SAFETY DATA SHEET

In accordance with Regulation (EC) 1907/2006 (REACH), Annex II

BENZALDEHYDE

Created on November 30, 2010
Revised on February 25, 2011

Emerald Performance Materials
Kalama Chemical

1. IDENTIFICATION OF THE SUBSTANCE AND OF THE COMPANY	
1.1 Product identifier	
Trade name:	Benzaldehyde
Chemical name:	Benzaldehyde
Other names:	Benzaldehyde; Benzoic aldehyde; Benzenecarbonal; Benzenecarboxaldehyde
INDEX number as listed in Annex VI of CLP:	605-012-00-5
CAS number:	100-52-7
REACH registration no:	01-2119455540-44-0000
1.2 Relevant identified uses of the substance or mixture and uses advised against	
Uses:	**Uses by workers in industrial settings** 1. Manufacturing of the substance in a closed continuous process. An operator regulates the process from an operator room and regularly takes samples (ES1) 2. Storing and forwarding (ES2) 3. Sampling, loading, filling, transfer, dumping, bagging of substance (charging/discharging) at non-dedicated facilities. Industrial setting. (ES3) 4. Sampling, loading, filling, transfer, dumping, bagging of substance (charging/discharging) at dedicated facilities. Industrial setting. (ES4) 5. Sampling (ES1) 6. Transfer of substance into small containers (dedicated filling line, including weighing). Industrial setting. (ES5) 7. Use of benzaldehyde in a closed batch process as an additive in the manufacturing of formulations for cosmetics. Some opportunity for contact with samples occur through sampling (ES6) 8. Use of benzaldehyde as an additive in the manufacturing of formulations for cosmetics using technologies related to mixing and blending, and where the process is in stages and provides the opportunity for significant contact at any stage (ES6) 9. Use of benzaldehyde in a closed batch process as a flavouring agent in food. Some opportunity for contact with samples occur through sampling (ES6) 10. Use of benzaldehyde as a flavouring agent in food using technologies related to mixing and blending, and where the process is in stages and provides the opportunity for significant contact at any stage (ES6) 11. Use of benzaldehyde in a closed batch process as an additive in the manufacturing of perfume fragrances. Some opportunity for contact with samples occur through

	sampling (ES6) 12. Use of benzaldehyde as an additive in the manufacturing of formulations for cosmetics using technologies related to mixing and blending, and where the process is in stages and provides the opportunity for significant contact at any stage (ES6) 13. Use of benzaldehyde as an additive in pharmaceuticals in a closed batch process. Some opportunity for contact with samples occur through sampling (ES6) 14. Use of benzaldehyde as an additive in pharmaceuticals using technologies related to mixing and blending, and where the process is in stages and provides the opportunity for significant contact at any stage (ES6) 15. Use of benzaldehyde as an intermediate in a closed process to synthesise other substances (ES2) 16. Use of benzaldehyde as an intermediate in closed, continuous process with occasional controlled exposure to synthesise other substances (ES2) 17. Use of benzaldehyde as an intermediate in a closed batch process to synthesise other substances (ES2) 18. Use of benzaldehyde as an intermediate in batch and other processes to synthesise other substances (ES2) **Uses by professional workers** 19. Use of lab chemicals in a professional setting (ES7)
Most common technical function of substance (what it does):	Intermediate; additive
Uses advised against:	None identified
1.3 Details of the supplier of the safety data sheet	
Manufacturer:	Emerald Kalama Chemical B.V. Havennr. 4322 Montrealweg 15 3197 KH Rotterdam-Botlek The Netherlands
Person responsible for the manufacturing:	Emerald Kalama Chemical B.V. Mijnweg 1 6167 AC Geleen The Netherlands purox.info@emeraldmaterials.nl
Department responsible for the Safety Data Sheet:	SHEQ Dept. Emerald Kalama Chemical B.V. Rotterdam
1.4 Emergency telephone number	
Emergency phone number:	Tel: +31 (0)181 249285
2. HAZARDS IDENTIFICATION	

2.1 Classification of the substance or mixture		
(see also Chapter 16 for information about the classification)		
2.2 Label elements		
Labelling in accordance with Regulation 1272/2008 (CLP)		
Hazard pictogram(s):		
Signal word:		Warning
Hazard statements:	H302 H319 H332 H335	Harmful if swallowed Causes serious eye irritation Harmful if inhaled May cause respiratory irritation
Precautionary statements:	P261 P270 P271 P301+P312 P304+P340 P312	Avoid breathing vapours/spray Do not eat, drink or smoke when using this product Use only outdoors or in a well-ventilated area IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing Call a POISON CENTER or doctor/physician if you feel unwell
Classification in accordance with Regulation 67/548/EEC		
Hazard pictogram(s):		 Harmful
Risk phrases: Safety phrases:	R20/22 R36/37 S24	Harmful by inhalation and if swallowed Irritating to eyes and respiratory system Avoid contact with skin
2.3 Other hazards		
PBT/vPvB criteria		The substance is not considered to be potentially PBT or vPvB according to the criteria as laid down in the guidance on information requirements part C (ECHA, May 2008).
Other hazards		Combustible This substance can ignite spontaneously when finely dispersed over large areas

3. COMPOSITION/INFORMATION ON INGREDIENTS

Substances

According to the REACH Regulation the product is a substance

Chemical name	**CAS no.**	**EU no.**	**IUPAC name**	**Purity**

Benzaldehyde	100-52-7	202-860-4	Benzaldehyde	100%

4. FIRST-AID MEASURES	
4.1 Description of first aid measures	
General:	Protection of first-aiders: Put on appropriate personal protective equipment. Move exposed person to fresh air. Remove contaminated clothing and shoes.
Eye contact:	Rinse with plenty of running water. Obtain medical attention if symptoms occur.
Skin contact:	Wash with soap and water. Remove contaminated clothing and shoes. Obtain medical attention if symptoms occur.
Ingestion:	If swallowed, rinse mouth with water (only if the person is conscious). Seek medical attention.
Inhalation:	If inhaled, remove to fresh air. Obtain medical attention if symptoms occur.
4.2 Most important symptoms and effects	
Eye contact:	May cause eye irritation (redness).
Skin contact:	The substance can be absorbed through skin. Defatting to the skin. Prolonged or repeated skin contact may result in: dermatitis.
Ingestion:	Exposure may cause nausea, headache and vomiting. Exposure to high levels may cause unconsciousness.
Inhalation:	Inhalation of vapour/mist may result in: asthma.
5. FIRE-FIGHTING MEASURES	
5.1 Extinguishing media	
Suitable:	Small fire: Use dry chemical or CO2 Large fire: Use water, foam or dry chemical powder
Not suitable:	Not known.

5.2 Special hazards arising from the substance or mixture

Vapour is explosive in air at temperatures higher than the flash point.

5.3 Advice for firefighters

Wear suitable protective clothing. Self-contained breathing apparatus.

Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Avoid creating dusty conditions and prevent wind dispersal. Avoid contact with eyes, skin, and clothing. Use suitable protectiveequipment. Keep away from sources of ignition. Take precautionary measures against static discharges. Use explosion-proof electrical (ventilating, lighting and material handling) equipment.

6.2 Environmental precautions

Prevent entry into sewers, basements or confined areas. Dyke if necessary.

6.3 Methods and material for containment and cleaning up

Small spill and leak: Take up with suitable material. Place in a suitable container. Clean up affected area with a large amount of water.

Large spill and leak: Prevent entry into sewers, basements or confined areas. Dyke if necessary. Absorb spill with inert material (e.g. dry sand or earth) and place in a chemical waste container. Recycle, if possible. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Keep away from sources of ignition.

6.4 Reference to other sections

See section 8 for personal protective equipment and section 13 for waste disposal.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Technical measures/ Precautions:	Use with adequate ventilation. Use suitable protective equipment. Avoid contact with eyes, skin and clothing. Ventilation required along the floor. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Take measures against static discharge. Keep away from sources of ignition.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures/ Storage conditions:	Store in a fireproof location. Keep away from incompatible materials and avoid specific conditions. The substance oxidizes on exposure to air. May form explosive peroxides. Store under nitrogen. Keep away from sources of ignition - No smoking. Tank openings should be inspected frequently, since benzoic acid can form, clogging the vent openings.
Incompatible products:	None known
Packaging material:	Suitable: Steel with synthetic lining or polyethylene containers. Not suitable: Iron, copper, bronze, aluminium.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 Control parameters

Regulated occupational exposure limit values:	None

Recommended occupational and consumer exposure limit values (following from the performed CSA)	

Exposure pattern	Derived No Effect Level (DNEL)	
	Workers	**General population**
Long-term – dermal, systemic effects	34.7 mg/kg bw/day	20.8 mg/kg bw/day
Long-term – inhalation, systemic effects	10.4 mg/m³	2.1 mg/m³
Long-term – oral, systemic effects	Not relevant	25 mg/kg bw/day
Long-term – dermal, local effects	4.5 mg/cm²	2.7 mg/cm²
Long-term – inhalation, local effects	6.3 mg/m³	1.3 mg/m³

8.2 Exposure controls	
Appropriate engineering controls:	Use only with adequate ventilation. Local exhaust ventilation should be provided. Use explosion proof electrical (ventilating, lighting and material handling) equipment.
Environmental exposure controls:	No special measures required.
Individual protection measures, such as personal protective equipment:	
Respiratory protection:	Wear filter mask, filtertype A.
Hand protection:	Wear suitable gloves. > 8 hours (breakthrough time): Butyl rubber, Viton. Replace damaged gloves. <u>Not to be used:</u> natural rubber (latex), nitrile rubber, neoprene, PVC
Eye protection:	Safety glasses with side shields.
Skin and body protection:	Wear suitable protective clothing.
Hygiene measures:	When using do not eat, drink or smoke. Wash hands after handling compounds and before eating, smoking and using the lavatory and at the end of the day.
Further information:	Advice on personal protection is applicable for high exposure levels. Select proper personal protection based on a risk assessment of the actual exposure situation.
9. PHYSICAL AND CHEMICAL PROPERTIES	
Information on basic physical and chemical properties	
Appearance:	Colourless liquid
Odour:	Almond-like
Taste:	burning aromatic taste
Melting/Freezing temperature:	-26 °C at 1013 hPa (data from peer reviewed handbook)

Boiling temperature: (initial and range)	179 °C at 1013 hPa (Based on weight of evidence on data from peer-reviewed handbooks)
Flash-point:	62 °C at 1013 hPa (data from peer reviewed handbook)
Flammability:	non flammable (expert statement)
Explosive properties:	Not explosive (expert statement)
Oxidizing properties:	Not oxidizing (expert statement)
Vapour pressure:	196 Pa at 25 °C (data from peer reviewed handbook)
Relative density (D4 (20)):	1.042 at 20°C (data from peer reviewed handbook)
Solubility in water:	The substance is readily soluble in water (> 1000 mg/L). 6950 mg/L at 25 °C (data from peer reviewed handbook)
Partition coefficient n-octanol/water:	log Kow 1.48 at 25 °C (data from peer reviewed handbook)
Viscosity:	1.321 mPa s (dynamic) at 25 °C (data from peer reviewed handbook)
Auto ignition temperature:	192°C at unknown pressure (data from peer reviewed handbook)
Surface tension:	Not surface active: 70.5 mN/m at 20.0°C (1 g/l / in water) (OECD 115, EC A.5: ring method).

10. STABILITY AND REACTIVITY

10.1 Reactivity

None identified

10.2 Chemical stability

Stable under recommended storage and handling conditions (see section 7). May discolour on exposure to light or air.

10.3 Possibility of hazardous reactions

The substance oxidizes on exposure to air. May form peroxides in contact with air.

10.4 Conditions to avoid

Keep away from heat, sparks and flame.

10.5 Incompatible materials

Oxidizing substances oxygen, air, performic acid, alkalis, alkali metals, aluminium, iron, copper, bronze, bases, phenols. Attacks many synthetic materials.

10.6 Hazardous decomposition products

Exposure to air: peroxides, benzoic acid.

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

ACUTE TOXICITY	
Acute oral toxicity:	LD50: 1430 mg/kg (OECD 401)
Acute dermal toxicity:	LD50: > 2000 mg/kg (read-across)

Acute inhalation toxicity:	LC50: 1000-5000 mg/m^3 (OECD 436)
LOCAL EFFECTS	
Skin irritation:	Not irritating to skin (no guideline followed)
Eye irritation:	Irritating (no guideline followed)
Respiratory irritation:	Irritating (read-across)
Skin sensitization:	Not sensitizing (weight of evidence)

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Fish:	96h-LC50: 1.07 mg/L (equivalent or similar to OECD Guideline 203)
Daphnia magna:	48h-LC50: 23.7 mg/l (estimated)
Algae:	96h-EC50: 31.3 mg/L (estimated)
Inhibition of microbial activity:	3h-EC50: 759 mg/L (OECD 209)

12.2 Persistence and degradability

Biodegradation:	Readily biodegradable (OECD 301B)
Hydrolysis:	Not relevant

12.3 Bioaccumulative potential

Octanol-water partition coefficient (K_{ow}):	Log Kow = 1.48

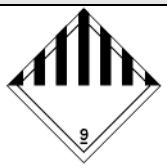
12.4 Results of PBT and vPvB assessment

	P	**B**	**T**
Relevant data:	Readily biodegradable	Log P_{ow} 1.48	L(E)C50 = 1.07 mg/l Not classified as CMR
PBT and vPvB Criteria fulfilled?	No	No	No

13. DISPOSAL CONSIDERATIONS

Methods of disposal (waste of residues; contaminated packaging):	Waste must be disposed of in accordance with national and local environmental regulations. Controlled biodegradation in waste water treatment is possible.

14. TRANSPORT INFORMATION

ADR/RID:	 UN Number: 1990 Proper shipping name: benzaldehyde Class: 9 Packing Group: III

	Hazard identification number: 90 Limited quantity: LQ28 CEFIC Tremcard: 90S1990
ADNR:	 UN Number: 1990 Proper shipping name: benzaldehyde Class: 9 Packing Group: III
IMDG:	 UN Number: 1990 Proper shipping name: benzaldehyde Class: 9 Packing Group: III EmS: F-A, S-A
IATA:	 UN Number: 1990 Proper shipping name: benzaldehyde Class: 9 Packing Group: III **Passenger and Cargo Aircraft** Quantity limitation: 100 L **Cargo Aircraft Only** Quantity limitation: 220 L **Limited Quantities - Passenger Aircraft** Quantity limitation: 30 kg
15. REGULATORY INFORMATION	
15.1 Safety, health and environmental regulation/legislation specific for the substance or mixture:	None
15.2 Chemical safety assessment:	In accordance with REACH article 14, a Chemical Safety assessment has been carried out for this substance
16. OTHER INFORMATION	

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

Classification in accordance with Regulation 1272/2008, as listed in Annex VI:

Harmful if swallowed (H302)

Classification in accordance with Regulation 1272/2008, by self-classification based on the performed CSA:

Harmful if swallowed (H302)
Causes serious eye irritation (H319)
Harmful if inhaled (H332)
May cause respiratory irritation (H335)

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Created/Revised by:	Safety, Health & Environment Department. Telephone no.: +31 (0)181 249285

ANNEX

1 Exposure scenario (1) **Manufacturing of the substance in a closed continuous process, with occasional exposure, including sampling**	
Use descriptors related to the life cycle stage	SU8/9 PROC2 ERC1
Name of contributing environmental scenario (1) and corresponding ERC	1. Environmental release during manufacturing (ERC1)
List of names of contributing worker scenarios (2) and corresponding PROC	2. Manufacturing in a closed continuous process, with occasional exposure (PROC2)
2.1 Contributing scenario (1) controlling environmental exposure during manufacturing	
Environmental release during manufacturing ERC1 An environmental assessment has been performed using the EUSES model version 2.1 and the ERCs for calculating environmental release.	
Product characteristics	
Product related conditions, e.g. the concentration of the substance in a mixture; viscosity of product; package design affecting exposure	Not applicable.
Amounts used	
Daily and annual amount per site (for uses in industrial setting) or daily and annual amount for wide disperse uses;	Confidential information.
Frequency and duration of use	
Intermittent (used < 12 times per year for not more than 24 h) or continuous use/release	Continuous.
Environment factors not influenced by risk management	
Flow rate of receiving surface water (m3/d, usually 18,000 m3/d for the standard town by default; please note: the default flow rate will be rarely changeable for downstream uses.	18,000 m3/day
Other given operational conditions affecting environmental exposure	
Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process (via air and waste water); dry or water based processes; conditions related to temperature and pressure; indoor or outdoor use of products; work in confined area or open air;	
Technical conditions and measures at process level (source) to prevent release	
Process design aiming to prevent releases and hence exposure to the environment; this includes in particular conditions ensuring rigorous containment; performance of the	During production discharges to water are negligible as all waste is recycled in a waste water treatment plant. Any discharge of benzaldehyde to the surface water is therefore not possible.

containment to be specified (e.g. by quantification of a release factor in section 9.x.2 of the CSR);	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Technical measures, e.g. on-site waste water and waste treatment techniques, scrubbers, filters and other technical measures aiming at reducing releases to air, sewage system, surface water or soil; this includes strictly controlled conditions (procedural and control technology) to minimise emissions; specify effectiveness of measures; specify the size of industrial sewage treatment plant (m3/d), degradation effectiveness and sludge treatment (if applicable);	Not applicable
Organizational measures to prevent/limit release from site	
Specific organisational measures or measures needed to support the functioning of particular technical measures. Those measures need to be reported in particular for demonstrating strictly controlled conditions.	Not applicable
Conditions and measures related to municipal sewage treatment plant	
Size of municipal sewage system/treatment plant (m3/d); specify degradation effectiveness; sludge treatment technique (disposal or recovery); measures to limit air emissions from sewage treatment (if applicable); please note: the default size of the municipal STP (2000 m3/d) will be rarely changeable for downstream uses.	Receiving sewage water flow rate is 2000 m3/day
Conditions and measures related to external treatment of waste for disposal	
Fraction of used amount transferred to external waste treatment for disposal; type of suitable treatment for waste generated by workers uses, e.g. hazardous waste incineration, chemical-physical treatment for emulsions, chemical oxidation of aqueous waste; specify effectiveness of treatment;	Not applicable
Conditions and measures related to external recovery of waste	
Fraction of used amount transferred to external waste treatment for recovery: specify type of suitable recovery operations for waste generated by workers uses, e.g. re-destillation of solvents, refinery process for lubricant waste, recovery of slags, heat recovery outside waste incinerators; specify effectiveness of measure;	Not applicable

Additional good practice advice beyond the REACH CSA

Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH, Thus, the downstream user is not obliged to i) carry out an own CSA and ii) to notify the use to the Agency, if he does not

implement these measures.	
Use specific measures expected to reduce the predicted exposure beyond the level estimated based on the exposure scenario.	Not applicable

2.2 Contributing scenario (2) controlling worker exposure for manufacturing in a closed continuous process, with occasional exposure, including sampling	
Manufacturing in a closed continuous process, with occasional exposure, including sampling	
PROC2	
Product characteristic	
Product related conditions, e.g. the concentration of the substance in a mixture, the physical state of that mixture (solid, liquid; if solid: level of dustiness), package design affecting exposure)	Liquid
Amounts used	
Amounts used at a workplace (per task or per shift); note: sometimes this information is not needed for assessment of worker's exposure	Not applicable for first tier assessment using ECETOC TRA
Frequency and duration of use/exposure	
Duration per task/activity (e.g. hours per shift) and frequency (e.g. single events or repeated) of exposure	More than 4 hours per day, repeated exposure (working life)
Human factors not influenced by risk management	
Particular conditions of use, e.g. body parts potentially exposed as a result of the nature of the activity	Exposed skin surface (cm2): 480 (two hands, face side only)
Other given operational conditions affecting workers exposure	
Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process into workers environment; room volume, whether the work is carried out outdoors/indoors, process conditions related to temperature and pressure.	Indoors
Technical conditions and measures at process level (source) to prevent release	
Process design aiming to prevent releases and hence exposure of workers; this in particular includes conditions ensuring rigorous containment; performance of containment to be specified (e.g. by quantification of residual losses or exposure)	Not applicable
Technical conditions and measures to control dispersion from source towards the worker	
Engineering controls, e.g. exhaust ventilation, general ventilation; specify effectiveness of measure	Not applicable
Organisational measures to prevent /limit releases, dispersion and exposure	
Specific organisational measures or measures needed to support the functioning of particular technical measures (e.g. training and supervision). Those measures need to be	Not applicable

reported in particular for demonstrating strictly controlled conditions (to justify exposure based waiving).	
Conditions and measures related to personal protection, hygiene and health evaluation	
Personal protection, e.g. wearing of gloves, face protection, full body dermal protection, goggles, respirator; specify effectiveness of measure; specify the suitable material for the PPE (where relevant) and advise how long the protective equipment can be used before replacement (if relevant)	- chemical goggles - substance task appropriate respirator

Exposure information and relevance to its source

Information for contributing scenario 1

Environmental exposure has been calculated using the EUSES model v2.1.

Environmental exposure	Unit	Exposure estimation	PNEC
Freshwater	mg/L	6.78E-05	1.07E-03
Marine water	mg/L	4.72E-06	1.07E-04
Sediment	mg/kg	1.44E-04	2.27E-03
Soil	mg/kg	1.7E-04	1.29E-03
STP	mg/l	0	7.59

Information for contributing scenario 2

Workers exposure estimation is calculated with ECETOC TRA model.

Workers exposure	Unit	Exposure estimation	DNEL
Long-term systemic dermal effects	mg/kg bw/day	1.37	34.7
Long-term systemic inhalation effects	mg/m3	4.42	10.4
Long-term dermal local effects	mg/cm2/day	0.2	4.5
Long-term inhalation local effects	mg/m3	4.42	6.3

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

Environment

Human health:
Using the first tier model of ECETOC TRA and assuming worst case operational conditions (no LEV, no PPE and 4-8 hours exposure) benzaldehyde does not pose a risk to human health for workers in this scenario. Therefore, no additional RMMs beside those that are mentioned above are needed to guarantee safe use for workers.

Additional good practice advice beyond the REACH CSA

Additional good practices (Operational Conditions and Risk Management Measures) beyond the REACH Chemical Safety Assessment established within Chemical Industry are also advised and communicated through Safety Data Sheets. Such as:

- Minimisation of manual phases;
- Minimisation of splashes and spills;
- Avoidance of contact with contaminated tools and objects;
- Regular cleaning of equipment and work area;
- Management/supervision in place to check that RMMs in place are being used correctly and OCs

followed;
- Training staff on good practice;
- Good standard of personal hygiene.

1 Exposure scenario (2) **Use as an intermediate to synthesise other substances including storing and forwarding**	
Use descriptors related to the life cycle stage	SU3 PROC1, PROC2, PROC3, PROC4 PC19 ERC6A
Name of contributing environmental scenario (1) and corresponding ERC	1. Environmental release during industrial use as intermediate (ERC6A)
List of names of contributing worker scenarios (2-n) and corresponding PROC	2. Industrial use in a closed continuous process, no likelihood of exposure including storing and forwarding (PROC1) 3. Industrial use in a closed continuous process with occasional controlled exposure (PROC2) 4. Industrial use in a closed batch process to synthesise other substances (PROC3) 5. Industrial use in batch and other processes where opportunity for exposure arises (PROC4)

2.1 Contributing scenario (1) controlling environmental exposure during industrial use as intermediate

Environmental release during industrial use as intermediate

ERC6A

An environmental assessment (site-specific for the three largest users covering 70% of the European market) has been performed using the EUSES model version 2.1 and the ERCs for calculating environmental release. Release factors from EUSES have been used to overwrite the release factors based on the ERC, because those were closer to realistic release factors provided by industry.

Product characteristics	
Product related conditions, e.g. the concentration of the substance in a mixture; viscosity of product; package design affecting exposure	Substance as such.
Amounts used	
Daily and annual amount per site (for uses in industrial setting) or daily and annual amount for wide disperse uses;	Confidential information.
Frequency and duration of use	
Intermittent (used < 12 times per year for not more than 24 h) or continuous use/release	Continuous.
Environment factors not influenced by risk management	
Flow rate of receiving surface water (m3/d, usually 18,000 m3/d for the standard town by default; please note: the default flow rate will be rarely changeable for downstream uses.	18,000 m3/day or 21,000 m3/day depending on site
Other given operational conditions affecting environmental exposure	
Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process (via air and waste water); dry or water based processes; conditions related to temperature and pressure; indoor or outdoor use of products; work in confined area or	Not applicable

open air;	
Technical conditions and measures at process level (source) to prevent release	
Process design aiming to prevent releases and hence exposure to the environment; this includes in particular conditions ensuring rigorous containment; performance of the containment to be specified (e.g. by quantification of a release factor in section 9.x.2 of the CSR);	Not applicable
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Technical measures, e.g. on-site waste water and waste treatment techniques, scrubbers, filters and other technical measures aiming at reducing releases to air, sewage system, surface water or soil; this includes strictly controlled conditions (procedural and control technology) to minimise emissions; specify effectiveness of measures; specify the size of industrial sewage treatment plant (m3/d), degradation effectiveness and sludge treatment (if applicable);	For the largest user an on-site STP with aerobic treatment followed by tertiary ozone treatment (98% efficiency)
Organizational measures to prevent/limit release from site	
Specific organisational measures or measures needed to support the functioning of particular technical measures. Those measures need to be reported in particular for demonstrating strictly controlled conditions.	Not applicable
Conditions and measures related to municipal sewage treatment plant	
Size of municipal sewage system/treatment plant (m3/d); specify degradation effectiveness; sludge treatment technique (disposal or recovery); measures to limit air emissions from sewage treatment (if applicable); please note: the default size of the municipal STP (2000 m3/d) will be rarely changeable for downstream uses.	Site 1: Receiving sewage water flow rate is 2000 m3/day Site 2: Receiving sewage water flow rate is 2000 m3/day. The effluent flows to the local municipal treatment plant. There it has an biological aerobic treatment with oxygen not air. Then this is followed by a tertiary ozone treatment plant. The oxygen treatment was put in to remove all the COD such that the ozone could remove the dyes from the dyeing factories in the area. So the removal from the plant is considered to be at least 99% for a readily biodegradable substance such as Benzaldehyde. This figure is used instead of the default of 87.5% removal Site 3: Receiving sewage water flow rate is 43,000 m3/day. This water is directly sent to a big domestic STP with biological treatment designed for an equivalent population of 358.000 inhabitants, with a daily flow of 43.000 m3/day and with an efficiency >95%.
Conditions and measures related to external treatment of waste for disposal	
Fraction of used amount transferred to external waste treatment for disposal; type of suitable treatment for waste generated by workers uses, e.g. hazardous waste	Site 1: Some of the waste streams from the site will contain trace benzaldehyde content however these are sent to third party disposal facilities -municipal sewer / incineration and physio chemical treatment plants. The municipal sewer and the

incineration, chemical-physical treatment for emulsions, chemical oxidation of aqueous waste; specify effectiveness of treatment;	physiochemical treatment plant will further treat the waste streams before they discharge to controlled waters. There is no discharge of benzaldehyde from the incinerator.
Conditions and measures related to external recovery of waste	
Fraction of used amount transferred to external waste treatment for recovery: specify type of suitable recovery operations for waste generated by workers uses, e.g. re-destillation of solvents, refinery process for lubricant waste, recovery of slags, heat recovery outside waste incinerators; specify effectiveness of measure;	Not applicable
Additional good practice advice beyond the REACH CSA Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH, Thus, the downstream user is not obliged to i) carry out an own CSA and ii) to notify the use to the Agency, if he does not implement these measures.	
Use specific measures expected to reduce the predicted exposure beyond the level estimated based on the exposure scenario.	Not applicable

2.2 Contributing scenario (2) controlling worker exposure for industrial use in a closed continuous process, no likelihood of exposure	
Industrial use in a closed continuous process, no likelihood of exposure	
PROC1	
Product characteristic	
Product related conditions, e.g. the concentration of the substance in a mixture, the physical state of that mixture (solid, liquid; if solid: level of dustiness), package design affecting exposure)	Liquid Substance as such
Amounts used	
Amounts used at a workplace (per task or per shift); note: sometimes this information is not needed for assessment of worker's exposure	Not applicable for first tier assessment using ECETOC TRA
Frequency and duration of use/exposure	
Duration per task/activity (e.g. hours per shift) and frequency (e.g. single events or repeated) of exposure	More than 4 hours per day, repeated exposure (working life)
Human factors not influenced by risk management	
Particular conditions of use, e.g. body parts potentially exposed as a result of the nature of the activity	Exposed skin surface (cm2): 240 (one hand, face side only)
Other given operational conditions affecting workers exposure	
Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process into workers environment; room volume, whether the work is carried out	Indoors

outdoors/indoors, process conditions related to temperature and pressure.	
Technical conditions and measures at process level (source) to prevent release	
Process design aiming to prevent releases and hence exposure of workers; this in particular includes conditions ensuring rigorous containment; performance of containment to be specified (e.g. by quantification of residual losses or exposure)	Not applicable
Technical conditions and measures to control dispersion from source towards the worker	
Engineering controls, e.g. exhaust ventilation, general ventilation; specify effectiveness of measure	Not applicable
Organisational measures to prevent /limit releases, dispersion and exposure	
Specific organisational measures or measures needed to support the functioning of particular technical measures (e.g. training and supervision). Those measures need to be reported in particular for demonstrating strictly controlled conditions (to justify exposure based waiving).	Not applicable
Conditions and measures related to personal protection, hygiene and health evaluation	
Personal protection, e.g. wearing of gloves, face protection, full body dermal protection, goggles, respirator; specify effectiveness of measure; specify the suitable material for the PPE (where relevant) and advise how long the protective equipment can be used before replacement (if relevant)	- chemical goggles - substance task appropriate respirator
2.3 Contributing scenario (3) controlling worker exposure for industrial use in a closed continuous process, with occasional controlled exposure	
Industrial use in a closed continuous process, with occasional controlled exposure	
PROC2	
Product characteristic	
Product related conditions, e.g. the concentration of the substance in a mixture, the physical state of that mixture (solid, liquid; if solid: level of dustiness), package design affecting exposure)	Liquid
Amounts used	
Amounts used at a workplace (per task or per shift); note: sometimes this information is not needed for assessment of worker's exposure	Not applicable for first tier assessment using ECETOC TRA
Frequency and duration of use/exposure	
Duration per task/activity (e.g. hours per shift) and frequency (e.g. single events or repeated) of exposure	More than 4 hours per day, repeated exposure (working life)
Human factors not influenced by risk management	
Particular conditions of use, e.g. body parts potentially exposed as a result of the nature of	Exposed skin surface (cm2): 480 (two hands, face side only)

the activity	
Other given operational conditions affecting workers exposure	
Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process into workers environment; room volume, whether the work is carried out outdoors/indoors, process conditions related to temperature and pressure.	Indoors
Technical conditions and measures at process level (source) to prevent release	
Process design aiming to prevent releases and hence exposure of workers; this in particular includes conditions ensuring rigorous containment; performance of containment to be specified (e.g. by quantification of residual losses or exposure)	Not applicable
Technical conditions and measures to control dispersion from source towards the worker	
Engineering controls, e.g. exhaust ventilation, general ventilation; specify effectiveness of measure	Not applicable
Organisational measures to prevent /limit releases, dispersion and exposure	
Specific organisational measures or measures needed to support the functioning of particular technical measures (e.g. training and supervision). Those measures need to be reported in particular for demonstrating strictly controlled conditions (to justify exposure based waiving).	Not applicable
Conditions and measures related to personal protection, hygiene and health evaluation	
Personal protection, e.g. wearing of gloves, face protection, full body dermal protection, goggles, respirator; specify effectiveness of measure; specify the suitable material for the PPE (where relevant) and advise how long the protective equipment can be used before replacement (if relevant)	- chemical goggles - substance task appropriate respirator
2.4 Contributing scenario (4) controlling worker exposure for industrial use in a closed batch process	
Industrial use in a closed batch process	
PROC3	
Product characteristic	
Product related conditions, e.g. the concentration of the substance in a mixture, the physical state of that mixture (solid, liquid; if solid: level of dustiness), package design affecting exposure)	Liquid Substance as such
Amounts used	
Amounts used at a workplace (per task or per shift); note: sometimes this information is not needed for assessment of worker's exposure	Not applicable for first tier assessment using ECETOC TRA
Frequency and duration of use/exposure	

Duration per task/activity (e.g. hours per shift) and frequency (e.g. single events or repeated) of exposure	More than 4 hours per day, repeated exposure (working life) with additional RMMs (LEV) 1 to 4 hours per day, repeated exposure (working life) without additional RMMs
Human factors not influenced by risk management	
Particular conditions of use, e.g. body parts potentially exposed as a result of the nature of the activity	Exposed skin surface (cm2): 240 (one hand, face side only)
Other given operational conditions affecting workers exposure	
Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process into workers environment; room volume, whether the work is carried out outdoors/indoors, process conditions related to temperature and pressure.	Indoors
Technical conditions and measures at process level (source) to prevent release	
Process design aiming to prevent releases and hence exposure of workers; this in particular includes conditions ensuring rigorous containment; performance of containment to be specified (e.g. by quantification of residual losses or exposure)	Not applicable
Technical conditions and measures to control dispersion from source towards the worker	
Engineering controls, e.g. exhaust ventilation, general ventilation; specify effectiveness of measure	IF working hours are more than 4 hours/day THEN LEV should be applied
Organisational measures to prevent /limit releases, dispersion and exposure	
Specific organisational measures or measures needed to support the functioning of particular technical measures (e.g. training and supervision). Those measures need to be reported in particular for demonstrating strictly controlled conditions (to justify exposure based waiving).	Not applicable
Conditions and measures related to personal protection, hygiene and health evaluation	
Personal protection, e.g. wearing of gloves, face protection, full body dermal protection, goggles, respirator; specify effectiveness of measure; specify the suitable material for the PPE (where relevant) and advise how long the protective equipment can be used before replacement (if relevant)	- chemical goggles - substance task appropriate respirator
2.5 Contributing scenario (5) controlling worker exposure for industrial use in batch and other processes where opportunity for exposure arises	
industrial use in batch and other processes where opportunity for exposure arises	
PROC4	
Product characteristic	
Product related conditions, e.g. the concentration of the substance in a mixture, the physical state of that mixture (solid, liquid;	Liquid Substance as such

if solid: level of dustiness), package design affecting exposure)	
Amounts used	
Amounts used at a workplace (per task or per shift); note: sometimes this information is not needed for assessment of worker's exposure	Not applicable for first tier assessment using ECETOC TRA
Frequency and duration of use/exposure	
Duration per task/activity (e.g. hours per shift) and frequency (e.g. single events or repeated) of exposure	More than 4 hours per day, repeated exposure (working life) if additional RMMs are applied (LEV) 15 minutes to 1 hour, repeated exposure (working life) if no additional RMMs are applied
Human factors not influenced by risk management	
Particular conditions of use, e.g. body parts potentially exposed as a result of the nature of the activity	Exposed skin surface (cm2): 480 (two hands, face side only)
Other given operational conditions affecting workers exposure	
Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process into workers environment; room volume, whether the work is carried out outdoors/indoors, process conditions related to temperature and pressure.	Indoors
Technical conditions and measures at process level (source) to prevent release	
Process design aiming to prevent releases and hence exposure of workers; this in particular includes conditions ensuring rigorous containment; performance of containment to be specified (e.g. by quantification of residual losses or exposure)	Not applicable
Technical conditions and measures to control dispersion from source towards the worker	
Engineering controls, e.g. exhaust ventilation, general ventilation; specify effectiveness of measure	IF working hours are more than 1 hour/day THEN LEV should be applied
Organisational measures to prevent /limit releases, dispersion and exposure	
Specific organisational measures or measures needed to support the functioning of particular technical measures (e.g. training and supervision). Those measures need to be reported in particular for demonstrating strictly controlled conditions (to justify exposure based waiving).	Not applicable
Conditions and measures related to personal protection, hygiene and health evaluation	
Personal protection, e.g. wearing of gloves, face protection, full body dermal protection, goggles, respirator; specify effectiveness of measure; specify the suitable material for the PPE (where relevant) and advise how long the protective equipment can be used before replacement (if relevant)	- chemical goggles - substance task appropriate respirator
Exposure information and relevance to its source	

Information for contributing scenario 1			
Environmental exposure has been calculated using the EUSES model v2.1. Only the highest calculated PEC will be reported here.			
Environmental exposure	Unit	Exposure estimation	PNEC
Freshwater	mg/L	1.02E-03	1.07E-03
Marine water	mg/L	4.69E-04[1]	1.07E-04
Sediment	mg/kg	2.17E-03	6.3E-03
Soil	mg/kg	6.74E-04	1.29E-03
STP	mg/l	1.1E-02	7.59
[1] The RCRs for the marine compartment are slightly above 1. There is no direct emission to the marine compartment. Considering this and taking into account that it is assumed that marine species are not more sensitive to this chemical and the fast degradation in the aquatic compartment, benzaldehyde is not considered to be of risk for this compartment.			

Information for contributing scenario 2			
Workers exposure estimation is calculated with ECETOC TRA model for PROC1.			
Workers exposure	Unit	Exposure estimation	DNEL
Long-term systemic dermal effects	mg/kg bw/day	3.43E-01	34.7
Long-term systemic inhalation effects	mg/m3	4.42E-02	10.4
Long-term dermal local effects	mg/cm2/day	0.1	4.5
Long-term inhalation local effects	mg/m3	4.42E-02	6.3

Information for contributing scenario 3			
Workers exposure estimation is calculated with ECETOC TRA model for PROC2.			
Workers exposure	Unit	Exposure estimation	DNEL
Long-term systemic dermal effects	mg/kg bw/day	1.37	34.7
Long-term systemic inhalation effects	mg/m3	4.42	10.4
Long-term dermal local effects	mg/cm2/day	0.2	4.5
Long-term inhalation local effects	mg/m3	4.42	6.3

Information for contributing scenario 4			
Workers exposure estimation is calculated with ECETOC TRA model for PROC3			
Workers exposure	Unit	Exposure estimation	DNEL
Long-term systemic dermal effects	mg/kg bw/day	3.43E-01 (without LEV) 3.43E-02 (with LEV)	34.7
Long-term systemic inhalation effects	mg/m3	7.96 (without LEV) 1.33 (with LEV)	10.4
Long-term dermal local effects	mg/cm2/day	0.01 (without LEV) 0.01 (with LEV)	4.5
Long-term inhalation local effects	mg/m3	7.96 (without LEV) 1.33 (with LEV)	6.3

Information for contributing scenario 5			
Workers exposure estimation is calculated with ECETOC TRA model for PROC4			
Workers exposure	Unit	Exposure estimation	DNEL
Long-term systemic dermal effects	mg/kg bw/day	6.86 (without LEV) 6.86E-01 (with LEV)	34.7
Long-term systemic inhalation effects	mg/m3	4.42 (without LEV) 2.21 (with LEV)	10.4
Long-term dermal local effects	mg/cm2/day	1 (without LEV) 0.1 (with LEV)	4.5
Long-term inhalation local effects	mg/m3	4.42 (without LEV) 2.21 (with LEV)	6.3

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

Environment:

Human health:
Contributing scenario 2
Using the first tier model of ECETOC TRA and assuming worst case operational conditions (no LEV, no PPE and 4-8 hours exposure) benzaldehyde does not pose a risk to human health for workers in this scenario. Therefore, no additional RMMs beside those that are mentioned above are needed to guarantee safe use for workers.
Contributing scenario 3
Using the first tier model of ECETOC TRA and assuming worst case operational conditions (no LEV, no PPE and 4-8 hours exposure) benzaldehyde does not pose a risk to human health for workers in this scenario. Therefore, no additional RMMs beside those that are mentioned above are needed to guarantee safe use for workers.
Contributing scenario 4
Using the first tier model of ECETOC TRA and assuming a working time of 1 to 4 hours benzaldehyde does not pose a risk to human health for workers in this scenario for long-term systemic effects. For long-term local effects via inhalation a small risk is identified, however taking into account the worst case assumptions made with the ECETOC model, a risk to human health for workers for long-term local effects is not expected. If longer working hours are considered further risk reduction measures have to be introduced, focusing on reduction of the inhalation exposure (LEV, PPE). If Local Exhaust Ventilation is applied 4-8 hours working hours can be applied.
Contributing scenario 5
Using the first tier model of ECETOC TRA and assuming a working time of 15 minutes to 1 hour benzaldehyde does not pose a risk to human health for workers in this scenario for long-term systemic/local effects. If longer working hours are considered further risk reduction measures have to be introduced, focusing on reduction of the inhalation exposure (LEV, PPE). If Local Exhaust Ventilation is applied 4-8 hours working hours can be applied.

Additional good practice advice beyond the REACH CSA

Additional good practices (Operational Conditions and Risk Management Measures) beyond the REACH Chemical Safety Assessment established within Chemical Industry are also advised and communicated through Safety Data Sheets. Such as:

- Minimisation of manual phases;
- Minimisation of splashes and spills;
- Avoidance of contact with contaminated tools and objects;
- Regular cleaning of equipment and work area;
- Management/supervision in place to check that RMMs in place are being used correctly and OCs

followed; - Training staff on good practice; - Good standard of personal hygiene.

1 Exposure scenario (3) **Charging/discharging at non-dedicated facilities in an industrial setting**	
Use descriptors related to the life cycle stage	SU3 PROC8A ERC (not relevant, covered by industrial uses)
List of names of contributing worker scenarios (1) and corresponding PROC	1. Charging/discharging at non-dedicated facilities in an industrial setting (PROC8A)
2.1 Contributing scenario (1) controlling worker exposure for charging/discharging at non-dedicated facilities in an industrial setting	
Charging/discharging at non-dedicated facilities in an industrial setting	
PROC8A	
Product characteristic	
Product related conditions, e.g. the concentration of the substance in a mixture, the physical state of that mixture (solid, liquid; if solid: level of dustiness), package design affecting exposure)	Liquid Substance as such
Amounts used	
Amounts used at a workplace (per task or per shift); note: sometimes this information is not needed for assessment of worker's exposure	Not applicable for first tier assessment using ECETOC TRA
Frequency and duration of use/exposure	
Duration per task/activity (e.g. hours per shift) and frequency (e.g. single events or repeated) of exposure	More than 4 hours per day, repeated exposure (working life) if additional RMMs are applied (LEV) 15 minutes to 1 hour, repeated exposure (working life) if no additional RMMs are applied
Human factors not influenced by risk management	
Particular conditions of use, e.g. body parts potentially exposed as a result of the nature of the activity	Exposed skin surface (cm2): 960 (two hands)
Other given operational conditions affecting workers exposure	
Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process into workers environment; room volume, whether the work is carried out outdoors/indoors, process conditions related to temperature and pressure.	Indoors
Technical conditions and measures at process level (source) to prevent release	
Process design aiming to prevent releases and hence exposure of workers; this in particular includes conditions ensuring rigorous containment; performance of containment to be specified (e.g. by quantification of residual losses or exposure)	Not applicable
Technical conditions and measures to control dispersion from source towards the worker	
Engineering controls, e.g. exhaust ventilation,	IF working hours are longer than 1 hour/day THEN LEV is

general ventilation; specify effectiveness of measure	needed.
Organisational measures to prevent /limit releases, dispersion and exposure	
Specific organisational measures or measures needed to support the functioning of particular technical measures (e.g. training and supervision). Those measures need to be reported in particular for demonstrating strictly controlled conditions (to justify exposure based waiving).	Not applicable
Conditions and measures related to personal protection, hygiene and health evaluation	
Personal protection, e.g. wearing of gloves, face protection, full body dermal protection, goggles, respirator; specify effectiveness of measure; specify the suitable material for the PPE (where relevant) and advise how long the protective equipment can be used before replacement (if relevant)	- chemical goggles - substance task appropriate respirator - IF no LEV is applied THEN gloves giving 90% reduction should be used

Exposure information and relevance to its source

Information for contributing scenario 1

Workers exposure estimation is calculated with ECETOC TRA model.

Workers exposure	Unit	Exposure estimation	DNEL
Long-term systemic dermal effects	mg/kg bw/day	1.37 (without LEV, with gloves) 0.137 (with LEV)	34.7
Long-term systemic inhalation effects	mg/m3	8.84 (without LEV) 4.42 (with LEV)	10.4
Long-term dermal local effects	mg/cm2/day	0.1 (without LEV, with gloves) 0.01 (with LEV)	4.5
Long-term inhalation local effects	mg/m3	8.84 (without LEV) 4.42 (with LEV)	6.3

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

Human health:
Using the first tier model of ECETOC TRA and assuming a working time of 15 minutes to 1 hour and using chemically resistant gloves benzaldehyde does not pose a risk to human health for workers in this scenario for long-term systemic effects. For long-term local effects via inhalation a small risk is identified, however taking into account the worst case assumptions made with the ECETOC model, a risk to human health for workers for long-term local effects is not expected. If longer working hours are considered further risk reduction measures have to be introduced, focusing on reduction of the inhalation exposure (LEV, PPE). If Local Exhaust Ventilation is applied 4-8 hours working hours can be applied.

Additional good practice advice beyond the REACH CSA

Additional good practices (Operational Conditions and Risk Management Measures) beyond the REACH Chemical Safety Assessment established within Chemical Industry are also advised and communicated through Safety Data Sheets. Such as:

- Minimisation of manual phases;
- Minimisation of splashes and spills;
- Avoidance of contact with contaminated tools and objects;
- Regular cleaning of equipment and work area;

- Management/supervision in place to check that RMMs in place are being used correctly and OCs followed; - Training staff on good practice; - Good standard of personal hygiene.

1 Exposure scenario (4) **Charging/discharging at dedicated facilities in an industrial setting**	
Use descriptors related to the life cycle stage	SU3 PROC8B ERC (not relevant, covered by industrial uses)
List of names of contributing worker scenarios (1) and corresponding PROC	1. Charging/discharging at dedicated facilities in an industrial setting (PROC8B)
2.1 Contributing scenario (1) controlling worker exposure for charging/discharging at dedicated facilities in an industrial setting	
Charging/discharging at dedicated facilities in an industrial setting	
PROC8B	
Product characteristic	
Product related conditions, e.g. the concentration of the substance in a mixture, the physical state of that mixture (solid, liquid; if solid: level of dustiness), package design affecting exposure)	Liquid Substance as such
Amounts used	
Amounts used at a workplace (per task or per shift); note: sometimes this information is not needed for assessment of worker's exposure	Not applicable for first tier assessment using ECETOC TRA
Frequency and duration of use/exposure	
Duration per task/activity (e.g. hours per shift) and frequency (e.g. single events or repeated) of exposure	More than 4 hours per day, repeated exposure (working life) if additional RMMs are applied (LEV) 15 minutes to 1 hour, repeated exposure (working life) if no additional RMMs are applied
Human factors not influenced by risk management	
Particular conditions of use, e.g. body parts potentially exposed as a result of the nature of the activity	Exposed skin surface (cm2): 480 (two hands, face side only)
Other given operational conditions affecting workers exposure	
Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process into workers environment; room volume, whether the work is carried out outdoors/indoors, process conditions related to temperature and pressure.	Indoors
Technical conditions and measures at process level (source) to prevent release	
Process design aiming to prevent releases and hence exposure of workers; this in particular includes conditions ensuring rigorous containment; performance of containment to be specified (e.g. by quantification of residual losses or exposure)	Not applicable
Technical conditions and measures to control dispersion from source towards the worker	
Engineering controls, e.g. exhaust ventilation,	IF working hours are longer than 1 hour/day THEN LEV is

general ventilation; specify effectiveness of measure	needed.
Organisational measures to prevent /limit releases, dispersion and exposure	
Specific organisational measures or measures needed to support the functioning of particular technical measures (e.g. training and supervision). Those measures need to be reported in particular for demonstrating strictly controlled conditions (to justify exposure based waiving).	Not applicable
Conditions and measures related to personal protection, hygiene and health evaluation	
Personal protection, e.g. wearing of gloves, face protection, full body dermal protection, goggles, respirator; specify effectiveness of measure; specify the suitable material for the PPE (where relevant) and advise how long the protective equipment can be used before replacement (if relevant)	- chemical goggles - substance task appropriate respirator
Exposure information and relevance to its source	
Information for contributing scenario 1	
Workers exposure estimation is calculated with ECETOC TRA model.	

Workers exposure	Unit	Exposure estimation	DNEL
Long-term systemic dermal effects	mg/kg bw/day	6.86 (without LEV) 0.686 (with LEV)	34.7
Long-term systemic inhalation effects	mg/m3	4.42 (without LEV) 6.63E-01 (with LEV)	10.4
Long-term dermal local effects	mg/cm2/day	1. (without LEV) 0.1 (with LEV)	4.5
Long-term inhalation local effects	mg/m3	4.42 (without LEV) 6.63E-01 (with LEV)	6.3

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

Human health:
Using the first tier model of ECETOC TRA and assuming a working time of 15 minutes to 1 hour benzaldehyde does not pose a risk to human health for workers in this scenario for long-term systemic/local effects. If longer working hours are considered further risk reduction measures have to be introduced, focusing on reduction of the inhalation exposure (LEV, PPE). If Local Exhaust Ventilation is applied 4-8 hours working hours can be applied.

Additional good practice advice beyond the REACH CSA

Additional good practices (Operational Conditions and Risk Management Measures) beyond the REACH Chemical Safety Assessment established within Chemical Industry are also advised and communicated through Safety Data Sheets. Such as:

- Minimisation of manual phases;
- Minimisation of splashes and spills;
- Avoidance of contact with contaminated tools and objects;
- Regular cleaning of equipment and work area;
- Management/supervision in place to check that RMMs in place are being used correctly and OCs followed;
- Training staff on good practice;
- Good standard of personal hygiene.

1 Exposure scenario (5) **Transfer of substance into small containers in an industrial setting**	
Use descriptors related to the life cycle stage	SU3 PROC9 ERC (not relevant, covered by industrial uses)
List of names of contributing worker scenarios (1) and corresponding PROC	1. Transfer of substance into small containers in an industrial setting (PROC9)
2.1 Contributing scenario (1) controlling worker exposure for transfer of substance into small containers in an industrial setting	
Transfer of substance into small containers in an industrial setting	
PROC9	
Product characteristic	
Product related conditions, e.g. the concentration of the substance in a mixture, the physical state of that mixture (solid, liquid; if solid: level of dustiness), package design affecting exposure)	Liquid Substance as such
Amounts used	
Amounts used at a workplace (per task or per shift); note: sometimes this information is not needed for assessment of worker's exposure	Not applicable for first tier assessment using ECETOC TRA
Frequency and duration of use/exposure	
Duration per task/activity (e.g. hours per shift) and frequency (e.g. single events or repeated) of exposure	More than 4 hours per day, repeated exposure (working life) if additional RMMs are applied (LEV) 15 minutes to 1 hour, repeated exposure (working life) if no additional RMMs are applied
Human factors not influenced by risk management	
Particular conditions of use, e.g. body parts potentially exposed as a result of the nature of the activity	Exposed skin surface (cm2): 480 (two hands, face side only)
Other given operational conditions affecting workers exposure	
Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process into workers environment; room volume, whether the work is carried out outdoors/indoors, process conditions related to temperature and pressure.	Indoors
Technical conditions and measures at process level (source) to prevent release	
Process design aiming to prevent releases and hence exposure of workers; this in particular includes conditions ensuring rigorous containment; performance of containment to be specified (e.g. by quantification of residual losses or exposure)	Not applicable
Technical conditions and measures to control dispersion from source towards the worker	
Engineering controls, e.g. exhaust ventilation, general ventilation; specify effectiveness of	IF working hours are longer than 1 hour/day THEN LEV is needed.

measure	
Organisational measures to prevent /limit releases, dispersion and exposure	
Specific organisational measures or measures needed to support the functioning of particular technical measures (e.g. training and supervision). Those measures need to be reported in particular for demonstrating strictly controlled conditions (to justify exposure based waiving).	Not applicable
Conditions and measures related to personal protection, hygiene and health evaluation	
Personal protection, e.g. wearing of gloves, face protection, full body dermal protection, goggles, respirator; specify effectiveness of measure; specify the suitable material for the PPE (where relevant) and advise how long the protective equipment can be used before replacement (if relevant)	- chemical goggles - substance task appropriate respirator

Exposure information and relevance to its source

Information for contributing scenario 1

Workers exposure estimation is calculated with ECETOC TRA model.

Workers exposure	Unit	Exposure estimation	DNEL
Long-term systemic dermal effects	mg/kg bw/day	6.86 (without LEV) 0.686 (with LEV)	34.7
Long-term systemic inhalation effects	mg/m3	4.42 (without LEV) 2.21 (with LEV)	10.4
Long-term dermal local effects	mg/cm2/day	1. (without LEV) 0.1 (with LEV)	4.5
Long-term inhalation local effects	mg/m3	4.42 (without LEV) 2.21 (with LEV)	6.3

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

Using the first tier model of ECETOC TRA and assuming a working time of 15 minutes to 1 hour benzaldehyde does not pose a risk to human health for workers in this scenario for long-term systemic/local effects. If longer working hours are considered further risk reduction measures have to be introduced, focusing on reduction of the inhalation exposure (LEV, PPE). If Local Exhaust Ventilation is applied 4-8 hours working hours can be applied.

Additional good practice advice beyond the REACH CSA

Additional good practices (Operational Conditions and Risk Management Measures) beyond the REACH Chemical Safety Assessment established within Chemical Industry are also advised and communicated through Safety Data Sheets. Such as:

- Minimisation of manual phases;
- Minimisation of splashes and spills;
- Avoidance of contact with contaminated tools and objects;
- Regular cleaning of equipment and work area;
- Management/supervision in place to check that RMMs in place are being used correctly and OCs followed;
- Training staff on good practice;
- Good standard of personal hygiene.

1 Exposure scenario (6) **Formulation of preparations in closed batch processes or in batch processes with multistage and/or significant contact**	
Use descriptors related to the life cycle stage	SU3/10 PROC3, PROC5 PC0/28/29/39 ECR2
Name of contributing environmental scenario (1) and corresponding ERC	1. Environmental release during formulation of preparations (ERC2)
List of names of contributing worker scenarios (2-n) and corresponding PROC	2. Formulation in a closed batch process (PROC3) 3. Formulation in batch processes with multistage and/or significant contact (PROC5)

2.1 Contributing scenario (1) controlling environmental exposure during formulation of preparations

Environmental release during formulation of preparations

ERC2

An environmental assessment has been performed using the EUSES model version 2.1 and the ERCs for calculating environmental release. About 5% of the total volume of benzaldehyde will be used for formulations to four different product categories. It is assumed that the 5% will be evenly distributed over these product categories and that there are at least 50 sites per PC doing formulation.

Product characteristics	
Product related conditions, e.g. the concentration of the substance in a mixture; viscosity of product; package design affecting exposure	Liquid Substance as such
Amounts used	
Daily and annual amount per site (for uses in industrial setting) or daily and annual amount for wide disperse uses;	Confidential information.
Frequency and duration of use	
Intermittent (used < 12 times per year for not more than 24 h) or continuous use/release	Continuous.
Environment factors not influenced by risk management	
Flow rate of receiving surface water (m3/d, usually 18,000 m3/d for the standard town by default; please note: the default flow rate will be rarely changeable for downstream uses.	18,000 m3/day
Other given operational conditions affecting environmental exposure	
Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process (via air and waste water); dry or water based processes; conditions related to temperature and pressure; indoor or outdoor use of products; work in confined area or open air;	Not applicable
Technical conditions and measures at process level (source) to prevent release	

Process design aiming to prevent releases and hence exposure to the environment; this includes in particular conditions ensuring rigorous containment; performance of the containment to be specified (e.g. by quantification of a release factor in section 9.x.2 of the CSR);	Not applicable
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Technical measures, e.g. on-site waste water and waste treatment techniques, scrubbers, filters and other technical measures aiming at reducing releases to air, sewage system, surface water or soil; this includes strictly controlled conditions (procedural and control technology) to minimise emissions; specify effectiveness of measures; specify the size of industrial sewage treatment plant (m3/d), degradation effectiveness and sludge treatment (if applicable);	Not applicable
Organizational measures to prevent/limit release from site	
Specific organisational measures or measures needed to support the functioning of particular technical measures. Those measures need to be reported in particular for demonstrating strictly controlled conditions.	Not applicable
Conditions and measures related to municipal sewage treatment plant	
Size of municipal sewage system/treatment plant (m3/d); specify degradation effectiveness; sludge treatment technique (disposal or recovery); measures to limit air emissions from sewage treatment (if applicable); please note: the default size of the municipal STP (2000 m3/d) will be rarely changeable for downstream uses.	Receiving sewage water flow rate is 2000 m3/day
Conditions and measures related to external treatment of waste for disposal	
Fraction of used amount transferred to external waste treatment for disposal; type of suitable treatment for waste generated by workers uses, e.g. hazardous waste incineration, chemical-physical treatment for emulsions, chemical oxidation of aqueous waste; specify effectiveness of treatment;	Not applicable.
Conditions and measures related to external recovery of waste	
Fraction of used amount transferred to external waste treatment for recovery: specify type of suitable recovery operations for waste generated by workers uses, e.g. re-destillation of solvents, refinery process for lubricant waste, recovery of slags, heat recovery outside waste incinerators; specify effectiveness of measure;	Not applicable

Additional good practice advice beyond the REACH CSA Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH, Thus, the downstream user is not obliged to i) carry out an own CSA and ii) to notify the use to the Agency, if he does not implement these measures.	
Use specific measures expected to reduce the predicted exposure beyond the level estimated based on the exposure scenario.	Not applicable
2.2 Contributing scenario (2) controlling worker exposure for formulation in a closed batch process	
Formulation in a closed batch process	
PROC3	
Product characteristic	
Product related conditions, e.g. the concentration of the substance in a mixture, the physical state of that mixture (solid, liquid; if solid: level of dustiness), package design affecting exposure)	Liquid Substance as such
Amounts used	
Amounts used at a workplace (per task or per shift); note: sometimes this information is not needed for assessment of worker's exposure	Not applicable for first tier assessment using ECETOC TRA
Frequency and duration of use/exposure	
Duration per task/activity (e.g. hours per shift) and frequency (e.g. single events or repeated) of exposure	More than 4 hours per day, repeated exposure (working life) with additional RMMs (LEV) 1 to 4 hours per day, repeated exposure (working life) without additional RMMs
Human factors not influenced by risk management	
Particular conditions of use, e.g. body parts potentially exposed as a result of the nature of the activity	Exposed skin surface (cm2): 240 (one hand, face side only)
Other given operational conditions affecting workers exposure	
Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process into workers environment; room volume, whether the work is carried out outdoors/indoors, process conditions related to temperature and pressure.	Indoors
Technical conditions and measures at process level (source) to prevent release	
Process design aiming to prevent releases and hence exposure of workers; this in particular includes conditions ensuring rigorous containment; performance of containment to be specified (e.g. by quantification of residual losses or exposure)	Not applicable
Technical conditions and measures to control dispersion from source towards the worker	
Engineering controls, e.g. exhaust ventilation, general ventilation; specify effectiveness of	IF working hours are more than 4 hours/day THEN LEV

measure	should be applied
Organisational measures to prevent /limit releases, dispersion and exposure	
Specific organisational measures or measures needed to support the functioning of particular technical measures (e.g. training and supervision). Those measures need to be reported in particular for demonstrating strictly controlled conditions (to justify exposure based waiving).	Not applicable
Conditions and measures related to personal protection, hygiene and health evaluation	
Personal protection, e.g. wearing of gloves, face protection, full body dermal protection, goggles, respirator; specify effectiveness of measure; specify the suitable material for the PPE (where relevant) and advise how long the protective equipment can be used before replacement (if relevant)	- chemical goggles - substance task appropriate respirator
2.3 Contributing scenario (3) controlling worker exposure for formulation in batch processes with multistage and/or significant contact	
Formulation in batch processes with multistage and/or significant contact	
PROC5	
Product characteristic	
Product related conditions, e.g. the concentration of the substance in a mixture, the physical state of that mixture (solid, liquid; if solid: level of dustiness), package design affecting exposure)	Liquid Substance as such
Amounts used	
Amounts used at a workplace (per task or per shift); note: sometimes this information is not needed for assessment of worker's exposure	Not applicable for first tier assessment using ECETOC TRA
Frequency and duration of use/exposure	
Duration per task/activity (e.g. hours per shift) and frequency (e.g. single events or repeated) of exposure	More than 4 hours per day, repeated exposure (working life) if additional RMMs are applied (LEV) 15 minutes to 1 hour, repeated exposure (working life) if no additional RMMs are applied
Human factors not influenced by risk management	
Particular conditions of use, e.g. body parts potentially exposed as a result of the nature of the activity	Exposed skin surface (cm2): 480 (two hands, face side only)
Other given operational conditions affecting workers exposure	
Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process into workers environment; room volume, whether the work is carried out outdoors/indoors, process conditions related to temperature and pressure.	Indoors
Technical conditions and measures at process level (source) to prevent release	
Process design aiming to prevent releases and	Not applicable

hence exposure of workers; this in particular includes conditions ensuring rigorous containment; performance of containment to be specified (e.g. by quantification of residual losses or exposure)	
Technical conditions and measures to control dispersion from source towards the worker	
Engineering controls, e.g. exhaust ventilation, general ventilation; specify effectiveness of measure	IF working hours are longer than 1 hour/day THEN LEV is needed.
Organisational measures to prevent /limit releases, dispersion and exposure	
Specific organisational measures or measures needed to support the functioning of particular technical measures (e.g. training and supervision). Those measures need to be reported in particular for demonstrating strictly controlled conditions (to justify exposure based waiving).	Not applicable
Conditions and measures related to personal protection, hygiene and health evaluation	
Personal protection, e.g. wearing of gloves, face protection, full body dermal protection, goggles, respirator; specify effectiveness of measure; specify the suitable material for the PPE (where relevant) and advise how long the protective equipment can be used before replacement (if relevant)	- chemical goggles - substance task appropriate respirator

Exposure information and relevance to its source

Information for contributing scenario 1

Environmental exposure has been calculated using the EUSES model v2.1.

Environmental exposure	Unit	Exposure estimation	PNEC
Freshwater	mg/L	9.48E-04	1.07E-03
Marine water	mg/L	7.13E-04[1]	1.07E-04
Sediment	mg/kg	2.01E-03	2.27E-03
Soil	mg/kg	1.03E-03	1.29E-03
STP	mg/l	8.8E-03	7.59

[1] The RCR for the marine compartment is slightly above 1. There is no direct emission to the marine compartment. Taking into account that it is assumed that marine species are not more sensitive to this chemical and the fast degradation in the aquatic compartment, benzaldehyde is not considered to be of risk for this compartment.

Information for contributing scenario 2

Workers exposure estimation is calculated with ECETOC TRA model.

Workers exposure	Unit	Exposure estimation	DNEL
Long-term systemic dermal effects	mg/kg bw/day	3.43E-01 (without LEV) 3.43E-02 (with LEV)	34.7
Long-term systemic inhalation effects	mg/m3	7.96 (without LEV) 1.33 (with LEV)	10.4
Long-term dermal local effects	mg/cm2/day	0.01 (without LEV) 0.01 (with LEV)	4.5
Long-term inhalation local effects	mg/m3	7.96 (without LEV)	6.3

		1.33 (with LEV)	
Information for contributing scenario 3			
Workers exposure estimation is calculated with ECETOC TRA model.			
Workers exposure	Unit	Exposure estimation	DNEL
Long-term systemic dermal effects	mg/kg bw/day	13.7 (without LEV) 6.86E-02 (with LEV)	34.7
Long-term systemic inhalation effects	mg/m3	4.42 (without LEV) 2.21 (with LEV)	10.4
Long-term dermal local effects	mg/cm2/day	2. (without LEV) 0.01 (with LEV)	4.5
Long-term inhalation local effects	mg/m3	4.42 (without LEV) 2.21 (with LEV)	6.3

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

Human health
Contributing scenario 2:
Using the first tier model of ECETOC TRA and assuming a working time of 1 to 4 hours benzaldehyde does not pose a risk to human health for workers in this scenario for long-term systemic effects. For long-term local effects via inhalation a small risk is identified, however taking into account the worst case assumptions made with the ECETOC model, a risk to human health for workers for long-term local effects is not expected. If longer working hours are considered further risk reduction measures have to be introduced, focusing on reduction of the inhalation exposure (LEV, PPE). If Local Exhaust Ventilation is applied 4-8 hours working hours can be applied.
Contributing scenario 3:
Using the first tier model of ECETOC TRA and assuming a working time of 15 minutes to 1 hour benzaldehyde does not pose a risk to human health for workers in this scenario for long-term systemic/local effects. If longer working hours are considered further risk reduction measures have to be introduced, focusing on reduction of the inhalation exposure (LEV, PPE). If Local Exhaust Ventilation is applied 4-8 hours working hours can be applied.

Additional good practice advice beyond the REACH CSA

Additional good practices (Operational Conditions and Risk Management Measures) beyond the REACH Chemical Safety Assessment established within Chemical Industry are also advised and communicated through Safety Data Sheets. Such as:

- Minimisation of manual phases;
- Minimisation of splashes and spills;
- Avoidance of contact with contaminated tools and objects;
- Regular cleaning of equipment and work area;
- Management/supervision in place to check that RMMs in place are being used correctly and OCs followed;
- Training staff on good practice;
- Good standard of personal hygiene.

1 Exposure scenario (7) **Professional use of laboratory chemicals – wide dispersive indoor use**	
Use descriptors related to the life cycle stage	SU22 PROC15 PC21 ECR8A
Name of contributing environmental scenario (1) and corresponding ERC	1. Environmental release during wide dispersive indoor use of processing aids in open systems (ERC8A)
List of names of contributing worker scenarios (2) and corresponding PROC	2. Professional use of laboratory chemicals (PROC15)
2.1 Contributing scenario (1) controlling environmental exposure during wide dispersive indoor use of processing aids in open systems	
Environmental release during wide dispersive indoor use of processing aids in open systems ERC8A The release from use as laboratory chemical will be insignificant compared to the other scenarios already described. Small amounts of benzaldehyde could be washed-out of e.g. laboratory glassware which then would be released to waste water and end up in the WWTP. The concentrations that will be released to surface waters will be negligible.	
2.2 Contributing scenario (2) controlling worker exposure for professional use of laboratory chemicals	
Professional use of laboratory chemicals	
PROC15	
Product characteristic	
Product related conditions, e.g. the concentration of the substance in a mixture, the physical state of that mixture (solid, liquid; if solid: level of dustiness), package design affecting exposure)	Liquid Substance as such
Amounts used	
Amounts used at a workplace (per task or per shift); note: sometimes this information is not needed for assessment of worker's exposure	Not applicable for first tier assessment using ECETOC TRA
Frequency and duration of use/exposure	
Duration per task/activity (e.g. hours per shift) and frequency (e.g. single events or repeated) of exposure	More than 4 hours per day, repeated exposure (working life) if additional RMMs are applied (LEV) 15 minutes to 1 hour, repeated exposure (working life) if no additional RMMs are applied
Human factors not influenced by risk management	
Particular conditions of use, e.g. body parts potentially exposed as a result of the nature of the activity	Exposed skin surface (cm2): 240 (one hand, face side only)
Other given operational conditions affecting workers exposure	
Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process into workers environment; room volume, whether the work is carried out outdoors/indoors, process	Indoors

conditions related to temperature and pressure.	
Technical conditions and measures at process level (source) to prevent release	
Process design aiming to prevent releases and hence exposure of workers; this in particular includes conditions ensuring rigorous containment; performance of containment to be specified (e.g. by quantification of residual losses or exposure)	Not applicable
Technical conditions and measures to control dispersion from source towards the worker	
Engineering controls, e.g. exhaust ventilation, general ventilation; specify effectiveness of measure	IF working hours are longer than 1 hour/day THEN LEV is needed.
Organisational measures to prevent /limit releases, dispersion and exposure	
Specific organisational measures or measures needed to support the functioning of particular technical measures (e.g. training and supervision). Those measures need to be reported in particular for demonstrating strictly controlled conditions (to justify exposure based waiving).	Not applicable
Conditions and measures related to personal protection, hygiene and health evaluation	
Personal protection, e.g. wearing of gloves, face protection, full body dermal protection, goggles, respirator; specify effectiveness of measure; specify the suitable material for the PPE (where relevant) and advise how long the protective equipment can be used before replacement (if relevant)	- chemical goggles - substance task appropriate respirator

Exposure information and relevance to its source

Information for contributing scenario 1

The release from use as laboratory chemical will be insignificant compared to the other scenarios already described. Small amounts of benzaldehyde could be washed-out of e.g. laboratory glassware which then would be released to waste water and end up in the WWTP. The concentrations that will be released to surface waters will be negligible.

Information for contributing scenario 2

Workers exposure estimation is calculated with ECETOC TRA model.

Workers exposure	Unit	Exposure estimation	DNEL
Long-term systemic dermal effects	mg/kg bw/day	3.43E-01 (without LEV) 3.43E-02 (with LEV)	34.7
Long-term systemic inhalation effects	mg/m3	4.42 (with and without LEV)	10.4
Long-term dermal local effects	mg/cm2/day	0.1 (without LEV) 0.01 (with LEV)	4.5
Long-term inhalation local effects	mg/m3	4.42 (with and without LEV)	6.3

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

Using the first tier model of ECETOC TRA and assuming a working time of 15 minutes to 1 hour benzaldehyde does not pose a risk to human health for workers in this scenario for long-term systemic/local effects. If longer working hours are considered further risk reduction measures have to be introduced, focusing on reduction of

the inhalation exposure (LEV, PPE). If Local Exhaust Ventilation is applied 4-8 hours working hours can be applied.

Additional good practice advice beyond the REACH CSA

Additional good practices (Operational Conditions and Risk Management Measures) beyond the REACH Chemical Safety Assessment established within Chemical Industry are also advised and communicated through Safety Data Sheets. Such as:

- Minimisation of manual phases;
- Minimisation of splashes and spills;
- Avoidance of contact with contaminated tools and objects;
- Regular cleaning of equipment and work area;
- Management/supervision in place to check that RMMs in place are being used correctly and OCs followed;
- Training staff on good practice;
- Good standard of personal hygiene.