

SAFETY DATA SHEET



Tetraethylenepentamine, TEPA

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

1.1 Product identifier

Product name : Tetraethylenepentamine, TEPA
Index number : 612-060-00-0
EC number : 292-587-7
REACH Registration number

Registration number	Legal entity
01-2119487290-37-0000	-

CAS number : 112-57-2
European Union: 90640-66-7

Other means of identification : -

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

Product use : Intermediate. Chemical synthesis.

Identified uses
ES 01: Manufacture - Industrial: PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC15; ERC01
ES 02: Formulation: Ashless dispersant - Industrial: PC20; PROC01, PROC02, PROC03, PROC04, PROC05, PROC08a, PROC08b, PROC09, PROC15; ERC02
ES 03: Formulation: Diesel and gasoline additive - Industrial: PC13; PROC03, PROC05, PROC08a, PROC08b, PROC09, PROC15; ERC02
ES 04: Formulation: lube oil - Industrial: PROC03, PROC05, PROC08a, PROC08b, PROC09; ERC02
ES 05: Formulation: Wood preservatives - Industrial: PC08; PROC03, PROC05, PROC08a, PROC08b, PROC09, PROC15; ERC02
ES 06: Formulation: Epoxy curing agent - Industrial: PC01; PROC03, PROC05, PROC08a, PROC08b, PROC09, PROC15; ERC02
ES 07: Formulation: Epoxy curing agent in paint - Industrial: PC09a; PROC03, PROC05, PROC08a, PROC08b, PROC09; ERC02
ES 08: Formulation: Coatings, Adhesives and inks - Industrial: PC01, PC09a, PC14, PC15, PC18, PC20; PROC01, PROC02, PROC03, PROC04, PROC05, PROC08a, PROC08b, PROC09; ERC02
ES 09: Formulation: Electroplating - Industrial: PC14, PC15; PROC02, PROC03, PROC08a, PROC08b, PROC13; ERC02
ES 10: Use at industrial sites: Ashless dispersant - Industrial: SU09; PC20; PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC15; ERC06a
ES 11: Use at industrial sites: Diesel and gasoline additive - Industrial: PC13; PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC15; ERC06a
ES 12: Use at industrial sites: lube oil - Industrial: SU08, SU09; PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC15; ERC06a
ES 13: Use at industrial sites: Wood preservatives - Industrial: PC08; PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC15; ERC06a
ES 14: Use at industrial sites: Epoxy curing agent - Industrial: SU09; PC01; PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC15; ERC06a
ES 15: Use at industrial sites: Epoxy curing agent in paint - Industrial: SU09; PC09a; PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC15; ERC06a
ES 16: Use at industrial sites: Processing aid - Industrial: SU09; PROC01, PROC02, PROC03, PROC04, PROC05, PROC08a, PROC08b, PROC09, PROC12, PROC13, PROC14, PROC15; ERC04
ES 17: Use at industrial sites: Coatings, Adhesives and inks - Industrial: SU0, SU14, SU15, SU17; PC01, PC09a, PC14, PC15, PC18, PC20; PROC02, PROC04, PROC05, PROC07, PROC08a, PROC08b, PROC10, PROC13; ERC06b
ES 18: Use at industrial sites: Electroplating - Industrial: SU0, SU14, SU15, SU17; PC14, PC15, PC20; PROC02, PROC03, PROC04, PROC05, PROC08a, PROC08b, PROC13, PROC15; ERC04, ERC05, ERC06b
ES 19: Use at industrial sites: Metal working fluids - Industrial: PC24, PC25; PROC02, PROC03, PROC07, PROC08a, PROC08b, PROC10, PROC13, PROC17, PROC18; ERC04
ES 20: Use at industrial sites: Corrosion inhibitor - Industrial: SU08, SU09; PROC03; ERC04

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ES 21: Use at industrial sites: Solvent - Industrial: SU08; PROC01, PROC02, PROC03, PROC08a, PROC08b, PROC09, PROC15; ERC04, ERC06b

See Annex to the Safety data sheet for additional information in the Exposure Scenario(s).

1.3 Details of the supplier of the safety data sheet

Delamine B.V.
Stationsplein 121
3818LE Amersfoort
The Netherlands
Telephone number: +31-334224600
e-mail address of person responsible for this SDS : sds.delamine@delamine.com

1.4 Emergency telephone number

Supplier

Telephone number : ☎ 352 323 3500 (24 h)

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Product definition : Multi-constituent substance

Classification according to Regulation (EC) No. 1272/2008 [CLP/GHS]

☑ Acute Tox. 4, H312
Skin Corr. 1B, H314
Eye Dam. 1, H318
Aquatic Chronic 2, H411

The product is classified as hazardous according to Regulation (EC) 1272/2008 as amended.

See Section 16 for the full text of the H statements declared above.

See Section 11 for more detailed information on health effects and symptoms.

2.2 Label elements

Hazard pictograms



Signal word : Danger

Hazard statements : ☑ H312 - Harmful in contact with skin.
H314 - Causes severe skin burns and eye damage.
H411 - Toxic to aquatic life with long lasting effects.

Precautionary statements

Prevention : P280 - Wear protective gloves. Wear eye or face protection. Wear protective clothing.
P260 - Do not breathe vapour.
P273 - Avoid release to the environment.

Response : P391 - Collect spillage.
P303 + P361 + P353 + P310 - IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. Immediately call a POISON CENTER or physician.
P305 + P351 + P338 + P310 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or physician.

Storage : Not applicable.

Disposal : Not applicable.

Hazardous ingredients : ☑ Amines, polyethylenepoly-, tetraethylenepentamine fraction

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SECTION 2: Hazards identification

Supplemental label elements : EUH071 - Corrosive to the respiratory tract.

Annex XVII - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles : Not applicable.

2.3 Other hazards

Product meets the criteria for PBT or vPvB according to Regulation (EC) No. 1907/2006, Annex XIII :

PBT	P	B	T	vPvB	vP	vB
No	Yes	No	No	No	Yes	No

Other hazards which do not result in classification : None known.

SECTION 3: Composition/information on ingredients

3.1 Substances : Multi-constituent substance

Product/ingredient name	Identifiers	%	Regulation (EC) No. 1272/2008 [CLP]	Type
Amines, polyethylenepoly-, tetraethylenepentamine fraction	REACH #: 01-2119487290-37 EC: 292-587-7 CAS: 90640-66-7 (Other means of identification CAS no. 112-57-2) Index: 612-060-00-0	100	Acute Tox. 4, H312 Skin Corr. 1B, H314 Eye Dam. 1, H318 Aquatic Chronic 2, H411 EUH071 See Section 16 for the full text of the H statements declared above.	[A]

There are no additional ingredients present which, within the current knowledge of the supplier, are classified and contribute to the classification of the substance and hence require reporting in this section.

Type

[A] Constituent

[B] Impurity

[C] Stabilising additive

Occupational exposure limits, if available, are listed in Section 8.

SECTION 4: First aid measures**4.1 Description of first aid measures**

Eye contact : Get medical attention immediately. Call a poison center or physician. Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician.

Inhalation : Get medical attention immediately. Call a poison center or physician. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

SECTION 4: First aid measures

- Skin contact** : Get medical attention immediately. Call a poison center or physician. Wash with plenty of soap and water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician. Wash clothing before reuse. Clean shoes thoroughly before reuse.
- Ingestion** : Get medical attention immediately. Call a poison center or physician. Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Chemical burns must be treated promptly by a physician. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.
- Protection of first-aiders** : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

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

- Eye contact** : Causes serious eye damage.
- Inhalation** : Corrosive to the respiratory tract. Causes burns.
- Skin contact** : Causes severe burns. Harmful in contact with skin.
- Ingestion** : No known significant effects or critical hazards.

Over-exposure signs/symptoms

- Eye contact** : Adverse symptoms may include the following:
pain
watering
redness
- Inhalation** : Adverse symptoms may include the following:
respiratory tract irritation
coughing
- Skin contact** : Adverse symptoms may include the following:
pain or irritation
redness
blistering may occur
- Ingestion** : Adverse symptoms may include the following:
stomach pains

4.3 Indication of any immediate medical attention and special treatment needed

- Notes to physician** : In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.
- Specific treatments** : No specific treatment.

SECTION 5: Firefighting measures**5.1 Extinguishing media**

- Suitable extinguishing media** : Use dry chemical, CO₂, water spray (fog) or foam. Dry sand or other suitable absorbent. Use an extinguishing agent suitable for the surrounding fire.
- Unsuitable extinguishing media** : Do not use water jet.

5.2 Special hazards arising from the substance or mixture

SECTION 5: Firefighting measures

- Hazards from the substance or mixture** : In a fire or if heated, a pressure increase will occur and the container may burst. This material is toxic to aquatic life with long lasting effects. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.
- Hazardous combustion products** : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
nitrogen oxides
- 5.3 Advice for firefighters**
- Special protective actions for fire-fighters** : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.
- Special protective equipment for fire-fighters** : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode. Clothing for fire-fighters (including helmets, protective boots and gloves) conforming to European standard EN 469 will provide a basic level of protection for chemical incidents.
- Additional information (Explosibility)** : Not considered to be a product presenting a risk of explosion.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

- For non-emergency personnel** : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Do not breathe vapour or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.
- For emergency responders** : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

6.2 Environmental precautions

- : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Water polluting material. May be harmful to the environment if released in large quantities. Collect spillage.

6.3 Methods and material for containment and cleaning up

- Small spill** : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.
- Large spill** : Stop leak if without risk. Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations. Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilt product.

6.4 Reference to other sections

- : See Section 1 for emergency contact information.
See Section 8 for information on appropriate personal protective equipment.
See Section 13 for additional waste treatment information.

SECTION 7: Handling and storage**7.1 Precautions for safe handling**

- Protective measures** : Put on appropriate personal protective equipment (see Section 8). Do not get in eyes or on skin or clothing. Do not breathe vapour or mist. Do not ingest. Avoid release to the environment. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Keep away from acids. Empty containers retain product residue and can be hazardous. Do not reuse container.
- Advice on general occupational hygiene** : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

7.2 Conditions for safe storage, including any incompatibilities

Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Separate from acids. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Seveso Directive - Reporting thresholds (in tonnes)**Danger criteria**

Category	Notification and MAPP threshold	Safety report threshold
E2: Hazardous to the aquatic environment - Chronic 2	200	500

7.3 Specific end use(s)

Section 7. Handling and storage: The information in this section contains generic advice and guidance. The list of Identified Uses in Section 1 should be consulted for any available use-specific information provided in the Exposure Scenario(s).

SECTION 8: Exposure controls/personal protection

The list of Identified Uses in Section 1 should be consulted for any available use-specific information provided in the Exposure Scenario(s).

8.1 Control parameters**Occupational exposure limits**

No exposure limit value known.

- Recommended monitoring procedures** : If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment. Reference should be made to monitoring standards, such as the following: European Standard EN 689 (Workplace atmospheres - Guidance for the assessment of exposure by inhalation to chemical agents for comparison with limit values and measurement strategy) European Standard EN 14042 (Workplace atmospheres - Guide for the application and use of procedures for the assessment of exposure to chemical and biological agents) European Standard EN 482 (Workplace atmospheres - General requirements for the performance of procedures for the measurement of chemical agents) Reference to national guidance documents for methods for the determination of hazardous substances will also be required.

DNELs/DMELs

SECTION 8: Exposure controls/personal protection

Product/ingredient name	Type	Exposure	Value	Population	Effects
Amines, polyethylenepoly-, tetraethylenepentamine fraction	DNEL	Long term Inhalation	0.82 mg/m ³	Workers	Systemic
	DNEL	Long term Dermal	0.25 mg/cm ²	Workers	Local
	DNEL	Long term Inhalation	0.14 mg/m ³	General population	Systemic
	DNEL	Long term Dermal	20.8 µg/cm ²	General population	Local
	DNEL	Long term Oral	0.21 mg/kg bw/day	General population	Systemic

PNECs

Product/ingredient name	Compartment Detail	Value	Method Detail
Amines, polyethylenepoly-, tetraethylenepentamine fraction	Fresh water	0.01 mg/l	Assessment Factors
	Marine water	0.001 mg/l	Assessment Factors
	Fresh water sediment	3.198 mg/kg dwt	Equilibrium Partitioning
	Marine water sediment	0.32 mg/kg dwt	Equilibrium Partitioning
	Sewage Treatment Plant	4.6 mg/l	Assessment Factors
	Soil	2.5 mg/kg dwt	Equilibrium Partitioning

8.2 Exposure controls

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles and/or face shield. If inhalation hazards exist, a full-face respirator may be required instead.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Recommended: Wear suitable gloves tested to EN374.

> 8 hours (breakthrough time): butyl rubber (thickness ≥0.3 mm), nitrile rubber (thickness ≥0.4 mm), Chloroprene (thickness ≥0.65 mm).

SECTION 8: Exposure controls/personal protection

- Body protection** : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
- Other skin protection** : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
- Respiratory protection** : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.
- Recommended: Combination filtering device (DIN EN 14387), Filter type: A-P2.
- Environmental exposure controls** : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

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

- Physical state** : Liquid.
- Colour** : Off-white. Clear.
- Odour** : Odourless.
- Odour threshold** : Not available.
- pH** : 13.5
- Melting point/freezing point** : -71°C
- Initial boiling point and boiling range** : 375°C
- Flash point** : Closed cup: 177°C
- Evaporation rate** : Not available.
- Flammability (solid, gas)** : Not applicable.
- Upper/lower flammability or explosive limits** : Not available.
- Vapour pressure** : 0.000019 kPa [room temperature]
- Vapour density** : Not available.
- Relative density** : Not available.
- Density** : 0.993 to 0.998 g/cm³ [20°C]
- Solubility(ies)** : Not available.
- Solubility in water** : >1000 g/l
- Partition coefficient: n-octanol/ water** : -2.6 (20°C)
- Auto-ignition temperature** : 330°C
- Decomposition temperature** : Not available.
- Viscosity** : Kinematic (room temperature): 0.807 cm²/s
Kinematic (40°C): 0.251 cm²/s
- Explosive properties** : Not considered to be a product presenting a risk of explosion.
- Oxidising properties** : None.

9.2 Other information

No additional information.

SECTION 10: Stability and reactivity

- 10.1 Reactivity** : No specific test data related to reactivity available for this product or its ingredients.
- 10.2 Chemical stability** : The product is stable.
- 10.3 Possibility of hazardous reactions** : Under normal conditions of storage and use, hazardous reactions will not occur.
Under normal conditions of storage and use, hazardous polymerisation will not occur.
- 10.4 Conditions to avoid** : aerosol or mist formation.
Keep away from heat, sparks and flame. Do not smoke.
- 10.5 Incompatible materials** : Reactive or incompatible with the following materials: oxidizing materials, metals, acids. Chlorinated hydrocarbon.
- 10.6 Hazardous decomposition products** : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

SECTION 11: Toxicological information**11.1 Information on toxicological effects****Acute toxicity**

Product/ingredient name	Result	Species	Dose	Exposure	Remarks
Amines, polyethylenepoly-, tetraethylenepentamine fraction	LD50 Dermal	Rabbit - Male	1260 mg/kg	-	-
	LD50 Oral	Rat - Male	3221 mg/kg	-	-

Conclusion/Summary : Harmful in contact with skin.

Acute toxicity estimates

Product/ingredient name	Oral (mg/kg)	Dermal (mg/kg)	Inhalation (gases) (ppm)	Inhalation (vapours) (mg/l)	Inhalation (dusts and mists) (mg/l)
Amines, polyethylenepoly-, tetraethylenepentamine fraction	3221	1260	N/A	N/A	N/A

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation	Remarks
Amines, polyethylenepoly-, tetraethylenepentamine fraction	Skin - Severe irritant [OECD 435]	Mammal - species unspecified	-	-	-	-

Conclusion/Summary

- Skin** : Causes severe burns.
- Eyes** : Causes serious eye damage.

Sensitisation**Conclusion/Summary**

- Skin** : No data available for this end-point, hence this classification is not considered to be applicable.

Mutagenicity

SECTION 11: Toxicological information

Product/ingredient name	Test	Experiment	Result	Remarks
Amines, polyethylenepoly-, tetraethylenepentamine fraction	OECD 476	Experiment: In vitro Subject: Mammalian-Animal	Positive	-
	OECD 474	Experiment: In vivo Subject: Mammalian-Animal	Negative	test substance: CAS no. 90640-67-8 (read-across)
	OECD 471	Experiment: In vitro Subject: Bacteria	Equivocal	-

Conclusion/Summary : Based on available data, the classification criteria are not met.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No data available for this end-point, hence this classification is not considered to be applicable.

Teratogenicity

Product/ingredient name	Result	Species	Dose	Exposure	Remarks
Amines, polyethylenepoly-, tetraethylenepentamine fraction	Negative - Oral	Rat	400 mg/kg NOAEL	-	test substance: CAS no. 4067-16-7 (read-across)
	Negative - Dermal [OECD 414]	Rabbit	125 mg/kg NOAEL	12 days; 6 hours per day	test substance: CAS no. 90640-67-8 (read-across)

Conclusion/Summary : Based on available data, the classification criteria are not met.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

- Eye contact** : Causes serious eye damage.
- Inhalation** : Corrosive to the respiratory tract. Causes burns.
- Skin contact** : Causes severe burns. Harmful in contact with skin.
- Ingestion** : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

- Eye contact** : Adverse symptoms may include the following:
pain
watering
redness

SECTION 11: Toxicological information

- Inhalation** : Adverse symptoms may include the following:
respiratory tract irritation
coughing
- Skin contact** : Adverse symptoms may include the following:
pain or irritation
redness
blistering may occur
- Ingestion** : Adverse symptoms may include the following:
stomach pains

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

- Potential immediate effects** : Not available.
- Potential delayed effects** : Not available.

Long term exposure

- Potential immediate effects** : Not available.
- Potential delayed effects** : Not available.

Potential chronic health effects

Product/ingredient name	Result	Species	Dose	Exposure	Remarks
Amines, polyethylenepoly-, tetraethylenepentamine fraction	Sub-chronic LOAEL Oral [OECD 408]	Rat - Male, Female	50 mg/kg	-	test substance: CAS no. 38260-01-4 (read-across).
	Sub-acute NOEL Dermal [OECD 410]	Rabbit - Male, Female	200 mg/kg systemic toxicity	20 days; 5 days per week	-
	Sub-acute NOAEL Dermal [OECD 410]	Rabbit - Male, Female	1.25 mg/cm ² Local effects	20 days; 5 days per week	-

- Conclusion/Summary** : Based on available data, the classification criteria are not met.
- General** : No known significant effects or critical hazards.
- Carcinogenicity** : No known significant effects or critical hazards.
- Mutagenicity** : No known significant effects or critical hazards.
- Teratogenicity** : No known significant effects or critical hazards.
- Developmental effects** : No known significant effects or critical hazards.
- Fertility effects** : No known significant effects or critical hazards.

Other information : Not available.

SECTION 12: Ecological information

12.1 Toxicity

Product/ingredient name	Result	Species	Exposure	Remarks
Amines, polyethylenepoly-, tetraethylenepentamine fraction	Acute EC50 6.8 mg/l Fresh water [OECD 201]	Algae - Pseudokirchnerella subcapitata	72 hours	-
	Acute EC50 24.1 mg/l Fresh water	Daphnia - Daphnia magna	48 hours	-

SECTION 12: Ecological information

	Acute LC50 420 mg/l Fresh water	Fish - Poecilia reticulata	96 hours	-
	Chronic EC10 1.9 mg/l Fresh water	Daphnia - Daphnia magna	21 days	test substance: CAS no. 90640-67-8 (read-across)
	Chronic NOEC 0.5 mg/l Fresh water [OECD 201]	Algae - Pseudokirchnerella subcapitata	72 hours	-

Conclusion/Summary : Toxic to aquatic life with long lasting effects.

12.2 Persistence and degradability

Product/ingredient name	Test	Result	Dose	Inoculum
Amines, polyethylenepoly-, tetraethylenepentamine fraction	OECD 302A	17 % - Not readily - 84 days	-	-
	OECD 301D	0 % - Not readily - 162 days	-	-

Conclusion/Summary : Not readily biodegradable.

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
Amines, polyethylenepoly-, tetraethylenepentamine fraction	-	-	Not readily

12.3 Bioaccumulative potential

Product/ingredient name	LogP _{ow}	BCF	Potential
Amines, polyethylenepoly-, tetraethylenepentamine fraction	-2.6	-	low

12.4 Mobility in soil

Soil/water partition coefficient (K_{oc}) : 3162.28

Mobility : Low mobility in soil predicted, based on the log K_{oc} value.

12.5 Results of PBT and vPvB assessment

Product/ingredient name	PBT	P	B	T	vPvB	vP	vB
Amines, polyethylenepoly-, tetraethylenepentamine fraction	No	Yes	No	No	No	Yes	No

12.6 Other adverse effects : No known significant effects or critical hazards.

SECTION 13: Disposal considerations

The information in this section contains generic advice and guidance. The list of Identified Uses in Section 1 should be consulted for any available use-specific information provided in the Exposure Scenario(s).

13.1 Waste treatment methods

Product

SECTION 13: Disposal considerations

- Methods of disposal** : The generation of waste should be avoided or minimised wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction.
- The allocation of waste identity numbers/waste descriptions must be carried out according to the EWC, specific to the industry and process.
- Hazardous waste** : The classification of the product may meet the criteria for a hazardous waste.
- Packaging**
- Methods of disposal** : The generation of waste should be avoided or minimised wherever possible.
- Special precautions** : This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

SECTION 14: Transport information

	ADR/RID	ADN	IMDG	IATA
14.1 UN number	UN2320	UN2320	UN2320	UN2320
14.2 UN proper shipping name	TETRAETHYLENEPENTAMINE	TETRAETHYLENEPENTAMINE	TETRAETHYLENEPENTAMINE	Tetraethylenepentamine
14.3 Transport hazard class(es)	8	8	8	8
Label				
14.4 Packing group	III	III	III	III
14.5 Environmental hazards	Yes.	Yes.	Marine Pollutant: Yes	Yes. The environmentally hazardous substance mark is not required.

Additional information

- ADR/RID** : The environmentally hazardous substance mark is not required when transported in sizes of ≤5 L or ≤5 kg.
Hazard identification number 80
Limited quantity 5 L
Tunnel code (E)
- ADN** : The environmentally hazardous substance mark is not required when transported in sizes of ≤5 L or ≤5 kg.
- IMDG** : The marine pollutant mark is not required when transported in sizes of ≤5 L or ≤5 kg.
Emergency schedules F-A, S-B
- IATA** : The environmentally hazardous substance mark may appear if required by other transportation regulations.
Quantity limitation Passenger and Cargo Aircraft: 5 L. Packaging instructions: 852. Cargo Aircraft Only: 60 L. Packaging instructions: 856. Limited Quantities - Passenger Aircraft: 1 L. Packaging instructions: Y841.
Special provisions A803

- 14.6 Special precautions for user** : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Tetraethylenepentamine, TEPA

SECTION 14: Transport information

14.7 Transport in bulk according to Annex II of Marpol and the IBC Code **Proper shipping name** : Tetraethylenepentamine
Ship type : 2
Pollution category : Y

SECTION 15: Regulatory information

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

EU Regulation (EC) No. 1907/2006 (REACH)

Annex XIV - List of substances subject to authorisation

Annex XIV

None of the components are listed.

Substances of very high concern

None of the components are listed.

Annex XVII - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles : Not applicable.

Other EU regulations

Ozone depleting substances (1005/2009/EU)

Not listed.

Prior Informed Consent (PIC) (649/2012/EU)

Not listed.

Seveso Directive

This product is controlled under the Seveso Directive.

Danger criteria

Category

E2: Hazardous to the aquatic environment - Chronic 2

National regulations

Hazchem code : 2X

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol (Annexes A, B, C, E)

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Inventory list

Australia inventory (AICS) : All components are listed or exempted.

Canada : All components are listed or exempted.

China : All components are listed or exempted.

Europe : All components are listed or exempted.

Japan : **Japan inventory (ENCS):**
All components are listed or exempted.

SECTION 15: Regulatory information

New Zealand	: All components are listed or exempted.
Philippines	: All components are listed or exempted.
Republic of Korea	: All components are listed or exempted.
Taiwan	: All components are listed or exempted.
Turkey	: All components are listed or exempted.
United States	: All components are listed or exempted.
Viet Nam	: All components are listed or exempted.

15.2 Chemical safety assessment : Complete.

SECTION 16: Other information

✔ Indicates information that has changed from previously issued version.

Abbreviations and acronyms :

- ADN = European Provisions concerning the International Carriage of Dangerous Goods by Inland Waterway
- ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
- ATE = Acute Toxicity Estimate
- BCF = Bioconcentration Factor
- CLP = Classification, Labelling and Packaging Regulation [Regulation (EC) No. 1272/2008]
- DMEL = Derived Minimal Effect Level
- DNEL = Derived No Effect Level
- EUH statement = CLP-specific Hazard statement
- EWC = European Waste Catalogue
- IATA = International Air Transport Association
- IBC = Intermediate Bulk Container
- IMDG = International Maritime Dangerous Goods
- LogPow = logarithm of the octanol/water partition coefficient
- MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
- N/A = Not available
- PBT = Persistent, Bioaccumulative and Toxic
- PNEC = Predicted No Effect Concentration
- RID = The Regulations concerning the International Carriage of Dangerous Goods by Rail
- RRN = REACH Registration Number
- SGG = Segregation Group
- vPvB = Very Persistent and Very Bioaccumulative

Procedure used to derive the classification according to Regulation (EC) No. 1272/2008 [CLP/GHS]

Classification	Justification
✔ Acute Tox. 4, H312 Skin Corr. 1B, H314 Eye Dam. 1, H318 Aquatic Chronic 2, H411	On basis of test data On basis of test data On basis of test data Calculation method

Full text of abbreviated H statements

H312	Harmful in contact with skin.
H314	Causes severe skin burns and eye damage.
H318	Causes serious eye damage.
H319	Causes serious eye irritation.
H411	Toxic to aquatic life with long lasting effects.

Full text of classifications [CLP/GHS]

Tetraethylenepentamine, TEPA

SECTION 16: Other information

Acute Tox. 4, H312 Aquatic Chronic 2, H411 EUH071 Eye Dam. 1, H318 Eye Irrit. 2, H319 Skin Corr. 1B, H314	ACUTE TOXICITY (dermal) - Category 4 LONG-TERM (CHRONIC) AQUATIC HAZARD - Category 2 Corrosive to the respiratory tract. SERIOUS EYE DAMAGE/EYE IRRITATION - Category 1 SERIOUS EYE DAMAGE/EYE IRRITATION - Category 2 SKIN CORROSION/IRRITATION - Category 1B
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Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition : Multi-constituent substance
Product name : Tetraethylenepentamine, TEPA

Section 1 - Title

Short title of the exposure scenario : Manufacture.

List of use descriptors : **Identified use name: ES 01:** Manufacture - Industrial: PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC15; ERC01
Process Category: PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC15
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC01

Environmental contributing scenarios : **Manufacture of the substance - ERC01**

Health Contributing scenarios : **Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions - PROC01**
Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions - PROC02
Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition - PROC03
Chemical production where opportunity for exposure arises - PROC04
Transfer of substance or mixture (charging and discharging) at non-dedicated facilities - PROC08a
Transfer of substance or mixture (charging and discharging) at dedicated facilities - PROC08b
Use as laboratory reagent - PROC15

Number of the ES	: 01
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Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Manufacture of the substance

Product characteristics : Liquid.

Amounts used : Annual site tonnage: 4650 tonnes/year.
 Fraction of Regional tonnage used locally: 0.25.
 Daily amount per site: 15.5 tonnes/day.

Frequency and duration of use : Emission days: ≥ 300 days per year.

Other conditions affecting environmental exposure : Receiving surface water flow ≥ 18000 m³/d.
 Release factor after on-site risk management:
 water: 0.000000484 % (Estimated release factor).
 Local release rate: 0.0000075 kg/day.
 air: 0.000736 % (Estimated release factor).
 Local release rate: 0.114 kg/day.
 Soil: 0 % (Estimated release factor).

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil : Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of ≥ 27.7 %.

- Organisational measures to prevent/limit release from site** : Prevent discharge of undissolved substance to or recover from onsite wastewater.
- Conditions and measures related to sewage treatment plant** : Sewage Treatment Plant: Yes. (Efficiency of at least 27.7 %) Assumed domestic sewage treatment plant flow 2000 m³/d. Application of the STP sludge on agricultural soil: Yes.
- Conditions and measures related to external treatment of waste for disposal** : Particular considerations on the waste treatment operations.

Contributing scenario controlling worker exposure for: All Contributing scenarios

- Product characteristics** : Liquid.
Vapour pressure (40 °C): 0.07 Pa.
- Concentration of substance in mixture or article** : Covers concentrations up to 100 %.
- Other conditions affecting workers exposure** : Indoor use.
Temperature: ≤40°C.
- Organisational measures to prevent/limit releases, dispersion and exposure** : - Any measure to eliminate exposure should be considered.
- Very high level of containment required, except for short term exposures e.g. taking samples.
- Design closed system to allow for easy maintenance.
- If possible keep equipment under negative pressure.
- Control staff entry to work area.
- Ensure all equipment well maintained.
- Permit to work for maintenance work.
- Regular cleaning of equipment and work area.
- Management/supervision in place to check that the RMMs in place are being used correctly and OCs followed.
- Training for staff on good practice.
- Procedures and training for emergency decontamination and disposal.
- Good standard of personal hygiene.
- Recording of any 'near miss' situations.
- Sensitizers - Without prejudice to relevant national legislation, pre-employment screening and appropriate health surveillance.

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

- Personal protection** : - All skin and mucous membranes with potential exposure protected with appropriate PPE (personal protective equipment)
- Substance/Task appropriate gloves.
- Skin coverage with appropriate barrier material based on potential for contact with the chemicals.
- Substance/task appropriate respiratory protection.
- Optional face shield.
- Eye protection.

Contributing scenario controlling worker exposure for 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

- Frequency and duration of use/exposure** : Exposure duration per day: ≤8 hours.
- Technical conditions and measures to control dispersion from source towards the worker** : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
- Conditions and measures related to personal protection, hygiene and health evaluation**
- Personal protection** : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Frequency and duration of use/exposure : Exposure duration per day: ≤8 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Inhalation - minimum efficiency of 30 %.
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 5: Chemical production where opportunity for exposure arises

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 6: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 7: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 95 %.

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

Tetraethylenepentamine, TEPA	Exposure Scenario: 01	Manufacture.
Personal protection	: Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.	
Respiratory protection	: Wear respiratory protection. Inhalation - minimum efficiency of 90 %.	
Contributing scenario controlling worker exposure for 8: Use as laboratory reagent		
Frequency and duration of use/exposure	: Exposure duration per day: ≤4 hours.	
Technical conditions and measures to control dispersion from source towards the worker	: Provide a basic standard of general ventilation (1 to 3 air changes per hour). Occupational Health and Safety Management System: Advanced. Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.	
Conditions and measures related to personal protection, hygiene and health evaluation		
Personal protection	: Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.	
Respiratory protection	: Wear respiratory protection. Inhalation - minimum efficiency of 90 %.	

Section 3 - Exposure estimation and reference to its source

Exposure estimation and reference to its source - Environment: 1: Manufacture of the substance		
Exposure assessment (environment):	: EUSES 2.1.2.	
Exposure estimation	: Freshwater: 0.0000179 mg/l. Risk characterisation ratio (PEC/PNEC): <0.01.	
	Freshwater sediment: 0.00571 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): <0.01.	
	Marine water: 0.00000175 mg/l. Risk characterisation ratio (PEC/PNEC): <0.01.	
	Marine water sediment: 0.00056 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): <0.01.	
	Sewage Treatment Plant: 0.00000271 mg/l. Risk characterisation ratio (PEC/PNEC): <0.01.	
	Soil: 0.00323 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): <0.01.	
Remark	: Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).	

Exposure estimation and reference to its source - Workers: 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions		
Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.	
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.09 mg/m ³ . Risk characterisation ratio: 0.109.	
	Worker - dermal, long-term - local: 0.000992 mg/cm ² . Risk characterisation ratio: <0.01.	
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	

Exposure estimation and reference to its source - Workers: 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

- Exposure assessment (human):** : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
- Exposure estimation** : **Worker - inhalative, long-term - systemic:** 0.627 mg/m³.
Risk characterisation ratio: 0.765.
- Worker - dermal, long-term - local:** 0.02 mg/cm².
Risk characterisation ratio: 0.08.
- Remark** : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

- Exposure assessment (human):** : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
- Exposure estimation** : **Worker - inhalative, long-term - systemic:** 0.161 mg/m³.
Risk characterisation ratio: 0.197.
- Worker - dermal, long-term - local:** 0.02 mg/cm².
Risk characterisation ratio: 0.081.
- Remark** : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 5: Chemical production where opportunity for exposure arises

- Exposure assessment (human):** : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
- Exposure estimation** : **Worker - inhalative, long-term - systemic:** 0.269 mg/m³.
Risk characterisation ratio: 0.328.
- Worker - dermal, long-term - local:** 0.1 mg/cm².
Risk characterisation ratio: 0.4.
- Remark** : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 6: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

- Exposure assessment (human):** : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
- Exposure estimation** : **Worker - inhalative, long-term - systemic:** 0.537 mg/m³.
Risk characterisation ratio: 0.655.
- Worker - dermal, long-term - local:** 0.1 mg/cm².
Risk characterisation ratio: 0.4.
- Remark** : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 7: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Exposure assessment (human): : ECETOC TRA worker v3
 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.134 mg/m³.
 Risk characterisation ratio: 0.164.

Worker - dermal, long-term - local: 0.1 mg/cm².
 Risk characterisation ratio: 0.4.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 8: Use as laboratory reagent

Exposure assessment (human): : ECETOC TRA worker v3
 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.269 mg/m³.
 Risk characterisation ratio: 0.328.

Worker - dermal, long-term - local: 0.00992 mg/cm².
 Risk characterisation ratio: 0.04.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

General : The immediate downstream user is required to evaluate whether the operational conditions and risk management measures described in the exposure scenario fit to his use. If other OC/RMM are adopted, the user has to ensure that risks are managed to at least equivalent levels. The risk assessment methods/tools given in section 3 may be used for this evaluation.

Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition : Multi-constituent substance
Product name : Tetraethylenepentamine, TEPA

Section 1 - Title

Short title of the exposure scenario : Formulation: Ashless dispersant; Processing aids such as pH-regulators, flocculants, precipitants, neutralization agents (PC20).

List of use descriptors : **Identified use name: ES 02:** Formulation: Ashless dispersant - Industrial: PC20; PROC01, PROC02, PROC03, PROC04, PROC05, PROC08a, PROC08b, PROC09, PROC15; ERC02

Process Category: PROC01, PROC02, PROC03, PROC04, PROC05, PROC08a, PROC08b, PROC09, PROC15

Substance supplied to that use in form of: As such

Subsequent service life relevant for that use: No.

Environmental Release Category: ERC02

Market sector by type of chemical product: PC20

Environmental contributing scenarios : **Formulation into mixture - ERC02**

Health Contributing scenarios : **Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions - PROC01**
Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions - PROC02

Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition - PROC03

Chemical production where opportunity for exposure arises - PROC04

Mixing or blending in batch processes - PROC05

Transfer of substance or mixture (charging and discharging) at non-dedicated facilities - PROC08a

Transfer of substance or mixture (charging and discharging) at dedicated facilities - PROC08b

Transfer of substance or mixture into small containers (dedicated filling line, including weighing) - PROC09

Use as laboratory reagent - PROC15

Number of the ES : 02

Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Formulation into mixture

Product characteristics : Liquid.

Amounts used : Annual site tonnage: 1210 tonnes/year.
 Fraction of Regional tonnage used locally: 0.25.
 Daily amount per site: 4.033 tonnes/day.

Frequency and duration of use : Emission days: ≥300 days per year.

Other conditions affecting environmental exposure : Receiving surface water flow ≥18000 m³/d.

Release factor after on-site risk management:
 water: 0 % (Estimated release factor).

Local release rate: 0 kg/day.

air: 0.000736 % (Estimated release factor).

Local release rate: 0.03 kg/day.

Soil: 0 % (Estimated release factor).

Tetraethylenepentamine, TEPA Exposure Scenario: 02 **Formulation: Ashless dispersant; Processing aids such as pH-regulators, flocculants, precipitants, neutralization agents (PC20).**

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil : Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of $\geq 27.7\%$.

Organisational measures to prevent/limit release from site : Prevent discharge of undissolved substance to or recover from onsite wastewater.

Conditions and measures related to sewage treatment plant : Sewage Treatment Plant: Yes. (Efficiency of at least 27.7 %) Assumed domestic sewage treatment plant flow 2000 m³/d. Application of the STP sludge on agricultural soil: Yes.

Conditions and measures related to external treatment of waste for disposal : Particular considerations on the waste treatment operations.

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics : Liquid.
Vapour pressure (40 °C): 0.07 Pa.

Concentration of substance in mixture or article : Covers concentrations up to 100 %.

Other conditions affecting workers exposure : Indoor use.
Temperature: $\leq 40^{\circ}\text{C}$.

Organisational measures to prevent/limit releases, dispersion and exposure :

- Any measure to eliminate exposure should be considered.
- Very high level of containment required, except for short term exposures e.g. taking samples.
- Design closed system to allow for easy maintenance.
- If possible keep equipment under negative pressure.
- Control staff entry to work area.
- Ensure all equipment well maintained.
- Permit to work for maintenance work.
- Regular cleaning of equipment and work area.
- Management/supervision in place to check that the RMMs in place are being used correctly and OCs followed.
- Training for staff on good practice.
- Procedures and training for emergency decontamination and disposal.
- Good standard of personal hygiene.
- Recording of any 'near miss' situations.
- Sensitizers - Without prejudice to relevant national legislation, pre-employment screening and appropriate health surveillance.

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

Personal protection :

- All skin and mucous membranes with potential exposure protected with appropriate PPE (personal protective equipment)
- Substance/Task appropriate gloves.
- Skin coverage with appropriate barrier material based on potential for contact with the chemicals.
- Substance/task appropriate respiratory protection.
- Optional face shield.
- Eye protection.

Contributing scenario controlling worker exposure for 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Frequency and duration of use/exposure : Exposure duration per day: ≤ 8 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour). Occupational Health and Safety Management System: Advanced.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Frequency and duration of use/exposure : Exposure duration per day: ≤8 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Inhalation - minimum efficiency of 30 %.
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 5: Chemical production where opportunity for exposure arises

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 6: Mixing or blending in batch processes

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 7: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 8: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 95 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing)

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 10: Use as laboratory reagent

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Section 3 - Exposure estimation and reference to its source

Exposure estimation and reference to its source - Environment: 1: Formulation into mixture

Exposure assessment (environment): : EUSES 2.1.2.

Exposure estimation : Freshwater: 0.0000176 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Freshwater sediment: 0.00563 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): <0.01.

Marine water: 0.00000173 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Marine water sediment: 0.000552 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): <0.01.

Sewage Treatment Plant: 0 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Soil: 0.00271 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): <0.01.

Remark : Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.09 mg/m³.
Risk characterisation ratio: 0.109.

Worker - dermal, long-term - local: 0.000992 mg/cm².
Risk characterisation ratio: <0.01.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.627 mg/m³.
Risk characterisation ratio: 0.765.

Worker - dermal, long-term - local: 0.02 mg/cm².
Risk characterisation ratio: 0.08.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.161 mg/m ³ . Risk characterisation ratio: 0.197. Worker - dermal, long-term - local: 0.02 mg/cm ² . Risk characterisation ratio: 0.081.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 5: Chemical production where opportunity for exposure arises

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 6: Mixing or blending in batch processes

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.2 mg/cm ² . Risk characterisation ratio: 0.8.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 7: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.537 mg/m ³ . Risk characterisation ratio: 0.655. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 8: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.134 mg/m ³ . Risk characterisation ratio: 0.164. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing)

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 10: Use as laboratory reagent

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.00992 mg/cm ² . Risk characterisation ratio: 0.04.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

General	: The immediate downstream user is required to evaluate whether the operational conditions and risk management measures described in the exposure scenario fit to his use. If other OC/RMM are adopted, the user has to ensure that risks are managed to at least equivalent levels. The risk assessment methods/tools given in section 3 may be used for this evaluation.
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Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition : Multi-constituent substance
Product name : Tetraethylenepentamine, TEPA

Section 1 - Title

Short title of the exposure scenario : Formulation: Diesel and gasoline additive; Fuels (PC13).
List of use descriptors : **Identified use name: ES 03:** Formulation: Diesel and gasoline additive - Industrial: PC13; PROC03, PROC05, PROC08a, PROC08b, PROC09, PROC15; ERC02
Process Category: PROC03, PROC05, PROC08a, PROC08b, PROC09, PROC15
Substance supplied to that use in form of: As such
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC02
Market sector by type of chemical product: PC13
Environmental contributing scenarios : **Formulation into mixture - ERC02**
Health Contributing scenarios : **Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition - PROC03**
Mixing or blending in batch processes - PROC05
Transfer of substance or mixture (charging and discharging) at non-dedicated facilities - PROC08a
Transfer of substance or mixture (charging and discharging) at dedicated facilities - PROC08b
Transfer of substance or mixture into small containers (dedicated filling line, including weighing) - PROC09
Use as laboratory reagent - PROC15

Number of the ES	: 03
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Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Formulation into mixture

Product characteristics	: Liquid.
Amounts used	: Annual site tonnage: 186 tonnes/year. Fraction of Regional tonnage used locally: 0.1. Daily amount per site: 0.51 tonnes/day.
Frequency and duration of use	: Emission days: ≥ 365 days per year.
Other conditions affecting environmental exposure	: Receiving surface water flow ≥ 18000 m ³ /d. Release factor after on-site risk management: water: 0 % (Estimated release factor). Local release rate: 0 kg/day. air: 0.000736 % (Estimated release factor). Local release rate: 0.00375 kg/day. Soil: 0 % (Estimated release factor).
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil	: Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of ≥ 27.7 %.
Organisational measures to prevent/limit release from site	: Prevent discharge of undissolved substance to or recover from onsite wastewater.

Tetraethylenepentamine, TEPA Exposure Scenario: 03 **Formulation: Diesel and gasoline additive; Fuels (PC13).**

Conditions and measures related to sewage treatment plant : Sewage Treatment Plant: Yes. (Efficiency of at least 27.7 %)
Assumed domestic sewage treatment plant flow 2000 m³/d.
Application of the STP sludge on agricultural soil: Yes.

Conditions and measures related to external treatment of waste for disposal : Particular considerations on the waste treatment operations.

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics : Liquid.
Vapour pressure (40 °C): 0.07 Pa.

Concentration of substance in mixture or article : Covers concentrations up to 100 %.

Other conditions affecting workers exposure : Indoor use.
Temperature: ≤40°C.

Organisational measures to prevent/limit releases, dispersion and exposure : - Any measure to eliminate exposure should be considered.
- Very high level of containment required, except for short term exposures e.g. taking samples.
- Design closed system to allow for easy maintenance.
- If possible keep equipment under negative pressure.
- Control staff entry to work area.
- Ensure all equipment well maintained.
- Permit to work for maintenance work.
- Regular cleaning of equipment and work area.
- Management/supervision in place to check that the RMMs in place are being used correctly and OCs followed.
- Training for staff on good practice.
- Procedures and training for emergency decontamination and disposal.
- Good standard of personal hygiene.
- Recording of any 'near miss' situations.
- Sensitizers - Without prejudice to relevant national legislation, pre-employment screening and appropriate health surveillance.

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

Personal protection : - All skin and mucous membranes with potential exposure protected with appropriate PPE (personal protective equipment)
- Substance/Task appropriate gloves.
- Skin coverage with appropriate barrier material based on potential for contact with the chemicals.
- Substance/task appropriate respiratory protection.
- Optional face shield.
- Eye protection.

Contributing scenario controlling worker exposure for 2: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 3: Mixing or blending in batch processes

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 4: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 5: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 95 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 6: Transfer of substance or mixture into small containers (dedicated filling line, including weighing)

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 7: Use as laboratory reagent

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Tetraethylenepentamine, TEPA Exposure Scenario: 03 **Formulation: Diesel and gasoline additive; Fuels (PC13).**

- Personal protection** : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.
- Respiratory protection** : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Section 3 - Exposure estimation and reference to its source

Exposure estimation and reference to its source - Environment: 1: Formulation into mixture

- Exposure assessment (environment):** : EUSES 2.1.2.
- Exposure estimation** : Freshwater: 0.0000176 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.
- Freshwater sediment: 0.00563 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): <0.01.
- Marine water: 0.00000173 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.
- Marine water sediment: 0.000552 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): <0.01.
- Sewage Treatment Plant: 0 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.
- Soil: 0.00257 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): <0.01.
- Remark** : Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 2: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

- Exposure assessment (human):** : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
- Exposure estimation** : **Worker - inhalative, long-term - systemic:** 0.161 mg/m³.
Risk characterisation ratio: 0.197.
- Worker - dermal, long-term - local:** 0.02 mg/cm².
Risk characterisation ratio: 0.081.
- Remark** : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 3: Mixing or blending in batch processes

- Exposure assessment (human):** : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
- Exposure estimation** : **Worker - inhalative, long-term - systemic:** 0.269 mg/m³.
Risk characterisation ratio: 0.328.
- Worker - dermal, long-term - local:** 0.2 mg/cm².
Risk characterisation ratio: 0.8.
- Remark** : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 4: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.537 mg/m³.
Risk characterisation ratio: 0.655.

Worker - dermal, long-term - local: 0.1 mg/cm².
Risk characterisation ratio: 0.4.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 5: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.134 mg/m³.
Risk characterisation ratio: 0.164.

Worker - dermal, long-term - local: 0.1 mg/cm².
Risk characterisation ratio: 0.4.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 6: Transfer of substance or mixture into small containers (dedicated filling line, including weighing)

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.269 mg/m³.
Risk characterisation ratio: 0.328.

Worker - dermal, long-term - local: 0.1 mg/cm².
Risk characterisation ratio: 0.4.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 7: Use as laboratory reagent

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.269 mg/m³.
Risk characterisation ratio: 0.328.

Worker - dermal, long-term - local: 0.00992 mg/cm².
Risk characterisation ratio: 0.04.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

General : The immediate downstream user is required to evaluate whether the operational conditions and risk management measures described in the exposure scenario fit to his use. If other OC/RMM are adopted, the user has to ensure that risks are managed to at least equivalent levels. The risk assessment methods/tools given in section 3 may be used for this evaluation.

Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition : Multi-constituent substance
Product name : Tetraethylenepentamine, TEPA

Section 1 - Title

Short title of the exposure scenario : Formulation: lube oil.

List of use descriptors : **Identified use name: ES 04:** Formulation: lube oil - Industrial: PROC03, PROC05, PROC08a, PROC08b, PROC09: ERC02
Process Category: PROC03, PROC05, PROC08a, PROC08b, PROC09
Substance supplied to that use in form of: As such
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC02

Environmental contributing scenarios : **Formulation into mixture - ERC02**

Health Contributing scenarios : **Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition - PROC03**
Mixing or blending in batch processes - PROC05
Transfer of substance or mixture (charging and discharging) at non-dedicated facilities - PROC08a
Transfer of substance or mixture (charging and discharging) at dedicated facilities - PROC08b
Transfer of substance or mixture into small containers (dedicated filling line, including weighing) - PROC09

Number of the ES	: 04
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Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Formulation into mixture

Product characteristics : Liquid.

Amounts used : Annual site tonnage: 1210 tonnes/year.
 Fraction of Regional tonnage used locally: 0.25.
 Daily amount per site: 5.5 tonnes/day.

Frequency and duration of use : Emission days: ≥ 220 days per year.

Other conditions affecting environmental exposure : Receiving surface water flow ≥ 18000 m³/d.
 Release factor after on-site risk management:
 water: 0.001 % (Estimated release factor).
 Local release rate: 0.055 kg/day.
 air: 0.000736 % (Estimated release factor).
 Local release rate: 0.04 kg/day.
 Soil: 0 % (Estimated release factor).

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil : Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of ≥ 27.7 %.

Organisational measures to prevent/limit release from site : Prevent discharge of undissolved substance to or recover from onsite wastewater.

Conditions and measures related to sewage treatment plant : Sewage Treatment Plant: Yes. (Efficiency of at least 27.7 %)
 Assumed domestic sewage treatment plant flow 2000 m³/d.
 Application of the STP sludge on agricultural soil: Yes.

Conditions and measures related to external treatment of waste for disposal : Particular considerations on the waste treatment operations.

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics : Liquid.
Vapour pressure (40 °C): 0.07 Pa.

Concentration of substance in mixture or article : Covers concentrations up to 100 %.

Other conditions affecting workers exposure : Indoor use.
Temperature: ≤40°C.

Organisational measures to prevent/limit releases, dispersion and exposure : - Any measure to eliminate exposure should be considered.
- Very high level of containment required, except for short term exposures e.g. taking samples.
- Design closed system to allow for easy maintenance.
- If possible keep equipment under negative pressure.
- Control staff entry to work area.
- Ensure all equipment well maintained.
- Permit to work for maintenance work.
- Regular cleaning of equipment and work area.
- Management/supervision in place to check that the RMMs in place are being used correctly and OCs followed.
- Training for staff on good practice.
- Procedures and training for emergency decontamination and disposal.
- Good standard of personal hygiene.
- Recording of any 'near miss' situations.
- Sensitizers - Without prejudice to relevant national legislation, pre-employment screening and appropriate health surveillance.

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

Personal protection : - All skin and mucous membranes with potential exposure protected with appropriate PPE (personal protective equipment)
- Substance/Task appropriate gloves.
- Skin coverage with appropriate barrier material based on potential for contact with the chemicals.
- Substance/task appropriate respiratory protection.
- Optional face shield.
- Eye protection.

Contributing scenario controlling worker exposure for 2: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 3: Mixing or blending in batch processes

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Tetraethylenepentamine, TEPA	Exposure Scenario: 04	Formulation: lube oil.
Personal protection	: Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.	
Respiratory protection	: Wear respiratory protection. Inhalation - minimum efficiency of 90 %.	
Contributing scenario controlling worker exposure for 4: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities		
Frequency and duration of use/exposure	: Exposure duration per day: ≤4 hours.	
Technical conditions and measures to control dispersion from source towards the worker	: Provide a basic standard of general ventilation (1 to 3 air changes per hour). Occupational Health and Safety Management System: Advanced. Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.	
Conditions and measures related to personal protection, hygiene and health evaluation		
Personal protection	: Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.	
Respiratory protection	: Wear respiratory protection. Inhalation - minimum efficiency of 90 %.	
Contributing scenario controlling worker exposure for 5: Transfer of substance or mixture (charging and discharging) at dedicated facilities		
Frequency and duration of use/exposure	: Exposure duration per day: ≤4 hours.	
Technical conditions and measures to control dispersion from source towards the worker	: Provide a basic standard of general ventilation (1 to 3 air changes per hour). Occupational Health and Safety Management System: Advanced. Local exhaust ventilation: Inhalation - minimum efficiency of 95 %.	
Conditions and measures related to personal protection, hygiene and health evaluation		
Personal protection	: Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.	
Respiratory protection	: Wear respiratory protection. Inhalation - minimum efficiency of 90 %.	
Contributing scenario controlling worker exposure for 6: Transfer of substance or mixture into small containers (dedicated filling line, including weighing)		
Frequency and duration of use/exposure	: Exposure duration per day: ≤4 hours.	
Technical conditions and measures to control dispersion from source towards the worker	: Provide a basic standard of general ventilation (1 to 3 air changes per hour). Occupational Health and Safety Management System: Advanced. Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.	
Conditions and measures related to personal protection, hygiene and health evaluation		
Personal protection	: Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.	
Respiratory protection	: Wear respiratory protection. Inhalation - minimum efficiency of 90 %.	

Section 3 - Exposure estimation and reference to its source

Exposure estimation and reference to its source - Environment: 1: Formulation into mixture	
Exposure assessment (environment):	: EUSES 2.1.2.
Exposure estimation	: Freshwater: 0.002 mg/l. Risk characterisation ratio (PEC/PNEC): 0.2.
	: Freshwater sediment: 0.638 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): 0.2.
	: Marine water: 0.0002 mg/l. Risk characterisation ratio (PEC/PNEC): 0.2.
	: Marine water sediment: 0.064 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): 0.2.
	: Sewage Treatment Plant: 0.02 mg/l. Risk characterisation ratio (PEC/PNEC): <0.01.

Remark : Soil: 0.311 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.124.
: Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 2: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.161 mg/m³.
Risk characterisation ratio: 0.197.

Worker - dermal, long-term - local: 0.02 mg/cm².
Risk characterisation ratio: 0.081.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 3: Mixing or blending in batch processes

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.269 mg/m³.
Risk characterisation ratio: 0.328.

Worker - dermal, long-term - local: 0.2 mg/cm².
Risk characterisation ratio: 0.8.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 4: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.537 mg/m³.
Risk characterisation ratio: 0.655.

Worker - dermal, long-term - local: 0.1 mg/cm².
Risk characterisation ratio: 0.4.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 5: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.134 mg/m³.
Risk characterisation ratio: 0.164.

Worker - dermal, long-term - local: 0.1 mg/cm².
Risk characterisation ratio: 0.4.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 6: Transfer of substance or mixture into small containers (dedicated filling line, including weighing)

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

General	: The immediate downstream user is required to evaluate whether the operational conditions and risk management measures described in the exposure scenario fit to his use. If other OC/RMM are adopted, the user has to ensure that risks are managed to at least equivalent levels. The risk assessment methods/tools given in section 3 may be used for this evaluation.
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Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition : Multi-constituent substance
Product name : Tetraethylenepentamine, TEPA

Section 1 - Title

Short title of the exposure scenario : Formulation: Wood preservatives; Biocidal products (PC08).

List of use descriptors : **Identified use name: ES 05:** Formulation: Wood preservatives - Industrial: PC08; PROC03, PROC05, PROC08a, PROC08b, PROC09, PROC15; ERC02
Process Category: PROC03, PROC05, PROC08a, PROC08b, PROC09, PROC15
Substance supplied to that use in form of: As such
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC02
Market sector by type of chemical product: PC08

Environmental contributing scenarios : **Formulation into mixture - ERC02**

Health Contributing scenarios : **Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition - PROC03**
Mixing or blending in batch processes - PROC05
Transfer of substance or mixture (charging and discharging) at non-dedicated facilities - PROC08a
Transfer of substance or mixture (charging and discharging) at dedicated facilities - PROC08b
Transfer of substance or mixture into small containers (dedicated filling line, including weighing) - PROC09
Use as laboratory reagent - PROC15

Number of the ES	: 05
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Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Formulation into mixture

Product characteristics	: Liquid.
Amounts used	: Annual site tonnage: 837 tonnes/year. Fraction of Regional tonnage used locally: 0.45. Daily amount per site: 3.81 tonnes/day.
Frequency and duration of use	: Emission days: ≥ 220 days per year.
Other conditions affecting environmental exposure	: Receiving surface water flow ≥ 18000 m ³ /d. Release factor after on-site risk management: water: 0.002 % (Estimated release factor). Local release rate: 0.076 kg/day. air: 0.000011 % (Estimated release factor). Local release rate: 0.000419 kg/day. Soil: 0 % (Estimated release factor).
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil	: Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of ≥ 27.7 %.
Organisational measures to prevent/limit release from site	: Prevent discharge of undissolved substance to or recover from onsite wastewater.

Conditions and measures related to sewage treatment plant : Sewage Treatment Plant: Yes. (Efficiency of at least 27.7 %) Assumed domestic sewage treatment plant flow 2000 m³/d. Application of the STP sludge on agricultural soil: Yes.

Conditions and measures related to external treatment of waste for disposal : Particular considerations on the waste treatment operations.

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics : Liquid. Vapour pressure (40 °C): 0.07 Pa.

Concentration of substance in mixture or article : Covers concentrations up to 100 %.

Other conditions affecting workers exposure : Indoor use. Temperature: ≤40°C.

Organisational measures to prevent/limit releases, dispersion and exposure : - Any measure to eliminate exposure should be considered.
 - Very high level of containment required, except for short term exposures e.g. taking samples.
 - Design closed system to allow for easy maintenance.
 - If possible keep equipment under negative pressure.
 - Control staff entry to work area.
 - Ensure all equipment well maintained.
 - Permit to work for maintenance work.
 - Regular cleaning of equipment and work area.
 - Management/supervision in place to check that the RMMs in place are being used correctly and OCs followed.
 - Training for staff on good practice.
 - Procedures and training for emergency decontamination and disposal.
 - Good standard of personal hygiene.
 - Recording of any 'near miss' situations.
 - Sensitizers - Without prejudice to relevant national legislation, pre-employment screening and appropriate health surveillance.

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

Personal protection : - All skin and mucous membranes with potential exposure protected with appropriate PPE (personal protective equipment)
 - Substance/Task appropriate gloves.
 - Skin coverage with appropriate barrier material based on potential for contact with the chemicals.
 - Substance/task appropriate respiratory protection.
 - Optional face shield.
 - Eye protection.

Contributing scenario controlling worker exposure for 2: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour). Occupational Health and Safety Management System: Advanced. Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 3: Mixing or blending in batch processes

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 4: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 5: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 95 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 6: Transfer of substance or mixture into small containers (dedicated filling line, including weighing)

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 7: Use as laboratory reagent

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Tetraethylenepentamine, TEPA	Exposure Scenario: 05	Formulation: Wood preservatives; Biocidal products (PC08).
Personal protection	: Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.	
Respiratory protection	: Wear respiratory protection. Inhalation - minimum efficiency of 90 %.	

Section 3 - Exposure estimation and reference to its source

Exposure estimation and reference to its source - Environment: 1: Formulation into mixture		
Exposure assessment (environment):	: EUSES 2.1.2.	
Exposure estimation	: Freshwater: 0.00276 mg/l. Risk characterisation ratio (PEC/PNEC): 0.276.	
	Freshwater sediment: 0.882 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): 0.276.	
	Marine water: 0.000276 mg/l. Risk characterisation ratio (PEC/PNEC): 0.276.	
	Marine water sediment: 0.088 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): 0.276.	
	Sewage Treatment Plant: 0.028 mg/l. Risk characterisation ratio (PEC/PNEC): <0.01.	
	Soil: 0.429 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): 0.172.	
Remark	: Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).	

Exposure estimation and reference to its source - Workers: 2: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition		
Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.	
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.161 mg/m ³ . Risk characterisation ratio: 0.197.	
	Worker - dermal, long-term - local: 0.02 mg/cm ² . Risk characterisation ratio: 0.081.	
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	

Exposure estimation and reference to its source - Workers: 3: Mixing or blending in batch processes		
Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.	
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328.	
	Worker - dermal, long-term - local: 0.2 mg/cm ² . Risk characterisation ratio: 0.8.	
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	

Exposure estimation and reference to its source - Workers: 4: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.537 mg/m ³ . Risk characterisation ratio: 0.655. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 5: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.134 mg/m ³ . Risk characterisation ratio: 0.164. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 6: Transfer of substance or mixture into small containers (dedicated filling line, including weighing)

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 7: Use as laboratory reagent

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.00992 mg/cm ² . Risk characterisation ratio: 0.04.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

General	: The immediate downstream user is required to evaluate whether the operational conditions and risk management measures described in the exposure scenario fit to his use. If other OC/RMM are adopted, the user has to ensure that risks are managed to at least equivalent levels. The risk assessment methods/tools given in section 3 may be used for this evaluation.
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Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition : Multi-constituent substance
Product name : Tetraethylenepentamine, TEPA

Section 1 - Title

Short title of the exposure scenario : Formulation: Epoxy curing agent; Adhesives, sealants (PC01).
List of use descriptors : **Identified use name: ES 06:** Formulation: Epoxy curing agent - Industrial: PC01; PROC03, PROC05, PROC08a, PROC08b, PROC09, PROC15; ERC02
Process Category: PROC03, PROC05, PROC08a, PROC08b, PROC09, PROC15
Substance supplied to that use in form of: As such
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC02
Market sector by type of chemical product: PC01
Environmental contributing scenarios : **Formulation into mixture - ERC02**
Health Contributing scenarios : **Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition - PROC03**
Mixing or blending in batch processes - PROC05
Transfer of substance or mixture (charging and discharging) at non-dedicated facilities - PROC08a
Transfer of substance or mixture (charging and discharging) at dedicated facilities - PROC08b
Transfer of substance or mixture into small containers (dedicated filling line, including weighing) - PROC09
Use as laboratory reagent - PROC15

Number of the ES	: 06
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Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Formulation into mixture

Product characteristics	: Liquid.
Amounts used	: Annual site tonnage: 1160 tonnes/year. Fraction of Regional tonnage used locally: 0.25. Daily amount per site: 5.273 tonnes/day.
Frequency and duration of use	: Emission days: ≥ 220 days per year.
Other conditions affecting environmental exposure	: Receiving surface water flow ≥ 18000 m ³ /d. Release factor after on-site risk management: water: 0 % (Estimated release factor). Local release rate: 0 kg/day. air: 0.000736 % (Estimated release factor). Local release rate: 0.039 kg/day. Soil: 0 % (Estimated release factor).
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil	: Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of ≥ 27.7 %.
Organisational measures to prevent/limit release from site	: Prevent discharge of undissolved substance to or recover from onsite wastewater.

Conditions and measures related to sewage treatment plant : Sewage Treatment Plant: Yes. (Efficiency of at least 27.7 %) Assumed domestic sewage treatment plant flow 2000 m³/d. Application of the STP sludge on agricultural soil: Yes.

Conditions and measures related to external treatment of waste for disposal : Particular considerations on the waste treatment operations.

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics : Liquid.
Vapour pressure (40 °C): 0.07 Pa.

Concentration of substance in mixture or article : Covers concentrations up to 100 %.

Other conditions affecting workers exposure : Indoor use.
Temperature: ≤40°C.

Organisational measures to prevent/limit releases, dispersion and exposure : - Any measure to eliminate exposure should be considered.
- Very high level of containment required, except for short term exposures e.g. taking samples.
- Design closed system to allow for easy maintenance.
- If possible keep equipment under negative pressure.
- Control staff entry to work area.
- Ensure all equipment well maintained.
- Permit to work for maintenance work.
- Regular cleaning of equipment and work area.
- Management/supervision in place to check that the RMMs in place are being used correctly and OCs followed.
- Training for staff on good practice.
- Procedures and training for emergency decontamination and disposal.
- Good standard of personal hygiene.
- Recording of any 'near miss' situations.
- Sensitizers - Without prejudice to relevant national legislation, pre-employment screening and appropriate health surveillance.

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

Personal protection : - All skin and mucous membranes with potential exposure protected with appropriate PPE (personal protective equipment)
- Substance/Task appropriate gloves.
- Skin coverage with appropriate barrier material based on potential for contact with the chemicals.
- Substance/task appropriate respiratory protection.
- Optional face shield.
- Eye protection.

Contributing scenario controlling worker exposure for 2: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 3: Mixing or blending in batch processes

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 4: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 5: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 95 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 6: Transfer of substance or mixture into small containers (dedicated filling line, including weighing)

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 7: Use as laboratory reagent

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Tetraethylenepentamine, TEPA	Exposure Scenario: 06	Formulation: Epoxy curing agent; Adhesives, sealants (PC01).
Personal protection	: Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.	
Respiratory protection	: Wear respiratory protection. Inhalation - minimum efficiency of 90 %.	

Section 3 - Exposure estimation and reference to its source

Exposure estimation and reference to its source - Environment: 1: Formulation into mixture		
Exposure assessment (environment):	: EUSES 2.1.2.	
Exposure estimation	: Freshwater: 0.0000176 mg/l. Risk characterisation ratio (PEC/PNEC): <0.01.	
	Freshwater sediment: 0.00563 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): <0.01.	
	Marine water: 0.00000173 mg/l. Risk characterisation ratio (PEC/PNEC): <0.01.	
	Marine water sediment: 0.000552 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): <0.01.	
	Sewage Treatment Plant: 0 mg/l. Risk characterisation ratio (PEC/PNEC): <0.01.	
	Soil: 0.00271 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): <0.01.	
Remark	: Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).	

Exposure estimation and reference to its source - Workers: 2: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition		
Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.	
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.161 mg/m ³ . Risk characterisation ratio: 0.197.	
	Worker - dermal, long-term - local: 0.02 mg/cm ² . Risk characterisation ratio: 0.081.	
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	

Exposure estimation and reference to its source - Workers: 3: Mixing or blending in batch processes		
Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.	
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328.	
	Worker - dermal, long-term - local: 0.2 mg/cm ² . Risk characterisation ratio: 0.8.	
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	

Exposure estimation and reference to its source - Workers: 4: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.537 mg/m ³ . Risk characterisation ratio: 0.655. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 5: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.134 mg/m ³ . Risk characterisation ratio: 0.164. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 6: Transfer of substance or mixture into small containers (dedicated filling line, including weighing)

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 7: Use as laboratory reagent

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.00992 mg/cm ² . Risk characterisation ratio: 0.04.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

General	: The immediate downstream user is required to evaluate whether the operational conditions and risk management measures described in the exposure scenario fit to his use. If other OC/RMM are adopted, the user has to ensure that risks are managed to at least equivalent levels. The risk assessment methods/tools given in section 3 may be used for this evaluation.
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Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition : Multi-constituent substance
Product name : Tetraethylenepentamine, TEPA

Section 1 - Title

Short title of the exposure scenario : Formulation: Epoxy curing agent in paint; Coatings and paints, thinners, paint removers (PC09a).
List of use descriptors : **Identified use name: ES 07:** Formulation: Epoxy curing agent in paint - Industrial: PC09a; PROC03, PROC05, PROC08a, PROC08b, PROC09; ERC02
Process Category: PROC03, PROC05, PROC08a, PROC08b, PROC09
Substance supplied to that use in form of: As such
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC02
Market sector by type of chemical product: PC09a

Environmental contributing scenarios : **Formulation into mixture - ERC02**

Health Contributing scenarios : **Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition - PROC03**
Mixing or blending in batch processes - PROC05
Transfer of substance or mixture (charging and discharging) at non-dedicated facilities - PROC08a
Transfer of substance or mixture (charging and discharging) at dedicated facilities - PROC08b
Transfer of substance or mixture into small containers (dedicated filling line, including weighing) - PROC09

Number of the ES	: 07
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Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Formulation into mixture

Product characteristics : Liquid.

Amounts used : Annual site tonnage: 465 tonnes/year.
 Fraction of Regional tonnage used locally: 0.25.
 Daily amount per site: 2.114 tonnes/day.

Frequency and duration of use : Emission days: ≥ 220 days per year.

Other conditions affecting environmental exposure : Receiving surface water flow ≥ 18000 m³/d.
 Release factor after on-site risk management:
 water: 0 % (Estimated release factor).
 Local release rate: 0 kg/day.
 air: 0.000736 % (Estimated release factor).
 Local release rate: 0.016 kg/day.
 Soil: 0 % (Estimated release factor).

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil : Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of ≥ 27.7 %.

Organisational measures to prevent/limit release from site : Prevent discharge of undissolved substance to or recover from onsite wastewater.

Tetraethylenepentamine, TEPA Exposure Scenario: 07 **Formulation: Epoxy curing agent in paint; Coatings and paints, thinners, paint removers (PC09a).**

Conditions and measures related to sewage treatment plant : Sewage Treatment Plant: Yes. (Efficiency of at least 27.7 %) Assumed domestic sewage treatment plant flow 2000 m³/d. Application of the STP sludge on agricultural soil: Yes.

Conditions and measures related to external treatment of waste for disposal : Particular considerations on the waste treatment operations.

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics : Liquid.
Vapour pressure (40 °C): 0.07 Pa.

Concentration of substance in mixture or article : Covers concentrations up to 100 %.

Other conditions affecting workers exposure : Indoor use.
Temperature: ≤40°C.

Organisational measures to prevent/limit releases, dispersion and exposure : - Any measure to eliminate exposure should be considered.
- Very high level of containment required, except for short term exposures e.g. taking samples.
- Design closed system to allow for easy maintenance.
- If possible keep equipment under negative pressure.
- Control staff entry to work area.
- Ensure all equipment well maintained.
- Permit to work for maintenance work.
- Regular cleaning of equipment and work area.
- Management/supervision in place to check that the RMMs in place are being used correctly and OCs followed.
- Training for staff on good practice.
- Procedures and training for emergency decontamination and disposal.
- Good standard of personal hygiene.
- Recording of any 'near miss' situations.
- Sensitizers - Without prejudice to relevant national legislation, pre-employment screening and appropriate health surveillance.

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

Personal protection : - All skin and mucous membranes with potential exposure protected with appropriate PPE (personal protective equipment)
- Substance/Task appropriate gloves.
- Skin coverage with appropriate barrier material based on potential for contact with the chemicals.
- Substance/task appropriate respiratory protection.
- Optional face shield.
- Eye protection.

Contributing scenario controlling worker exposure for 2: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 3: Mixing or blending in batch processes

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 4: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 5: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 95 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 6: Transfer of substance or mixture into small containers (dedicated filling line, including weighing)

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Section 3 - Exposure estimation and reference to its source

Exposure estimation and reference to its source - Environment: 1: Formulation into mixture

Exposure assessment (environment): : EUSES 2.1.2.

Exposure estimation : Freshwater: 0.0000176 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Freshwater sediment: 0.00563 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): <0.01.

Marine water: 0.00000173 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Marine water sediment: 0.000552 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): <0.01.

Sewage Treatment Plant: 0 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Soil: 0.00261 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): <0.01.

Remark : Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 2: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.161 mg/m³.
Risk characterisation ratio: 0.197.

Worker - dermal, long-term - local: 0.02 mg/cm².
Risk characterisation ratio: 0.081.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 3: Mixing or blending in batch processes

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.269 mg/m³.
Risk characterisation ratio: 0.328.

Worker - dermal, long-term - local: 0.2 mg/cm².
Risk characterisation ratio: 0.8.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 4: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.537 mg/m ³ . Risk characterisation ratio: 0.655. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 5: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.134 mg/m ³ . Risk characterisation ratio: 0.164. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 6: Transfer of substance or mixture into small containers (dedicated filling line, including weighing)

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

General	: The immediate downstream user is required to evaluate whether the operational conditions and risk management measures described in the exposure scenario fit to his use. If other OC/RMM are adopted, the user has to ensure that risks are managed to at least equivalent levels. The risk assessment methods/tools given in section 3 may be used for this evaluation.
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Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition : Multi-constituent substance
Product name : Tetraethylenepentamine, TEPA

Section 1 - Title

Short title of the exposure scenario : Formulation: Coatings, Adhesives and inks; Various products (PC01, PC09a, PC14, PC15, PC18, PC20).

List of use descriptors : **Identified use name: ES 08:** Formulation: Coatings, Adhesives and inks - Industrial: PC01, PC09a, PC14, PC15, PC18, PC20; PROC01, PROC02, PROC03, PROC04, PROC05, PROC08a, PROC08b, PROC09; ERC02
Process Category: PROC01, PROC02, PROC03, PROC04, PROC05, PROC08a, PROC08b, PROC09
Substance supplied to that use in form of: As such
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC02
Market sector by type of chemical product: PC01, PC09a, PC14, PC15, PC18, PC20

Environmental contributing scenarios : **Formulation into mixture - ERC02**

Health Contributing scenarios : **Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions - PROC01**
Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions - PROC02
Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition - PROC03
Chemical production where opportunity for exposure arises - PROC04
Mixing or blending in batch processes - PROC05
Transfer of substance or mixture (charging and discharging) at non-dedicated facilities - PROC08a
Transfer of substance or mixture (charging and discharging) at dedicated facilities - PROC08b
Transfer of substance or mixture into small containers (dedicated filling line, including weighing) - PROC09

Number of the ES : 08

Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Formulation into mixture	
Product characteristics	: Liquid.
Amounts used	: Annual site tonnage: 465 tonnes/year. Fraction of Regional tonnage used locally: 0.25. Daily amount per site: 2.114 tonnes/day.
Frequency and duration of use	: Emission days: ≥220 days per year.
Other conditions affecting environmental exposure	: Receiving surface water flow ≥18000 m ³ /d. Release factor after on-site risk management: water: 0 % (Estimated release factor). Local release rate: 0 kg/day. air: 0.000736 % (Estimated release factor). Local release rate: 0.016 kg/day. Soil: 0 % (Estimated release factor).

Tetraethylenepentamine, TEPA Exposure Scenario: 08 **Formulation: Coatings, Adhesives and inks; Various products (PC01, PC09a, PC14, PC15, PC18, PC20).**

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil : Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of $\geq 27.7\%$.

Organisational measures to prevent/limit release from site : Prevent discharge of undissolved substance to or recover from onsite wastewater.

Conditions and measures related to sewage treatment plant : Sewage Treatment Plant: Yes. (Efficiency of at least 27.7 %) Assumed domestic sewage treatment plant flow 2000 m³/d. Application of the STP sludge on agricultural soil: Yes.

Conditions and measures related to external treatment of waste for disposal : Particular considerations on the waste treatment operations.

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics : Liquid.
Vapour pressure (40 °C): 0.07 Pa.

Concentration of substance in mixture or article : Covers concentrations up to 100 %.

Other conditions affecting workers exposure : Indoor use.
Temperature: $\leq 40^{\circ}\text{C}$.

Organisational measures to prevent/limit releases, dispersion and exposure :

- Any measure to eliminate exposure should be considered.
- Very high level of containment required, except for short term exposures e.g. taking samples.
- Design closed system to allow for easy maintenance.
- If possible keep equipment under negative pressure.
- Control staff entry to work area.
- Ensure all equipment well maintained.
- Permit to work for maintenance work.
- Regular cleaning of equipment and work area.
- Management/supervision in place to check that the RMMs in place are being used correctly and OCs followed.
- Training for staff on good practice.
- Procedures and training for emergency decontamination and disposal.
- Good standard of personal hygiene.
- Recording of any 'near miss' situations.
- Sensitizers - Without prejudice to relevant national legislation, pre-employment screening and appropriate health surveillance.

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

Personal protection :

- All skin and mucous membranes with potential exposure protected with appropriate PPE (personal protective equipment)
- Substance/Task appropriate gloves.
- Skin coverage with appropriate barrier material based on potential for contact with the chemicals.
- Substance/task appropriate respiratory protection.
- Optional face shield.
- Eye protection.

Contributing scenario controlling worker exposure for 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Frequency and duration of use/exposure : Exposure duration per day: ≤ 8 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour). Occupational Health and Safety Management System: Advanced.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Frequency and duration of use/exposure : Exposure duration per day: ≤8 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Inhalation - minimum efficiency of 30 %.
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 5: Chemical production where opportunity for exposure arises

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 6: Mixing or blending in batch processes

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 7: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 8: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 95 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing)

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Section 3 - Exposure estimation and reference to its source

Exposure estimation and reference to its source - Environment: 1: Formulation into mixture

Exposure assessment (environment): : EUSES 2.1.2.

Exposure estimation : Freshwater: 0.0000176 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Freshwater sediment: 0.00563 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): <0.01.

Marine water: 0.00000173 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Marine water sediment: 0.000552 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): <0.01.

Sewage Treatment Plant: 0 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Tetraethylenepentamine, TEPA Exposure Scenario: 08 **Formulation: Coatings, Adhesives and inks; Various products (PC01, PC09a, PC14, PC15, PC18, PC20).**

Soil: 0.00261 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): <0.01.
Remark : Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.09 mg/m³.
Risk characterisation ratio: 0.109.

Worker - dermal, long-term - local: 0.000992 mg/cm².
Risk characterisation ratio: <0.01.
Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.627 mg/m³.
Risk characterisation ratio: 0.765.

Worker - dermal, long-term - local: 0.02 mg/cm².
Risk characterisation ratio: 0.08.
Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.161 mg/m³.
Risk characterisation ratio: 0.197.

Worker - dermal, long-term - local: 0.02 mg/cm².
Risk characterisation ratio: 0.081.
Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 5: Chemical production where opportunity for exposure arises

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.269 mg/m³.
Risk characterisation ratio: 0.328.

Worker - dermal, long-term - local: 0.1 mg/cm².
Risk characterisation ratio: 0.4.
Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 6: Mixing or blending in batch processes

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.2 mg/cm ² . Risk characterisation ratio: 0.8.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 7: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.537 mg/m ³ . Risk characterisation ratio: 0.655. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 8: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.134 mg/m ³ . Risk characterisation ratio: 0.164. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing)

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

General

: The immediate downstream user is required to evaluate whether the operational conditions and risk management measures described in the exposure scenario fit to his use. If other OC/RMM are adopted, the user has to ensure that risks are managed to at least equivalent levels. The risk assessment methods/tools given in section 3 may be used for this evaluation.

Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition : Multi-constituent substance
Product name : Tetraethylenepentamine, TEPA

Section 1 - Title

Short title of the exposure scenario : Formulation: Electroplating; Various products (PC14, PC15).
List of use descriptors : **Identified use name: ES 09:** Formulation: Electroplating - Industrial: PC14, PC15; PROC02, PROC03, PROC08a, PROC08b, PROC13; ERC02
Process Category: PROC02, PROC03, PROC08a, PROC08b, PROC13
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC02
Market sector by type of chemical product: PC14, PC15
Environmental contributing scenarios : **Formulation into mixture - ERC02**
Health Contributing scenarios : **Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions - PROC02**
Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition - PROC03
Transfer of substance or mixture (charging and discharging) at non-dedicated facilities - PROC08a
Transfer of substance or mixture (charging and discharging) at dedicated facilities - PROC08b
Treatment of articles by dipping and pouring - PROC13

Number of the ES	: 09
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Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Formulation into mixture

Product characteristics : Liquid.
Amounts used : Annual site tonnage: 46.5 tonnes/year.
 Fraction of Regional tonnage used locally: 0.25.
 Daily amount per site: 0.155 tonnes/day.
Frequency and duration of use : Emission days: ≥ 300 days per year.
Other conditions affecting environmental exposure : Receiving surface water flow ≥ 18000 m³/d.
 Release factor after on-site risk management:
 water: 0.005 % (Estimated release factor).
 Local release rate: 0.00775 kg/day.
 air: 0.0005 % (Estimated release factor).
 Local release rate: 0.000775 kg/day.
 Soil: 0.01 % (Estimated release factor).
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil : Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of ≥ 27.7 %.
Organisational measures to prevent/limit release from site : Prevent discharge of undissolved substance to or recover from onsite wastewater.

Conditions and measures related to sewage treatment plant : Sewage Treatment Plant: Yes. (Efficiency of at least 27.7 %) Assumed domestic sewage treatment plant flow 2000 m³/d. Application of the STP sludge on agricultural soil: Yes.

Conditions and measures related to external treatment of waste for disposal : Particular considerations on the waste treatment operations.

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics : Liquid. Vapour pressure (40 °C): 0.07 Pa.

Concentration of substance in mixture or article : Covers concentrations up to 100 %.

Other conditions affecting workers exposure : Indoor use. Temperature: ≤40°C.

Organisational measures to prevent/limit releases, dispersion and exposure : - Any measure to eliminate exposure should be considered.
 - Very high level of containment required, except for short term exposures e.g. taking samples.
 - Design closed system to allow for easy maintenance.
 - If possible keep equipment under negative pressure.
 - Control staff entry to work area.
 - Ensure all equipment well maintained.
 - Permit to work for maintenance work.
 - Regular cleaning of equipment and work area.
 - Management/supervision in place to check that the RMMs in place are being used correctly and OCs followed.
 - Training for staff on good practice.
 - Procedures and training for emergency decontamination and disposal.
 - Good standard of personal hygiene.
 - Recording of any 'near miss' situations.
 - Sensitizers - Without prejudice to relevant national legislation, pre-employment screening and appropriate health surveillance.

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

Personal protection : - All skin and mucous membranes with potential exposure protected with appropriate PPE (personal protective equipment)
 - Substance/Task appropriate gloves.
 - Skin coverage with appropriate barrier material based on potential for contact with the chemicals.
 - Substance/task appropriate respiratory protection.
 - Optional face shield.
 - Eye protection.

Contributing scenario controlling worker exposure for 2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Frequency and duration of use/exposure : Exposure duration per day: ≤8 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Inhalation - minimum efficiency of 30 %. Occupational Health and Safety Management System: Advanced. Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 4: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 5: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 95 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 6: Treatment of articles by dipping and pouring

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Section 3 - Exposure estimation and reference to its source

Exposure estimation and reference to its source - Environment: 1: Formulation into mixture

Exposure assessment (environment): : EUSES 2.1.2.

Exposure estimation : Freshwater: 0.000296 mg/l.
Risk characterisation ratio (PEC/PNEC): 0.03.

Freshwater sediment: 0.095 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.03.

Marine water: 0.0000296 mg/l.
Risk characterisation ratio (PEC/PNEC): 0.03.

Marine water sediment: 0.00947 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.03.

Sewage Treatment Plant: 0.0028 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Soil: 0.046 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.018.

Remark : Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.627 mg/m³.
Risk characterisation ratio: 0.765.

Worker - dermal, long-term - local: 0.02 mg/cm².
Risk characterisation ratio: 0.08.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.161 mg/m³.
Risk characterisation ratio: 0.197.

Worker - dermal, long-term - local: 0.02 mg/cm².
Risk characterisation ratio: 0.081.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 4: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.537 mg/m ³ . Risk characterisation ratio: 0.655. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 5: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.134 mg/m ³ . Risk characterisation ratio: 0.164. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 6: Treatment of articles by dipping and pouring

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.537 mg/m ³ . Risk characterisation ratio: 0.655. Worker - dermal, long-term - local: 0.2 mg/cm ² . Risk characterisation ratio: 0.8.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

General	: The immediate downstream user is required to evaluate whether the operational conditions and risk management measures described in the exposure scenario fit to his use. If other OC/RMM are adopted, the user has to ensure that risks are managed to at least equivalent levels. The risk assessment methods/tools given in section 3 may be used for this evaluation.
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Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition : Multi-constituent substance
Product name : Tetraethylenepentamine, TEPA

Section 1 - Title

Short title of the exposure scenario : Use at industrial sites: Ashless dispersant; Manufacture of fine chemicals (SU09); Processing aids such as pH-regulators, flocculants, precipitants, neutralization agents (PC20).

List of use descriptors : **Identified use name: ES 10:** Use at industrial sites: Ashless dispersant - Industrial: SU09; PC20; PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC15; ERC06a
Process Category: PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC15
Substance supplied to that use in form of: As such
Sector of end use: SU09
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC06a
Market sector by type of chemical product: PC20

Environmental contributing scenarios : **Use of intermediate - ERC06a**

Health Contributing scenarios : **Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions - PROC01**
Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions - PROC02
Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition - PROC03
Chemical production where opportunity for exposure arises - PROC04
Transfer of substance or mixture (charging and discharging) at non-dedicated facilities - PROC08a
Transfer of substance or mixture (charging and discharging) at dedicated facilities - PROC08b
Use as laboratory reagent - PROC15

Number of the ES	: 10
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Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Use of intermediate

Product characteristics : Liquid.
Amounts used : Annual site tonnage: 1210 tonnes/year.
 Fraction of Regional tonnage used locally: 0.25.
 Daily amount per site: 4.033 tonnes/day.
Frequency and duration of use : Emission days: ≥300 days per year.
Other conditions affecting environmental exposure : Receiving surface water flow ≥18000 m³/d.
 Release factor after on-site risk management:
 water: 0 % (Estimated release factor).
 Local release rate: 0 kg/day.
 air: 0.000736 % (Estimated release factor).
 Local release rate: 0.03 kg/day.
 Soil: 0 % (Estimated release factor).

Tetraethylenepentamine, TEPA Exposure Scenario: 10 **Use at industrial sites: Ashless dispersant; Manufacture of fine chemicals (SU09); Processing aids such as pH-regulators, flocculants, precipitants, neutralization agents (PC20).**

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil : Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of $\geq 27.7\%$.

Organisational measures to prevent/limit release from site : Prevent discharge of undissolved substance to or recover from onsite wastewater.

Conditions and measures related to sewage treatment plant : Sewage Treatment Plant: Yes. (Efficiency of at least 27.7 %) Assumed domestic sewage treatment plant flow 2000 m³/d. Application of the STP sludge on agricultural soil: Yes.

Conditions and measures related to external treatment of waste for disposal : Particular considerations on the waste treatment operations.

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics : Liquid.
Vapour pressure (40 °C): 0.07 Pa.

Concentration of substance in mixture or article : Covers concentrations up to 100 %.

Other conditions affecting workers exposure : Indoor use.
Temperature: $\leq 40^{\circ}\text{C}$.

Organisational measures to prevent/limit releases, dispersion and exposure : - Any measure to eliminate exposure should be considered.
- Very high level of containment required, except for short term exposures e.g. taking samples.
- Design closed system to allow for easy maintenance.
- If possible keep equipment under negative pressure.
- Control staff entry to work area.
- Ensure all equipment well maintained.
- Permit to work for maintenance work.
- Regular cleaning of equipment and work area.
- Management/supervision in place to check that the RMMs in place are being used correctly and OCs followed.
- Training for staff on good practice.
- Procedures and training for emergency decontamination and disposal.
- Good standard of personal hygiene.
- Recording of any 'near miss' situations.
- Sensitizers - Without prejudice to relevant national legislation, pre-employment screening and appropriate health surveillance.

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

Personal protection : - All skin and mucous membranes with potential exposure protected with appropriate PPE (personal protective equipment)
- Substance/Task appropriate gloves.
- Skin coverage with appropriate barrier material based on potential for contact with the chemicals.
- Substance/task appropriate respiratory protection.
- Optional face shield.
- Eye protection.

Contributing scenario controlling worker exposure for 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Frequency and duration of use/exposure : Exposure duration per day: ≤ 8 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour). Occupational Health and Safety Management System: Advanced.

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

Tetraethylenepentamine, TEPA Exposure Scenario: 10 **Use at industrial sites: Ashless dispersant; Manufacture of fine chemicals (SU09); Processing aids such as pH-regulators, flocculants, precipitants, neutralization agents (PC20).**

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Frequency and duration of use/exposure : Exposure duration per day: ≤8 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Inhalation - minimum efficiency of 30 %.
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 5: Chemical production where opportunity for exposure arises

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 6: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Tetraethylenepentamine, TEPA Exposure Scenario: 10

Use at industrial sites: Ashless dispersant; Manufacture of fine chemicals (SU09); Processing aids such as pH-regulators, flocculants, precipitants, neutralization agents (PC20).

Contributing scenario controlling worker exposure for 7: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 95 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 8: Use as laboratory reagent

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Section 3 - Exposure estimation and reference to its source

Exposure estimation and reference to its source - Environment: 1: Use of intermediate

Exposure assessment (environment): : EUSES 2.1.2.

Exposure estimation : Freshwater: 0.0000176 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Freshwater sediment: 0.00563 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): <0.01.

Marine water: 0.00000173 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Marine water sediment: 0.000552 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): <0.01.

Sewage Treatment Plant: 0 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Soil: 0.00271 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): <0.01.

Remark : Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Exposure assessment (human): : ECETOC TRA worker v3
 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.09 mg/m³.
 Risk characterisation ratio: 0.109.

Worker - dermal, long-term - local: 0.000992 mg/cm².
 Risk characterisation ratio: <0.01.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Exposure assessment (human): : ECETOC TRA worker v3
 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.627 mg/m³.
 Risk characterisation ratio: 0.765.

Worker - dermal, long-term - local: 0.02 mg/cm².
 Risk characterisation ratio: 0.08.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Exposure assessment (human): : ECETOC TRA worker v3
 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.161 mg/m³.
 Risk characterisation ratio: 0.197.

Worker - dermal, long-term - local: 0.02 mg/cm².
 Risk characterisation ratio: 0.081.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 5: Chemical production where opportunity for exposure arises

Exposure assessment (human): : ECETOC TRA worker v3
 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.269 mg/m³.
 Risk characterisation ratio: 0.328.

Worker - dermal, long-term - local: 0.1 mg/cm².
 Risk characterisation ratio: 0.4.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Tetraethylenepentamine, TEPA Exposure Scenario: 10 **Use at industrial sites: Ashless dispersant; Manufacture of fine chemicals (SU09); Processing aids such as pH-regulators, flocculants, precipitants, neutralization agents (PC20).**

Exposure estimation and reference to its source - Workers: 6: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.537 mg/m³.
Risk characterisation ratio: 0.655.

Worker - dermal, long-term - local: 0.1 mg/cm².
Risk characterisation ratio: 0.4.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 7: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.134 mg/m³.
Risk characterisation ratio: 0.164.

Worker - dermal, long-term - local: 0.1 mg/cm².
Risk characterisation ratio: 0.4.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 8: Use as laboratory reagent

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.269 mg/m³.
Risk characterisation ratio: 0.328.

Worker - dermal, long-term - local: 0.00992 mg/cm².
Risk characterisation ratio: 0.04.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

General : The immediate downstream user is required to evaluate whether the operational conditions and risk management measures described in the exposure scenario fit to his use. If other OC/RMM are adopted, the user has to ensure that risks are managed to at least equivalent levels. The risk assessment methods/tools given in section 3 may be used for this evaluation.

Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition : Multi-constituent substance
Product name : Tetraethylenepentamine, TEPA

Section 1 - Title

Short title of the exposure scenario : Use at industrial sites: Diesel and gasoline additive; Fuels (PC13).

List of use descriptors : **Identified use name: ES 11:** Use at industrial sites: Diesel and gasoline additive - Industrial: PC13; PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC15; ERC06a
Process Category: PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC15
Substance supplied to that use in form of: As such
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC06a
Market sector by type of chemical product: PC13

Environmental contributing scenarios : **Use of intermediate** - ERC06a

Health Contributing scenarios : **Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions** - PROC01
Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions - PROC02
Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition - PROC03
Chemical production where opportunity for exposure arises - PROC04
Transfer of substance or mixture (charging and discharging) at non-dedicated facilities - PROC08a
Transfer of substance or mixture (charging and discharging) at dedicated facilities - PROC08b
Use as laboratory reagent - PROC15

Number of the ES	: 11
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Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Use of intermediate

Product characteristics : Liquid.

Amounts used : Annual site tonnage: 186 tonnes/year.
 Fraction of Regional tonnage used locally: 0.1.
 Daily amount per site: 0.51 tonnes/day.

Frequency and duration of use : Emission days: ≥365 days per year.

Other conditions affecting environmental exposure : Receiving surface water flow ≥18000 m³/d.
 Release factor after on-site risk management:
 water: 0 % (Estimated release factor).
 Local release rate: 0 kg/day.
 air: 0.000736 % (Estimated release factor).
 Local release rate: 0.00375 kg/day.
 Soil: 0 % (Estimated release factor).

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil	: Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of $\geq 27.7\%$.
Organisational measures to prevent/limit release from site	: Prevent discharge of undissolved substance to or recover from onsite wastewater.
Conditions and measures related to sewage treatment plant	: Sewage Treatment Plant: Yes. (Efficiency of at least 27.7 %) Assumed domestic sewage treatment plant flow 2000 m ³ /d. Application of the STP sludge on agricultural soil: Yes.
Conditions and measures related to external treatment of waste for disposal	: Particular considerations on the waste treatment operations.

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics	: Liquid. Vapour pressure (40 °C): 0.07 Pa.
Concentration of substance in mixture or article	: Covers concentrations up to 100 %.
Other conditions affecting workers exposure	: Indoor use. Temperature: $\leq 40^{\circ}\text{C}$.
Organisational measures to prevent/limit releases, dispersion and exposure	: - Any measure to eliminate exposure should be considered. - Very high level of containment required, except for short term exposures e.g. taking samples. - Design closed system to allow for easy maintenance. - If possible keep equipment under negative pressure. - Control staff entry to work area. - Ensure all equipment well maintained. - Permit to work for maintenance work. - Regular cleaning of equipment and work area. - Management/supervision in place to check that the RMMs in place are being used correctly and OCs followed. - Training for staff on good practice. - Procedures and training for emergency decontamination and disposal. - Good standard of personal hygiene. - Recording of any 'near miss' situations. - Sensitizers - Without prejudice to relevant national legislation, pre-employment screening and appropriate health surveillance.

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

Personal protection	: - All skin and mucous membranes with potential exposure protected with appropriate PPE (personal protective equipment) - Substance/Task appropriate gloves. - Skin coverage with appropriate barrier material based on potential for contact with the chemicals. - Substance/task appropriate respiratory protection. - Optional face shield. - Eye protection.
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Contributing scenario controlling worker exposure for 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Frequency and duration of use/exposure	: Exposure duration per day: ≤ 8 hours.
Technical conditions and measures to control dispersion from source towards the worker	: Provide a basic standard of general ventilation (1 to 3 air changes per hour). Occupational Health and Safety Management System: Advanced.
Conditions and measures related to personal protection, hygiene and health evaluation	
Personal protection	: Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Frequency and duration of use/exposure : Exposure duration per day: ≤8 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Inhalation - minimum efficiency of 30 %.
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 5: Chemical production where opportunity for exposure arises

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 6: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 7: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 95 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 8: Use as laboratory reagent

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Section 3 - Exposure estimation and reference to its source**Exposure estimation and reference to its source - Environment: 1: Use of intermediate**

Exposure assessment (environment): : EUSES 2.1.2.

Exposure estimation : Freshwater: 0.0000176 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Freshwater sediment: 0.00563 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): <0.01.

Marine water: 0.00000173 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Marine water sediment: 0.000552 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): <0.01.

Sewage Treatment Plant: 0 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Soil: 0.00257 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): <0.01.

Remark : Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.09 mg/m³.
Risk characterisation ratio: 0.109.

Worker - dermal, long-term - local: 0.000992 mg/cm².
Risk characterisation ratio: <0.01.

Tetraethylenepentamine, TEPA	Exposure Scenario: 11	Use at industrial sites: Diesel and gasoline additive; Fuels (PC13).
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	
Exposure estimation and reference to its source - Workers: 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions		
Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.	
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.627 mg/m ³ . Risk characterisation ratio: 0.765.	
	: Worker - dermal, long-term - local: 0.02 mg/cm ² . Risk characterisation ratio: 0.08.	
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	
Exposure estimation and reference to its source - Workers: 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition		
Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.	
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.161 mg/m ³ . Risk characterisation ratio: 0.197.	
	: Worker - dermal, long-term - local: 0.02 mg/cm ² . Risk characterisation ratio: 0.081.	
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	
Exposure estimation and reference to its source - Workers: 5: Chemical production where opportunity for exposure arises		
Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.	
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328.	
	: Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.	
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	
Exposure estimation and reference to its source - Workers: 6: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities		
Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.	
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.537 mg/m ³ . Risk characterisation ratio: 0.655.	
	: Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.	
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	

Exposure estimation and reference to its source - Workers: 7: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.134 mg/m ³ . Risk characterisation ratio: 0.164. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 8: Use as laboratory reagent

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.00992 mg/cm ² . Risk characterisation ratio: 0.04.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

General	: The immediate downstream user is required to evaluate whether the operational conditions and risk management measures described in the exposure scenario fit to his use. If other OC/RMM are adopted, the user has to ensure that risks are managed to at least equivalent levels. The risk assessment methods/tools given in section 3 may be used for this evaluation.
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Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition : Multi-constituent substance
Product name : Tetraethylenepentamine, TEPA

Section 1 - Title

Short title of the exposure scenario : Use at industrial sites: lube oil; Various sectors (SU08, SU09).

List of use descriptors : **Identified use name: ES 12:** Use at industrial sites: lube oil - Industrial: SU08, SU09; PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC15; ERC06a
Process Category: PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC15
Substance supplied to that use in form of: As such
Sector of end use: SU08, SU09
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC06a

Environmental contributing scenarios : **Use of intermediate** - ERC06a

Health Contributing scenarios : **Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions** - PROC01
Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions - PROC02
Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition - PROC03
Chemical production where opportunity for exposure arises - PROC04
Transfer of substance or mixture (charging and discharging) at non-dedicated facilities - PROC08a
Transfer of substance or mixture (charging and discharging) at dedicated facilities - PROC08b
Use as laboratory reagent - PROC15

Number of the ES	: 12
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Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Use of intermediate

Product characteristics : Liquid.

Amounts used : Annual site tonnage: 1210 tonnes/year.
 Fraction of Regional tonnage used locally: 0.25.
 Daily amount per site: 5.5 tonnes/day.

Frequency and duration of use : Emission days: ≥ 220 days per year.

Other conditions affecting environmental exposure : Receiving surface water flow ≥ 18000 m³/d.
 Release factor after on-site risk management:
 water: 0.001 % (Estimated release factor).
 Local release rate: 0.055 kg/day.
 air: 0.000736 % (Estimated release factor).
 Local release rate: 0.04 kg/day.
 Soil: 0 % (Estimated release factor).

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil : Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of ≥ 27.7 %.

Organisational measures to prevent/limit release from site	: Prevent discharge of undissolved substance to or recover from onsite wastewater.
Conditions and measures related to sewage treatment plant	: Sewage Treatment Plant: Yes. (Efficiency of at least 27.7 %) Assumed domestic sewage treatment plant flow 2000 m ³ /d. Application of the STP sludge on agricultural soil: Yes.
Conditions and measures related to external treatment of waste for disposal	: Particular considerations on the waste treatment operations.

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics	: Liquid. Vapour pressure (40 °C): 0.07 Pa.
Concentration of substance in mixture or article	: Covers concentrations up to 100 %.
Other conditions affecting workers exposure	: Indoor use. Temperature: ≤40°C.
Organisational measures to prevent/limit releases, dispersion and exposure	: - Any measure to eliminate exposure should be considered. - Very high level of containment required, except for short term exposures e.g. taking samples. - Design closed system to allow for easy maintenance. - If possible keep equipment under negative pressure. - Control staff entry to work area. - Ensure all equipment well maintained. - Permit to work for maintenance work. - Regular cleaning of equipment and work area. - Management/supervision in place to check that the RMMs in place are being used correctly and OCs followed. - Training for staff on good practice. - Procedures and training for emergency decontamination and disposal. - Good standard of personal hygiene. - Recording of any 'near miss' situations. - Sensitizers - Without prejudice to relevant national legislation, pre-employment screening and appropriate health surveillance.

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

Personal protection	: - All skin and mucous membranes with potential exposure protected with appropriate PPE (personal protective equipment) - Substance/Task appropriate gloves. - Skin coverage with appropriate barrier material based on potential for contact with the chemicals. - Substance/task appropriate respiratory protection. - Optional face shield. - Eye protection.
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Contributing scenario controlling worker exposure for 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Frequency and duration of use/exposure	: Exposure duration per day: ≤8 hours.
Technical conditions and measures to control dispersion from source towards the worker	: Provide a basic standard of general ventilation (1 to 3 air changes per hour). Occupational Health and Safety Management System: Advanced.
Conditions and measures related to personal protection, hygiene and health evaluation	
Personal protection	: Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Frequency and duration of use/exposure : Exposure duration per day: ≤8 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Inhalation - minimum efficiency of 30 %.
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 5: Chemical production where opportunity for exposure arises

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 6: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 7: Transfer of substance or mixture (charging and discharging) at dedicated facilities

- Frequency and duration of use/exposure** : Exposure duration per day: ≤4 hours.
- Technical conditions and measures to control dispersion from source towards the worker** : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 95 %.
- Conditions and measures related to personal protection, hygiene and health evaluation**
- Personal protection** : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.
- Respiratory protection** : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 8: Use as laboratory reagent

- Frequency and duration of use/exposure** : Exposure duration per day: ≤4 hours.
- Technical conditions and measures to control dispersion from source towards the worker** : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.
- Conditions and measures related to personal protection, hygiene and health evaluation**
- Personal protection** : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.
- Respiratory protection** : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Section 3 - Exposure estimation and reference to its source

Exposure estimation and reference to its source - Environment: 1: Use of intermediate

- Exposure assessment (environment):** : EUSES 2.1.2.
- Exposure estimation** : Freshwater: 0.002 mg/l.
Risk characterisation ratio (PEC/PNEC): 0.2.
- Freshwater sediment: 0.638 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.2.
- Marine water: 0.0002 mg/l.
Risk characterisation ratio (PEC/PNEC): 0.2.
- Marine water sediment: 0.064 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.2.
- Sewage Treatment Plant: 0.02 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.
- Soil: 0.311 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.124.
- Remark** : Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

- Exposure assessment (human):** : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
- Exposure estimation** : **Worker - inhalative, long-term - systemic:** 0.09 mg/m³.
Risk characterisation ratio: 0.109.
- Worker - dermal, long-term - local:** 0.000992 mg/cm².
Risk characterisation ratio: <0.01.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.627 mg/m³.
Risk characterisation ratio: 0.765.

Worker - dermal, long-term - local: 0.02 mg/cm².
Risk characterisation ratio: 0.08.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.161 mg/m³.
Risk characterisation ratio: 0.197.

Worker - dermal, long-term - local: 0.02 mg/cm².
Risk characterisation ratio: 0.081.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 5: Chemical production where opportunity for exposure arises

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.269 mg/m³.
Risk characterisation ratio: 0.328.

Worker - dermal, long-term - local: 0.1 mg/cm².
Risk characterisation ratio: 0.4.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 6: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.537 mg/m³.
Risk characterisation ratio: 0.655.

Worker - dermal, long-term - local: 0.1 mg/cm².
Risk characterisation ratio: 0.4.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 7: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.134 mg/m ³ . Risk characterisation ratio: 0.164. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 8: Use as laboratory reagent

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.00992 mg/cm ² . Risk characterisation ratio: 0.04.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

General	: The immediate downstream user is required to evaluate whether the operational conditions and risk management measures described in the exposure scenario fit to his use. If other OC/RMM are adopted, the user has to ensure that risks are managed to at least equivalent levels. The risk assessment methods/tools given in section 3 may be used for this evaluation.
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Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition : Multi-constituent substance
Product name : Tetraethylenepentamine, TEPA

Section 1 - Title

Short title of the exposure scenario : Use at industrial sites: Wood preservatives; Biocidal products (PC08).

List of use descriptors : **Identified use name: ES 13:** Use at industrial sites: Wood preservatives - Industrial: PC08; PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC15; ERC06a
Process Category: PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC15
Substance supplied to that use in form of: As such
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC06a
Market sector by type of chemical product: PC08

Environmental contributing scenarios : **Use of intermediate** - ERC06a

Health Contributing scenarios : **Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions** - PROC01
Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions - PROC02
Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition - PROC03
Chemical production where opportunity for exposure arises - PROC04
Transfer of substance or mixture (charging and discharging) at non-dedicated facilities - PROC08a
Transfer of substance or mixture (charging and discharging) at dedicated facilities - PROC08b
Use as laboratory reagent - PROC15

Number of the ES	: 13
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Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Use of intermediate

Product characteristics : Liquid.

Amounts used : Annual site tonnage: 837 tonnes/year.
 Fraction of Regional tonnage used locally: 0.45.
 Daily amount per site: 3.81 tonnes/day.

Frequency and duration of use : Emission days: ≥ 220 days per year.

Other conditions affecting environmental exposure : Receiving surface water flow ≥ 18000 m³/d.
 Release factor after on-site risk management:
 water: 0.002 % (Estimated release factor).
 Local release rate: 0.076 kg/day.
 air: 0.000011 % (Estimated release factor).
 Local release rate: 0.000419 kg/day.
 Soil: 0 % (Estimated release factor).

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil	: Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of ≥27.7 %.
Organisational measures to prevent/limit release from site	: Prevent discharge of undissolved substance to or recover from onsite wastewater.
Conditions and measures related to sewage treatment plant	: Sewage Treatment Plant: Yes. (Efficiency of at least 27.7 %) Assumed domestic sewage treatment plant flow 2000 m ³ /d. Application of the STP sludge on agricultural soil: Yes.
Conditions and measures related to external treatment of waste for disposal	: Particular considerations on the waste treatment operations.

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics	: Liquid. Vapour pressure (40 °C): 0.07 Pa.
Concentration of substance in mixture or article	: Covers concentrations up to 100 %.
Other conditions affecting workers exposure	: Indoor use. Temperature: ≤40°C.
Organisational measures to prevent/limit releases, dispersion and exposure	: - Any measure to eliminate exposure should be considered. - Very high level of containment required, except for short term exposures e.g. taking samples. - Design closed system to allow for easy maintenance. - If possible keep equipment under negative pressure. - Control staff entry to work area. - Ensure all equipment well maintained. - Permit to work for maintenance work. - Regular cleaning of equipment and work area. - Management/supervision in place to check that the RMMs in place are being used correctly and OCs followed. - Training for staff on good practice. - Procedures and training for emergency decontamination and disposal. - Good standard of personal hygiene. - Recording of any 'near miss' situations. - Sensitizers - Without prejudice to relevant national legislation, pre-employment screening and appropriate health surveillance.

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

Personal protection	: - All skin and mucous membranes with potential exposure protected with appropriate PPE (personal protective equipment) - Substance/Task appropriate gloves. - Skin coverage with appropriate barrier material based on potential for contact with the chemicals. - Substance/task appropriate respiratory protection. - Optional face shield. - Eye protection.
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Contributing scenario controlling worker exposure for 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Frequency and duration of use/exposure	: Exposure duration per day: ≤8 hours.
Technical conditions and measures to control dispersion from source towards the worker	: Provide a basic standard of general ventilation (1 to 3 air changes per hour). Occupational Health and Safety Management System: Advanced.
Conditions and measures related to personal protection, hygiene and health evaluation	
Personal protection	: Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Frequency and duration of use/exposure : Exposure duration per day: ≤8 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Inhalation - minimum efficiency of 30 %.
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 5: Chemical production where opportunity for exposure arises

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 6: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 7: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 95 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 8: Use as laboratory reagent

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Section 3 - Exposure estimation and reference to its source**Exposure estimation and reference to its source - Environment: 1: Use of intermediate**

Exposure assessment (environment): : EUSES 2.1.2.

Exposure estimation : Freshwater: 0.00276 mg/l.
Risk characterisation ratio (PEC/PNEC): 0.276.

Freshwater sediment: 0.882 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.276.

Marine water: 0.000276 mg/l.
Risk characterisation ratio (PEC/PNEC): 0.276.

Marine water sediment: 0.088 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.276.

Sewage Treatment Plant: 0.028 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Soil: 0.429 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.172.

Remark : Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.09 mg/m³.
Risk characterisation ratio: 0.109.

Worker - dermal, long-term - local: 0.000992 mg/cm².
Risk characterisation ratio: <0.01.

Tetraethylenepentamine, TEPA	Exposure Scenario: 13	Use at industrial sites: Wood preservatives; Biocidal products (PC08).
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	
Exposure estimation and reference to its source - Workers: 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions		
Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.	
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.627 mg/m ³ . Risk characterisation ratio: 0.765.	
	: Worker - dermal, long-term - local: 0.02 mg/cm ² . Risk characterisation ratio: 0.08.	
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	
Exposure estimation and reference to its source - Workers: 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition		
Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.	
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.161 mg/m ³ . Risk characterisation ratio: 0.197.	
	: Worker - dermal, long-term - local: 0.02 mg/cm ² . Risk characterisation ratio: 0.081.	
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	
Exposure estimation and reference to its source - Workers: 5: Chemical production where opportunity for exposure arises		
Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.	
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328.	
	: Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.	
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	
Exposure estimation and reference to its source - Workers: 6: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities		
Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.	
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.537 mg/m ³ . Risk characterisation ratio: 0.655.	
	: Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.	
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	

Exposure estimation and reference to its source - Workers: 7: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.134 mg/m ³ . Risk characterisation ratio: 0.164. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 8: Use as laboratory reagent

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.00992 mg/cm ² . Risk characterisation ratio: 0.04.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

General	: The immediate downstream user is required to evaluate whether the operational conditions and risk management measures described in the exposure scenario fit to his use. If other OC/RMM are adopted, the user has to ensure that risks are managed to at least equivalent levels. The risk assessment methods/tools given in section 3 may be used for this evaluation.
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Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition : Multi-constituent substance
Product name : Tetraethylenepentamine, TEPA

Section 1 - Title

Short title of the exposure scenario : Use at industrial sites: Epoxy curing agent; Manufacture of fine chemicals (SU09); Adhesives, sealants (PC01).

List of use descriptors : **Identified use name: ES 14:** Use at industrial sites: Epoxy curing agent - Industrial: SU09; PC01; PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC15; ERC06a
Process Category: PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC15
Substance supplied to that use in form of: As such
Sector of end use: SU09
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC06a
Market sector by type of chemical product: PC01

Environmental contributing scenarios : **Use of intermediate** - ERC06a

Health Contributing scenarios : **Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions** - PROC01
Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions - PROC02
Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition - PROC03
Chemical production where opportunity for exposure arises - PROC04
Transfer of substance or mixture (charging and discharging) at non-dedicated facilities - PROC08a
Transfer of substance or mixture (charging and discharging) at dedicated facilities - PROC08b
Use as laboratory reagent - PROC15

Number of the ES : 14

Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Use of intermediate	
Product characteristics	: Liquid.
Amounts used	: Annual site tonnage: 1160 tonnes/year. Fraction of Regional tonnage used locally: 0.25. Daily amount per site: 5.273 tonnes/day.
Frequency and duration of use	: Emission days: ≥220 days per year.
Other conditions affecting environmental exposure	: Receiving surface water flow ≥18000 m³/d. Release factor after on-site risk management: water: 0 % (Estimated release factor). Local release rate: 0 kg/day. air: 0.000736 % (Estimated release factor). Local release rate: 0.039 kg/day. Soil: 0 % (Estimated release factor).

Tetraethylenepentamine, TEPA Exposure Scenario: 14 **Use at industrial sites: Epoxy curing agent; Manufacture of fine chemicals (SU09); Adhesives, sealants (PC01).**

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil : Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of $\geq 27.7\%$.

Organisational measures to prevent/limit release from site : Prevent discharge of undissolved substance to or recover from onsite wastewater.

Conditions and measures related to sewage treatment plant : Sewage Treatment Plant: Yes. (Efficiency of at least 27.7 %) Assumed domestic sewage treatment plant flow 2000 m³/d. Application of the STP sludge on agricultural soil: Yes.

Conditions and measures related to external treatment of waste for disposal : Particular considerations on the waste treatment operations.

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics : Liquid.
Vapour pressure (40 °C): 0.07 Pa.

Concentration of substance in mixture or article : Covers concentrations up to 100 %.

Other conditions affecting workers exposure : Indoor use.
Temperature: $\leq 40^{\circ}\text{C}$.

Organisational measures to prevent/limit releases, dispersion and exposure :
- Any measure to eliminate exposure should be considered.
- Very high level of containment required, except for short term exposures e.g. taking samples.
- Design closed system to allow for easy maintenance.
- If possible keep equipment under negative pressure.
- Control staff entry to work area.
- Ensure all equipment well maintained.
- Permit to work for maintenance work.
- Regular cleaning of equipment and work area.
- Management/supervision in place to check that the RMMs in place are being used correctly and OCs followed.
- Training for staff on good practice.
- Procedures and training for emergency decontamination and disposal.
- Good standard of personal hygiene.
- Recording of any 'near miss' situations.
- Sensitizers - Without prejudice to relevant national legislation, pre-employment screening and appropriate health surveillance.

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

Personal protection :
- All skin and mucous membranes with potential exposure protected with appropriate PPE (personal protective equipment)
- Substance/Task appropriate gloves.
- Skin coverage with appropriate barrier material based on potential for contact with the chemicals.
- Substance/task appropriate respiratory protection.
- Optional face shield.
- Eye protection.

Contributing scenario controlling worker exposure for 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Frequency and duration of use/exposure : Exposure duration per day: ≤ 8 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Frequency and duration of use/exposure : Exposure duration per day: ≤8 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Inhalation - minimum efficiency of 30 %.
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 5: Chemical production where opportunity for exposure arises

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 6: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 7: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 95 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 8: Use as laboratory reagent

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Section 3 - Exposure estimation and reference to its source

Exposure estimation and reference to its source - Environment: 1: Use of intermediate

Exposure assessment (environment): : EUSES 2.1.2.

Exposure estimation : Freshwater: 0.0000176 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Freshwater sediment: 0.00563 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): <0.01.

Marine water: 0.00000173 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Marine water sediment: 0.000552 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): <0.01.

Sewage Treatment Plant: 0 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Soil: 0.00271 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): <0.01.

Remark : Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Tetraethylenepentamine, TEPA Exposure Scenario: 14 **Use at industrial sites: Epoxy curing agent; Manufacture of fine chemicals (SU09); Adhesives, sealants (PC01).**

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.09 mg/m³.
Risk characterisation ratio: 0.109.

Worker - dermal, long-term - local: 0.000992 mg/cm².
Risk characterisation ratio: <0.01.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.627 mg/m³.
Risk characterisation ratio: 0.765.

Worker - dermal, long-term - local: 0.02 mg/cm².
Risk characterisation ratio: 0.08.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.161 mg/m³.
Risk characterisation ratio: 0.197.

Worker - dermal, long-term - local: 0.02 mg/cm².
Risk characterisation ratio: 0.081.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 5: Chemical production where opportunity for exposure arises

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.269 mg/m³.
Risk characterisation ratio: 0.328.

Worker - dermal, long-term - local: 0.1 mg/cm².
Risk characterisation ratio: 0.4.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 6: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.537 mg/m³.
Risk characterisation ratio: 0.655.

Worker - dermal, long-term - local: 0.1 mg/cm².
Risk characterisation ratio: 0.4.

Tetraethylenepentamine, TEPA	Exposure Scenario: 14	Use at industrial sites: Epoxy curing agent; Manufacture of fine chemicals (SU09); Adhesives, sealants (PC01).
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	
Exposure estimation and reference to its source - Workers: 7: Transfer of substance or mixture (charging and discharging) at dedicated facilities		
Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.	
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.134 mg/m ³ . Risk characterisation ratio: 0.164. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.	
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	
Exposure estimation and reference to its source - Workers: 8: Use as laboratory reagent		
Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.	
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.00992 mg/cm ² . Risk characterisation ratio: 0.04.	
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

General	: The immediate downstream user is required to evaluate whether the operational conditions and risk management measures described in the exposure scenario fit to his use. If other OC/RMM are adopted, the user has to ensure that risks are managed to at least equivalent levels. The risk assessment methods/tools given in section 3 may be used for this evaluation.
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Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition : Multi-constituent substance
Product name : Tetraethylenepentamine, TEPA

Section 1 - Title

Short title of the exposure scenario : Use at industrial sites: Epoxy curing agent in paint; Manufacture of fine chemicals (SU09); Coatings and paints, thinners, paint removers (PC09a).

List of use descriptors : **Identified use name: ES 15:** Use at industrial sites: Epoxy curing agent in paint - Industrial: SU09; PC09a; PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC15; ERC06a
Process Category: PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC15
Substance supplied to that use in form of: As such
Sector of end use: SU09
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC06a
Market sector by type of chemical product: PC09a

Environmental contributing scenarios : **Use of intermediate** - ERC06a

Health Contributing scenarios : **Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions** - PROC01
Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions - PROC02
Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition - PROC03
Chemical production where opportunity for exposure arises - PROC04
Transfer of substance or mixture (charging and discharging) at non-dedicated facilities - PROC08a
Transfer of substance or mixture (charging and discharging) at dedicated facilities - PROC08b
Use as laboratory reagent - PROC15

Number of the ES	: 15
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Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Use of intermediate	
Product characteristics	: Liquid.
Amounts used	: Annual site tonnage: 465 tonnes/year. Fraction of Regional tonnage used locally: 0.25. Daily amount per site: 2.114 tonnes/day.
Frequency and duration of use	: Emission days: ≥220 days per year.
Other conditions affecting environmental exposure	: Receiving surface water flow ≥18000 m³/d. Release factor after on-site risk management: water: 0 % (Estimated release factor). Local release rate: 0 kg/day. air: 0.000736 % (Estimated release factor). Local release rate: 0.016 kg/day. Soil: 0 % (Estimated release factor).

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil	: Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of $\geq 27.7\%$.
Organisational measures to prevent/limit release from site	: Prevent discharge of undissolved substance to or recover from onsite wastewater.
Conditions and measures related to sewage treatment plant	: Sewage Treatment Plant: Yes. (Efficiency of at least 27.7 %) Assumed domestic sewage treatment plant flow 2000 m ³ /d. Application of the STP sludge on agricultural soil: Yes.
Conditions and measures related to external treatment of waste for disposal	: Particular considerations on the waste treatment operations.

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics	: Liquid. Vapour pressure (40 °C): 0.07 Pa.
Concentration of substance in mixture or article	: Covers concentrations up to 100 %.
Other conditions affecting workers exposure	: Indoor use. Temperature: $\leq 40^{\circ}\text{C}$.
Organisational measures to prevent/limit releases, dispersion and exposure	: - Any measure to eliminate exposure should be considered. - Very high level of containment required, except for short term exposures e.g. taking samples. - Design closed system to allow for easy maintenance. - If possible keep equipment under negative pressure. - Control staff entry to work area. - Ensure all equipment well maintained. - Permit to work for maintenance work. - Regular cleaning of equipment and work area. - Management/supervision in place to check that the RMMs in place are being used correctly and OCs followed. - Training for staff on good practice. - Procedures and training for emergency decontamination and disposal. - Good standard of personal hygiene. - Recording of any 'near miss' situations. - Sensitizers - Without prejudice to relevant national legislation, pre-employment screening and appropriate health surveillance.

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

Personal protection	: - All skin and mucous membranes with potential exposure protected with appropriate PPE (personal protective equipment) - Substance/Task appropriate gloves. - Skin coverage with appropriate barrier material based on potential for contact with the chemicals. - Substance/task appropriate respiratory protection. - Optional face shield. - Eye protection.
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Contributing scenario controlling worker exposure for 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Frequency and duration of use/exposure	: Exposure duration per day: ≤ 8 hours.
Technical conditions and measures to control dispersion from source towards the worker	: Provide a basic standard of general ventilation (1 to 3 air changes per hour). Occupational Health and Safety Management System: Advanced.

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

Tetraethylenepentamine, TEPA	Exposure Scenario: 15	Use at industrial sites: Epoxy curing agent in paint; Manufacture of fine chemicals (SU09); Coatings and paints, thinners, paint removers (PC09a).
Personal protection	: Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.	
Contributing scenario controlling worker exposure for 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions		
Frequency and duration of use/exposure	: Exposure duration per day: ≤8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	: Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Inhalation - minimum efficiency of 30 %. Occupational Health and Safety Management System: Advanced. Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.	
Conditions and measures related to personal protection, hygiene and health evaluation		
Personal protection	: Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.	
Contributing scenario controlling worker exposure for 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition		
Frequency and duration of use/exposure	: Exposure duration per day: ≤4 hours.	
Technical conditions and measures to control dispersion from source towards the worker	: Provide a basic standard of general ventilation (1 to 3 air changes per hour). Occupational Health and Safety Management System: Advanced. Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.	
Conditions and measures related to personal protection, hygiene and health evaluation		
Personal protection	: Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.	
Respiratory protection	: Wear respiratory protection. Inhalation - minimum efficiency of 90 %.	
Contributing scenario controlling worker exposure for 5: Chemical production where opportunity for exposure arises		
Frequency and duration of use/exposure	: Exposure duration per day: ≤4 hours.	
Technical conditions and measures to control dispersion from source towards the worker	: Provide a basic standard of general ventilation (1 to 3 air changes per hour). Occupational Health and Safety Management System: Advanced. Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.	
Conditions and measures related to personal protection, hygiene and health evaluation		
Personal protection	: Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.	
Respiratory protection	: Wear respiratory protection. Inhalation - minimum efficiency of 90 %.	
Contributing scenario controlling worker exposure for 6: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities		
Frequency and duration of use/exposure	: Exposure duration per day: ≤4 hours.	
Technical conditions and measures to control dispersion from source towards the worker	: Provide a basic standard of general ventilation (1 to 3 air changes per hour). Occupational Health and Safety Management System: Advanced. Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.	
Conditions and measures related to personal protection, hygiene and health evaluation		
Personal protection	: Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.	
Respiratory protection	: Wear respiratory protection. Inhalation - minimum efficiency of 90 %.	

Tetraethylenepentamine, TEPA Exposure Scenario: 15

Use at industrial sites: Epoxy curing agent in paint; Manufacture of fine chemicals (SU09); Coatings and paints, thinners, paint removers (PC09a).

Contributing scenario controlling worker exposure for 7: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 95 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 8: Use as laboratory reagent

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Section 3 - Exposure estimation and reference to its source

Exposure estimation and reference to its source - Environment: 1: Use of intermediate

Exposure assessment (environment): : EUSES 2.1.2.

Exposure estimation : Freshwater: 0.0000176 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Freshwater sediment: 0.00563 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): <0.01.

Marine water: 0.00000173 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Marine water sediment: 0.000552 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): <0.01.

Sewage Treatment Plant: 0 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Soil: 0.00261 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): <0.01.

Remark : Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Tetraethylenepentamine, TEPA Exposure Scenario: 15 **Use at industrial sites: Epoxy curing agent in paint; Manufacture of fine chemicals (SU09); Coatings and paints, thinners, paint removers (PC09a).**

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.09 mg/m³.
Risk characterisation ratio: 0.109.

Worker - dermal, long-term - local: 0.000992 mg/cm².
Risk characterisation ratio: <0.01.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.627 mg/m³.
Risk characterisation ratio: 0.765.

Worker - dermal, long-term - local: 0.02 mg/cm².
Risk characterisation ratio: 0.08.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.161 mg/m³.
Risk characterisation ratio: 0.197.

Worker - dermal, long-term - local: 0.02 mg/cm².
Risk characterisation ratio: 0.081.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 5: Chemical production where opportunity for exposure arises

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.269 mg/m³.
Risk characterisation ratio: 0.328.

Worker - dermal, long-term - local: 0.1 mg/cm².
Risk characterisation ratio: 0.4.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 6: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.537 mg/m³.
Risk characterisation ratio: 0.655.

Worker - dermal, long-term - local: 0.1 mg/cm².
Risk characterisation ratio: 0.4.

Tetraethylenepentamine, TEPA Exposure Scenario: 15 **Use at industrial sites: Epoxy curing agent in paint; Manufacture of fine chemicals (SU09); Coatings and paints, thinners, paint removers (PC09a).**

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 7: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.134 mg/m³.
Risk characterisation ratio: 0.164.
Worker - dermal, long-term - local: 0.1 mg/cm².
Risk characterisation ratio: 0.4.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 8: Use as laboratory reagent

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.269 mg/m³.
Risk characterisation ratio: 0.328.
Worker - dermal, long-term - local: 0.00992 mg/cm².
Risk characterisation ratio: 0.04.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

General : The immediate downstream user is required to evaluate whether the operational conditions and risk management measures described in the exposure scenario fit to his use. If other OC/RMM are adopted, the user has to ensure that risks are managed to at least equivalent levels. The risk assessment methods/tools given in section 3 may be used for this evaluation.

Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition : Multi-constituent substance
Product name : Tetraethylenepentamine, TEPA

Section 1 - Title

Short title of the exposure scenario : Use at industrial sites: Processing aid; Manufacture of fine chemicals (SU09).

List of use descriptors : **Identified use name: ES 16:** Use at industrial sites: Processing aid - Industrial: SU09; PROC01, PROC02, PROC03, PROC04, PROC05, PROC08a, PROC08b, PROC09, PROC12, PROC13, PROC14, PROC15; ERC04
Process Category: PROC01, PROC02, PROC03, PROC04, PROC05, PROC08a, PROC08b, PROC09, PROC12, PROC13, PROC14, PROC15
Substance supplied to that use in form of: As such
Sector of end use: SU09
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC04

Environmental contributing scenarios : **Use of non-reactive processing aid at industrial site (no inclusion into or onto article) - ERC04**

Health Contributing scenarios : **Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions - PROC01**
Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions - PROC02
Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition - PROC03
Chemical production where opportunity for exposure arises - PROC04
Mixing or blending in batch processes - PROC05
Transfer of substance or mixture (charging and discharging) at non-dedicated facilities - PROC08a
Transfer of substance or mixture (charging and discharging) at dedicated facilities - PROC08b
Transfer of substance or mixture into small containers (dedicated filling line, including weighing) - PROC09
Use of blowing agents in manufacture of foam - PROC12
Treatment of articles by dipping and pouring - PROC13
Tabletting, compression, extrusion, pelletisation, granulation - PROC14
Use as laboratory reagent - PROC15

Number of the ES	: 16
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Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Use of non-reactive processing aid at industrial site (no inclusion into or onto article)	
Product characteristics	: Liquid.
Amounts used	: Annual site tonnage: 100 tonnes/year. Daily amount per site: 5 tonnes/day.
Other conditions affecting environmental exposure	: Receiving surface water flow $\geq 18000 \text{ m}^3/\text{d}$.
	Release factor after on-site risk management: water: 0.005 % (Estimated release factor). Local release rate: 0.25 kg/day. air: 0.0005 % (Estimated release factor). Local release rate: 0.025 kg/day. Soil: 0 % (Estimated release factor).

Conditions and measures related to sewage treatment plant : Sewage Treatment Plant: Yes. (Efficiency of at least 27.7 %) Assumed domestic sewage treatment plant flow 2000 m³/d. Application of the STP sludge on agricultural soil: Yes.

Conditions and measures related to external treatment of waste for disposal : Particular considerations on the waste treatment operations.

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics : Liquid. Vapour pressure (40 °C): 0.07 Pa.

Concentration of substance in mixture or article : Covers concentrations up to 100 %.

Other conditions affecting workers exposure : Indoor use. Temperature: ≤40°C.

Organisational measures to prevent/limit releases, dispersion and exposure : - Any measure to eliminate exposure should be considered.
 - Very high level of containment required, except for short term exposures e.g. taking samples.
 - Design closed system to allow for easy maintenance.
 - If possible keep equipment under negative pressure.
 - Control staff entry to work area.
 - Ensure all equipment well maintained.
 - Permit to work for maintenance work.
 - Regular cleaning of equipment and work area.
 - Management/supervision in place to check that the RMMs in place are being used correctly and OCs followed.
 - Training for staff on good practice.
 - Procedures and training for emergency decontamination and disposal.
 - Good standard of personal hygiene.
 - Recording of any 'near miss' situations.
 - Sensitizers - Without prejudice to relevant national legislation, pre-employment screening and appropriate health surveillance.

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

Personal protection : - All skin and mucous membranes with potential exposure protected with appropriate PPE (personal protective equipment)
 - Substance/Task appropriate gloves.
 - Skin coverage with appropriate barrier material based on potential for contact with the chemicals.
 - Substance/task appropriate respiratory protection.
 - Optional face shield.
 - Eye protection.

Contributing scenario controlling worker exposure for 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Frequency and duration of use/exposure : Exposure duration per day: ≤8 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour). Occupational Health and Safety Management System: Advanced.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Frequency and duration of use/exposure : Exposure duration per day: ≤8 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Inhalation - minimum efficiency of 30 %.
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 5: Chemical production where opportunity for exposure arises

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 6: Mixing or blending in batch processes

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 7: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

- Personal protection** : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.
- Respiratory protection** : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 8: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 95 %.

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

- Personal protection** : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.
- Respiratory protection** : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing)

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

- Personal protection** : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.
- Respiratory protection** : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 10: Use of blowing agents in manufacture of foam

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

- Personal protection** : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.
- Respiratory protection** : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 11: Treatment of articles by dipping and pouring

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

- Personal protection** : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.
- Respiratory protection** : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 12: Tableting, compression, extrusion, pelletisation, granulation

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 13: Use as laboratory reagent

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Section 3 - Exposure estimation and reference to its source**Exposure estimation and reference to its source - Environment: 1: Use of non-reactive processing aid at industrial site (no inclusion into or onto article)**

Exposure assessment (environment): : EUSES 2.1.2.

Exposure estimation : Freshwater: 0.00901 mg/l.
Risk characterisation ratio (PEC/PNEC): 0.901.

Freshwater sediment: 2.882 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.901.

Marine water: 0.000901 mg/l.
Risk characterisation ratio (PEC/PNEC): 0.901.

Marine water sediment: 0.288 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.901.

Sewage Treatment Plant: 0.09 mg/l.
Risk characterisation ratio (PEC/PNEC): 0.02.

Soil: 1.403 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.561.

Remark : Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Tetraethylenepentamine, TEPA	Exposure Scenario: 16	Use at industrial sites: Processing aid; Manufacture of fine chemicals (SU09).
Exposure estimation	Worker - inhalative, long-term - systemic: 0.09 mg/m ³ . Risk characterisation ratio: 0.109. Worker - dermal, long-term - local: 0.000992 mg/cm ² . Risk characterisation ratio: <0.01.	
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	
Exposure estimation and reference to its source - Workers: 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions		
Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.	
Exposure estimation	Worker - inhalative, long-term - systemic: 0.627 mg/m ³ . Risk characterisation ratio: 0.765. Worker - dermal, long-term - local: 0.02 mg/cm ² . Risk characterisation ratio: 0.08.	
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	
Exposure estimation and reference to its source - Workers: 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition		
Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.	
Exposure estimation	Worker - inhalative, long-term - systemic: 0.161 mg/m ³ . Risk characterisation ratio: 0.197. Worker - dermal, long-term - local: 0.02 mg/cm ² . Risk characterisation ratio: 0.081.	
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	
Exposure estimation and reference to its source - Workers: 5: Chemical production where opportunity for exposure arises		
Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.	
Exposure estimation	Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.	
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	
Exposure estimation and reference to its source - Workers: 6: Mixing or blending in batch processes		
Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.	
Exposure estimation	Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.2 mg/cm ² . Risk characterisation ratio: 0.8.	
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	

Exposure estimation and reference to its source - Workers: 7: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.537 mg/m ³ . Risk characterisation ratio: 0.655. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 8: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.134 mg/m ³ . Risk characterisation ratio: 0.164. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing)

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 10: Use of blowing agents in manufacture of foam

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.108 mg/m ³ . Risk characterisation ratio: 0.131. Worker - dermal, long-term - local: 0.00992 mg/cm ² . Risk characterisation ratio: 0.04.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 11: Treatment of articles by dipping and pouring

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.537 mg/m ³ . Risk characterisation ratio: 0.655. Worker - dermal, long-term - local: 0.2 mg/cm ² . Risk characterisation ratio: 0.8.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 12: Tableting, compression, extrusion, pelletisation, granulation

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.05 mg/cm ² . Risk characterisation ratio: 0.2.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 13: Use as laboratory reagent

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.00992 mg/cm ² . Risk characterisation ratio: 0.04.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

General	: The immediate downstream user is required to evaluate whether the operational conditions and risk management measures described in the exposure scenario fit to his use. If other OC/RMM are adopted, the user has to ensure that risks are managed to at least equivalent levels. The risk assessment methods/tools given in section 3 may be used for this evaluation.
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Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition : Multi-constituent substance
Product name : Tetraethylenepentamine, TEPA

Section 1 - Title

Short title of the exposure scenario : Use at industrial sites: Coatings, Adhesives and inks; Various sectors (SU0 (galvanic separation), SU14, SU15, SU17); Various products (PC01, PC09a, PC14, PC15, PC18, PC20).

List of use descriptors : **Identified use name: ES 17:** Use at industrial sites: Coatings, Adhesives and inks - Industrial: SU0, SU14, SU15, SU17; PC01, PC09a, PC14, PC15, PC18, PC20; PROC02, PROC04, PROC05, PROC07, PROC08a, PROC08b, PROC10, PROC13; ERC06b
Process Category: PROC02, PROC04, PROC05, PROC07, PROC08a, PROC08b, PROC10, PROC13
Substance supplied to that use in form of: As such
Sector of end use: SU0, SU14, SU15, SU17
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC06b
Market sector by type of chemical product: PC01, PC09a, PC14, PC15, PC18, PC20

Environmental contributing scenarios : **Use of reactive processing aid at industrial site (no inclusion into or onto article) - ERC06b**

Health Contributing scenarios : **Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions - PROC02**
Chemical production where opportunity for exposure arises - PROC04
Mixing or blending in batch processes - PROC05
Industrial spraying (25 - 100 %) - PROC07
Industrial spraying (5 - 25 %) - PROC07
Transfer of substance or mixture (charging and discharging) at non-dedicated facilities - PROC08a
Transfer of substance or mixture (charging and discharging) at dedicated facilities - PROC08b
Roller application or brushing - PROC10
Treatment of articles by dipping and pouring - PROC13

Number of the ES	: 17
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Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Use of reactive processing aid at industrial site (no inclusion into or onto article)

Product characteristics : Liquid.
Amounts used : Annual site tonnage: 465 tonnes/year.
Daily amount per site: 2.114 tonnes/day.
Frequency and duration of use : Emission days: ≥220 days per year.
Other conditions affecting environmental exposure : Receiving surface water flow ≥18000 m³/d.
Release factor after on-site risk management:
water: 0 % (Estimated release factor).
Local release rate: 0 kg/day.
air: 0.000736 % (Estimated release factor).
Local release rate: 0.016 kg/day.
Soil: 0 % (Estimated release factor).

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil	: Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of $\geq 27.7\%$.
Organisational measures to prevent/limit release from site	: Prevent discharge of undissolved substance to or recover from onsite wastewater.
Conditions and measures related to sewage treatment plant	: Sewage Treatment Plant: Yes. (Efficiency of at least 27.7 %) Assumed domestic sewage treatment plant flow 2000 m ³ /d. Application of the STP sludge on agricultural soil: Yes.
Conditions and measures related to external treatment of waste for disposal	: Particular considerations on the waste treatment operations.

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics	: Liquid. Vapour pressure (40 °C): 0.07 Pa.
Other conditions affecting workers exposure	: Indoor use. Temperature: $\leq 40^{\circ}\text{C}$.
Organisational measures to prevent/limit releases, dispersion and exposure	: - Any measure to eliminate exposure should be considered. - Very high level of containment required, except for short term exposures e.g. taking samples. - Design closed system to allow for easy maintenance. - If possible keep equipment under negative pressure. - Control staff entry to work area. - Ensure all equipment well maintained. - Permit to work for maintenance work. - Regular cleaning of equipment and work area. - Management/supervision in place to check that the RMMs in place are being used correctly and OCs followed. - Training for staff on good practice. - Procedures and training for emergency decontamination and disposal. - Good standard of personal hygiene. - Recording of any 'near miss' situations. - Sensitizers - Without prejudice to relevant national legislation, pre-employment screening and appropriate health surveillance.
Conditions and measures related to personal protection, hygiene and health evaluation	
Personal protection	: - All skin and mucous membranes with potential exposure protected with appropriate PPE (personal protective equipment) - Substance/Task appropriate gloves. - Skin coverage with appropriate barrier material based on potential for contact with the chemicals. - Substance/task appropriate respiratory protection. - Optional face shield. - Eye protection.

Contributing scenario controlling worker exposure for 2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Product characteristics	: Covers concentrations up to 100 %.
Frequency and duration of use/exposure	: Exposure duration per day: ≤ 8 hours.
Technical conditions and measures to control dispersion from source towards the worker	: Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Inhalation - minimum efficiency of 30 %. Occupational Health and Safety Management System: Advanced. Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.
Conditions and measures related to personal protection, hygiene and health evaluation	
Personal protection	: Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 3: Chemical production where opportunity for exposure arises

- Product characteristics** : Covers concentrations up to 100 %.
- Frequency and duration of use/exposure** : Exposure duration per day: ≤4 hours.
- Technical conditions and measures to control dispersion from source towards the worker** : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

- Personal protection** : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.
- Respiratory protection** : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 4: Mixing or blending in batch processes

- Product characteristics** : Covers concentrations up to 100 %.
- Frequency and duration of use/exposure** : Exposure duration per day: ≤4 hours.
- Technical conditions and measures to control dispersion from source towards the worker** : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

- Personal protection** : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.
- Respiratory protection** : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 5: Industrial spraying (25 - 100 %)

- Product characteristics** : Covers concentrations up to 100 %.
- Frequency and duration of use/exposure** : Exposure duration per day: ≤4 hours.
Frequency: 4-5 days per week.
- Other conditions affecting workers exposure** : Distance of worker from source: <1 m (emission source within breathing zone of the worker).
Task is followed by a period of evaporation, drying or curing.
Ensure that the task is not carried out by more than one worker simultaneously.
Room size: 100-1000 m³.
- Technical conditions and measures to control dispersion from source towards the worker** : General ventilation: Mechanical ventilation: Inhalation - minimum efficiency of 44 %.
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 55 %.

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

- Personal protection** : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.
- Respiratory protection** : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 6: Industrial spraying (5 - 25 %)

- Product characteristics** : Covers concentrations up to 25 %.
- Frequency and duration of use/exposure** : Exposure duration per day: ≤4 hours.
Frequency: 4-5 days per week.
- Other conditions affecting workers exposure** : Distance of worker from source: <1 m (emission source within breathing zone of the worker).
Task is followed by a period of evaporation, drying or curing.
Ensure that the task is not carried out by more than one worker simultaneously.
Room size: 100-1000 m³.

Tetraethylenepentamine, TEPA Exposure Scenario: 17 **Use at industrial sites: Coatings, Adhesives and inks; Various sectors (SU0 (galvanic separation), SU14, SU15, SU17); Various products (PC01, PC09a, PC14, PC15, PC18, PC20).**

Technical conditions and measures to control dispersion from source towards the worker : General ventilation: Mechanical ventilation: Inhalation - minimum efficiency of 44 %.
Occupational Health and Safety Management System: Advanced.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 7: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Product characteristics : Covers concentrations up to 100 %.

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 8: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Product characteristics : Covers concentrations up to 100 %.

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 95 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 9: Roller application or brushing

Product characteristics : Covers concentrations up to 100 %.

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 10: Treatment of articles by dipping and pouring

Product characteristics	: Covers concentrations up to 100 %.
Frequency and duration of use/exposure	: Exposure duration per day: ≤4 hours.
Technical conditions and measures to control dispersion from source towards the worker	: Provide a basic standard of general ventilation (1 to 3 air changes per hour). Occupational Health and Safety Management System: Advanced. Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.
Conditions and measures related to personal protection, hygiene and health evaluation	
Personal protection	: Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.
Respiratory protection	: Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Section 3 - Exposure estimation and reference to its source

Exposure estimation and reference to its source - Environment: 1: Use of reactive processing aid at industrial site (no inclusion into or onto article)

Exposure assessment (environment):	: EUSES 2.1.2.
Exposure estimation	: Freshwater: 0.0000176 mg/l. Risk characterisation ratio (PEC/PNEC): <0.01. Freshwater sediment: 0.00563 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): <0.01. Marine water: 0.00000173 mg/l. Risk characterisation ratio (PEC/PNEC): <0.01. Marine water sediment: 0.000552 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): <0.01. Sewage Treatment Plant: 0 mg/l. Risk characterisation ratio (PEC/PNEC): <0.01. Soil: 0.00261 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): <0.01.
Remark	: Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.627 mg/m³. Risk characterisation ratio: 0.765. Worker - dermal, long-term - local: 0.02 mg/cm². Risk characterisation ratio: 0.08.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 3: Chemical production where opportunity for exposure arises

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 4: Mixing or blending in batch processes

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.2 mg/cm ² . Risk characterisation ratio: 0.8.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 5: Industrial spraying (25 - 100 %)

Exposure assessment (human):	: Inhalation exposure: Stoffenmanager v7.5.2 Dermal exposure: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.4 mg/m ³ . Risk characterisation ratio: 0.488. Worker - dermal, long-term - local: 0.2 mg/cm ² . Risk characterisation ratio: 0.8.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 6: Industrial spraying (5 - 25 %)

Exposure assessment (human):	: Inhalation exposure: Stoffenmanager v7.5.2 Dermal exposure: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.35 mg/m ³ . Risk characterisation ratio: 0.427. Worker - dermal, long-term - local: 0.12 mg/cm ² . Risk characterisation ratio: 0.48.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 7: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.537 mg/m ³ . Risk characterisation ratio: 0.655. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 8: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.134 mg/m ³ . Risk characterisation ratio: 0.164. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 9: Roller application or brushing

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.537 mg/m ³ . Risk characterisation ratio: 0.655. Worker - dermal, long-term - local: 0.2 mg/cm ² . Risk characterisation ratio: 0.8.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 10: Treatment of articles by dipping and pouring

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.537 mg/m ³ . Risk characterisation ratio: 0.655. Worker - dermal, long-term - local: 0.2 mg/cm ² . Risk characterisation ratio: 0.8.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

General

: The immediate downstream user is required to evaluate whether the operational conditions and risk management measures described in the exposure scenario fit to his use. If other OC/RMM are adopted, the user has to ensure that risks are managed to at least equivalent levels. The risk assessment methods/tools given in section 3 may be used for this evaluation.

Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition : Multi-constituent substance
Product name : Tetraethylenepentamine, TEPA

Section 1 - Title

Short title of the exposure scenario : Use at industrial sites: Electroplating; Various sectors (SU0 (galvanic separation), SU14, SU15, SU17); Various products (PC14, PC15, PC20).

List of use descriptors : **Identified use name: ES 18:** Use at industrial sites: Electroplating - Industrial: SU0, SU14, SU15, SU17; PC14, PC15, PC20; PROC02, PROC03, PROC04, PROC05, PROC08a, PROC08b, PROC13, PROC15; ERC04, ERC05, ERC06b
Process Category: PROC02, PROC03, PROC04, PROC05, PROC08a, PROC08b, PROC13, PROC15
Sector of end use: SU0, SU14, SU15, SU17
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC04, ERC05, ERC06b
Market sector by type of chemical product: PC14, PC15, PC20

Environmental contributing scenarios : **Use of non-reactive processing aid at industrial site (no inclusion into or onto article) - ERC04**
Use at industrial site leading to inclusion into/onto article - ERC05
Use of reactive processing aid at industrial site (no inclusion into or onto article) - ERC06b

Health Contributing scenarios : **Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions - PROC02**
Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition - PROC03
Chemical production where opportunity for exposure arises - PROC04
Mixing or blending in batch processes - PROC05
Transfer of substance or mixture (charging and discharging) at non-dedicated facilities - PROC08a
Transfer of substance or mixture (charging and discharging) at dedicated facilities - PROC08b
Treatment of articles by dipping and pouring - PROC13
Use as laboratory reagent - PROC15

Number of the ES	: 18
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Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Use of non-reactive processing aid at industrial site (no inclusion into or onto article)

Product characteristics : Liquid.

Amounts used : Annual site tonnage: 46.5 tonnes/year.
 Fraction of Regional tonnage used locally: 0.25.
 Daily amount per site: 0.155 tonnes/day.

Frequency and duration of use : Emission days: ≥ 300 days per year.

Other conditions affecting environmental exposure : Receiving surface water flow ≥ 18000 m³/d.

Release factor after on-site risk management:
 water: 0.005 % (Estimated release factor).
 Local release rate: 0.00775 kg/day.
 air: 0.0005 % (Estimated release factor).
 Local release rate: 0.000775 kg/day.
 Soil: 0.01 % (Estimated release factor).

Tetraethylenepentamine, TEPA Exposure Scenario: 18 **Use at industrial sites: Electroplating; Various sectors (SU0 (galvanic separation), SU14, SU15, SU17); Various products (PC14, PC15, PC20).**

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil : Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of $\geq 27.7\%$.

Organisational measures to prevent/limit release from site : Prevent discharge of undissolved substance to or recover from onsite wastewater.

Conditions and measures related to sewage treatment plant : Sewage Treatment Plant: Yes. (Efficiency of at least 27.7 %) Assumed domestic sewage treatment plant flow 2000 m³/d. Application of the STP sludge on agricultural soil: Yes.

Conditions and measures related to external treatment of waste for disposal : Particular considerations on the waste treatment operations.

Contributing scenario controlling environmental exposure for 2: Use at industrial site leading to inclusion into/ onto article

Product characteristics : Liquid.

Amounts used : Annual site tonnage: 46.5 tonnes/year. Fraction of Regional tonnage used locally: 0.25. Daily amount per site: 0.155 tonnes/day.

Frequency and duration of use : Emission days: ≥ 300 days per year.

Other conditions affecting environmental exposure : Receiving surface water flow ≥ 18000 m³/d.
Release factor after on-site risk management:
water: 0.005 % (Estimated release factor).
Local release rate: 0.00775 kg/day.
air: 0.0005 % (Estimated release factor).
Local release rate: 0.000775 kg/day.
Soil: 0.01 % (Estimated release factor).

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil : Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of $\geq 27.7\%$.

Organisational measures to prevent/limit release from site : Prevent discharge of undissolved substance to or recover from onsite wastewater.

Conditions and measures related to sewage treatment plant : Sewage Treatment Plant: Yes. (Efficiency of at least 27.7 %) Assumed domestic sewage treatment plant flow 2000 m³/d. Application of the STP sludge on agricultural soil: Yes.

Conditions and measures related to external treatment of waste for disposal : Particular considerations on the waste treatment operations.

Contributing scenario controlling environmental exposure for 3: Use of reactive processing aid at industrial site (no inclusion into or onto article)

Product characteristics : Liquid.

Amounts used : Annual site tonnage: 46.5 tonnes/year. Fraction of Regional tonnage used locally: 0.25. Daily amount per site: 0.155 tonnes/day.

Frequency and duration of use : Emission days: ≥ 300 days per year.

Other conditions affecting environmental exposure : Receiving surface water flow ≥ 18000 m³/d.
Release factor after on-site risk management:
water: 0.005 % (Estimated release factor).
Local release rate: 0.00775 kg/day.
air: 0.0005 % (Estimated release factor).
Local release rate: 0.000775 kg/day.

Tetraethylenepentamine, TEPA Exposure Scenario: 18 **Use at industrial sites: Electroplating; Various sectors (SU0 (galvanic separation), SU14, SU15, SU17); Various products (PC14, PC15, PC20).**

Soil: 0.01 % (Estimated release factor).

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil : Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of ≥ 27.7 %.

Organisational measures to prevent/limit release from site : Prevent discharge of undissolved substance to or recover from onsite wastewater.

Conditions and measures related to sewage treatment plant : Sewage Treatment Plant: Yes. (Efficiency of at least 27.7 %) Assumed domestic sewage treatment plant flow 2000 m³/d. Application of the STP sludge on agricultural soil: Yes.

Conditions and measures related to external treatment of waste for disposal : Particular considerations on the waste treatment operations.

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics : Liquid.
Vapour pressure (40 °C): 0.07 Pa.

Concentration of substance in mixture or article : Covers concentrations up to 100 %.

Other conditions affecting workers exposure : Indoor use.
Temperature: $\leq 40^{\circ}\text{C}$.

Organisational measures to prevent/limit releases, dispersion and exposure : - Any measure to eliminate exposure should be considered.
- Very high level of containment required, except for short term exposures e.g. taking samples.
- Design closed system to allow for easy maintenance.
- If possible keep equipment under negative pressure.
- Control staff entry to work area.
- Ensure all equipment well maintained.
- Permit to work for maintenance work.
- Regular cleaning of equipment and work area.
- Management/supervision in place to check that the RMMs in place are being used correctly and OCs followed.
- Training for staff on good practice.
- Procedures and training for emergency decontamination and disposal.
- Good standard of personal hygiene.
- Recording of any 'near miss' situations.
- Sensitizers - Without prejudice to relevant national legislation, pre-employment screening and appropriate health surveillance.

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

Personal protection : - All skin and mucous membranes with potential exposure protected with appropriate PPE (personal protective equipment)
- Substance/Task appropriate gloves.
- Skin coverage with appropriate barrier material based on potential for contact with the chemicals.
- Substance/task appropriate respiratory protection.
- Optional face shield.
- Eye protection.

Contributing scenario controlling worker exposure for 4: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Frequency and duration of use/exposure : Exposure duration per day: ≤ 8 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Inhalation - minimum efficiency of 30 %.
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Tetraethylenepentamine, TEPA Exposure Scenario: 18 **Use at industrial sites: Electroplating; Various sectors (SU0 (galvanic separation), SU14, SU15, SU17); Various products (PC14, PC15, PC20).**

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 5: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 6: Chemical production where opportunity for exposure arises

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 7: Mixing or blending in batch processes

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 8: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 9: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 95 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 10: Treatment of articles by dipping and pouring

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 11: Use as laboratory reagent

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Section 3 - Exposure estimation and reference to its source

Exposure estimation and reference to its source - Environment: 1: Use of non-reactive processing aid at industrial site (no inclusion into or onto article)

Exposure assessment (environment): : EUSES 2.1.2.

Exposure estimation : Freshwater: 0.000296 mg/l.
Risk characterisation ratio (PEC/PNEC): 0.03.

Freshwater sediment: 0.095 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.03.

Marine water: 0.0000296 mg/l.
Risk characterisation ratio (PEC/PNEC): 0.03.

Marine water sediment: 0.00947 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.03.

Sewage Treatment Plant: 0.0028 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Soil: 0.046 mg/kg dwt.

Tetraethylenepentamine, TEPA Exposure Scenario: 18 **Use at industrial sites: Electroplating; Various sectors (SU0 (galvanic separation), SU14, SU15, SU17); Various products (PC14, PC15, PC20).**

Remark : Risk characterisation ratio (PEC/PNEC): 0.018.
: Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Environment: 2: Use at industrial site leading to inclusion into/ onto article

Exposure assessment (environment): : EUSES 2.1.2.

Exposure estimation : Freshwater: 0.000296 mg/l.
Risk characterisation ratio (PEC/PNEC): 0.03.

Freshwater sediment: 0.095 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.03.

Marine water: 0.0000296 mg/l.
Risk characterisation ratio (PEC/PNEC): 0.03.

Marine water sediment: 0.00947 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.03.

Sewage Treatment Plant: 0.0028 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Soil: 0.046 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.018.

Remark : Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Environment: 3: Use of reactive processing aid at industrial site (no inclusion into or onto article)

Exposure assessment (environment): : EUSES 2.1.2.

Exposure estimation : Freshwater: 0.000296 mg/l.
Risk characterisation ratio (PEC/PNEC): 0.03.

Freshwater sediment: 0.095 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.03.

Marine water: 0.0000296 mg/l.
Risk characterisation ratio (PEC/PNEC): 0.03.

Marine water sediment: 0.00947 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.03.

Sewage Treatment Plant: 0.0028 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Soil: 0.046 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.018.

Remark : Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 4: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.627 mg/m³.
Risk characterisation ratio: 0.765.

Worker - dermal, long-term - local: 0.02 mg/cm².
Risk characterisation ratio: 0.08.

Tetraethylenepentamine, TEPA Exposure Scenario: 18 **Use at industrial sites: Electroplating; Various sectors (SU0 (galvanic separation), SU14, SU15, SU17); Various products (PC14, PC15, PC20).**

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 5: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.161 mg/m³.
Risk characterisation ratio: 0.197.
Worker - dermal, long-term - local: 0.02 mg/cm².
Risk characterisation ratio: 0.081.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 6: Chemical production where opportunity for exposure arises

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.269 mg/m³.
Risk characterisation ratio: 0.328.
Worker - dermal, long-term - local: 0.1 mg/cm².
Risk characterisation ratio: 0.4.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 7: Mixing or blending in batch processes

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.269 mg/m³.
Risk characterisation ratio: 0.328.
Worker - dermal, long-term - local: 0.2 mg/cm².
Risk characterisation ratio: 0.8.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 8: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.537 mg/m³.
Risk characterisation ratio: 0.655.
Worker - dermal, long-term - local: 0.1 mg/cm².
Risk characterisation ratio: 0.4.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 9: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.134 mg/m ³ . Risk characterisation ratio: 0.164. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 10: Treatment of articles by dipping and pouring

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.537 mg/m ³ . Risk characterisation ratio: 0.655. Worker - dermal, long-term - local: 0.2 mg/cm ² . Risk characterisation ratio: 0.8.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 11: Use as laboratory reagent

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.00992 mg/cm ² . Risk characterisation ratio: 0.04.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

General	: The immediate downstream user is required to evaluate whether the operational conditions and risk management measures described in the exposure scenario fit to his use. If other OC/RMM are adopted, the user has to ensure that risks are managed to at least equivalent levels. The risk assessment methods/tools given in section 3 may be used for this evaluation.
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Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition : Multi-constituent substance
Product name : Tetraethylenepentamine, TEPA

Section 1 - Title

Short title of the exposure scenario : Use at industrial sites: Metal working fluids; Various products (PC24, PC25).

List of use descriptors : **Identified use name: ES 19:** Use at industrial sites: Metal working fluids - Industrial: PC24, PC25; PROC02, PROC03, PROC07, PROC08a, PROC08b, PROC10, PROC13, PROC17, PROC18; ERC04
Process Category: PROC02, PROC03, PROC07, PROC08a, PROC08b, PROC10, PROC13, PROC17, PROC18
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC04
Market sector by type of chemical product: PC24, PC25

Environmental contributing scenarios : **Use of non-reactive processing aid at industrial site (no inclusion into or onto article) - ERC04**

Health Contributing scenarios : **Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions - PROC02**
Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition - PROC03
Industrial spraying (25 - 100 %) - PROC07
Industrial spraying (5 - 25 %) - PROC07
Transfer of substance or mixture (charging and discharging) at non-dedicated facilities - PROC08a
Transfer of substance or mixture (charging and discharging) at dedicated facilities - PROC08b
Roller application or brushing - PROC10
Treatment of articles by dipping and pouring - PROC13
Lubrication at high energy conditions in metal working operations - PROC17
General greasing/lubrication at high kinetic energy conditions - PROC18

Number of the ES	: 19
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Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Use of non-reactive processing aid at industrial site (no inclusion into or onto article)

Product characteristics : Liquid.
Amounts used : Annual site tonnage: 1210 tonnes/year.
 Fraction of Regional tonnage used locally: 0.25.
 Daily amount per site: 5.5 tonnes/day.
Frequency and duration of use : Emission days: ≥ 220 days per year.
Other conditions affecting environmental exposure : Receiving surface water flow ≥ 18000 m³/d.
 Release factor after on-site risk management:
 water: 0.001 % (Estimated release factor).
 Local release rate: 0.055 kg/day.
 air: 0.000736 % (Estimated release factor).
 Local release rate: 0.04 kg/day.
 Soil: 0 % (Estimated release factor).

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil	: Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of $\geq 27.7\%$.
Organisational measures to prevent/limit release from site	: Prevent discharge of undissolved substance to or recover from onsite wastewater.
Conditions and measures related to sewage treatment plant	: Sewage Treatment Plant: Yes. (Efficiency of at least 27.7 %) Assumed domestic sewage treatment plant flow 2000 m ³ /d. Application of the STP sludge on agricultural soil: Yes.
Conditions and measures related to external treatment of waste for disposal	: Particular considerations on the waste treatment operations.

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics	: Liquid. Vapour pressure (40 °C): 0.07 Pa.
Other conditions affecting workers exposure	: Indoor use. Temperature: $\leq 40^{\circ}\text{C}$.
Organisational measures to prevent/limit releases, dispersion and exposure	: - Any measure to eliminate exposure should be considered. - Very high level of containment required, except for short term exposures e.g. taking samples. - Design closed system to allow for easy maintenance. - If possible keep equipment under negative pressure. - Control staff entry to work area. - Ensure all equipment well maintained. - Permit to work for maintenance work. - Regular cleaning of equipment and work area. - Management/supervision in place to check that the RMMs in place are being used correctly and OCs followed. - Training for staff on good practice. - Procedures and training for emergency decontamination and disposal. - Good standard of personal hygiene. - Recording of any 'near miss' situations. - Sensitizers - Without prejudice to relevant national legislation, pre-employment screening and appropriate health surveillance.
Conditions and measures related to personal protection, hygiene and health evaluation	
Personal protection	: - All skin and mucous membranes with potential exposure protected with appropriate PPE (personal protective equipment) - Substance/Task appropriate gloves. - Skin coverage with appropriate barrier material based on potential for contact with the chemicals. - Substance/task appropriate respiratory protection. - Optional face shield. - Eye protection.

Contributing scenario controlling worker exposure for 2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Product characteristics	: Covers concentrations up to 100 %.
Frequency and duration of use/exposure	: Exposure duration per day: ≤ 8 hours.
Technical conditions and measures to control dispersion from source towards the worker	: Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Inhalation - minimum efficiency of 30 %. Occupational Health and Safety Management System: Advanced. Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.
Conditions and measures related to personal protection, hygiene and health evaluation	
Personal protection	: Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

- Product characteristics** : Covers concentrations up to 100 %.
- Frequency and duration of use/exposure** : Exposure duration per day: ≤4 hours.
- Technical conditions and measures to control dispersion from source towards the worker** : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

- Personal protection** : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.
- Respiratory protection** : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 4: Industrial spraying (25 - 100 %)

- Product characteristics** : Covers concentrations up to 100 %.
- Frequency and duration of use/exposure** : Exposure duration per day: ≤4 hours.
Frequency: 4-5 days per week.
- Other conditions affecting workers exposure** : Distance of worker from source: <1 m (emission source within breathing zone of the worker).
Task is followed by a period of evaporation, drying or curing.
Ensure that the task is not carried out by more than one worker simultaneously.
Room size: 100-1000 m³.
- Technical conditions and measures to control dispersion from source towards the worker** : General ventilation: Mechanical ventilation: Inhalation - minimum efficiency of 44 %.
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 55 %.

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

- Personal protection** : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.
- Respiratory protection** : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 5: Industrial spraying (5 - 25 %)

- Product characteristics** : Covers concentrations up to 25 %.
- Frequency and duration of use/exposure** : Exposure duration per day: ≤4 hours.
Frequency: 4-5 days per week.
- Other conditions affecting workers exposure** : Distance of worker from source: <1 m (emission source within breathing zone of the worker).
Task is followed by a period of evaporation, drying or curing.
Ensure that the task is not carried out by more than one worker simultaneously.
Room size: 100-1000 m³.
- Technical conditions and measures to control dispersion from source towards the worker** : General ventilation: Mechanical ventilation: Inhalation - minimum efficiency of 44 %.
Occupational Health and Safety Management System: Advanced.

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

- Personal protection** : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.
- Respiratory protection** : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 6: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

- Product characteristics** : Covers concentrations up to 100 %.
- Frequency and duration of use/exposure** : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 7: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Product characteristics : Covers concentrations up to 100 %.

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 95 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 8: Roller application or brushing

Product characteristics : Covers concentrations up to 100 %.

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 9: Treatment of articles by dipping and pouring

Product characteristics : Covers concentrations up to 100 %.

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 10: Lubrication at high energy conditions in metal working operations

Product characteristics : Covers concentrations up to 100 %.

Frequency and duration of use/exposure : Exposure duration per day: ≤1 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Tetraethylenepentamine, TEPA	Exposure Scenario: 19	Use at industrial sites: Metal working fluids; Various products (PC24, PC25).
Personal protection	: Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.	
Respiratory protection	: Wear respiratory protection. Inhalation - minimum efficiency of 90 %.	
Contributing scenario controlling worker exposure for 11: General greasing/lubrication at high kinetic energy conditions		
Product characteristics	: Covers concentrations up to 100 %.	
Frequency and duration of use/exposure	: Exposure duration per day: ≤1 hours.	
Technical conditions and measures to control dispersion from source towards the worker	: Provide a basic standard of general ventilation (1 to 3 air changes per hour). Occupational Health and Safety Management System: Advanced. Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.	
Conditions and measures related to personal protection, hygiene and health evaluation		
Personal protection	: Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.	
Respiratory protection	: Wear respiratory protection. Inhalation - minimum efficiency of 90 %.	

Section 3 - Exposure estimation and reference to its source

Exposure estimation and reference to its source - Environment: 1: Use of non-reactive processing aid at industrial site (no inclusion into or onto article)	
Exposure assessment (environment):	: EUSES 2.1.2.
Exposure estimation	: Freshwater: 0.002 mg/l. Risk characterisation ratio (PEC/PNEC): 0.2. Freshwater sediment: 0.638 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): 0.2. Marine water: 0.0002 mg/l. Risk characterisation ratio (PEC/PNEC): 0.2. Marine water sediment: 0.064 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): 0.2. Sewage Treatment Plant: 0.02 mg/l. Risk characterisation ratio (PEC/PNEC): <0.01. Soil: 0.311 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): 0.124.
Remark	: Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions	
Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.627 mg/m ³ . Risk characterisation ratio: 0.765. Worker - dermal, long-term - local: 0.02 mg/cm ² . Risk characterisation ratio: 0.08.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.161 mg/m ³ . Risk characterisation ratio: 0.197. Worker - dermal, long-term - local: 0.02 mg/cm ² . Risk characterisation ratio: 0.081.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 4: Industrial spraying (25 - 100 %)

Exposure assessment (human):	: Inhalation exposure: Stoffenmanager v7.5.2 Dermal exposure: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.4 mg/m ³ . Risk characterisation ratio: 0.488. Worker - dermal, long-term - local: 0.2 mg/cm ² . Risk characterisation ratio: 0.8.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 5: Industrial spraying (5 - 25 %)

Exposure assessment (human):	: Inhalation exposure: Stoffenmanager v7.5.2 Dermal exposure: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.35 mg/m ³ . Risk characterisation ratio: 0.427. Worker - dermal, long-term - local: 0.12 mg/cm ² . Risk characterisation ratio: 0.48.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 6: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.537 mg/m ³ . Risk characterisation ratio: 0.655. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 7: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.134 mg/m ³ . Risk characterisation ratio: 0.164. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 8: Roller application or brushing

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.537 mg/m ³ . Risk characterisation ratio: 0.655. Worker - dermal, long-term - local: 0.2 mg/cm ² . Risk characterisation ratio: 0.8.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 9: Treatment of articles by dipping and pouring

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.537 mg/m ³ . Risk characterisation ratio: 0.655. Worker - dermal, long-term - local: 0.2 mg/cm ² . Risk characterisation ratio: 0.8.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 10: Lubrication at high energy conditions in metal working operations

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.358 mg/m ³ . Risk characterisation ratio: 0.437. Worker - dermal, long-term - local: 0.2 mg/cm ² . Risk characterisation ratio: 0.8.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 11: General greasing/lubrication at high kinetic energy conditions

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
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Tetraethylenepentamine, TEPA	Exposure Scenario: 19	Use at industrial sites: Metal working fluids; Various products (PC24, PC25).
Exposure estimation	<p>Worker - inhalative, long-term - systemic: 0.358 mg/m³. Risk characterisation ratio: 0.437.</p> <p>Worker - dermal, long-term - local: 0.1 mg/cm². Risk characterisation ratio: 0.4.</p>	
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

General	: The immediate downstream user is required to evaluate whether the operational conditions and risk management measures described in the exposure scenario fit to his use. If other OC/RMM are adopted, the user has to ensure that risks are managed to at least equivalent levels. The risk assessment methods/tools given in section 3 may be used for this evaluation.
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Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition : Multi-constituent substance
Product name : Tetraethylenepentamine, TEPA

Section 1 - Title

Short title of the exposure scenario : Use at industrial sites: Corrosion inhibitor; Various sectors (SU08, SU09).
List of use descriptors : **Identified use name: ES 20:** Use at industrial sites: Corrosion inhibitor - Industrial: SU08, SU09; PROC03; ERC04
Process Category: PROC03
Sector of end use: SU08, SU09
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC04
Environmental contributing scenarios : **Use of non-reactive processing aid at industrial site (no inclusion into or onto article) - ERC04**
Health Contributing scenarios : **Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition - PROC03**

Number of the ES	: 20
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Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Use of non-reactive processing aid at industrial site (no inclusion into or onto article)

Product characteristics	: Liquid.
Amounts used	: Annual site tonnage: 232 tonnes/year. Fraction of Regional tonnage used locally: 0.25. Daily amount per site: 0.773 tonnes/day.
Frequency and duration of use	: Emission days: ≥ 300 days per year.
Other conditions affecting environmental exposure	: Receiving surface water flow ≥ 18000 m ³ /d. Release factor after on-site risk management: water: 0.001 % (Estimated release factor). Local release rate: 0.00773 kg/day. air: 0.000736 % (Estimated release factor). Local release rate: 0.00569 kg/day. Soil: 0 % (Estimated release factor).
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil	: Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of ≥ 27.7 %.
Organisational measures to prevent/limit release from site	: Prevent discharge of undissolved substance to or recover from onsite wastewater.
Conditions and measures related to sewage treatment plant	: Sewage Treatment Plant: Yes. (Efficiency of at least 27.7 %) Assumed domestic sewage treatment plant flow 2000 m ³ /d. Application of the STP sludge on agricultural soil: Yes.
Conditions and measures related to external treatment of waste for disposal	: Particular considerations on the waste treatment operations.

Contributing scenario controlling worker exposure for: All Contributing scenarios

- Product characteristics** : Liquid.
Vapour pressure (40 °C): 0.07 Pa.
- Concentration of substance in mixture or article** : Covers concentrations up to 100 %.
- Other conditions affecting workers exposure** : Indoor use.
Temperature: ≤40°C.
- Organisational measures to prevent/limit releases, dispersion and exposure** : - Any measure to eliminate exposure should be considered.
- Very high level of containment required, except for short term exposures e.g. taking samples.
- Design closed system to allow for easy maintenance.
- If possible keep equipment under negative pressure.
- Control staff entry to work area.
- Ensure all equipment well maintained.
- Permit to work for maintenance work.
- Regular cleaning of equipment and work area.
- Management/supervision in place to check that the RMMs in place are being used correctly and OCs followed.
- Training for staff on good practice.
- Procedures and training for emergency decontamination and disposal.
- Good standard of personal hygiene.
- Recording of any 'near miss' situations.
- Sensitizers - Without prejudice to relevant national legislation, pre-employment screening and appropriate health surveillance.

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

- Personal protection** : - All skin and mucous membranes with potential exposure protected with appropriate PPE (personal protective equipment)
- Substance/Task appropriate gloves.
- Skin coverage with appropriate barrier material based on potential for contact with the chemicals.
- Substance/task appropriate respiratory protection.
- Optional face shield.
- Eye protection.

Contributing scenario controlling worker exposure for 2: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

- Frequency and duration of use/exposure** : Exposure duration per day: ≤4 hours.
- Technical conditions and measures to control dispersion from source towards the worker** : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

- Personal protection** : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.
- Respiratory protection** : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Section 3 - Exposure estimation and reference to its source**Exposure estimation and reference to its source - Environment: 1: Use of non-reactive processing aid at industrial site (no inclusion into or onto article)**

- Exposure assessment (environment):** : EUSES 2.1.2.

Tetraethylenepentamine, TEPA	Exposure Scenario: 20	Use at industrial sites: Corrosion inhibitor; Various sectors (SU08, SU09).
Exposure estimation	<p>Freshwater: 0.000296 mg/l. Risk characterisation ratio (PEC/PNEC): 0.03.</p> <p>Freshwater sediment: 0.095 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): 0.03.</p> <p>Marine water: 0.0000295 mg/l. Risk characterisation ratio (PEC/PNEC): 0.03.</p> <p>Marine water sediment: 0.00945 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): 0.03.</p> <p>Sewage Treatment Plant: 0.00279 mg/l. Risk characterisation ratio (PEC/PNEC): <0.01.</p> <p>Soil: 0.046 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): 0.018.</p>	
Remark	: Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).	

Exposure estimation and reference to its source - Workers: 2: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition		
Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.	
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.161 mg/m ³ . Risk characterisation ratio: 0.197.	
	: Worker - dermal, long-term - local: 0.02 mg/cm ² . Risk characterisation ratio: 0.081.	
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).	

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

General	: The immediate downstream user is required to evaluate whether the operational conditions and risk management measures described in the exposure scenario fit to his use. If other OC/RMM are adopted, the user has to ensure that risks are managed to at least equivalent levels. The risk assessment methods/tools given in section 3 may be used for this evaluation.
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Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition : Multi-constituent substance
Product name : Tetraethylenepentamine, TEPA

Section 1 - Title

Short title of the exposure scenario : Use at industrial sites: Solvent; Manufacture of bulk, large scale chemicals (including petroleum products) (SU08).

List of use descriptors : **Identified use name: ES 21:** Use at industrial sites: Solvent - Industrial: SU08; PROC01, PROC02, PROC03, PROC08a, PROC08b, PROC09, PROC15; ERC04, ERC06b
Process Category: PROC01, PROC02, PROC03, PROC08a, PROC08b, PROC09, PROC15
Substance supplied to that use in form of: As such
Sector of end use: SU08
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC04, ERC06b

Environmental contributing scenarios : **Use of non-reactive processing aid at industrial site (no inclusion into or onto article) - ERC04**
Use of reactive processing aid at industrial site (no inclusion into or onto article) - ERC06b

Health Contributing scenarios : **Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions - PROC01**
Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions - PROC02
Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition - PROC03
Transfer of substance or mixture (charging and discharging) at non-dedicated facilities - PROC08a
Transfer of substance or mixture (charging and discharging) at dedicated facilities - PROC08b
Transfer of substance or mixture into small containers (dedicated filling line, including weighing) - PROC09
Use as laboratory reagent - PROC15

Number of the ES	: 21
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Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Use of non-reactive processing aid at industrial site (no inclusion into or onto article)

Product characteristics : Liquid.
Amounts used : Annual site tonnage: 100 tonnes/year.
Daily amount per site: 5 tonnes/day.
Other conditions affecting environmental exposure : Receiving surface water flow $\geq 18000 \text{ m}^3/\text{d}$.
Release factor after on-site risk management:
water: 0.005 % (Estimated release factor).
Local release rate: 0.25 kg/day.
air: 0.0005 % (Estimated release factor).
Local release rate: 0.025 kg/day.
Soil: 0 % (Estimated release factor).

Conditions and measures related to sewage treatment plant : Sewage Treatment Plant: Yes. (Efficiency of at least 27.7 %)
Assumed domestic sewage treatment plant flow $2000 \text{ m}^3/\text{d}$.
Application of the STP sludge on agricultural soil: Yes.

Tetraethylenepentamine, TEPA Exposure Scenario: 21 **Use at industrial sites: Solvent; Manufacture of bulk, large scale chemicals (including petroleum products) (SU08).**

Conditions and measures related to external treatment of waste for disposal : Particular considerations on the waste treatment operations.

Contributing scenario controlling environmental exposure for 2: Use of reactive processing aid at industrial site (no inclusion into or onto article)

Product characteristics : Liquid.

Amounts used : Annual site tonnage: 100 tonnes/year.
Daily amount per site: 0.274 tonnes/day.

Frequency and duration of use : Emission days: ≥ 365 days per year.

Other conditions affecting environmental exposure : Receiving surface water flow ≥ 18000 m³/d.

Release factor after on-site risk management:
water: 0.01 % (Estimated release factor).
Local release rate: 0.027 kg/day.
air: 0.1 % (Estimated release factor).
Local release rate: 0.274 kg/day.
Soil: 0 % (Estimated release factor).

Conditions and measures related to sewage treatment plant : Sewage Treatment Plant: Yes. (Efficiency of at least 27.7 %)
Assumed domestic sewage treatment plant flow 2000 m³/d.
Application of the STP sludge on agricultural soil: Yes.

Conditions and measures related to external treatment of waste for disposal : Particular considerations on the waste treatment operations.

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics : Liquid.
Vapour pressure (40 °C): 0.07 Pa.

Concentration of substance in mixture or article : Covers concentrations up to 100 %.

Other conditions affecting workers exposure : Indoor use.
Temperature: ≤ 40 °C.

Organisational measures to prevent/limit releases, dispersion and exposure : - Any measure to eliminate exposure should be considered.
- Very high level of containment required, except for short term exposures e.g. taking samples.
- Design closed system to allow for easy maintenance.
- If possible keep equipment under negative pressure.
- Control staff entry to work area.
- Ensure all equipment well maintained.
- Permit to work for maintenance work.
- Regular cleaning of equipment and work area.
- Management/supervision in place to check that the RMMs in place are being used correctly and OCs followed.
- Training for staff on good practice.
- Procedures and training for emergency decontamination and disposal.
- Good standard of personal hygiene.
- Recording of any 'near miss' situations.
- Sensitizers - Without prejudice to relevant national legislation, pre-employment screening and appropriate health surveillance.

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

Personal protection : - All skin and mucous membranes with potential exposure protected with appropriate PPE (personal protective equipment)
- Substance/Task appropriate gloves.
- Skin coverage with appropriate barrier material based on potential for contact with the chemicals.
- Substance/task appropriate respiratory protection.
- Optional face shield.
- Eye protection.

Contributing scenario controlling worker exposure for 3: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Frequency and duration of use/exposure : Exposure duration per day: ≤8 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 4: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Frequency and duration of use/exposure : Exposure duration per day: ≤8 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Inhalation - minimum efficiency of 30 %.
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 5: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 6: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 7: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 95 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 8: Transfer of substance or mixture into small containers (dedicated filling line, including weighing)

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Contributing scenario controlling worker exposure for 9: Use as laboratory reagent

Frequency and duration of use/exposure : Exposure duration per day: ≤4 hours.

Technical conditions and measures to control dispersion from source towards the worker : Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Occupational Health and Safety Management System: Advanced.
Local exhaust ventilation: Inhalation - minimum efficiency of 90 %.

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

Personal protection : Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - minimum efficiency of 90 %.

Respiratory protection : Wear respiratory protection. Inhalation - minimum efficiency of 90 %.

Section 3 - Exposure estimation and reference to its source**Exposure estimation and reference to its source - Environment: 1: Use of non-reactive processing aid at industrial site (no inclusion into or onto article)**

Exposure assessment (environment): : EUSES 2.1.2.

Exposure estimation : Freshwater: 0.00901 mg/l.
Risk characterisation ratio (PEC/PNEC): 0.901.

Freshwater sediment: 2.882 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.901.

Marine water: 0.000901 mg/l.
Risk characterisation ratio (PEC/PNEC): 0.901.

Marine water sediment: 0.288 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.901.

Sewage Treatment Plant: 0.09 mg/l.
Risk characterisation ratio (PEC/PNEC): 0.02.

Tetraethylenepentamine, TEPA Exposure Scenario: 21 **Use at industrial sites: Solvent; Manufacture of bulk, large scale chemicals (including petroleum products) (SU08).**

Remark : Soil: 1.403 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.561.
: Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Environment: 2: Use of reactive processing aid at industrial site (no inclusion into or onto article)

Exposure assessment (environment): : EUSES 2.1.2.

Exposure estimation : Freshwater: 0.001 mg/l.
Risk characterisation ratio (PEC/PNEC): 0.1.

Freshwater sediment: 0.321 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.1.

Marine water: 0.0001 mg/l.
Risk characterisation ratio (PEC/PNEC): 0.1.

Marine water sediment: 0.032 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.1.

Sewage Treatment Plant: 0.0099 mg/l.
Risk characterisation ratio (PEC/PNEC): <0.01.

Soil: 0.158 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.063.

Remark : Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 3: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.09 mg/m³.
Risk characterisation ratio: 0.109.

Worker - dermal, long-term - local: 0.000992 mg/cm².
Risk characterisation ratio: <0.01.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 4: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Exposure assessment (human): : ECETOC TRA worker v3
Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.

Exposure estimation : **Worker - inhalative, long-term - systemic:** 0.627 mg/m³.
Risk characterisation ratio: 0.765.

Worker - dermal, long-term - local: 0.02 mg/cm².
Risk characterisation ratio: 0.08.

Remark : Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 5: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.161 mg/m ³ . Risk characterisation ratio: 0.197. Worker - dermal, long-term - local: 0.02 mg/cm ² . Risk characterisation ratio: 0.081.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 6: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.537 mg/m ³ . Risk characterisation ratio: 0.655. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 7: Transfer of substance or mixture (charging and discharging) at dedicated facilities

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.134 mg/m ³ . Risk characterisation ratio: 0.164. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 8: Transfer of substance or mixture into small containers (dedicated filling line, including weighing)

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.1 mg/cm ² . Risk characterisation ratio: 0.4.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 9: Use as laboratory reagent

Exposure assessment (human):	: ECETOC TRA worker v3 Inhalation, local, short-term/long-term; Inhalation, systemic, short-term; Dermal, systemic/local, short-term; Eye, local: Qualitative approach used to conclude safe use.
Exposure estimation	: Worker - inhalative, long-term - systemic: 0.269 mg/m ³ . Risk characterisation ratio: 0.328. Worker - dermal, long-term - local: 0.00992 mg/cm ² . Risk characterisation ratio: 0.04.
Remark	: Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

General	: The immediate downstream user is required to evaluate whether the operational conditions and risk management measures described in the exposure scenario fit to his use. If other OC/RMM are adopted, the user has to ensure that risks are managed to at least equivalent levels. The risk assessment methods/tools given in section 3 may be used for this evaluation.
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