *Provide extract ventilation to points where emissions occur [E54].*	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) with specific activity training) and (other) appropriate dermal protection [Effectiveness Dermal: 95%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.2.16.2. Exposure and risks for workers

Table 9.36. Exposure concentrations and risks for workers

see Table 9.16. Exposure concentrations and risks for workers in Section 9.1.13.2

9.2.17. Worker CS 17: Drum/batch transfers [CS8]. Dedicated facility [CS81]; RPE (APF 10), Indoor, 1h (PROC 8b)

9.2.17.1. Conditions of use – specific to CS

	Method
• Duration of activity: <=1 h/day	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
• Respiratory protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) with specific activity training) and (other) appropriate dermal protection [Effectiveness Dermal: 95%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.2.17.2. Exposure and risks for workers

Table 9.37. Exposure concentrations and risks for workers

see Table 9.18. Exposure concentrations and risks for workers in Section 9.1.15.2

9.2.18. Worker CS 18: Production or preparation or articles by tabletting, compression, extrusion or pelletisation [CS100]; LEV, Indoor, 4hrs (PROC 14)

9.2.18.1. Conditions of use – specific to CS

	Method
• Duration of activity: <=4 h/day	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Handle substance within a predominantly closed system provided with extract ventilation [E49]*	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Respiratory protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.2.18.2. Exposure and risks for workers

Table 9.38. Exposure concentrations and risks for workers

Route of exposure and type of effects		**Exposure concentration**	**Risk quantification**
Inhalation, systemic, long term	Benzene	0.683 mg/m³ (TRA Workers) Exposure/DMEL = 0.36	Final RCR = 0.36 Exposure/DMEL =

Route of exposure and type of effects		Exposure concentration	Risk quantification
	DCPD	0.116 mg/m³ (TRA Workers) RCR = 0.05	0.36
Inhalation, systemic, acute	Benzene	4.556 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	0.116 mg/m³ (TRA Workers) RCR = 0.05	Final RCR = 0.05
Inhalation, local, acute	DCPD	0.771 mg/m³ (TRA Workers) RCR = 4.81E-3	Final RCR < 0.01
Dermal, systemic, long term	Benzene	0.041 mg/kg bw/day (TRA Workers)	Final RCR = 0.361 Qualitative risk
	DCPD	0.343 mg/kg bw/day (TRA Workers) RCR = 0.361	
Dermal, local, long term	Benzene	6E-3 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	6E-3 mg/cm² (TRA Workers)	Qualitative risk
Combined routes, systemic, long-term			Final RCR = 0.411

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.2.19. Worker CS 19: Drum and small package filling [CS6]; Enhanced General Ventilation (5-10 ACH), Indoor (PROC 9)

9.2.19.1. Conditions of use – specific to CS

	Method
• Duration of activity: <=1 h/day	TRA Workers 3.0
• General ventilation: Enhanced general ventilation (5-10 air changes per hour) [Effectiveness Inhalation: 70%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%]	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.2.19.2. Exposure and risks for workers

Table 9.39. Exposure concentrations and risks for workers

Route of exposure and type of effects		Exposure concentration	Risk quantification
Inhalation, systemic, long term	Benzene	0.781 mg/m³ (TRA Workers) Exposure/DMEL = 0.411	Final RCR = 0.411 Exposure/DMEL = 0.411
	DCPD	0.165 mg/m³ (TRA Workers) RCR = 0.072	
Inhalation, systemic, acute	Benzene	15.62 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	0.165 mg/m³ (TRA Workers) RCR = 0.072	Final RCR = 0.072

Route of exposure and type of effects		Exposure concentration	Risk quantification
Inhalation, local, acute	DCPD	3.305 mg/m³ (TRA Workers) RCR = 0.021	Final RCR = 0.021
Dermal, systemic, long term	Benzene	0.027 mg/kg bw/day (TRA Workers)	Final RCR = 0.722 Qualitative risk
	DCPD	0.686 mg/kg bw/day (TRA Workers) RCR = 0.722	
Dermal, local, long term	Benzene	4E-3 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	4E-3 mg/cm² (TRA Workers)	Qualitative risk
Combined routes, systemic, long-term			Final RCR = 0.794

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.2.20. Worker CS 20: Drum and small package filling [CS6]; RPE (APF 10), Indoor, 1h (PROC 9)

9.2.20.1. Conditions of use – specific to CS

	Method
• Duration of activity: <=1 h/day	TRA Workers 3.0
• General ventilation: Enhanced general ventilation (5-10 air changes per hour) [Effectiveness Inhalation: 70%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
• Respiratory protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.2.20.2. Exposure and risks for workers

Table 9.40. Exposure concentrations and risks for workers

see Table 9.39. Exposure concentrations and risks for workers in Section 9.2.19.2

9.2.21. Worker CS 21: Equipment cleaning and maintenance [CS39]; RPE (APF 10), Indoor, 4hrs (PROC 8a, PROC 28)

9.2.21.1. Conditions of use – specific to CS

	Method
• Duration of activity: <=4 h/day	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *LEV has been added to equate to the SOP. Drain down and flush system prior to equipment break-in or maintenance [E55]*	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Respiratory protection:Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) with specific activity training) and (other) appropriate dermal protection [Effectiveness	TRA Workers 3.0

	Method
Dermal: 95%]	
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see "General part (for ESs 1,2,6)" from p. 23.

9.2.21.2. Exposure and risks for workers

Table 9.41. Exposure concentrations and risks for workers

see Table 9.19. Exposure concentrations and risks for workers in Section 9.1.16.2 (or Tab. 9.35 in 9.2.15.2)

9.2.22. Worker CS 22: Storage [CS67]; Outdoor (PROC 1, PROC 2)

9.2.22.1. Conditions of use – specific to CS

	Method
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Outdoor (this eliminates the General Ventilation condition)	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see "General part (for ESs 1,2,6)" from p. 23.

9.2.22.2. Exposure and risks for workers

Table 9.42. Exposure concentrations and risks for workers

see Table 9.5. Exposure concentrations and risks for workers in Section 9.1.2.2 (or Tab. 9.22.in 9.1.2.2)

9.2.23. Worker CS 23: Storage [CS67]; Indoor, 0.25hrs (PROC 2, PROC 1)

9.2.23.1. Conditions of use – specific to CS

	Method
• Duration of activity: <= 0.25 h/day	TRA Workers 3.0
• Closed continuous process with occasional controlled exposure	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see "General part (for ESs 1,2,6)" from p. 23.

9.2.23.2. Exposure and risks for workers

Table 9.43. Exposure concentrations and risks for workers

Route of exposure and type of effects		**Exposure concentration**	**Risk quantification**
Inhalační, systémová, chronická	Benzen	1.139 mg/m³ (TRA Workers) Expozice/DMEL = 0.6	Celkové RCR = 0.6 Expozice/DMEL = 0.6
	DCPD	0.386 mg/m³ (TRA Workers) RCR = 0.167	
Inhalační, systémová, akutní	Benzen	45.56 mg/m³ (TRA Workers)	Kvalitativní riziko

Route of exposure and type of effects		**Exposure concentration**	**Risk quantification**
Inhalační, lokální, chronická	DCPD	0.386 mg/m³ (TRA Workers) RCR = 0.167	Celkové RCR = 0.167
Inhalační, lokální, akutní	DCPD	15.42 mg/m³ (TRA Workers) RCR = 0.096	Celkové RCR = 0.096
Dermální, systémová, chronická	Benzen	2.74E-3 mg/kg bw/den (TRA Workers)	Celkové RCR = 0.144 Kvalitativní riziko
	DCPD	0.137 mg/kg bw/den (TRA Workers) RCR = 0.144	
Dermální, lokální, chronická	Benzen	4E-4 mg/cm² (TRA Workers)	Kvalitativní riziko
Dermální, lokální, akutní	Benzen	4E-4 mg/cm² (TRA Workers)	Kvalitativní riziko
Kombinovaná, systémová, chronická			Celkové RCR = 0.311

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.6. Exposure scenario 6: Use at industrial sites - Polymer Production

Environment contributing scenario(s):	
CS 1 Polymer Production	ERC 6c
Worker contributing scenario(s):	
CS 2 General exposures (closed systems) [CS15]. Continuous process [CS54]. No sampling [CS57]; Indoor	PROC 1
CS 3 Bulk transfers [CS14]. Transport [CS58]. With sample collection [CS56]; LEV, Indoor	PROC 8b
CS 4 Polymerisation (bulk and batch) [CS65]. Continuous process [CS54]. With sample collection [CS56]; Outdoor, 4hrs	PROC 2
CS 5 Polymerisation (bulk and batch) [CS65]. Batch process [CS55]. With sample collection [CS56]; Outdoor, 1hr	PROC 3
CS 6 Polymerisation (bulk and batch) [CS65]. Batch process [CS55]. With sample collection [CS56]. Elevated Temperature; LEV, Indoor	PROC 3
CS 7 Finishing operations [CS102]. Batch process [CS55]. With sample collection [CS56]; Outdoor, 1hr	PROC 3
CS 8 Intermediate polymer storage [CS66]; 5%, LEV	PROC 4
CS 9 Additivation and stabilisation [CS69]; 5%, LEV	PROC 3
CS 10 Mixing in containers [CS23]. Batch process [CS55]; 5%, LEV	PROC 5
CS 11 Pelletizing [CS53]. Extrusion and masterbatching [CS88]; 5%, LEV	PROC 6
CS 12 Pelletizing [CS53]; 5%, LEV	PROC 14
CS 13 Pelletisation and pellet screening [CS68]. (open systems) [CS108]. Rework of articles [CS86]; 5%, LEV	PROC 8b, PROC 21
CS 14 Bulk transfers [CS14]. Continuous process [CS54]. With sample collection [CS56]; 5%, LEV	PROC 3
CS 15 Transport [CS58]. With sample collection [CS56]; 5%, LEV	PROC 8b
CS 16 Equipment maintenance [CS5]; LEV	PROC 8a, PROC 28
CS 17 Storage [CS67]. With occasional controlled exposure [CS137]; 5%, 1hr	PROC 2, PROC 1

9.6.1. Environmental contributing scenario ENV CS 1: Polymer Production (ERC 6c)

See Petrorisk modelling for the environmental compartment stated from page 19.

9.6.2. Worker CS 2: General exposures (closed systems) [CS15]. Continuous process [CS54]. No sampling [CS57]; Indoor (PROC 1)

9.6.2.1. Conditions of use – specific to CS

	Method
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
• Closed process without likelihood of exposure *No specific measures identified [EI20].*	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.6.2.2. Exposure and risks for workers

Table 9.99. Exposure concentrations and risks for workers

see Table 9.5. Exposure concentrations and risks for workers in Section 9.1.2.2

9.6.3. Worker CS 3: Bulk transfers [CS14]. Transport [CS58]. With sample collection [CS56]; LEV, Indoor (PROC 8b)

9.6.3.1. Conditions of use – specific to CS

	Method
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
• General ventilation: Enhanced general ventilation (5-10 air changes per hour) [Effectiveness Inhalation: 70%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 95%, Dermal: 0%]	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with specific activity training) and (other) appropriate dermal protection [Effectiveness Dermal: 95%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.6.3.2. Exposure and risks for workers

Table 9.100. Exposure concentrations and risks for workers

Route of exposure and type of effects		**Exposure concentration**	**Risk quantification**
Inhalation, systemic, long term	Benzene	1.465 mg/m³ (TRA Workers) Exposure/DMEL = 0.771	Final RCR = 0.771 Exposure/DMEL = 0.771
	DCPD	0.413 mg/m³ (TRA Workers) RCR = 0.179	
Inhalation, systemic, acute	Benzene	5.858 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long	DCPD	0.413 mg/m³ (TRA Workers)	Final RCR = 0.179

Route of exposure and type of effects		Exposure concentration	Risk quantification
term		RCR = 0.179	
Inhalation, local, acute	DCPD	1.653 mg/m³ (TRA Workers) RCR = 0.01	Final RCR = 0.01
Dermal, systemic, long term	Benzene	0.137 mg/kg bw/day (TRA Workers)	Final RCR = 0.722 Qualitative risk
	DCPD	0.686 mg/kg bw/day (TRA Workers) RCR = 0.722	
Dermal, local, long term	Benzene	1E-2 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	1E-2 mg/cm² (TRA Workers)	Qualitative risk
Combined routes, systemic, long-term			Final RCR = 0.9

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.6.4. Worker CS 4: Polymerisation (bulk and batch) [CS65]. Continuous process [CS54]. With sample collection [CS56]; Outdoor, 4hrs (PROC 2)

9.6.4.1. Conditions of use – specific to CS

	Method
• Duration of activity: <= 4.0 h/day	TRA Workers 3.0
• Closed continuous process with occasional controlled exposure	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
• Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%]	TRA Workers 3.0
• Place of use: Outdoor (this eliminates the General Ventilation condition)	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.6.4.2. Exposure and risks for workers

Table 9.101. Exposure concentrations and risks for workers

Route of exposure and type of effects		Exposure concentration	Risk quantification
Inhalation, systemic, long term	Benzene	0.683 mg/m³ (TRA Workers) Exposure/DMEL = 0.36	Final RCR = 0.36 Exposure/DMEL = 0.36
	DCPD	0.231 mg/m³ (TRA Workers) RCR = 0.1	
Inhalation, systemic, acute	Benzene	4.556 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	0.231 mg/m³ (TRA Workers) RCR = 0.1	Final RCR = 0.1
Inhalation, local, acute	DCPD	1.542 mg/m³ (TRA Workers) RCR = 9.63E-3	Final RCR < 0.01
Dermal, systemic, long term	Benzene	0.016 mg/kg bw/day (TRA Workers)	Final RCR = 0.144 Qualitative risk

Route of exposure and type of effects		Exposure concentration	Risk quantification
	DCPD	0.137 mg/kg bw/day (TRA Workers) RCR = 0.144	
Dermal, local, long term	Benzene	2.4E-3 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	2.4E-3 mg/cm² (TRA Workers)	Qualitative risk
Combined routes, systemic, long-term			Final RCR = 0.244

9.6.5. Worke RCR = Risk Characterization Ratio (RCR <1 safe use)

9.6.5 Worker CS 5: Polymerisation (bulk and batch) [CS65]. Batch process [CS55]. With sample collection [CS56]; Outdoor, 1hr (PROC 3)

9.6.5.1. Conditions of use – specific to CS

	Method
• Duration of activity: <= 1.0 h/day	TRA Workers 3.0
• Closed batch process with occasional controlled exposure	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
• Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%]	TRA Workers 3.0
• Place of use: Outdoor (this eliminates the General Ventilation condition)	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.6.5.2. Exposure and risks for workers

Table 9.102. Exposure concentrations and risks for workers

Route of exposure and type of effects		Exposure concentration	Risk quantification
Inhalation, systemic, long term	Benzene	0.456 mg/m³ (TRA Workers) Exposure/DMEL = 0.24	Final RCR = 0.24 Exposure/DMEL = 0.24
	DCPD	0.231 mg/m³ (TRA Workers) RCR = 0.1	
Inhalation, systemic, acute	Benzene	9.113 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	0.231 mg/m³ (TRA Workers) RCR = 0.1	Final RCR = 0.1
Inhalation, local, acute	DCPD	4.627 mg/m³ (TRA Workers) RCR = 0.029	Final RCR = 0.029
Dermal, systemic, long term	Benzene	2.76E-3 mg/kg bw/day (TRA Workers)	Final RCR = 0.073 Qualitative risk
	DCPD	0.069 mg/kg bw/day (TRA Workers) RCR = 0.073	
Dermal, local, long term	Benzene	8.05E-4 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	8.05E-4 mg/cm² (TRA Workers)	Qualitative risk
Combined routes,			Final RCR = 0.173

Route of exposure and type of effects		Exposure concentration	Risk quantification
systemic, long-term			

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.6.6. Worker CS 6: Polymerisation (bulk and batch) [CS65]. Batch process [CS55]. With sample collection [CS56]; Elevated Temperature; LEV, Indoor (PROC 3)

9.6.6.1. Conditions of use – specific to CS

	Method
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
• Closed batch process with occasional controlled exposure	TRA Workers 3.0
• General ventilation: Enhanced general ventilation (5-10 air changes per hour) [Effectiveness Inhalation: 70%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%]	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.6.6.2. Exposure and risks for workers

Table 9.103. Exposure concentrations and risks for workers

Route of exposure and type of effects		Exposure concentration	Risk quantification
Inhalation, systemic, long term	Benzene	0.976 mg/m³ (TRA Workers) Exposure/DMEL = 0.514	Final RCR = 0.514 Exposure/DMEL = 0.514
	DCPD	0.496 mg/m³ (TRA Workers) RCR = 0.215	
Inhalation, systemic, acute	Benzene	3.905 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	0.496 mg/m³ (TRA Workers) RCR = 0.215	Final RCR = 0.215
Inhalation, local, acute	DCPD	1.983 mg/m³ (TRA Workers) RCR = 0.012	Final RCR = 0.012
Dermal, systemic, long term	Benzene	0.014 mg/kg bw/day (TRA Workers)	Final RCR = 0.073 Qualitative risk
	DCPD	0.069 mg/kg bw/day (TRA Workers) RCR = 0.073	
Dermal, local, long term	Benzene	4.02E-3 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	4.02E-3 mg/cm² (TRA Workers)	Qualitative risk
Combined routes, systemic, long-term			Final RCR = 0.287

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.6.7. Worker CS 7: Finishing operations [CS102]. Batch process [CS55]. With sample collection [CS56]; Outdoor, 1hr (PROC 3)

9.6.7.1. Conditions of use – specific to CS

	Method
• Duration of activity: <= 1.0 h/day	TRA Workers 3.0
• Closed batch process with occasional controlled exposure	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
• Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%]	TRA Workers 3.0
• Place of use: Outdoor (this eliminates the General Ventilation condition)	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.6.7.2. Exposure and risks for workers

Table 9.104. Exposure concentrations and risks for workers

see Table 9.102. Exposure concentrations and risks for workers in Section 9.6.5.2

9.6.8. Worker CS 8: Intermediate polymer storage [CS66]; 5%, LEV (PROC 4)

9.6.8.1. Conditions of use – specific to CS

	Method
• Percentage (w/w) of substance in mixture/article: <= 5 %	TRA Workers 3.0
• Duration of activity: <= 8 h/day	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%]	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.6.8.2. Exposure and risks for workers

Table 9.105. Exposure concentrations and risks for workers

Route of exposure and type of effects		Exposure concentration	Risk quantification
Inhalation, systemic, long term	Benzene	0.911 mg/m³ (TRA Workers) Exposure/DMEL = 0.48	Final RCR = 0.48 Exposure/DMEL = 0.48
	DCPD	0.386 mg/m³ (TRA Workers) RCR = 0.167	
Inhalation, systemic, acute	Benzene	3.645 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	0.386 mg/m³ (TRA Workers) RCR = 0.167	Final RCR = 0.167
Inhalation, local, acute	DCPD	1.542 mg/m³ (TRA Workers) RCR = 9.63E-3	Final RCR < 0.01
Dermal, systemic, long term	Benzene	0.027 mg/kg bw/day (TRA Workers)	Final RCR = 0.144 Qualitative risk

Route of exposure and type of effects		Exposure concentration	Risk quantification
	DCPD	0.137 mg/kg bw/day (TRA Workers) RCR = 0.144	
Dermal, local, long term	Benzene	4E-3 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	4E-3 mg/cm² (TRA Workers)	Qualitative risk
Combined routes, systemic, long-term			Final RCR = 0.311

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.6.9. Worker CS 9: Additivation and stabilisation [CS69]; 5%, LEV (PROC 3)

9.6.9.1. Conditions of use – specific to CS

	Method
• Percentage (w/w) of substance in mixture/article: <= 5 %	TRA Workers 3.0
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
• Closed batch process with occasional controlled exposure	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%]	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.6.9.2. Exposure and risks for workers

Table 9.106. Exposure concentrations and risks for workers

Route of exposure and type of effects		Exposure concentration	Risk quantification
Inhalation, systemic, long term	Benzene	0.456 mg/m³ (TRA Workers) Exposure/DMEL = 0.24	Final RCR = 0.24 Exposure/DMEL = 0.24
	DCPD	0.231 mg/m³ (TRA Workers) RCR = 0.1	
Inhalation, systemic, acute	Benzene	1.823 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	0.231 mg/m³ (TRA Workers) RCR = 0.1	Final RCR = 0.1
Inhalation, local, acute	DCPD	0.925 mg/m³ (TRA Workers) RCR = 5.78E-3	Final RCR < 0.01
Dermal, systemic, long term	Benzene	2.76E-3 mg/kg bw/day (TRA Workers)	Final RCR = 0.015 Qualitative risk
	DCPD	0.014 mg/kg bw/day (TRA Workers) RCR = 0.015	
Dermal, local, long term	Benzene	8.05E-4 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	8.05E-4 mg/cm² (TRA Workers)	Qualitative risk

Route of exposure and type of effects		Exposure concentration	Risk quantification
Combined routes, systemic, long-term			Final RCR = 0.115

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.6.10. Worker CS 10: Mixing in containers [CS23]. Batch process [CS55]; 5%, LEV (PROC 5)

9.6.10.1. Conditions of use – specific to CS

	Method
• Percentage (w/w) of substance in mixture/article: <= 5 %	TRA Workers 3.0
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
• General ventilation: Enhanced general ventilation (5-10 air changes per hour) [Effectiveness Inhalation: 70%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%]	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.6.10.2. Exposure and risks for workers

Table 9.107. Exposure concentrations and risks for workers

Route of exposure and type of effects		Exposure concentration	Risk quantification
Inhalation, systemic, long term	Benzene	0.976 mg/m³ (TRA Workers) Exposure/DMEL = 0.514	Final RCR = 0.514 Exposure/DMEL = 0.514
	DCPD	0.165 mg/m³ (TRA Workers) RCR = 0.072	
Inhalation, systemic, acute	Benzene	3.905 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	0.165 mg/m³ (TRA Workers) RCR = 0.072	Final RCR = 0.1
Inhalation, local, acute	DCPD	0.661 mg/m³ (TRA Workers) RCR = 4.13E-3	Final RCR < 0.01
Dermal, systemic, long term	Benzene	0.055 mg/kg bw/day (TRA Workers)	Final RCR = 0.289 Qualitative risk
	DCPD	0.274 mg/kg bw/day (TRA Workers) RCR = 0.289	
Dermal, local, long term	Benzene	8E-3 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	8E-3 mg/cm² (TRA Workers)	Qualitative risk
Combined routes, systemic, long-term			Final RCR = 0.36

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.6.11. Worker CS 11: Pelletizing [CS53]. Extrusion and masterbatching [CS88]; 5%, LEV (PROC 6)

9.6.11.1. Conditions of use – specific to CS

	Method
• Percentage (w/w) of substance in mixture/article: <= 5 %	TRA Workers 3.0
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
• General ventilation: Enhanced general ventilation (5-10 air changes per hour) [Effectiveness Inhalation: 70%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%]	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.6.11.2. Exposure and risks for workers

Table 9.108. Exposure concentrations and risks for workers

Route of exposure and type of effects		**Exposure concentration**	**Risk quantification**
Inhalation, systemic, long term	Benzene	0.976 mg/m³ (TRA Workers) Exposure/DMEL = 0.514	Final RCR = 0.514 Exposure/DMEL = 0.514
	DCPD	0.165 mg/m³ (TRA Workers) RCR = 0.072	
Inhalation, systemic, acute	Benzene	3.905 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	0.165 mg/m³ (TRA Workers) RCR = 0.072	Final RCR = 0.1
Inhalation, local, acute	DCPD	0.661 mg/m³ (TRA Workers) RCR = 4.13E-3	Final RCR < 0.01
Dermal, systemic, long term	Benzene	0.11 mg/kg bw/day (TRA Workers)	Final RCR = 0.577 Qualitative risk
	DCPD	0.549 mg/kg bw/day (TRA Workers) RCR = 0.577	
Dermal, local, long term	Benzene	8E-3 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	8E-3 mg/cm² (TRA Workers)	Qualitative risk
Combined routes, systemic, long-term			Final RCR = 0.649

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.6.12. Worker CS 12: Pelletizing [CS53]; 5%, LEV (PROC 14)

9.6.12.1. Conditions of use – specific to CS

	Method
• Percentage (w/w) of substance in mixture/article: <= 5 %	TRA Workers 3.0
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
• General ventilation: Enhanced general ventilation (5-10 air changes per hour)	TRA Workers 3.0

	Method
[Effectiveness Inhalation: 70%]	
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%]	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.6.12.2. Exposure and risks for workers

Table 9.109. Exposure concentrations and risks for workers

Route of exposure and type of effects		**Exposure concentration**	**Risk quantification**
Inhalation, systemic, long term	Benzene	0.976 mg/m³ (TRA Workers) Exposure/DMEL = 0.514	Final RCR = 0.514 Exposure/DMEL = 0.514
	DCPD	0.165 mg/m³ (TRA Workers) RCR = 0.072	
Inhalation, systemic, acute	Benzene	3.905 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	0.165 mg/m³ (TRA Workers) RCR = 0.072	Final RCR = 0.1
Inhalation, local, acute	DCPD	0.661 mg/m³ (TRA Workers) RCR = 4.13E-3	Final RCR < 0.01
Dermal, systemic, long term	Benzene	0.14 mg/kg bw/day (TRA Workers)	Final RCR = 0.072 Qualitative risk
	DCPD	0.069 mg/kg bw/day (TRA Workers) RCR = 0.072	
Dermal, local, long term	Benzene	2E-3 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	2E-3 mg/cm² (TRA Workers)	Qualitative risk
Combined routes, systemic, long-term			Final RCR = 0.144

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.6.13. Worker CS 13: Pelletisation and pellet screening [CS68]. (open systems) [CS108]. Rework of articles [CS86]; 5%, LEV (PROC 8b, PROC 21)

9.6.13.1. Conditions of use – specific to CS

	Method
• Percentage (w/w) of substance in mixture/article: <= 5 %	TRA Workers 3.0
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 95%, Dermal: 0%]	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see "General part (for ESs 1,2,6)" from p. 23.

9.6.13.2. Exposure and risks for workers

Table 9.110. Exposure concentrations and risks for workers

Route of exposure and type of effects		Exposure concentration	Risk quantification
Inhalation, systemic, long term	Benzene	0.683 mg/m³ (TRA Workers) Exposure/DMEL = 0.36	Final RCR = 0.36 Exposure/DMEL = 0.36
	DCPD	0.193 mg/m³ (TRA Workers) RCR = 0.083	
Inhalation, systemic, acute	Benzene	2.734 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	0.193 mg/m³ (TRA Workers) RCR = 0.083	Final RCR = 0.083
Inhalation, local, acute	DCPD	0.771 mg/m³ (TRA Workers) RCR = 4.81E-3	Final RCR < 0.01
Dermal, systemic, long term	Benzene	0.055 mg/kg bw/day (TRA Workers)	Final RCR = 0.289 Qualitative risk
	DCPD	0.274 mg/kg bw/day (TRA Workers) RCR = 0.289	
Dermal, local, long term	Benzene	4E-3 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	4E-3 mg/cm² (TRA Workers)	Qualitative risk
Combined routes, systemic, long-term			Final RCR = 0.372

RCR = Risk Characterization Ratio (RCR <1 safe use)

9.6.14. Worker CS 14: Bulk transfers [CS14]. Continuous process [CS54]. With sample collection [CS56]; 5%, LEV (PROC 3)

9.6.14.1. Conditions of use – specific to CS

	Method
• Percentage (w/w) of substance in mixture/article: <= 5 %	TRA Workers 3.0
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
• Closed batch process with occasional controlled exposure	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%]	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see "General part (for ESs 1,2,6)" from p. 23.

9.6.14.2. Exposure and risks for workers

Table 9.111. Exposure concentrations and risks for workers

see Table 9.106. Exposure concentrations and risks for workers in Section 9.6.9.2

9.6.15. Worker CS 15: Transport [CS58]. With sample collection [CS56]; 5%, LEV (PROC 8b)

9.6.15.1. Conditions of use – specific to CS

	Method
• Percentage (w/w) of substance in mixture/article: <= 5 %	TRA Workers 3.0
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 95%, Dermal: 0%]	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.6.15.2. Exposure and risks for workers

Table 9.112. Exposure concentrations and risks for workers

see Table 9.110. Exposure concentrations and risks for workers in Section 9.6.13.2

9.6.16. Worker CS 16: Equipment maintenance [CS5]; LEV (PROC 8a, PROC 28)

9.6.16.1. Conditions of use – specific to CS

	Method
• Duration of activity: <=4 h/day	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *LEV has been added to equate to the SOP. Drain down and flush system prior to equipment break-in or maintenance [E55]*	TRA Workers 3.0
• Respiratory protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) with specific activity training) and (other) appropriate dermal protection [Effectiveness Dermal: 95%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.6.16.2. Exposure and risks for workers

Table 9.113. Exposure concentrations and risks for workers

see Table 9.19. Exposure concentrations and risks for workers in Section 9.1.16.2

9.6.17. Worker CS 17: Storage [CS67]. With occasional controlled exposure [CS137]; 5%, 1hr (PROC 2, PROC 1)

9.6.17.1. Conditions of use – specific to CS

	Method
• Percentage (w/w) of substance in mixture/article: <= 5 %	TRA Workers 3.0

	Method
• Duration of activity: <= 1.0 h/day	TRA Workers 3.0
• Closed continuous process with occasional controlled exposure	TRA Workers 3.0
• General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
• Respiratory Protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

Note: conditions of use common to all ESs apply at the same time, see “General part (for ESs 1,2,6)” from p. 23.

9.6.17.2. Exposure and risks for workers

Table 9.114. Exposure concentrations and risks for workers

Route of exposure and type of effects		**Exposure concentration**	**Risk quantification**
Inhalation, systemic, long term	Benzene	0.456 mg/m³ (TRA Workers) Exposure/DMEL = 0.24	Final RCR = 0.24 Exposure/DMEL = 0.24
	DCPD	0.154 mg/m³ (TRA Workers) RCR = 0.067	
Inhalation, systemic, acute	Benzene	9.113 mg/m³ (TRA Workers)	Qualitative risk
Inhalation, local, long term	DCPD	0.154 mg/m³ (TRA Workers) RCR = 0.067	Final RCR = 0.067
Inhalation, local, acute	DCPD	3.085 mg/m³ (TRA Workers) RCR = 0.019	Final RCR = 0.019
Dermal, systemic, long term	Benzene	1.1E-3 mg/kg bw/day (TRA Workers)	Final RCR = 0.029 Qualitative risk
	DCPD	0.027 mg/kg bw/day (TRA Workers) RCR = 0.029	
Dermal, local, long term	Benzene	1.6E-4 mg/cm² (TRA Workers)	Qualitative risk
Dermal, local, acute	Benzene	1.6E-4 mg/cm² (TRA Workers)	Qualitative risk
Combined routes, systemic, long-term			Final RCR = 0.096

RCR = Risk Characterization Ratio (RCR <1 safe use)