SAFETY DATA SHEET

N-Aminoethylpiperazine, AEP

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

1.1 Product identifier

Product name : N-Aminoethylpiperazine, AEP

Index number : 612-105-00-4

EC number : 205-411-0

REACH Registration number

Registration number	Legal entity
01-2119471486-30-0003	-

CAS number : 140-31-8

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
ES01: Manufacture - Industrial: PROC01, PROC02, PROC03, PROC08b, PROC15, PROC28; ERC01. **ES02:** Formulation and (re)packing of substances and mixtures - Industrial: PROC01, PROC02, PROC03, PROC08b, PROC09, PROC15, PROC28; ERC02. **ES03:** Industrial Use in Epoxy/PU Curing Industrial - Industrial: PROC01, PROC02, PROC03, PROC07, PROC08b, PROC10, PROC15, PROC28; ERC06d. **ES04:** Professional Use in Epoxy/PU Curing - Professional: PC01; PROC01, PROC05, PROC06, PROC08a, PROC10, PROC11, PROC19, PROC28; ERC08b, ERC08e. **ES05:** Monomer in Polymer Manufacture of polyamides and copolymers - Industrial: PROC01, PROC02, PROC03, PROC06, PROC08b, PROC14, PROC15, PROC28; ERC04. **ES06:** Gas Sweetening - Industrial: PROC01, PROC02, PROC03, PROC08b, PROC28; ERC07.

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 : +1 352 323 3500 (24 h)

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Product definition : Mono-constituent substance

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

SECTION 2: Hazards identification

Acute Tox. 4, H302
Acute Tox. 3, H311
Skin Corr. 1B, H314
Eye Dam. 1, H318
Skin Sens. 1, H317
Repr. 2, H361 (oral)
STOT RE 1, H372
Aquatic Chronic 3, H412

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 :
H302 - Harmful if swallowed.
H311 - Toxic in contact with skin.
H314 - Causes severe skin burns and eye damage.
H317 - May cause an allergic skin reaction.
H361 - Suspected of damaging fertility or the unborn child. (oral)
H372 - Causes damage to organs through prolonged or repeated exposure.
H412 - Harmful to aquatic life with long lasting effects.

Precautionary statements

Prevention :
P201 - Obtain special instructions before use.
P280 - Wear protective gloves, protective clothing and eye or face protection.
P273 - Avoid release to the environment.
P260 - Do not breathe vapour.

Response :
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 doctor.
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 doctor.

Storage : Not applicable.

Disposal : Not applicable.

Hazardous ingredients : 2-piperazin-1-ylethylamine

Supplemental label elements : Not applicable.

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	Yes	No	No	No

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

SECTION 3: Composition/information on ingredients

3.1 Substances : Mono-constituent substance

Product/ingredient name	Identifiers	%	Classification	Type
2-piperazin-1-ylethylamine	REACH #: 01-2119471486-30 EC: 205-411-0 CAS: 140-31-8 Index: 612-105-00-4	98 - 100	Acute Tox. 4, H302 Acute Tox. 3, H311 Skin Corr. 1B, H314 Eye Dam. 1, H318 Skin Sens. 1, H317 Repr. 2, H361 (oral) STOT RE 1, H372 (respiratory tract) (inhalation) Aquatic Chronic 3, H412	[1]
2-(2-aminoethylamino)ethanol	REACH #: 01-2119456894-24 EC: 203-867-5 CAS: 111-41-1 Index: 603-194-00-0	0.2	Skin Corr. 1B, H314 Eye Dam. 1, H318 Skin Sens. 1B, H317 Repr. 1B, H360 Lact., H362 **See Section 16 for the full text of the H statements declared above.**	[2]

Product/ingredient name	Specific Conc. Limits, M-factors and ATEs
2-piperazin-1-ylethylamine	ATE [Oral] = 500 mg/kg ATE [Dermal] = 866 mg/kg
2-(2-aminoethylamino)ethanol	-

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

[1] Constituent
[2] Impurity

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.

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. In the event of any complaints or symptoms, avoid further exposure. Wash clothing before reuse. Clean shoes thoroughly before reuse.

SECTION 4: First aid measures

Ingestion : Get medical attention immediately. Call a poison center or physician. Wash out mouth with water. Remove dentures if any. 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 : No known significant effects or critical hazards.

Skin contact : Causes severe burns. Toxic in contact with skin. May cause an allergic skin reaction.

Ingestion : Harmful if swallowed.

Over-exposure signs/symptoms

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

Inhalation : No specific data.

Skin contact : Adverse symptoms may include the following:
pain or irritation
redness
blistering may occur

Ingestion : Adverse symptoms may include the following:
stomach pains
reduced foetal weight
increase in foetal deaths
skeletal malformations

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, CO_2, 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

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 harmful 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.

SECTION 5: Firefighting measures

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.

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). Persons with a history of skin sensitization problems should not be employed in any process in which this product is used. Avoid exposure - obtain special instructions before use. Avoid exposure during pregnancy. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not breathe vapour or mist. Do not breathe dust or mist. Do not ingest. Avoid release to the environment. If during normal use the material presents a respiratory hazard, use

SECTION 7: Handling and storage

only with adequate ventilation or wear appropriate respirator. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. 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. 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.

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.

Biological exposure indices

None known.

Recommended monitoring procedures : 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

Product/ingredient name	Type	Exposure	Value	Population	Effects
2-piperazin-1-ylethylamine	DNEL	Long term Inhalation	10.6 mg/m³	Workers	Systemic
	DNEL	Short term Inhalation	10.6 mg/m³	Workers	Systemic
	DNEL	Long term Inhalation	15 µg/m³	Workers	Local
	DNEL	Short term Inhalation	80 µg/m³	Workers	Local
	DNEL	Long term Dermal	3.33 mg/kg bw/day	Workers	Systemic
2-(2-aminoethylamino)ethanol	DNEL	Long term Inhalation	0.704 mg/m³	Workers	Systemic

SECTION 8: Exposure controls/personal protection

	DNEL	Long term Dermal	2 mg/kg bw/day	Workers	Systemic
	DNEL	Long term Inhalation	0.174 mg/m³	General population	Systemic
	DNEL	Long term Dermal	1 mg/kg bw/day	General population	Systemic
	DNEL	Long term Oral	0.1 mg/kg bw/day	General population	Systemic

PNECs

Product/ingredient name	Compartment Detail	Value	Method Detail
2-piperazin-1-ylethylamine	Fresh water	0.058 mg/l	Assessment Factors
	Marine water	0.006 mg/l	Assessment Factors
	Fresh water sediment	215 mg/kg dwt	Equilibrium Partitioning
	Marine water sediment	21.5 mg/kg dwt	Equilibrium Partitioning
	Sewage Treatment Plant	250 mg/l	Assessment Factors
	Soil	1 mg/kg dwt	Assessment Factors
	Intermittent release	0.58 mg/l	Assessment Factors
2-(2-aminoethylamino)ethanol	Fresh water	0.022 mg/l	Assessment Factors
	Marine water	0.002 mg/l	Assessment Factors
	Sewage Treatment Plant	82.2 mg/l	Assessment Factors
	Fresh water sediment	0.172 mg/kg dwt	Assessment Factors
	Marine water sediment	0.017 mg/kg dwt	Assessment Factors
	Soil	0.019 mg/kg dwt	Assessment Factors

8.2 Exposure controls

Appropriate engineering controls : 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. Contaminated work clothing should not be allowed out of the workplace. 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: Wear tightly-sealed safety glasses (EN 166). Wear suitable face shield. If inhalation hazards exist, a full-face respirator may be required instead.

Skin protection

SECTION 8: Exposure controls/personal 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).

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

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

9.1 Information on basic physical and chemical properties

Appearance

Physical state : Liquid.

Colour : Clear. Colourless.

Odour : Ammonia.

Odour threshold : Not available.

pH : 11.4

Melting point/freezing point : -19°C

Initial boiling point and boiling range : 220.4°C

Flash point : Closed cup: 99°C (210.2°F) [ASTM D 93-07]

Evaporation rate : Not available.

Flammability : Not applicable.

Lower and upper explosion limit : Lower: 1.1%
Upper: 9.4%

Vapour pressure : 0.0052 kPa

Vapour density : 4.4 [Air = 1]

Relative density : Not available.

Density : 0.98 g/cm³ [20°C]

Solubility in water : 100 g/l

Miscible with water : Yes.

Partition coefficient: n-octanol/water : -1.48

Auto-ignition temperature : >300°C

Decomposition temperature : Not available.

Viscosity : Dynamic: 14.1 mPa·s

Explosive properties : Not considered to be a product presenting a risk of explosion.

SECTION 9: Physical and chemical properties

Oxidising properties : Not applicable.

Particle characteristics

Median particle size : Not applicable.

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: oxidising 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 hazard classes as defined in Regulation (EC) No 1272/2008

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure	Remarks
2-piperazin-1-ylethylamine	LD50 Dermal	Rabbit - Male	866 mg/kg	-	-
	LD50 Oral	Rat - Male	2140 mg/kg	-	-
2-(2-aminoethylamino) ethanol	LD50 Dermal [OECD 402]	Rat - Male, Female	>2000 mg/kg	-	-
	LD50 Oral [OECD 401]	Rat - Male, Female	2150 mg/kg	-	-

Conclusion/Summary : Toxic in contact with skin. Harmful if swallowed.

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)
2-piperazin-1-ylethylamine	500	866	N/A	N/A	N/A

Irritation/Corrosion

SECTION 11: Toxicological information

Product/ingredient name	Result	Species	Score	Exposure	Observation	Remarks
2-piperazin-1-ylethylamine	Eyes - Severe irritant	Rabbit	-	-	7 days	-
	Skin - Visible necrosis	Rabbit	-	24 hours	24 hours	-
2-(2-aminoethylamino) ethanol	Eyes - Oedema of the conjunctivae [OECD 405]	Rabbit	3	24 hours	8 days	-
	Skin - Visible necrosis [OECD 404]	Rabbit	-	4 hours	14 days	-

Conclusion/Summary

Skin : Causes severe burns.

Eyes : Causes serious eye damage.

Respiratory : Not available.

Sensitisation

Product/ingredient name	Route of exposure	Species	Result	Remarks
2-piperazin-1-ylethylamine	skin	Guinea pig	Sensitising [OECD 406]	-
2-(2-aminoethylamino) ethanol	skin	Mouse	Sensitising [OECD 429]	-

Conclusion/Summary

Skin : May cause an allergic skin reaction.

Respiratory : Not available.

Mutagenicity

Product/ingredient name	Test	Experiment	Result	Remarks
2-piperazin-1-ylethylamine	OECD 471	Experiment: In vitro Subject: Bacteria	Negative	-
	OECD 490	Experiment: In vitro Subject: Mammalian-Animal	Negative	-
	EPA 560/6-83-001	Experiment: In vivo Subject: Mammalian-Animal	Negative	-
2-(2-aminoethylamino) ethanol	OECD 477	Experiment: In vivo Subject: Insect Cell: Germ	Negative	-

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

Carcinogenicity

Conclusion/Summary : Not available.

Reproductive toxicity

Product/ingredient name	Maternal toxicity	Fertility	Developmental toxin	Species	Dose	Exposure	Remarks

SECTION 11: Toxicological information

2-piperazin-1-ylethylamine	Negative	-	Positive	Rabbit	Oral: 150 mg/kg NOAEL	-	OECD 414
	Negative	Negative	Negative	Rat	Oral: 598 mg/kg NOAEL	-	OECD 422
2-(2-aminoethylamino) ethanol	Positive	Positive	Positive	Rat - Male, Female	Oral	-	OECD 421

Conclusion/Summary : Suspected of damaging fertility or the unborn child.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Product/ingredient name	Category	Route of exposure	Target organs
2-piperazin-1-ylethylamine	Category 1	inhalation	respiratory tract

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : No known significant effects or critical hazards.

Skin contact : Causes severe burns. Toxic in contact with skin. May cause an allergic skin reaction.

Ingestion : Harmful if swallowed.

Symptoms related to the physical, chemical and toxicological characteristics

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

Inhalation : No specific data.

Skin contact : Adverse symptoms may include the following:
pain or irritation
redness
blistering may occur

Ingestion : Adverse symptoms may include the following:
stomach pains
reduced foetal weight
increase in foetal deaths
skeletal malformations

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

SECTION 11: Toxicological information

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Product/ingredient name	Result	Species	Dose	Exposure	Remarks
2-piperazin-1-ylethylamine	Sub-chronic NOAEL Oral [OECD 422]	Rat - Male	152 mg/kg	-	-
	Sub-chronic NOEL Dermal [OECD 410]	Rat - Male, Female	1000 mg/kg	-	-
	Sub-chronic NOEL Inhalation Vapour [OECD 413]	Rat - Male, Female	53.5 mg/m³	90 days	-
2-(2-aminoethylamino) ethanol	Sub-acute NOAEL Dermal [OECD 410]	Rat - Male, Female	1000 mg/kg	4 weeks; 5 days per week	-
	Sub-acute NOEL Oral [OECD 407]	Rat - Male, Female	60 mg/kg	28 days	-

Conclusion/Summary : Causes damage to organs through prolonged or repeated exposure.

General : Causes damage to organs through prolonged or repeated exposure. Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : Suspected of damaging fertility or the unborn child. (oral)

11.2 Information on other hazards

11.2.1 Endocrine disrupting properties

No known significant effects or critical hazards (Human Health).

11.2.2 Other information

Not available.

SECTION 12: Ecological information

12.1 Toxicity

Product/ingredient name	Result	Species	Exposure	Remarks
2-piperazin-1-ylethylamine	Acute EC50 >1000 mg/l Fresh water [OECD 201]	Algae - Pseudokirchneriella subcapitata	72 hours	-
	Acute EC50 58 mg/l [OECD 202]	Daphnia - Daphnia magna	48 hours	-
	Acute LC50 2190 mg/l Fresh water	Fish - Pimephales promelas	96 hours	-
2-(2-aminoethylamino) ethanol	Acute EC50 920 mg/l Marine water [ISO 10253]	Algae	72 hours	-
	Acute EC50 190 mg/l Fresh water [OECD 202]	Daphnia	48 hours	-
	Acute LC50 640 mg/l Fresh water	Fish	96 hours	-

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

SECTION 12: Ecological information

12.2 Persistence and degradability

Product/ingredient name	Test	Result	Dose	Inoculum
2-piperazin-1-ylethylamine	OECD 301F	0 % - Not readily - 28 days	-	-
2-(2-aminoethylamino) ethanol	OECD 301F	>60 % - Readily - 28 days	-	-

Conclusion/Summary : Not readily biodegradable.

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
2-piperazin-1-ylethylamine	-	-	Not readily
2-(2-aminoethylamino) ethanol	-	-	Readily

12.3 Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
2-piperazin-1-ylethylamine	-1.48	-	low
2-(2-aminoethylamino) ethanol	-1.46	2.1	low

12.4 Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Mobility : Not available.

12.5 Results of PBT and vPvB assessment

Product/ingredient name	PBT	P	B	T	vPvB	vP	vB
2-piperazin-1-ylethylamine	No	Yes	No	Yes	No	No	No

12.6 Endocrine disrupting properties

No known significant effects or critical hazards (Environment).

12.7 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

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.

SECTION 13: Disposal considerations

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 spilt material and runoff and contact with soil, waterways, drains and sewers.

SECTION 14: Transport information

	ADR/RID	ADN	IMDG	IATA
14.1 UN number or ID number	UN2815	UN2815	UN2815	UN2815
14.2 UN proper shipping name	N-AMINOETHYLPIPERAZINE	N-AMINOETHYLPIPERAZINE	N-AMINOETHYLPIPERAZINE	N-Aminoethylpiperazine
14.3 Transport hazard class(es)	8 (6.1)	8 (6.1)	8 (6.1)	8 (6.1)
Label				
14.4 Packing group	III	III	III	III
14.5 Environmental hazards	No.	Yes.	Marine Pollutant: No	No.

Additional information

ADR/RID : **Hazard identification number** 86
Limited quantity 5 L
Tunnel code (E)

ADN : The product is only regulated as an environmentally hazardous substance when transported in tank vessels.

IATA : **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.

14.7 Maritime transport in bulk according to IMO instruments

Proper shipping name : N-Aminoethylpiperazine

Remarks : **Liquid bulk cargoes:**
Ship type: 3
Pollution category: Z

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

Country	Name	Restriction
EU	2-(2-aminoethylamino)ethanol	30
GB	2-(2-aminoethylamino)ethanol	30

SECTION 15: Regulatory information

Label: Not applicable.

Other EU regulations

Ozone depleting substances (1005/2009/EU)

Not listed.

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

Not listed.

Persistent Organic Pollutants

Not listed.

Seveso Directive

This product is not controlled under the Seveso Directive.

National regulations

There are no known additional national regulations relevant to the SDS.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

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	:	All components are listed or exempted.
Canada	:	All components are listed or exempted.
China	:	All components are listed or exempted.
Eurasian Economic Union	:	**Russian Federation inventory**: All components are listed or exempted.
Japan	:	**Japan inventory (CSCL):** All components are listed or exempted.
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.
Thailand	:	All components are listed or exempted.
Turkey	:	All components are listed or exempted.
United States	:	All components are active 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, H302	Regulatory data
Acute Tox. 3, H311	Expert judgment
Skin Corr. 1B, H314	Regulatory data
Eye Dam. 1, H318	Expert judgment
Skin Sens. 1, H317	Regulatory data
Repr. 2, H361 (oral)	Expert judgment
STOT RE 1, H372	Calculation method
Aquatic Chronic 3, H412	Regulatory data

Full text of abbreviated H statements

H302	Harmful if swallowed.
H311	Toxic in contact with skin.
H314	Causes severe skin burns and eye damage.
H317	May cause an allergic skin reaction.
H318	Causes serious eye damage.
H360	May damage fertility or the unborn child.
H361	Suspected of damaging fertility or the unborn child.
H362	May cause harm to breast-fed children.
H372	Causes damage to organs through prolonged or repeated exposure.
H412	Harmful to aquatic life with long lasting effects.

Full text of classifications [CLP/GHS]

Acute Tox. 3	ACUTE TOXICITY - Category 3
Acute Tox. 4	ACUTE TOXICITY - Category 4
Aquatic Chronic 3	LONG-TERM (CHRONIC) AQUATIC HAZARD - Category 3
Eye Dam. 1	SERIOUS EYE DAMAGE/EYE IRRITATION - Category 1
Lact.	REPRODUCTIVE TOXICITY - Effects on or via lactation
Repr. 1B	REPRODUCTIVE TOXICITY - Category 1B
Repr. 2	REPRODUCTIVE TOXICITY - Category 2
Skin Corr. 1B	SKIN CORROSION/IRRITATION - Category 1B
Skin Sens. 1	SKIN SENSITISATION - Category 1
Skin Sens. 1B	SKIN SENSITISATION - Category 1B
STOT RE 1	SPECIFIC TARGET ORGAN TOXICITY - REPEATED EXPOSURE

SECTION 16: Other information

	- Category 1

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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)

Professional

Identification of the substance or mixture

Product definition	:	Mono-constituent substance
Product name	:	N-Aminoethylpiperazine, AEP

Section 1 - Title

Short title of the exposure scenario	:	Widespread use by professional workers; Adhesives, sealants (PC01).
List of use descriptors	:	**Identified use name: ES04:** Professional Use in Epoxy/PU Curing - Professional: PC01; PROC01, PROC05, PROC06, PROC08a, PROC10, PROC11, PROC19, PROC28; ERC08b, ERC08e. **Process Category:** PROC01, PROC05, PROC06, PROC08a, PROC10, PROC11, PROC19, PROC28 **Subsequent service life relevant for that use:** No. **Environmental Release Category:** ERC08b, ERC08e **Market sector by type of chemical product:** PC01
Environmental contributing scenarios	:	**Widespread use of reactive processing aid (no inclusion into or onto article, indoor) -** ERC08b **Widespread use of reactive processing aid (no inclusion into or onto article, outdoor) -** ERC08e
Health Contributing scenarios	:	**Storage -** PROC01 **Mixing operations -** PROC05 **Curing -** PROC06 **Material transfers; Non-dedicated facility -** PROC08a **Professional application of coatings and inks; Rolling, Brushing -** PROC10 **Professional application of coatings and inks; Spraying -** PROC11 **Manual activities involving hand contact -** PROC19 **Equipment cleaning and maintenance -** PROC28
Number of the ES	:	04
Additional information	:	Information concerning technical function: Intermediate (precursor).

Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Widespread use of reactive processing aid (no inclusion into or onto article, indoor)

Amounts used	:	Daily local widespread use amount: ≤0.00275 tonnes/day.
Other conditions affecting environmental exposure	:	Indoor and outdoor use. Release factor after on-site risk management: water: 2% (ERC08b, ERC08e). Local release rate: 0.055 kg/day. air: 0.1% (ERC08b, ERC08e). Soil: 1% (ERC08e).
Technical conditions and measures at process level (source) to prevent release	:	Process with efficient use of raw materials. Automation in raw materials handling: Manual. Equipment cleaned with water, washing disposed of with wastewater. Upon curing, substances are included into matrix without intended release to the environment.
Conditions and measures related to sewage treatment plant	:	Sewage Treatment Plant: Yes. (Efficiency of at least: 0.031%).

Conditions and measures related to external treatment of waste for disposal	:	Disposal should be in accordance with applicable regional, national and local laws and regulations. This product should be treated as a hazardous waste according to EC Directive 2008/98/EC. Prevent entry into sewers, water courses, basements or confined areas. Equipment cleaned with organic solvent, washings are collected and disposed of as solvent waste.

Contributing scenario controlling environmental exposure for 2: Widespread use of reactive processing aid (no inclusion into or onto article, outdoor)

Amounts used	:	Daily local widespread use amount: ≤0.00275 tonnes/day.
Other conditions affecting environmental exposure	:	Indoor and outdoor use. Release factor after on-site risk management: water: 2% (ERC08b, ERC08e). Local release rate: 0.055 kg/day. air: 0.1% (ERC08b, ERC08e). Soil: 1% (ERC08e).
Technical conditions and measures at process level (source) to prevent release	:	Process with efficient use of raw materials. Automation in raw materials handling: Manual. Equipment cleaned with water, washing disposed of with wastewater. Upon curing, substances are included into matrix without intended release to the environment.
Conditions and measures related to sewage treatment plant	:	Sewage Treatment Plant: Yes. (Efficiency of at least: 0.031%).
Conditions and measures related to external treatment of waste for disposal	:	Disposal should be in accordance with applicable regional, national and local laws and regulations. This product should be treated as a hazardous waste according to EC Directive 2008/98/EC. Prevent entry into sewers, water courses, basements or confined areas. Equipment cleaned with organic solvent, washings are collected and disposed of as solvent waste.

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics	:	Liquid with low viscosity. Vapour pressure (20°C): 5.255 Pa.
Other conditions affecting workers exposure	:	Indoor use.
Organisational measures to prevent/limit releases, dispersion and exposure	:	Avoid all skin contact with product, clean up contamination/spills as soon as they occur. Wear gloves (tested to EN374) if hand contamination likely, wash off any skin contamination immediately. Provide basic employee training to prevent/minimise exposures and to report any skin problems that may develop. Avoid direct contact with the substance/mixture/product by establishing organisational measures. Avoid splashing. Avoid contact with contaminated tools and objects. Regular cleaning of equipment. Regular cleaning of work area. Supervision in place to check that the risk management measures in place are being used correctly and operational conditions followed. Training for staff on good practice. Good standard of personal hygiene.

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

Personal protection	:	Use suitable eye protection. Wear suitable gloves tested to EN374.

Contributing scenario controlling worker exposure for 3: Storage

Product characteristics	:	Weight fraction of substance in the article: 1.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 100%.
Frequency and duration of use/exposure	:	Covers daily exposures up to 8 hours. Exposure period, Distance of worker from source > 1 m: 480 minutes.
Other conditions affecting workers exposure	:	Operating temperature: ≤20°C. Room size: Any. Activities with open liquid surfaces or open reservoirs - activity with undisturbed surfaces (no aerosol formation). Open surface: > 3 m³.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Demonstrable and effective housekeeping practices are in place. Containment - high. Effectiveness of containment: 99.9%.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Basic. Store substance within a closed system. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

Contributing scenario controlling worker exposure for 4: Mixing operations

Product characteristics	:	Weight fraction of substance in the article: 1.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 100%.
Frequency and duration of use/exposure	:	Covers exposure up to 1 hour. Exposure period, Distance of worker from source < 1 m: 60 minutes. Non-exposure period: 420 minutes.
Other conditions affecting workers exposure	:	Operating temperature: ≤20°C. Room size: Any. Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces. Open surface: 0.1 - 0.3 m².
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Demonstrable and effective housekeeping practices are in place.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Basic. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*) Local exhaust ventilation: Inhalation - minimum efficiency of 90%. Ensure fixed capturing hood is used. Efficiency of at least 90%.

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

Personal protection	:	Use suitable eye 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: Curing

Product characteristics	:	Weight fraction of substance in the article: 0.2.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 20%.
Frequency and duration of use/exposure	:	Covers daily exposures up to 8 hours. Exposure period, Distance of worker from source > 1 m: 480 minutes.
Other conditions affecting workers exposure	:	Operating temperature: ≤60°C. Room size: 300 m³. Handling of contaminated objects. Activities with treated/contaminated objects (Surfaces 1 - 3 m²). Contamination 10 - 90% of surface.

Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Demonstrable and effective housekeeping practices are in place. Containment - high. Effectiveness of containment: 99.9%.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Basic. Handle substance within a closed system. Assumes a good basic standard of occupational hygiene is implemented. Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). >3 ach (air changes per hour). (*ART*) Local exhaust ventilation: Inhalation - minimum efficiency of 50%.

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

Personal protection	:	Use suitable eye 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 6: Material transfers; Non-dedicated facility

Product characteristics	:	Weight fraction of substance in the article: 1.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 100%.
Frequency and duration of use/exposure	:	Covers exposure up to 1 hour. Exposure period, Distance of worker from source < 1 m: 60 minutes. Non-exposure period: 420 minutes.
Other conditions affecting workers exposure	:	Operating temperature: ≤20°C. Room size: Any. Transfer of liquid products - falling liquids. Splash loading.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Demonstrable and effective housekeeping practices are in place. Containment: Open process. Transfer of liquid products - falling liquids: 1 - 10 L/min.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Basic. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*) Local exhaust ventilation: Inhalation - minimum efficiency of 90%. Ensure fixed capturing hood is used. Efficiency of at least 90%.

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

Personal protection	:	Use suitable eye 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 7: Professional application of coatings and inks; Rolling, Brushing

Product characteristics	:	Weight fraction of substance in the article: 0.2.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 20%.
Frequency and duration of use/exposure	:	Covers exposure up to 4 hours. Exposure period, Distance of worker from source < 1 m: 240 minutes. Non-exposure period: 240 minutes.
Other conditions affecting workers exposure	:	Operating temperature: ≤20°C. Room size: Any. Spreading of liquid products. Spreading of liquids at surfaces or work pieces 1 - 3 m²/hour.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Demonstrable and effective housekeeping practices are in place. No barriers or screens: Efficiency of at least 80%.

Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Basic. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*) Local exhaust ventilation: Inhalation - minimum efficiency of 90%. Ensure that the activity takes place in a downward laminar flow booth. (*ART*)

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

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

Contributing scenario controlling worker exposure for 8: Professional application of coatings and inks; Spraying

Product characteristics	:	Weight fraction of substance in the article: 0.2.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 20%.
Frequency and duration of use/exposure	:	Covers exposure up to 2 hours. Exposure period, Distance of worker from source < 1 m: 120 minutes. Non-exposure period: 360 minutes.
Other conditions affecting workers exposure	:	Operating temperature: ≤20°C. Room size: Any. Surface spraying of liquids. Moderate application rate (0.3 - 3 l/minute). Spraying with no or low compressed air use.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Demonstrable and effective housekeeping practices are in place.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Basic. Provide down-flow spray room. Ensure that worker is in a separated (control) room with independent clean air supply. Apply within a vented cab supplied with filtered air under positive pressure and with a protection factor of >40. Efficiency of at least 97.5%. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

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

Personal protection	:	Use suitable eye 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 9: Manual activities involving hand contact

Product characteristics	:	Weight fraction of substance in the article: 1.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 100%.
Frequency and duration of use/exposure	:	Covers exposure up to 1 hour. Exposure period, Distance of worker from source < 1 m: 60 minutes. Non-exposure period: 420 minutes.
Human factors not influenced by risk management	:	Body weight: 70 kg.
Other conditions affecting workers exposure	:	Operating temperature: ≤20°C. Room size: Any. Activities with open liquid surfaces or open reservoirs - activity with undisturbed surfaces (no aerosol formation). Open surface: 0.1 - 0.3 m².
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Demonstrable and effective housekeeping practices are in place.

Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Basic. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

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

Personal protection	:	Use suitable eye 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 10: Equipment cleaning and maintenance

Product characteristics	:	Weight fraction of substance in the article: 1.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 100%.
Frequency and duration of use/exposure	:	Covers exposure up to 1 hour. Exposure period, Distance of worker from source < 1 m: 60 minutes. Non-exposure period: 420 minutes.
Other conditions affecting workers exposure	:	Operating temperature: ≤20°C. Room size: Any. Handling of contaminated objects. Activities with treated/contaminated objects (Surfaces: 1 - 3 m²). Contamination 10 - 90% of surface.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Demonstrable and effective housekeeping practices are in place.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Basic. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

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

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

Section 3 - Exposure estimation and reference to its source

Exposure estimation and reference to its source - Environment: 1: Widespread use of reactive processing aid (no inclusion into or onto article, indoor)

Exposure assessment (environment):	:	EUSES v2.1.2.
Exposure estimation	:	Freshwater: 0.019 mg/l. Risk characterisation ratio (PEC/PNEC): 0.335. Freshwater sediment: 0.073 mg/kg dwt. Risk characterisation ratio (PEC/PNEC):< 0.01. Marine water: 0.00194 mg/l. Risk characterisation ratio (PEC/PNEC): 0.334. Marine water sediment: 0.00732 mg/kg dwt. Risk characterisation ratio (PEC/PNEC):< 0.01. Sewage Treatment Plant: 0.027 mg/l. Risk characterisation ratio (PEC/PNEC):< 0.01. Soil: 0.011 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): 0.011.
Remark	:	Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Environment: 2: Widespread use of reactive processing aid (no inclusion into or onto article, outdoor)

Exposure assessment (environment):	:	EUSES v2.1.2.
Exposure estimation	:	Freshwater: 0.019 mg/l. Risk characterisation ratio (PEC/PNEC): 0.335. Freshwater sediment: 0.073 mg/kg dwt. Risk characterisation ratio (PEC/PNEC):< 0.01. Marine water: 0.00194 mg/l. Risk characterisation ratio (PEC/PNEC): 0.334. Marine water sediment: 0.00732 mg/kg dwt. Risk characterisation ratio (PEC/PNEC):< 0.01. Sewage Treatment Plant: 0.027 mg/l. Risk characterisation ratio (PEC/PNEC):< 0.01. Soil: 0.011 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): 0.011.
Remark	:	Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 3: Storage

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.000036 mg/m³. Risk characterisation ratio: <0.01. **Worker - dermal, long-term - systemic:** 0.034 mg/kg bw/day. 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: Mixing operations

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0077 mg/m³. Risk characterisation ratio: 0.513. **Worker - dermal, long-term - systemic:** 1.371 mg/kg bw/day. Risk characterisation ratio: 0.412.
Remark	:	Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 5: Curing

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0091 mg/m³. Risk characterisation ratio: 0.607. **Worker - dermal, long-term - systemic:** 1.646 mg/kg bw/day. Risk characterisation ratio: 0.494.
Remark	:	Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 6: Material transfers; Non-dedicated facility

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0068 mg/m³. Risk characterisation ratio: 0.453. **Worker - dermal, long-term - systemic:** 1.371 mg/kg bw/day. Risk characterisation ratio: 0.412.
Remark	:	Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 7: Professional application of coatings and inks; Rolling, Brushing

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0073 mg/m³. Risk characterisation ratio: 0.487. **Worker - dermal, long-term - systemic:** 1.646 mg/kg bw/day. Risk characterisation ratio: 0.494.
Remark	:	Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 8: Professional application of coatings and inks; Spraying

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3 (Modified version).
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.012 mg/m³. Risk characterisation ratio: 0.8. **Worker - dermal, long-term - systemic:** 1.607 mg/kg bw/day. Risk characterisation ratio: 0.483.
Remark	:	Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 9: Manual activities involving hand contact

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: Used Riskofderm model. Version 2.1.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0076 mg/m³. Risk characterisation ratio: 0.507. **Worker - dermal, long-term - systemic:** 2.274 mg/kg bw/day. Risk characterisation ratio: 0.683.
Remark	:	Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 10: Equipment cleaning and maintenance

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0076 mg/m³. Risk characterisation ratio: 0.507. **Worker - dermal, long-term - systemic:** 1.371 mg/kg bw/day. Risk characterisation ratio: 0.412. Remarks: Exposure Estimation: PROC08a
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.
Environment	:	Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.

Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition	:	Mono-constituent substance
Product name	:	N-Aminoethylpiperazine, AEP

Section 1 - Title

Short title of the exposure scenario	:	Use at industrial sites.
List of use descriptors	:	**Identified use name: ES03:** Industrial Use in Epoxy/PU Curing Industrial - Industrial: PROC01, PROC02, PROC03, PROC07, PROC08b, PROC10, PROC15, PROC28; ERC06d. **Process Category:** PROC01, PROC02, PROC03, PROC07, PROC08b, PROC10, PROC15, PROC28 **Subsequent service life relevant for that use:** No. **Environmental Release Category:** ERC06d
Environmental contributing scenarios	:	**Use of reactive process regulators in polymerisation processes at industrial site (inclusion or not into/onto article) -** ERC06d
Health Contributing scenarios	:	**Storage -** PROC01 **General exposures (closed systems); Continuous process; With sample collection -** PROC02 **General exposures; Use in contained batch processes; With sample collection -** PROC03 **Industrial application of coatings and inks; Spraying; Closed systems -** PROC07 **Bulk transfers; Dedicated facility -** PROC08b **Industrial application of coatings and inks; Rolling, Brushing; Closed systems -** PROC10 **Laboratory activities -** PROC15 **Equipment cleaning and maintenance -** PROC28
Number of the ES	:	03
Additional information	:	Information concerning technical function: Intermediate (precursor).

Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Use of reactive process regulators in polymerisation processes at industrial site (inclusion or not into/onto article)

Amounts used	:	Daily amount per site: ≤15 tonnes/day. Annual amount per site: ≤5000 tonnes/year.
Other conditions affecting environmental exposure	:	Receiving surface water flow: ≥18000 m³/d. Release factor after on-site risk management: water: 0.005% (ERC06d). Local release rate: 0.75 kg/day. air: 35% (ERC06d). Local release rate: 5250 kg/day. Soil: 0.025% (ERC06d).
Conditions and measures related to sewage treatment plant	:	Sewage Treatment Plant: Yes. (Efficiency of at least: 0.031%). Discharge rate: ≥2000 m³/d. Application of the STP sludge on agricultural soil: Yes.
Conditions and measures related to external treatment of waste for disposal	:	Disposal should be in accordance with applicable regional, national and local laws and regulations. This product should be treated as a hazardous waste according to EC Directive 2008/98/EC. Prevent entry into sewers, water courses, basements or confined areas.

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics	:	Liquid with low viscosity. Vapour pressure (20°C): 5.255 Pa.
Other conditions affecting workers exposure	:	Indoor use.
Organisational measures to prevent/limit releases, dispersion and exposure	:	Avoid all skin contact with product, clean up contamination/spills as soon as they occur. Wear gloves (tested to EN374) if hand contamination likely, wash off any skin contamination immediately. Provide basic employee training to prevent/minimise exposures and to report any skin problems that may develop. Avoid direct contact with the substance/mixture/product by establishing organisational measures. Avoid splashing. Avoid contact with contaminated tools and objects. Regular cleaning of equipment. Regular cleaning of work area. Supervision in place to check that the risk management measures in place are being used correctly and operational conditions followed. Training for staff on good practice. Good standard of personal hygiene.

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

Personal protection	:	Use suitable eye protection. Wear suitable gloves tested to EN374.

Contributing scenario controlling worker exposure for 2: Storage

Product characteristics	:	Weight fraction of substance in the article: 1.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 100%.
Frequency and duration of use/exposure	:	Covers daily exposures up to 8 hours. Exposure period, Distance of worker from source > 1 m: 480 minutes.
Other conditions affecting workers exposure	:	Operating temperature: ≤20°C. Room size: Any. Activities with open liquid surfaces or open reservoirs - activity with undisturbed surfaces (no aerosol formation). Open surface: > 3 m³.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Demonstrable and effective housekeeping practices are in place. Containment - high. Effectiveness of containment: 99.9%.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Store substance within a closed system. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

Contributing scenario controlling worker exposure for 3: General exposures (closed systems); Continuous process; With sample collection

Product characteristics	:	Weight fraction of substance in the article: 1.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 100%.
Frequency and duration of use/exposure	:	Covers daily exposures up to 8 hours. Activity/Process 1: Exposure period, Distance of worker from source < 1 m: 10 minutes. Activity/Process 2: Exposure period, Distance of worker from source < 1 m: 50 minutes. Activity/Process 3: Exposure period, Distance of worker from source > 1 m: 420 minutes.

Other conditions affecting workers exposure : Operating temperature: ≤20°C.
Room size: 1000 m³.

Activity/Process 1: Transfer of liquid products - falling liquids:
- Splash loading.

Activity/Process 2: Handling of contaminated objects:
- Activities with treated/contaminated objects (Surfaces: 1 - 3 m²).
- Contamination 10 - 90% of surface.

Activity/Process 3: Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces:
- Open surface: > 3 m³.

Technical conditions and measures at process level (source) to prevent release : The process is not fully enclosed or the integrity of that enclosure is not regularly monitored.

Activity/Process 1: Transfer of liquid products - falling liquids:
- General housekeeping practices are in place.
- Transfer of liquid products - falling liquids: < 0.1 L/min.
- Handling that reduces contact between product and adjacent air.

Activity/Process 2: Handling of contaminated objects:
- Demonstrable and effective housekeeping practices are in place.

Activity/Process 3: Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces:
- Demonstrable and effective housekeeping practices are in place.
- Containment - high. Effectiveness of containment: 99.9%.

Technical conditions and measures to control dispersion from source towards the worker : Occupational Health and Safety Management System: Advanced.
Handle substance within a closed system.
Assumes a good basic standard of occupational hygiene is implemented.
Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Only good natural ventilation. (*ART*)

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

Personal protection : Use suitable eye 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: General exposures; Use in contained batch processes; With sample collection

Product characteristics : Weight fraction of substance in the article: 1.

Concentration of substance in mixture or article : Covers percentage substance in the product up to 100%.

Frequency and duration of use/exposure : Covers daily exposures up to 8 hours.
Activity/Process 1: Exposure period, Distance of worker from source < 1 m: 20 minutes.
Activity/Process 2: Exposure period, Distance of worker from source < 1 m: 60 minutes.
Activity/Process 3: Exposure period, Distance of worker from source > 1 m: 380 minutes.
Activity/Process 4: Exposure period, Distance of worker from source < 1 m: 20 minutes.

Other conditions affecting workers exposure : Operating temperature: ≤20°C.
Room size: 1000 m³.

Activity/Process 1: Transfer of liquid products - falling liquids:
- Splash loading.

Activity/Process 2 / 4: Handling of contaminated objects:
- Activities with treated/contaminated objects (Surfaces: 1 - 3 m²).
- Contamination 10 - 90% of surface.

Activity/Process 3: Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces:

- Open surface: > 3 m³.

Technical conditions and measures at process level (source) to prevent release : The process is not fully enclosed or the integrity of that enclosure is not regularly monitored.

Activity/Process 1: Transfer of liquid products - falling liquids:
- General housekeeping practices are in place.
- Transfer of liquid products - falling liquids: < 0.1 L/min.
- Handling that reduces contact between product and adjacent air.

Activity/Process 2 / 4: Handling of contaminated objects:
- Demonstrable and effective housekeeping practices are in place.

Activity/Process 3: Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces:
- Demonstrable and effective housekeeping practices are in place.
- Containment - high. Effectiveness of containment: 99.9%.

Technical conditions and measures to control dispersion from source towards the worker : Occupational Health and Safety Management System: Advanced.
Handle substance within a closed system.
Assumes a good basic standard of occupational hygiene is implemented.
Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Only good natural ventilation. (*ART*)

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

Personal protection : Use suitable eye 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: Industrial application of coatings and inks; Spraying; Closed systems

Product characteristics : Weight fraction of substance in the article: 0.2.

Concentration of substance in mixture or article : Covers percentage substance in the product up to 20%.

Frequency and duration of use/exposure : Covers daily exposures up to 8 hours.
Activity/Process 1: Exposure period, Distance of worker from source > 1 m: 120 minutes.
Activity/Process 2: Exposure period, Distance of worker from source > 1 m: 360 minutes.

Other conditions affecting workers exposure : Operating temperature: ≤60°C.
Room size: 3000 m³.

Activity/Process 1: Surface spraying of liquids.:
- High application rate (> 3 l/minute).
- Ensure that direction of application is only horizontal or downward.
- Spraying with no or low compressed air use.

Activity/Process 2: Handling of contaminated objects:
- Activities with treated/contaminated objects (Surfaces: 1 - 3 m²).
- Contamination 10 - 90% of surface.

Technical conditions and measures at process level (source) to prevent release : Activity/Process 1: Surface spraying of liquids. / Activity/Process 2: Handling of contaminated objects:
- The process is not fully enclosed or the integrity of that enclosure is not regularly monitored.
- Demonstrable and effective housekeeping practices are in place.
- Containment - high. Effectiveness of containment: 99.9%.

Technical conditions and measures to control dispersion from source towards the worker : Occupational Health and Safety Management System: Advanced.
Handle substance within a closed system.
Assumes a good basic standard of occupational hygiene is implemented.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
>3 ach (air changes per hour). (*ART*)
Local exhaust ventilation: Inhalation - minimum efficiency of 50%.
Localised controls (secondary): Provide extract ventilation to points where emissions occur. Efficiency of at least ≥ 50%. (*ART*)

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

Personal protection	:	Use suitable eye 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 6: Bulk transfers; Dedicated facility

Product characteristics	:	Weight fraction of substance in the article: 1.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 100%.
Frequency and duration of use/exposure	:	Covers exposure up to 4 hours. Activity/Process 1: Exposure period, Distance of worker from source < 1 m: 20 minutes. Activity/Process 2: Exposure period, Distance of worker from source > 1 m: 200 minutes. Activity/Process 3: Exposure period, Distance of worker from source < 1 m: 20 minutes. Non-exposure period: 240 minutes.
Other conditions affecting workers exposure	:	Operating temperature: ≤20°C. Room size: 1000 m³. Activity/Process 1: Transfer of liquid products - falling liquids: - Splash loading. Activity/Process 3: Handling of contaminated objects: - Activities with treated/contaminated objects (Surfaces: 1 - 3 m²). - Contamination 10 - 90% of surface.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Activity/Process 1: Transfer of liquid products - falling liquids: - General housekeeping practices are in place. - Transfer of liquid products - falling liquids: < 0.1 L/min. - Handling that reduces contact between product and adjacent air. Activity/Process 2: Transfer of liquid products - Bottom loading: - Demonstrable and effective housekeeping practices are in place. - Transfer of liquid products - Bottom loading: >1000 L/min. Activity/Process 3: Handling of contaminated objects: - Demonstrable and effective housekeeping practices are in place.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

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

Personal protection	:	Use suitable eye 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 7: Industrial application of coatings and inks; Rolling, Brushing; Closed systems

Product characteristics	:	Weight fraction of substance in the article: 0.2.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 20%.
Frequency and duration of use/exposure	:	Covers daily exposures up to 8 hours. Activity/Process 1: Exposure period, Distance of worker from source > 1 m: 120 minutes. Activity/Process 2: Exposure period, Distance of worker from source > 1 m: 360 minutes.

Other conditions affecting workers exposure	:	Operating temperature: ≤60°C. Room size: 3000 m³. Activity/Process 1: Spreading of liquid products: - Spreading of liquids at surfaces or work pieces > 3 m²/hour. Activity/Process 2: Handling of contaminated objects: - Activities with treated/contaminated objects (Surfaces: > 3 m²). - Contamination 10 - 90% of surface.
Technical conditions and measures at process level (source) to prevent release	:	Activity/Process 1: Spreading of liquid products / Activity/Process 2: Handling of contaminated objects: - The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. - Demonstrable and effective housekeeping practices are in place. - Containment - high. Effectiveness of containment: 99.9%.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Handle substance within a closed system. Assumes a good basic standard of occupational hygiene is implemented. Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). >3 ach (air changes per hour). (*ART*) Local exhaust ventilation: Inhalation - minimum efficiency of 50%. Localised controls (secondary): Provide extract ventilation to points where emissions occur. Efficiency of at least ≥ 50%. (*ART*)

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

Personal protection	:	Use suitable eye 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 8: Laboratory activities

Product characteristics	:	Weight fraction of substance in the article: 1.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 100%.
Frequency and duration of use/exposure	:	Covers exposure up to 1 hour. Exposure period, Distance of worker from source < 1 m: 60 minutes. Non-exposure period: 420 minutes.
Other conditions affecting workers exposure	:	Operating temperature: ≤20°C. Room size: Any. Transfer of liquid products - falling liquids. Splash loading.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. General housekeeping practices are in place. Containment: Open process. Transfer of liquid products - falling liquids: < 0.1 L/min.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Assumes a good basic standard of occupational hygiene is implemented. Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). >3 ach (air changes per hour). (*ART*) Local exhaust ventilation: Inhalation - minimum efficiency of 95%. Handle in a fume cupboard. Efficiency of at least 99%.

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

Personal protection	:	Use suitable eye 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 9: Equipment cleaning and maintenance

Product characteristics	:	Weight fraction of substance in the article: 1.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 100%.
Frequency and duration of use/exposure	:	Covers exposure up to 2 hours. Exposure period, Distance of worker from source < 1 m: 120 minutes. Non-exposure period: 360 minutes.
Other conditions affecting workers exposure	:	Operating temperature: ≤20°C. Room size: Any. Handling of contaminated objects. Activities with treated/contaminated objects (Surfaces: 1 - 3 m²). Contamination 10 - 90% of surface.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Demonstrable and effective housekeeping practices are in place.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

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

Personal protection	:	Use suitable eye protection. Wear chemical-resistant gloves (tested to EN374) in combination with 'basic' employee training. Dermal - 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 process regulators in polymerisation processes at industrial site (inclusion or not into/onto article)

Exposure assessment (environment):	:	EUSES v2.1.2.
Exposure estimation	:	Freshwater: 0.054 mg/l. Risk characterisation ratio (PEC/PNEC): 0.934. Freshwater sediment: 0.205 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): <0.01. Marine water: 0.00541 mg/l. Risk characterisation ratio (PEC/PNEC): 0.933. Marine water sediment: 0.02 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): <0.01. Sewage Treatment Plant: 0.375 mg/l. Risk characterisation ratio (PEC/PNEC): <0.01. Soil: 0.685 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): 0.685.
Remark	:	Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 2: Storage

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.000036 mg/m³. Risk characterisation ratio: <0.01. **Worker - dermal, long-term - systemic:** 0.034 mg/kg bw/day. 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: General exposures (closed systems); Continuous process; With sample collection

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0027 mg/m³. Risk characterisation ratio: 0.18. **Worker - dermal, long-term - systemic:** 0.137 mg/kg bw/day. Risk characterisation ratio: 0.041.
Remark	:	Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 4: General exposures; Use in contained batch processes; With sample collection

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0038 mg/m³. Risk characterisation ratio: 0.253. **Worker - dermal, long-term - systemic:** 0.069 mg/kg bw/day. Risk characterisation ratio: 0.021.
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 application of coatings and inks; Spraying; Closed systems

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0049 mg/m³. Risk characterisation ratio: 0.327. **Worker - dermal, long-term - systemic:** 0.082 mg/kg bw/day. Risk characterisation ratio: 0.025. Remarks: Exposure Estimation: PROC02
Remark	:	Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 6: Bulk transfers; Dedicated facility

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0034 mg/m³. Risk characterisation ratio: 0.227. **Worker - dermal, long-term - systemic:** 1.371 mg/kg bw/day. Risk characterisation ratio: 0.412.
Remark	:	Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 7: Industrial application of coatings and inks; Rolling, Brushing; Closed systems

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0044 mg/m³. Risk characterisation ratio: 0.293. **Worker - dermal, long-term - systemic:** 0.082 mg/kg bw/day. Risk characterisation ratio: 0.025. Remarks: Exposure Estimation: PROC02
Remark	:	Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 8: Laboratory activities

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.00017 mg/m³. Risk characterisation ratio: 0.011. **Worker - dermal, long-term - systemic:** 0.034 mg/kg bw/day. 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: 9: Equipment cleaning and maintenance

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0046 mg/m³. Risk characterisation ratio: 0.307. **Worker - dermal, long-term - systemic:** 1.371 mg/kg bw/day. Risk characterisation ratio: 0.412. Remarks: Exposure Estimation: PROC08a
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.
Environment	:	Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.

Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition	:	Mono-constituent substance
Product name	:	N-Aminoethylpiperazine, AEP

Section 1 - Title

Short title of the exposure scenario	:	Manufacture.
List of use descriptors	:	**Identified use name: ES01:** Manufacture - Industrial: PROC01, PROC02, PROC03, PROC08b, PROC15, PROC28; ERC01. **Process Category:** PROC01, PROC02, PROC03, PROC08b, PROC15, PROC28 **Subsequent service life relevant for that use:** No. **Environmental Release Category:** ERC01
Environmental contributing scenarios	:	**Manufacture: -** ERC01
Health Contributing scenarios	:	**Storage -** PROC01 **General exposures (closed systems); No sampling -** PROC01 **General exposures (closed systems); Continuous process; With sample collection -** PROC02 **General exposures; Use in contained batch processes; With sample collection -** PROC03 **Bulk transfers; Dedicated facility -** PROC08b **Laboratory activities -** PROC15 **Equipment cleaning and maintenance -** PROC28
Number of the ES	:	01

Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Manufacture:

Amounts used	:	Daily amount per site: ≤20 tonnes/day. Annual amount per site: ≤2000 tonnes/year.
Other conditions affecting environmental exposure	:	Release factor after on-site risk management: water: 0.00334% (measured data). Local release rate: 0.667 kg/day. air: 0.01% (Estimated release factor). Local release rate: 2.0 kg/day. Soil: 0.01% (Estimated release factor).
Conditions and measures related to sewage treatment plant	:	Sewage Treatment Plant: Yes. (Efficiency of at least: 0.031%). Discharge rate: ≥2000 m³/d. Application of the STP sludge on agricultural soil: Yes.
Conditions and measures related to external treatment of waste for disposal	:	Disposal should be in accordance with applicable regional, national and local laws and regulations. This product should be treated as a hazardous waste according to EC Directive 2008/98/EC. Prevent entry into sewers, water courses, basements or confined areas.

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics	:	Liquid with low viscosity. Weight fraction of substance in the article: 1. Vapour pressure (20°C): 5.255 Pa.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 100%.
Other conditions affecting workers exposure	:	Indoor use. Operating temperature: ≤20°C.

Organisational measures to prevent/limit releases, dispersion and exposure	:	Avoid all skin contact with product, clean up contamination/spills as soon as they occur. Wear gloves (tested to EN374) if hand contamination likely, wash off any skin contamination immediately. Provide basic employee training to prevent/minimise exposures and to report any skin problems that may develop. Avoid direct contact with the substance/mixture/product by establishing organisational measures. Avoid splashing. Avoid contact with contaminated tools and objects. Regular cleaning of equipment. Regular cleaning of work area. Supervision in place to check that the risk management measures in place are being used correctly and operational conditions followed. Training for staff on good practice. Good standard of personal hygiene.

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

Personal protection	:	Use suitable eye protection. Wear suitable gloves tested to EN374.

Contributing scenario controlling worker exposure for 2: Storage

Frequency and duration of use/exposure	:	Covers daily exposures up to 8 hours. Exposure period, Distance of worker from source > 1 m: 480 minutes.
Other conditions affecting workers exposure	:	Room size: Any. Activities with open liquid surfaces or open reservoirs - activity with undisturbed surfaces (no aerosol formation). Open surface: > 3 m³.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Demonstrable and effective housekeeping practices are in place. Containment - high. Effectiveness of containment: 99.9%.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Store substance within a closed system. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

Contributing scenario controlling worker exposure for 3: General exposures (closed systems); No sampling

Frequency and duration of use/exposure	:	Covers daily exposures up to 8 hours. Exposure period, Distance of worker from source > 1 m: 480 minutes.
Other conditions affecting workers exposure	:	Room size: 1000 m³. Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces. Open surface: > 3 m³.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Demonstrable and effective housekeeping practices are in place. Containment - high. Effectiveness of containment: 99.9%.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Handle substance within a closed system. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

Contributing scenario controlling worker exposure for 4: General exposures (closed systems); Continuous process; With sample collection

Frequency and duration of use/exposure	:	Covers daily exposures up to 8 hours. Activity/Process 1: Exposure period, Distance of worker from source < 1 m: 10 minutes. Activity/Process 2: Exposure period, Distance of worker from source < 1 m: 50 minutes. Activity/Process 3: Exposure period, Distance of worker from source > 1 m: 420 minutes.

Other conditions affecting workers exposure	:	Room size: 1000 m³. Activity/Process 1: Transfer of liquid products - falling liquids: - Splash loading. Activity/Process 2: Handling of contaminated objects: - Activities with treated/contaminated objects (Surfaces: 1 - 3 m²). - Contamination 10 - 90% of surface. Activity/Process 3: Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces: - Open surface: > 3 m³.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Activity/Process 1: Transfer of liquid products - falling liquids: - General housekeeping practices are in place. - Transfer of liquid products - falling liquids: < 0.1 L/min. - Handling that reduces contact between product and adjacent air. Activity/Process 2: Handling of contaminated objects: - Demonstrable and effective housekeeping practices are in place. Activity/Process 3: Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces: - Demonstrable and effective housekeeping practices are in place. - Containment - high. Effectiveness of containment: 99.9%.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Handle substance within a closed system. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

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

Personal protection	:	Use suitable eye 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: General exposures; Use in contained batch processes; With sample collection

Frequency and duration of use/exposure	:	Covers daily exposures up to 8 hours. Activity/Process 1: Exposure period, Distance of worker from source < 1 m: 20 minutes. Activity/Process 2: Exposure period, Distance of worker from source < 1 m: 60 minutes. Activity/Process 3: Exposure period, Distance of worker from source > 1 m: 380 minutes. Activity/Process 4: Exposure period, Distance of worker from source < 1 m: 20 minutes.
Other conditions affecting workers exposure	:	Room size: 1000 m³. Activity/Process 1: Transfer of liquid products - falling liquids: - Splash loading. Activity/Process 2 / 4: Handling of contaminated objects: - Activities with treated/contaminated objects (Surfaces: 1 - 3 m²). - Contamination 10 - 90% of surface. Activity/Process 3: Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces: - Open surface: > 3 m³.

Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Activity/Process 1: Transfer of liquid products - falling liquids: - General housekeeping practices are in place. - Transfer of liquid products - falling liquids: < 0.1 L/min. - Handling that reduces contact between product and adjacent air. Activity/Process 2 / 4: Handling of contaminated objects: - Demonstrable and effective housekeeping practices are in place. Activity/Process 3: Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces: - Demonstrable and effective housekeeping practices are in place. - Containment - high. Effectiveness of containment: 99.9%.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Handle substance within a closed system. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

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

Personal protection	:	Use suitable eye 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 6: Bulk transfers; Dedicated facility

Frequency and duration of use/exposure	:	Covers exposure up to 4 hours. Activity/Process 1: Exposure period, Distance of worker from source < 1 m: 20 minutes. Activity/Process 2: Exposure period, Distance of worker from source > 1 m: 200 minutes. Activity/Process 3: Exposure period, Distance of worker from source < 1 m: 20 minutes. Non-exposure period: 240 minutes.
Other conditions affecting workers exposure	:	Room size: 1000 m³. Activity/Process 1: Transfer of liquid products - falling liquids: - Splash loading. Activity/Process 3: Handling of contaminated objects: - Activities with treated/contaminated objects (Surfaces: 1 - 3 m²). - Contamination 10 - 90% of surface.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Activity/Process 1: Transfer of liquid products - falling liquids: - General housekeeping practices are in place. - Transfer of liquid products - falling liquids: < 0.1 L/min. - Handling that reduces contact between product and adjacent air. Activity/Process 2: Transfer of liquid products - Bottom loading: - Demonstrable and effective housekeeping practices are in place. - Transfer of liquid products - Bottom loading: >1000 L/min. Activity/Process 3: Handling of contaminated objects: - Demonstrable and effective housekeeping practices are in place.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

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

Personal protection	:	Use suitable eye 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 7: Laboratory activities

Frequency and duration of use/exposure	:	Covers exposure up to 1 hour. Exposure period, Distance of worker from source < 1 m: 60 minutes. Non-exposure period: 420 minutes.
Other conditions affecting workers exposure	:	Room size: Any. Transfer of liquid products - falling liquids. Splash loading.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. General housekeeping practices are in place. Containment: Open process. Transfer of liquid products - falling liquids: < 0.1 L/min.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Assumes a good basic standard of occupational hygiene is implemented. Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Local exhaust ventilation: Inhalation - minimum efficiency of 95%. Handle in a fume cupboard. Efficiency of at least 99%.

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

Personal protection	:	Use suitable eye 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 8: Equipment cleaning and maintenance

Frequency and duration of use/exposure	:	Covers exposure up to 2 hours. Exposure period, Distance of worker from source < 1 m: 120 minutes. Non-exposure period: 360 minutes.
Other conditions affecting workers exposure	:	Room size: Any. Handling of contaminated objects. Activities with treated/contaminated objects (Surfaces: 1 - 3 m²). Contamination 10 - 90% of surface.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Demonstrable and effective housekeeping practices are in place.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

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

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

Section 3 - Exposure estimation and reference to its source

Exposure estimation and reference to its source - Environment: 1: Manufacture:

Exposure assessment (environment):	:	EUSES v2.1.2.
Exposure estimation	:	Freshwater: 0.05 mg/l. Risk characterisation ratio (PEC/PNEC): 0.862. Freshwater sediment: 0.189 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): <0.01. Marine water: 0.005 mg/l. Risk characterisation ratio (PEC/PNEC): 0.861. Marine water sediment: 0.019 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): <0.01. Sewage Treatment Plant: 0.333 mg/l. Risk characterisation ratio (PEC/PNEC): <0.01.

Soil: 0.011 mg/kg dwt.
Risk characterisation ratio (PEC/PNEC): 0.011.

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

Exposure estimation and reference to its source - Workers: 2: Storage

Exposure assessment (human): : Inhalation exposure: Used ART model. Version 1.5.
Dermal exposure: ECETOC TRA worker v3.

Exposure estimation : **Worker - inhalative, long-term - local:** 0.00036 mg/m³.
Risk characterisation ratio: 0.024.

Worker - dermal, long-term - systemic: 0.034 mg/kg bw/day.
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: General exposures (closed systems); No sampling

Exposure assessment (human): : Inhalation exposure: Used ART model. Version 1.5.
Dermal exposure: ECETOC TRA worker v3.

Exposure estimation : **Worker - inhalative, long-term - local:** 0.0013 mg/m³.
Risk characterisation ratio: 0.087.

Worker - dermal, long-term - systemic: 0.034 mg/kg bw/day.
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: General exposures (closed systems); Continuous process; With sample collection

Exposure assessment (human): : Inhalation exposure: Used ART model. Version 1.5.
Dermal exposure: ECETOC TRA worker v3.

Exposure estimation : **Worker - inhalative, long-term - local:** 0.0027 mg/m³.
Risk characterisation ratio: 0.18.

Worker - dermal, long-term - systemic: 0.137 mg/kg bw/day.
Risk characterisation ratio: 0.041.

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

Exposure estimation and reference to its source - Workers: 5: General exposures; Use in contained batch processes; With sample collection

Exposure assessment (human): : Inhalation exposure: Used ART model. Version 1.5.
Dermal exposure: ECETOC TRA worker v3.

Exposure estimation : **Worker - inhalative, long-term - local:** 0.0038 mg/m³.
Risk characterisation ratio: 0.252.

Worker - dermal, long-term - systemic: 0.069 mg/kg bw/day.
Risk characterisation ratio: 0.021.

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

Exposure estimation and reference to its source - Workers: 6: Bulk transfers; Dedicated facility

Exposure assessment (human): : Inhalation exposure: Used ART model. Version 1.5.
Dermal exposure: ECETOC TRA worker v3.

Exposure estimation : **Worker - inhalative, long-term - local:** 0.0034 mg/m³.
Risk characterisation ratio: 0.227.

Worker - dermal, long-term - systemic: 1.371 mg/kg bw/day.
Risk characterisation ratio: 0.412.

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

Exposure estimation and reference to its source - Workers: 7: Laboratory activities

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.00017 mg/m³. Risk characterisation ratio: 0.011. **Worker - dermal, long-term - systemic:** 0.034 mg/kg bw/day. 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: 8: Equipment cleaning and maintenance

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0046 mg/m³. Risk characterisation ratio: 0.307. **Worker - dermal, long-term - systemic:** 1.371 mg/kg bw/day. Risk characterisation ratio: 0.412. Remarks: Exposure Estimation: PROC08a
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.
Environment	:	Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.

Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition	:	Mono-constituent substance
Product name	:	N-Aminoethylpiperazine, AEP

Section 1 - Title

Short title of the exposure scenario	:	Formulation or re-packing.
List of use descriptors	:	**Identified use name: ES02:** Formulation and (re)packing of substances and mixtures - Industrial: PROC01, PROC02, PROC03, PROC08b, PROC09, PROC15, PROC28; ERC02. **Process Category:** PROC01, PROC02, PROC03, PROC08b, PROC09, PROC15, PROC28 **Subsequent service life relevant for that use:** No. **Environmental Release Category:** ERC02
Environmental contributing scenarios	:	**Formulation and (re)packing of substances and mixtures -** ERC02
Health Contributing scenarios	:	**Storage -** PROC01 **General exposures (closed systems); No sampling -** PROC01 **General exposures (closed systems); Continuous process; With sample collection -** PROC02 **General exposures; Use in contained batch processes; With sample collection -** PROC03 **Bulk transfers; Dedicated facility -** PROC08b **Drum and small package filling; Dedicated facility; Automated task -** PROC09 **Laboratory activities -** PROC15 **Equipment cleaning and maintenance -** PROC28
Number of the ES	:	02
Additional information	:	Information concerning technical function: Intermediate (precursor).

Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Formulation and (re)packing of substances and mixtures

Amounts used	:	Daily amount per site: ≤16.66 tonnes/day. Annual amount per site: ≤5000 tonnes/year.
Other conditions affecting environmental exposure	:	Indoor use. Water contact during use: No. Release factor after on-site risk management: water: 0% (FEICA SPERC 2.1b.v3). Local release rate: 0 kg/day. air: 0.36% (FEICA SPERC 2.1b.v3). Local release rate: 60 kg/day. Soil: 0% (FEICA SPERC 2.1b.v3). Local release rate: 0 kg/day.
Technical conditions and measures at process level (source) to prevent release	:	Process with efficient use of raw materials. Automation in raw materials handling: high.
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil	:	Suitable technique(s) to limit releases to air: Adsorption, Incineration. Air - minimum efficiency of 80%.
Conditions and measures related to sewage treatment plant	:	Sewage Treatment Plant: Yes. (Efficiency of at least: 0.031%). Discharge rate: ≥2000 m³/d. Application of the STP sludge on agricultural soil: Yes.

Conditions and measures related to external treatment of waste for disposal	:	Disposal should be in accordance with applicable regional, national and local laws and regulations. This product should be treated as a hazardous waste according to EC Directive 2008/98/EC. Prevent entry into sewers, water courses, basements or confined areas. Equipment cleaned with organic solvent, washings are collected and disposed of as solvent waste. Vapor recovery (e.g. adsorption) or other technique for reducing volatiles emissions (incineration, thermal oxidation).

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics	:	Liquid with low viscosity. Weight fraction of substance in the article: 1. Vapour pressure (20°C): 5.255 Pa.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 100%.
Other conditions affecting workers exposure	:	Indoor use. Operating temperature: ≤20°C.
Organisational measures to prevent/limit releases, dispersion and exposure	:	Avoid all skin contact with product, clean up contamination/spills as soon as they occur. Wear gloves (tested to EN374) if hand contamination likely, wash off any skin contamination immediately. Provide basic employee training to prevent/minimise exposures and to report any skin problems that may develop. Avoid direct contact with the substance/mixture/product by establishing organisational measures. Avoid splashing. Avoid contact with contaminated tools and objects. Regular cleaning of equipment. Regular cleaning of work area. Supervision in place to check that the risk management measures in place are being used correctly and operational conditions followed. Training for staff on good practice. Good standard of personal hygiene.

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

Personal protection	:	Use suitable eye protection. Wear suitable gloves tested to EN374.

Contributing scenario controlling worker exposure for 2: Storage

Frequency and duration of use/exposure	:	Covers daily exposures up to 8 hours. Exposure period, Distance of worker from source > 1 m: 480 minutes.
Other conditions affecting workers exposure	:	Room size: Any. Activities with open liquid surfaces or open reservoirs - activity with undisturbed surfaces (no aerosol formation). Open surface: > 3 m^3.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Demonstrable and effective housekeeping practices are in place. Containment - high. Effectiveness of containment: 99.9%.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Store substance within a closed system. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

Contributing scenario controlling worker exposure for 3: General exposures (closed systems); No sampling

Frequency and duration of use/exposure	:	Covers daily exposures up to 8 hours. Exposure period, Distance of worker from source > 1 m: 480 minutes.
Other conditions affecting workers exposure	:	Room size: 1000 m³. Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces. Open surface: > 3 m³.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Demonstrable and effective housekeeping practices are in place. Containment - high. Effectiveness of containment: 99.9%.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Handle substance within a closed system. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

Contributing scenario controlling worker exposure for 4: General exposures (closed systems); Continuous process; With sample collection

Frequency and duration of use/exposure	:	Covers daily exposures up to 8 hours. Activity/Process 1: Exposure period, Distance of worker from source < 1 m: 10 minutes. Activity/Process 2: Exposure period, Distance of worker from source < 1 m: 50 minutes. Activity/Process 3: Exposure period, Distance of worker from source > 1 m: 420 minutes.
Other conditions affecting workers exposure	:	Room size: 1000 m³. Activity/Process 1: Transfer of liquid products - falling liquids: - Splash loading. Activity/Process 2: Handling of contaminated objects: - Activities with treated/contaminated objects (Surfaces: 1 - 3 m²). - Contamination 10 - 90% of surface. Activity/Process 3: Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces: - Open surface: > 3 m³.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Activity/Process 1: Transfer of liquid products - falling liquids: - General housekeeping practices are in place. - Transfer of liquid products - falling liquids: < 0.1 L/min. - Handling that reduces contact between product and adjacent air. Activity/Process 2: Handling of contaminated objects: - Demonstrable and effective housekeeping practices are in place. Activity/Process 3: Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces: - Demonstrable and effective housekeeping practices are in place. - Containment - high. Effectiveness of containment: 99.9%.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Handle substance within a closed system. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

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

Personal protection	:	Use suitable eye 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: General exposures; Use in contained batch processes; With sample collection

Frequency and duration of use/exposure : Covers daily exposures up to 8 hours.
Activity/Process 1: Exposure period, Distance of worker from source < 1 m: 20 minutes.
Activity/Process 2: Exposure period, Distance of worker from source < 1 m: 60 minutes.
Activity/Process 3: Exposure period, Distance of worker from source > 1 m: 380 minutes.
Activity/Process 4: Exposure period, Distance of worker from source < 1 m: 20 minutes.

Other conditions affecting workers exposure : Room size: 1000 m³.

Activity/Process 1: Transfer of liquid products - falling liquids:
- Splash loading.

Activity/Process 2 / 4: Handling of contaminated objects:
- Activities with treated/contaminated objects (Surfaces: 1 - 3 m²).
- Contamination 10 - 90% of surface.

Activity/Process 3: Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces:
- Open surface: > 3 m³.

Technical conditions and measures at process level (source) to prevent release : The process is not fully enclosed or the integrity of that enclosure is not regularly monitored.

Activity/Process 1: Transfer of liquid products - falling liquids:
- General housekeeping practices are in place.
- Transfer of liquid products - falling liquids: < 0.1 L/min.
- Handling that reduces contact between product and adjacent air.

Activity/Process 2 / 4: Handling of contaminated objects:
- Demonstrable and effective housekeeping practices are in place.

Activity/Process 3: Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces:
- Demonstrable and effective housekeeping practices are in place.
- Containment - high. Effectiveness of containment: 99.9%.

Technical conditions and measures to control dispersion from source towards the worker : Occupational Health and Safety Management System: Advanced.
Handle substance within a closed system.
Assumes a good basic standard of occupational hygiene is implemented.
Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Only good natural ventilation. (*ART*)

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

Personal protection : Use suitable eye 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 6: Bulk transfers; Dedicated facility

Frequency and duration of use/exposure : Covers exposure up to 4 hours.
Activity/Process 1: Exposure period, Distance of worker from source < 1 m: 20 minutes.
Activity/Process 2: Exposure period, Distance of worker from source > 1 m: 200 minutes.
Activity/Process 3: Exposure period, Distance of worker from source < 1 m: 20 minutes.
Non-exposure period: 240 minutes.

Other conditions affecting workers exposure : Room size: 1000 m³.

Activity/Process 1: Transfer of liquid products - falling liquids:
- Splash loading.

Activity/Process 3: Handling of contaminated objects:
- Activities with treated/contaminated objects (Surfaces: 1 - 3 m²).
- Contamination 10 - 90% of surface.

Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Activity/Process 1: Transfer of liquid products - falling liquids: - General housekeeping practices are in place. - Transfer of liquid products - falling liquids: < 0.1 L/min. - Handling that reduces contact between product and adjacent air. Activity/Process 2: Transfer of liquid products - Bottom loading: - Demonstrable and effective housekeeping practices are in place. - Transfer of liquid products - Bottom loading: >1000 L/min. Activity/Process 3: Handling of contaminated objects: - Demonstrable and effective housekeeping practices are in place.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

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

Personal protection	:	Use suitable eye 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 7: Drum and small package filling; Dedicated facility; Automated task

Frequency and duration of use/exposure	:	Covers exposure up to 4 hours. Activity/Process 1: Exposure period, Distance of worker from source < 1 m: 30 minutes. Activity/Process 2: Exposure period, Distance of worker from source > 1 m: 210 minutes. Non-exposure period: 240 minutes.
Other conditions affecting workers exposure	:	Room size: 1000 m³. Splash loading.
Technical conditions and measures at process level (source) to prevent release	:	Activity/Process 1 / 2: Transfer of liquid products - falling liquids: - The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. - Demonstrable and effective housekeeping practices are in place. - Transfer of liquid products - falling liquids: 100 - 1000 L/min. - Handling that reduces contact between product and adjacent air.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*) Local exhaust ventilation. Ensure fixed capturing hood is used. Inhalation - minimum efficiency of 90%. Fill containers/cans at dedicated fill points supplied with local extract ventilation. Efficiency of at least 90%.

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

Personal protection	:	Use suitable eye 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 8: Laboratory activities

Frequency and duration of use/exposure	:	Covers exposure up to 1 hour. Exposure period, Distance of worker from source < 1 m: 60 minutes. Non-exposure period: 420 minutes.
Other conditions affecting workers exposure	:	Room size: Any. Transfer of liquid products - falling liquids. Splash loading.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. General housekeeping practices are in place. Containment: Open process. Transfer of liquid products - falling liquids: < 0.1 L/min.

Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Assumes a good basic standard of occupational hygiene is implemented. Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). >3 ach (air changes per hour). (*ART*) Local exhaust ventilation: Inhalation - minimum efficiency of 95%. Handle in a fume cupboard. Efficiency of at least 99%.

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

Personal protection	:	Use suitable eye 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 9: Equipment cleaning and maintenance

Frequency and duration of use/exposure	:	Covers exposure up to 2 hours. Exposure period, Distance of worker from source < 1 m: 120 minutes. Non-exposure period: 360 minutes.
Other conditions affecting workers exposure	:	Room size: Any. Handling of contaminated objects. Activities with treated/contaminated objects (Surfaces: 1 - 3 m²). Contamination 10 - 90% of surface.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Demonstrable and effective housekeeping practices are in place.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

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

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

Section 3 - Exposure estimation and reference to its source

Exposure estimation and reference to its source - Environment: 1: Formulation and (re)packing of substances and mixtures

Exposure assessment (environment):	:	EUSES v2.1.2.
Exposure estimation	:	Freshwater: 0.017 mg/l. Risk characterisation ratio (PEC/PNEC): 0.287. Freshwater sediment: 0.063 mg/kg dwt. Risk characterisation ratio (PEC/PNEC):< 0.01. Marine water: 0.00166 mg/l. Risk characterisation ratio (PEC/PNEC): 0.286. Marine water sediment: 0.00628 mg/kg dwt. Risk characterisation ratio (PEC/PNEC):< 0.01. Sewage Treatment Plant: 0 mg/l. Risk characterisation ratio (PEC/PNEC):< 0.01. Soil: 0.018 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: Storage

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.000036 mg/m³. Risk characterisation ratio: < 0.01. **Worker - dermal, long-term - systemic:** 0.034 mg/kg bw/day. 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: General exposures (closed systems); No sampling

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0013 mg/m³. Risk characterisation ratio: 0.087. **Worker - dermal, long-term - systemic:** 0.034 mg/kg bw/day. 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: General exposures (closed systems); Continuous process; With sample collection

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0027 mg/m³. Risk characterisation ratio: 0.18. **Worker - dermal, long-term - systemic:** 0.137 mg/kg bw/day. Risk characterisation ratio: 0.041.
Remark	:	Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 5: General exposures; Use in contained batch processes; With sample collection

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0038 mg/m³. Risk characterisation ratio: 0.253. **Worker - dermal, long-term - systemic:** 0.069 mg/kg bw/day. Risk characterisation ratio: 0.021.
Remark	:	Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 6: Bulk transfers; Dedicated facility

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0034 mg/m³. Risk characterisation ratio: 0.227. **Worker - dermal, long-term - systemic:** 1.371 mg/kg bw/day. Risk characterisation ratio: 0.412.
Remark	:	Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 7: Drum and small package filling; Dedicated facility; Automated task

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.01 mg/m³. Risk characterisation ratio: 0.667. **Worker - dermal, long-term - systemic:** 0.686 mg/kg bw/day. Risk characterisation ratio: 0.206.
Remark	:	Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 8: Laboratory activities

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.00017 mg/m³. Risk characterisation ratio: 0.011. **Worker - dermal, long-term - systemic:** 0.034 mg/kg bw/day. 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: 9: Equipment cleaning and maintenance

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0046 mg/m³. Risk characterisation ratio: 0.307. **Worker - dermal, long-term - systemic:** 1.371 mg/kg bw/day. Risk characterisation ratio: 0.412. Remarks: Exposure Estimation: PROC08a
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.
Environment	:	Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.

Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition	:	Mono-constituent substance
Product name	:	N-Aminoethylpiperazine, AEP

Section 1 - Title

Short title of the exposure scenario	:	Use at industrial sites.
List of use descriptors	:	**Identified use name: ES05:** Monomer in Polymer Manufacture of polyamides and copolymers - Industrial: PROC01, PROC02, PROC03, PROC06, PROC08b, PROC14, PROC15, PROC28; ERC04. **Process Category:** PROC01, PROC02, PROC03, PROC06, PROC08b, PROC14, PROC15, PROC28 **Subsequent service life relevant for that use:** No. **Environmental Release Category:** ERC04
Environmental contributing scenarios	:	**Monomer in Polymer Manufacture of polyamides and copolymers -** ERC04
Health Contributing scenarios	:	**Storage -** PROC01 **General exposures (closed systems); No sampling -** PROC01 **Polymerisation (closed systems); Continuous process; With sample collection -** PROC02 **Polymerisation; Use in contained batch processes; With sample collection -** PROC03 **Pelletisation (extrusion); elevated temperature -** PROC06 **Bulk transfers; Dedicated facility -** PROC08b **Pelletisation (extrusion) -** PROC14 **Laboratory activities -** PROC15 **Equipment cleaning and maintenance -** PROC28
Number of the ES	:	05
Additional information	:	Information concerning technical function: Intermediate (precursor).

Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Monomer in Polymer Manufacture of polyamides and copolymers

Amounts used	:	Daily amount per site: ≤50 tonnes/day. Annual amount per site: ≤5000 tonnes/year.
Other conditions affecting environmental exposure	:	Indoor use. Release factor after on-site risk management: water: 0 % (ESVOC SPERC 4.21a.v1). Local release rate: 0 kg/day. air: 10 % (ESVOC SPERC 4.21a.v1). Local release rate: 5000 kg/day. Soil: 0.001 % (ESVOC SPERC 4.21a.v1). Local release rate: 0 kg/day.
Conditions and measures related to sewage treatment plant	:	Sewage Treatment Plant: Yes. (Efficiency of at least: 0.031%). Discharge rate: ≥2000 m³/d. Application of the STP sludge on agricultural soil: Yes.
Conditions and measures related to external treatment of waste for disposal	:	Disposal should be in accordance with applicable regional, national and local laws and regulations. This product should be treated as a hazardous waste according to EC Directive 2008/98/EC. Prevent entry into sewers, water courses, basements or confined areas.

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics	:	Liquid with low viscosity. Vapour pressure (20°C): 5.255 Pa.
Other conditions affecting workers exposure	:	Indoor use.
Organisational measures to prevent/limit releases, dispersion and exposure	:	Avoid all skin contact with product, clean up contamination/spills as soon as they occur. Wear gloves (tested to EN374) if hand contamination likely, wash off any skin contamination immediately. Provide basic employee training to prevent/minimise exposures and to report any skin problems that may develop. Avoid direct contact with the substance/mixture/product by establishing organisational measures. Avoid splashing. Avoid contact with contaminated tools and objects. Regular cleaning of equipment. Regular cleaning of work area. Supervision in place to check that the risk management measures in place are being used correctly and operational conditions followed. Training for staff on good practice. Good standard of personal hygiene.

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

Personal protection	:	Use suitable eye protection. Wear suitable gloves tested to EN374.

Contributing scenario controlling worker exposure for 2: Storage

Product characteristics	:	Weight fraction of substance in the article: 1.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 100%.
Frequency and duration of use/exposure	:	Covers daily exposures up to 8 hours. Exposure period, Distance of worker from source > 1 m: 480 minutes.
Other conditions affecting workers exposure	:	Operating temperature: ≤20°C. Room size: Any. Activities with open liquid surfaces or open reservoirs - activity with undisturbed surfaces (no aerosol formation). Open surface: > 3 m³.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Demonstrable and effective housekeeping practices are in place. Containment - high. Effectiveness of containment: 99.9%.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Store substance within a closed system. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

Contributing scenario controlling worker exposure for 3: General exposures (closed systems); No sampling

Product characteristics	:	Weight fraction of substance in the article: 1.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 100%.
Frequency and duration of use/exposure	:	Covers daily exposures up to 8 hours. Exposure period, Distance of worker from source > 1 m: 480 minutes.
Other conditions affecting workers exposure	:	Operating temperature: ≤20°C. Room size: 1000 m³. Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces. Open surface: > 3 m³.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Demonstrable and effective housekeeping practices are in place. Containment - high. Effectiveness of containment: 99.9%.

Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Handle substance within a closed system. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

Contributing scenario controlling worker exposure for 4: Polymerisation (closed systems); Continuous process; With sample collection

Product characteristics	:	Weight fraction of substance in the article: 1.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 100%.
Frequency and duration of use/exposure	:	Covers daily exposures up to 8 hours. Activity/Process 1: Exposure period, Distance of worker from source < 1 m: 10 minutes. Activity/Process 2: Exposure period, Distance of worker from source < 1 m: 50 minutes. Activity/Process 3: Exposure period, Distance of worker from source > 1 m: 420 minutes.
Other conditions affecting workers exposure	:	Operating temperature: ≤20°C. Room size: 1000 m³. Activity/Process 1: Transfer of liquid products - falling liquids: - Splash loading. Activity/Process 2: Handling of contaminated objects: - Activities with treated/contaminated objects (Surfaces: 1 - 3 m²). - Contamination 10 - 90% of surface. Activity/Process 3: Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces: - Open surface: > 3 m³.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Activity/Process 1: Transfer of liquid products - falling liquids: - General housekeeping practices are in place. - Transfer of liquid products - falling liquids: < 0.1 L/min. - Handling that reduces contact between product and adjacent air. Activity/Process 2: Handling of contaminated objects: - Demonstrable and effective housekeeping practices are in place. Activity/Process 3: Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces: - Demonstrable and effective housekeeping practices are in place. - Containment - high. Effectiveness of containment: 99.9%.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Handle substance within a closed system. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

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

Personal protection	:	Use suitable eye 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: Polymerisation; Use in contained batch processes; With sample collection

Product characteristics	:	Weight fraction of substance in the article: 1.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 100%.
Frequency and duration of use/exposure	:	Covers daily exposures up to 8 hours. Activity/Process 1: Exposure period, Distance of worker from source < 1 m: 20 minutes. Activity/Process 2: Exposure period, Distance of worker from source < 1 m: 60 minutes. Activity/Process 3: Exposure period, Distance of worker from source > 1 m: 380 minutes. Activity/Process 4: Exposure period, Distance of worker from source < 1 m: 20 minutes.
Other conditions affecting workers exposure	:	Operating temperature: ≤20°C. Room size: 1000 m³. Activity/Process 1: Transfer of liquid products - falling liquids: - Splash loading. Activity/Process 2 / 4: Handling of contaminated objects: - Activities with treated/contaminated objects (Surfaces: 1 - 3 m²). - Contamination 10 - 90% of surface. Activity/Process 3: Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces: - Open surface: > 3 m³.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Activity/Process 1: Transfer of liquid products - falling liquids: - General housekeeping practices are in place. - Transfer of liquid products - falling liquids: < 0.1 L/min. - Handling that reduces contact between product and adjacent air. Activity/Process 2 / 4: Handling of contaminated objects: - Demonstrable and effective housekeeping practices are in place. Activity/Process 3: Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces: - Demonstrable and effective housekeeping practices are in place. - Containment - high. Effectiveness of containment: 99.9%.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Handle substance within a closed system. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

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

Personal protection	:	Use suitable eye 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 6: Pelletisation (extrusion); elevated temperature

In accordance with Article 14 (2a-f) of the REACH Regulation (EC) No 1907/2006, exposure estimation and risk characterisation does not need to be performed if the substance in a mixture is less than 0.1%.

Product characteristics	:	Liquid mole fraction: 0.2. activity coefficient: 1.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 0.1%.
Frequency and duration of use/exposure	:	Covers daily exposures up to 8 hours. Exposure period, Distance of worker from source > 1 m: 480 minutes.

Other conditions affecting workers exposure	:	Operating temperature: ≤60°C. Room size: 300 m³. Handling of contaminated objects. Activities with treated/contaminated objects (Surfaces 1 - 3 m²). Contamination 10 - 90% of surface.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Demonstrable and effective housekeeping practices are in place. Containment - high. Effectiveness of containment: 99.9%.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*) Local exhaust ventilation Inhalation - minimum efficiency of 50%. Localised controls (secondary): Provide extract ventilation to points where emissions occur. Efficiency of at least ≥ 50%. (*ART*)

Contributing scenario controlling worker exposure for 7: Bulk transfers; Dedicated facility

Product characteristics	:	Weight fraction of substance in the article: 1.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 100%.
Frequency and duration of use/exposure	:	Covers exposure up to 4 hours. Activity/Process 1: Exposure period, Distance of worker from source < 1 m: 20 minutes. Activity/Process 2: Exposure period, Distance of worker from source > 1 m: 200 minutes. Activity/Process 3: Exposure period, Distance of worker from source < 1 m: 20 minutes. Non-exposure period: 240 minutes.
Other conditions affecting workers exposure	:	Operating temperature: ≤20°C. Room size: 1000 m³. Activity/Process 1: Transfer of liquid products - falling liquids: - Splash loading. Activity/Process 3: Handling of contaminated objects: - Activities with treated/contaminated objects (Surfaces: 1 - 3 m²). - Contamination 10 - 90% of surface.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Activity/Process 1: Transfer of liquid products - falling liquids: - General housekeeping practices are in place. - Transfer of liquid products - falling liquids: < 0.1 L/min. - Handling that reduces contact between product and adjacent air. Activity/Process 2: Transfer of liquid products - Bottom loading: - Demonstrable and effective housekeeping practices are in place. - Transfer of liquid products - Bottom loading: >1000 L/min. Activity/Process 3: Handling of contaminated objects: - Demonstrable and effective housekeeping practices are in place.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

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

Personal protection	:	Use suitable eye 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 8: Pelletisation (extrusion)

In accordance with Article 14 (2a-f) of the REACH Regulation (EC) No 1907/2006, exposure estimation and risk characterisation does not need to be performed if the substance in a mixture is less than 0.1%.

Product characteristics	:	Liquid mole fraction: 0.2. activity coefficient: 1.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 0.1%.
Frequency and duration of use/exposure	:	Covers daily exposures up to 8 hours.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

Contributing scenario controlling worker exposure for 9: Laboratory activities

Product characteristics	:	Weight fraction of substance in the article: 1.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 100%.
Frequency and duration of use/exposure	:	Covers exposure up to 1 hour. Exposure period, Distance of worker from source < 1 m: 60 minutes. Non-exposure period: 420 minutes.
Other conditions affecting workers exposure	:	Operating temperature: ≤20°C. Room size: Any. Transfer of liquid products - falling liquids. Splash loading.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. General housekeeping practices are in place. Containment: Open process. Transfer of liquid products - falling liquids: < 0.1 L/min.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Assumes a good basic standard of occupational hygiene is implemented. Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). >3 ach (air changes per hour). (*ART*) Local exhaust ventilation: Inhalation - minimum efficiency of 95%. Handle in a fume cupboard. Efficiency of at least 99%.

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

Personal protection	:	Use suitable eye 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 10: Equipment cleaning and maintenance

Product characteristics	:	Weight fraction of substance in the article: 1.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 100%.
Frequency and duration of use/exposure	:	Covers exposure up to 2 hours. Exposure period, Distance of worker from source < 1 m: 120 minutes. Non-exposure period: 360 minutes.
Other conditions affecting workers exposure	:	Operating temperature: ≤20°C. Room size: Any. Handling of contaminated objects. Activities with treated/contaminated objects (Surfaces: 1 - 3 m²). Contamination 10 - 90% of surface.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Demonstrable and effective housekeeping practices are in place.

Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

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

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

Section 3 - Exposure estimation and reference to its source

Exposure estimation and reference to its source - Environment: 1: Monomer in Polymer Manufacture of polyamides and copolymers

Exposure assessment (environment):	:	EUSES v2.1.2.
Exposure estimation	:	Freshwater: 0.0107 mg/l. Risk characterisation ratio (PEC/PNEC): 0.287. Freshwater sediment: 0.063 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): <0.01. Marine water: 0.00166 mg/l. Risk characterisation ratio (PEC/PNEC): 0.286. Marine water sediment: 0.00628 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): <0.01. Sewage Treatment Plant: 0.0 mg/l. Risk characterisation ratio (PEC/PNEC): <0.01. Soil: 0.204 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): 0.204.
Remark	:	Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 2: Storage

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.000036 mg/m³. Risk characterisation ratio: <0.01. **Worker - dermal, long-term - systemic:** 0.034 mg/kg bw/day. 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: General exposures (closed systems); No sampling

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0013 mg/m³. Risk characterisation ratio: 0.087. **Worker - dermal, long-term - systemic:** 0.034 mg/kg bw/day. 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: Polymerisation (closed systems); Continuous process; With sample collection

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0027 mg/m³. Risk characterisation ratio: 0.18. **Worker - dermal, long-term - systemic:** 0.137 mg/kg bw/day. Risk characterisation ratio: 0.041.
Remark	:	Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 5: Polymerisation; Use in contained batch processes; With sample collection

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0038 mg/m³. Risk characterisation ratio: 0.253. **Worker - dermal, long-term - systemic:** 0.069 mg/kg bw/day. Risk characterisation ratio: 0.021.
Remark	:	Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 6: Pelletisation (extrusion); elevated temperature

Exposure assessment (human):	:	In accordance with Article 14 (2a-f) of the REACH Regulation (EC) No 1907/2006, exposure estimation and risk characterisation does not need to be performed if the substance in a mixture is less than 0.1%.
Exposure estimation	:	Not applicable.

Exposure estimation and reference to its source - Workers: 7: Bulk transfers; Dedicated facility

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0034 mg/m³. Risk characterisation ratio: 0.227. **Worker - dermal, long-term - systemic:** 1.371 mg/kg bw/day. Risk characterisation ratio: 0.412.
Remark	:	Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 8: Pelletisation (extrusion)

Exposure assessment (human):	:	In accordance with Article 14 (2a-f) of the REACH Regulation (EC) No 1907/2006, exposure estimation and risk characterisation does not need to be performed if the substance in a mixture is less than 0.1%.
Exposure estimation	:	Not applicable.

Exposure estimation and reference to its source - Workers: 9: Laboratory activities

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.00017 mg/m³. Risk characterisation ratio: 0.011. **Worker - dermal, long-term - systemic:** 0.034 mg/kg bw/day. 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: 10: Equipment cleaning and maintenance

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0046 mg/m³. Risk characterisation ratio: 0.307. **Worker - dermal, long-term - systemic:** 1.371 mg/kg bw/day. Risk characterisation ratio: 0.412. Remarks: Exposure Estimation: PROC08a
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.
Environment	:	Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.

Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition	:	Mono-constituent substance
Product name	:	N-Aminoethylpiperazine, AEP

Section 1 - Title

Short title of the exposure scenario	:	Use at industrial sites.
List of use descriptors	:	**Identified use name: ES06:** Gas Sweetening - Industrial: PROC01, PROC02, PROC03, PROC08b, PROC28; ERC07. **Process Category:** PROC01, PROC02, PROC03, PROC08b, PROC28 **Subsequent service life relevant for that use:** No. **Environmental Release Category:** ERC07
Environmental contributing scenarios	:	**Gas Sweetening -** ERC07
Health Contributing scenarios	:	**Storage -** PROC01 **General exposures (closed systems); No sampling -** PROC01 **Polymerisation (closed systems); Continuous process; With sample collection -** PROC02 **Polymerisation; Use in contained batch processes; With sample collection -** PROC03 **Bulk transfers; Dedicated facility -** PROC08b **Equipment cleaning and maintenance -** PROC28
Number of the ES	:	06
Additional information	:	Information concerning technical function: Intermediate (precursor).

Section 2 - Exposure controls

Contributing scenario controlling environmental exposure for 1: Gas Sweetening

Amounts used	:	Daily amount per site: ≤0.5 tonnes/day. Annual amount per site: ≤50 tonnes/year.
Other conditions affecting environmental exposure	:	Release factor after on-site risk management: water: 0.1% (ESVOC SPERC 7.13a.v1). Local release rate: 0.5 kg/day. air: 0.05% (ESVOC SPERC 7.13a.v1). Local release rate: 0.25 kg/day. Soil: 0.1% (ESVOC SPERC 7.13a.v1). Local release rate: 0 kg/day.
Conditions and measures related to sewage treatment plant	:	Sewage Treatment Plant: Yes. (Efficiency of at least: 0.031%). Discharge rate: ≥2000 m³/d. Application of the STP sludge on agricultural soil: Yes.
Conditions and measures related to external treatment of waste for disposal	:	Disposal should be in accordance with applicable regional, national and local laws and regulations. This product should be treated as a hazardous waste according to EC Directive 2008/98/EC. Prevent entry into sewers, water courses, basements or confined areas.

Contributing scenario controlling worker exposure for: All Contributing scenarios

Product characteristics	:	Liquid with low viscosity. Weight fraction of substance in the article: 1. Vapour pressure (20°C): 5.255 Pa.
Concentration of substance in mixture or article	:	Covers percentage substance in the product up to 100%.
Other conditions affecting workers exposure	:	Indoor use. Operating temperature: ≤20°C.

Organisational measures to prevent/limit releases, dispersion and exposure	:	Avoid all skin contact with product, clean up contamination/spills as soon as they occur. Wear gloves (tested to EN374) if hand contamination likely, wash off any skin contamination immediately. Provide basic employee training to prevent/minimise exposures and to report any skin problems that may develop. Avoid direct contact with the substance/mixture/product by establishing organisational measures. Avoid splashing. Avoid contact with contaminated tools and objects. Regular cleaning of equipment. Regular cleaning of work area. Supervision in place to check that the risk management measures in place are being used correctly and operational conditions followed. Training for staff on good practice. Good standard of personal hygiene.

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

Personal protection	:	Use suitable eye protection. Wear suitable gloves tested to EN374.

Contributing scenario controlling worker exposure for 2: Storage

Frequency and duration of use/exposure	:	Covers daily exposures up to 8 hours. Exposure period, Distance of worker from source > 1 m: 480 minutes.
Other conditions affecting workers exposure	:	Room size: Any. Activities with open liquid surfaces or open reservoirs - activity with undisturbed surfaces (no aerosol formation). Open surface: > 3 m³.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Demonstrable and effective housekeeping practices are in place. Containment - high. Effectiveness of containment: 99.9%.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Store substance within a closed system. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

Contributing scenario controlling worker exposure for 3: General exposures (closed systems); No sampling

Frequency and duration of use/exposure	:	Covers daily exposures up to 8 hours. Exposure period, Distance of worker from source > 1 m: 480 minutes.
Other conditions affecting workers exposure	:	Room size: 1000 m³. Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces. Open surface: > 3 m³.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Demonstrable and effective housekeeping practices are in place. Containment - high. Effectiveness of containment: 99.9%.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Handle substance within a closed system. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

Contributing scenario controlling worker exposure for 4: Polymerisation (closed systems); Continuous process; With sample collection

Frequency and duration of use/exposure	:	Covers daily exposures up to 8 hours. Activity/Process 1: Exposure period, Distance of worker from source < 1 m: 10 minutes. Activity/Process 2: Exposure period, Distance of worker from source < 1 m: 50 minutes. Activity/Process 3: Exposure period, Distance of worker from source > 1 m: 420 minutes.

Other conditions affecting workers exposure	:	Room size: 1000 m³. Activity/Process 1: Transfer of liquid products - falling liquids: - Splash loading. Activity/Process 2: Handling of contaminated objects: - Activities with treated/contaminated objects (Surfaces: 1 - 3 m²). - Contamination 10 - 90% of surface. Activity/Process 3: Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces: - Open surface: > 3 m³.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Activity/Process 1: Transfer of liquid products - falling liquids: - General housekeeping practices are in place. - Transfer of liquid products - falling liquids: < 0.1 L/min. - Handling that reduces contact between product and adjacent air. Activity/Process 2: Handling of contaminated objects: - Demonstrable and effective housekeeping practices are in place. Activity/Process 3: Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces: - Demonstrable and effective housekeeping practices are in place. - Containment - high. Effectiveness of containment: 99.9%.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Handle substance within a closed system. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

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

Personal protection	:	Use suitable eye 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: Polymerisation; Use in contained batch processes; With sample collection

Frequency and duration of use/exposure	:	Covers daily exposures up to 8 hours. Activity/Process 1: Exposure period, Distance of worker from source < 1 m: 20 minutes. Activity/Process 2: Exposure period, Distance of worker from source < 1 m: 60 minutes. Activity/Process 3: Exposure period, Distance of worker from source > 1 m: 380 minutes. Activity/Process 4: Exposure period, Distance of worker from source < 1 m: 20 minutes.
Other conditions affecting workers exposure	:	Room size: 1000 m³. Activity/Process 1: Transfer of liquid products - falling liquids: - Splash loading. Activity/Process 2 / 4: Handling of contaminated objects: - Activities with treated/contaminated objects (Surfaces: 1 - 3 m²). - Contamination 10 - 90% of surface. Activity/Process 3: Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces: - Open surface: > 3 m³.

Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Activity/Process 1: Transfer of liquid products - falling liquids: - General housekeeping practices are in place. - Transfer of liquid products - falling liquids: < 0.1 L/min. - Handling that reduces contact between product and adjacent air. Activity/Process 2 / 4: Handling of contaminated objects: - Demonstrable and effective housekeeping practices are in place. Activity/Process 3: Activities with open liquid surfaces or open reservoirs - activity with agitated surfaces: - Demonstrable and effective housekeeping practices are in place. - Containment - high. Effectiveness of containment: 99.9%.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Handle substance within a closed system. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

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

Personal protection	:	Use suitable eye 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 6: Bulk transfers; Dedicated facility

Frequency and duration of use/exposure	:	Covers exposure up to 4 hours. Activity/Process 1: Exposure period, Distance of worker from source < 1 m: 20 minutes. Activity/Process 2: Exposure period, Distance of worker from source > 1 m: 200 minutes. Activity/Process 3: Exposure period, Distance of worker from source < 1 m: 20 minutes. Non-exposure period: 240 minutes.
Other conditions affecting workers exposure	:	Room size: 1000 m³. Activity/Process 1: Transfer of liquid products - falling liquids: - Splash loading. Activity/Process 3: Handling of contaminated objects: - Activities with treated/contaminated objects (Surfaces: 1 - 3 m²). - Contamination 10 - 90% of surface.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Activity/Process 1: Transfer of liquid products - falling liquids: - General housekeeping practices are in place. - Transfer of liquid products - falling liquids: < 0.1 L/min. - Handling that reduces contact between product and adjacent air. Activity/Process 2: Transfer of liquid products - Bottom loading: - Demonstrable and effective housekeeping practices are in place. - Transfer of liquid products - Bottom loading: >1000 L/min. Activity/Process 3: Handling of contaminated objects: - Demonstrable and effective housekeeping practices are in place.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

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

Personal protection	:	Use suitable eye 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 7: Equipment cleaning and maintenance

Frequency and duration of use/exposure	:	Covers exposure up to 2 hours. Exposure period, Distance of worker from source < 1 m: 120 minutes. Non-exposure period: 360 minutes.
Other conditions affecting workers exposure	:	Room size: Any. Handling of contaminated objects. Activities with treated/contaminated objects (Surfaces: 1 - 3 m²). Contamination 10 - 90% of surface.
Technical conditions and measures at process level (source) to prevent release	:	The process is not fully enclosed or the integrity of that enclosure is not regularly monitored. Demonstrable and effective housekeeping practices are in place.
Technical conditions and measures to control dispersion from source towards the worker	:	Occupational Health and Safety Management System: Advanced. Assumes a good basic standard of occupational hygiene is implemented. Provide a basic standard of general ventilation (1 to 3 air changes per hour). Only good natural ventilation. (*ART*)

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

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

Section 3 - Exposure estimation and reference to its source

Exposure estimation and reference to its source - Environment: 1: Gas Sweetening

Exposure assessment (environment):	:	EUSES v2.1.2.
Exposure estimation	:	Freshwater: 0.042 mg/l. Risk characterisation ratio (PEC/PNEC): 0.718. Freshwater sediment: 0.157 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): <0.01. Marine water: 0.00416 mg/l. Risk characterisation ratio (PEC/PNEC): 0.717. Marine water sediment: 0.016 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): <0.01. Sewage Treatment Plant: 0.25 mg/l. Risk characterisation ratio (PEC/PNEC): <0.01. Soil: 0.011 mg/kg dwt. Risk characterisation ratio (PEC/PNEC): 0.011.
Remark	:	Based on the applied RMMs the risk towards environment is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 2: Storage

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.000036 mg/m³. Risk characterisation ratio: < 0.01. **Worker - dermal, long-term - systemic:** 0.034 mg/kg bw/day. 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: General exposures (closed systems); No sampling

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0013 mg/m³. Risk characterisation ratio: 0.087. **Worker - dermal, long-term - systemic:** 0.034 mg/kg bw/day. 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: Polymerisation (closed systems); Continuous process; With sample collection

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0027 mg/m³. Risk characterisation ratio: 0.18. **Worker - dermal, long-term - systemic:** 0.137 mg/kg bw/day. Risk characterisation ratio: 0.041.
Remark	:	Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 5: Polymerisation; Use in contained batch processes; With sample collection

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0038 mg/m³. Risk characterisation ratio: 0.253. **Worker - dermal, long-term - systemic:** 0.069 mg/kg bw/day. Risk characterisation ratio: 0.021.
Remark	:	Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 6: Bulk transfers; Dedicated facility

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0034 mg/m³. Risk characterisation ratio: 0.227. **Worker - dermal, long-term - systemic:** 1.371 mg/kg bw/day. Risk characterisation ratio: 0.412.
Remark	:	Based on the applied RMMs the risk towards humans is sufficiently controlled (RCR < 1).

Exposure estimation and reference to its source - Workers: 7: Equipment cleaning and maintenance

Exposure assessment (human):	:	Inhalation exposure: Used ART model. Version 1.5. Dermal exposure: ECETOC TRA worker v3.
Exposure estimation	:	**Worker - inhalative, long-term - local:** 0.0046 mg/m³. Risk characterisation ratio: 0.307. **Worker - dermal, long-term - systemic:** 1.371 mg/kg bw/day. Risk characterisation ratio: 0.412. Remarks: Exposure Estimation: PROC08a
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.
Environment	:	Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.