SAFETY DATA SHEET

Piperazine anhydrous, PIP

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

1.1 Product identifier

Product name : Piperazine anhydrous, PIP

Index number : 612-057-01-1

EC number : 203-808-3

REACH Registration number

Registration number	Legal entity
01-2119480384-35-0001	Delamine BV

CAS number : 110-85-0

Product description : Not applicable

Product type : Solid.

Chemical formula : C4-H10-N2

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

Product use : Intermediate. Chemical synthesis. Pharmaceuticals.

Area of application : Industrial applications.

Identified uses
Flaking of piperazine - Industrial Formulation - Industrial Manufacture of substance - Industrial Use as an intermediate and in polymerisation - Industrial Use of gas - washer formulations, in scrubbers - Industrial

1.3 Details of the supplier of the safety data sheet

DELAMINE B.V.
Barchman Wuytierslaan 10
3818 LH Amersfoort
Netherlands
Telephone number: +31-334676897

e-mail address of person responsible for this SDS : SDS.Delamine@delamine.com

1.4 Emergency telephone number

Supplier

Telephone number : GBK/Infotrac ID 104075 : International (001) 352 323 3500 (24 hours per day)

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

Flam. Sol. 1, H228
Skin Corr. 1B, H314
Eye Dam. 1, H318
Resp. Sens. 1, H334
Skin Sens. 1, H317
Repr. 2, H361fd (Fertility and Unborn child)

Classification according to Directive 67/548/EEC [DSD]

F; R11
Repr. Cat. 3; R62, R63
C; R34
R42/43

See Section 16 for the full text of the R phrases or 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 : Flammable solid.
Causes severe skin burns and eye damage.
May cause allergy or asthma symptoms or breathing difficulties if inhaled.
May cause an allergic skin reaction.
Suspected of damaging fertility. Suspected of damaging the unborn child.

Precautionary statements

Prevention : Obtain special instructions before use. Wear protective gloves: > 8 hours (breakthrough time): neoprene. Wear eye or face protection. Wear protective clothing. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

Response : 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. Do not breathe dust/fume/gas/mist/vapours/spray. IF exposed or concerned: Get medical attention.

Storage : Store locked up.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazardous ingredients : Piperazine

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.

Special packaging requirements

Containers to be fitted with child-resistant fastenings : Not applicable.

Tactile warning of danger : Not applicable.

2.3 Other hazards

SECTION 2: Hazards identification

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

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

Other hazards which do not result in classification : Neurotoxic effects and dermatitis.

SECTION 3: Composition/information on ingredients

Substance/mixture : Mono-constituent substance

Product/ingredient name	Identifiers	%	Classification		Type
			67/548/EEC	Regulation (EC) No. 1272/2008 [CLP]	
Piperazine	EC: 203-808-3 CAS: 110-85-0 Index: 612-057-01-1	100	F; R11 Repr. Cat. 3; R62, R63 C; R34 R42/43 **See Section 16 for the full text of the R-phrases declared above.**	Flam. Sol. 1, H228 Skin Corr. 1B, H314 Eye Dam. 1, H318 Resp. Sens. 1, H334 Skin Sens. 1, H317 Repr. 2, H361fd (Fertility and Unborn child) **See Section 16 for the full text of the H statements declared above.**	[A]

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

Type

[A] Constituent
[B] Impurity
[C] Stabilising additive

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

SECTION 4: First aid measures

4.1 Description of first aid measures

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

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

SECTION 4: First aid measures

Skin contact : Get medical attention immediately. Call a poison center or physician. Wash with plenty of soap and water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician. In the event of any complaints or symptoms, avoid further exposure. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Get medical attention immediately. Call a poison center or physician. Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Chemical burns must be treated promptly by a physician. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

4.2 Most important symptoms and effects, both acute and delayed

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : May give off gas, vapor or dust that is very irritating or corrosive to the respiratory system. May cause allergy or asthma symptoms or breathing difficulties if inhaled. Exposure to decomposition products may cause a health hazard. Serious effects may be delayed following exposure.

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

Ingestion : May cause burns to mouth, throat and stomach.

Over-exposure signs/symptoms

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

Inhalation : Adverse symptoms may include the following:
wheezing and breathing difficulties
asthma
reduced foetal weight
increase in foetal deaths
skeletal malformations

Skin contact : Adverse symptoms may include the following:
pain or irritation
redness
blistering may occur
reduced foetal weight
increase in foetal deaths
skeletal malformations

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

SECTION 4: First aid measures

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 dry chemical, CO_2, water spray (fog) or foam.

Unsuitable extinguishing media : Halones

5.2 Special hazards arising from the substance or mixture

Hazards from the substance or mixture : Flammable solid.

Hazardous thermal decomposition 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. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

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.

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. Shut off all ignition sources. No flares, smoking or flames in hazard area. 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).

6.3 Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Place spilled material in a designated, labeled waste container. Dispose of via a licensed waste disposal contractor.

SECTION 6: Accidental release measures

Large spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Dispose of via a licensed waste disposal contractor.

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

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).

7.1 Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Persons with a history of skin sensitisation problems or asthma, allergies or chronic or recurrent respiratory disease 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 ingest. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use only non-sparking tools. 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 a segregated and approved area. 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. Eliminate all ignition sources. Separate from oxidizing materials. 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.

Seveso II Directive - Reporting thresholds (in tonnes)

Danger criteria

Category	Notification and MAPP threshold	Safety report threshold
C7b: Highly flammable (R11)	5000	50000

7.3 Specific end use(s)

Recommendations : No specific data.

Industrial sector specific solutions : No specific data.

SECTION 8: Exposure controls/personal protection

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).

8.1 Control parameters

Occupational exposure limits

Product/ingredient name	Exposure limit values
Piperazine	**EH40/2005 WELs (United Kingdom (UK), 12/2011). Skin sensitiser. Inhalation sensitiser.** STEL: 0.3 mg/m³ 15 minutes. TWA: 0.1 mg/m³ 8 hours.

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

DNELs/DMELs

Product/ingredient name	Type	Exposure	Value	Population	Effects
Piperazine	DNEL	Short term Dermal	0.042 mg/kg bw/day	Workers	Systemic
	DNEL	Short term Inhalation	0.3 mg/m³	Workers	Systemic
	DNEL	Short term Inhalation	0.3 mg/m³	Workers	Local
	DNEL	Long term Dermal	0.014 mg/kg bw/day	Workers	Systemic
	DNEL	Long term Inhalation	0.1 mg/m³	Workers	Systemic
	DNEL	Long term Inhalation	0.1 mg/m³	Workers	Local
	DNEL	Long term Oral	1.5 mg/kg bw/day	Consumers	Systemic

PNECs

Product/ingredient name	Compartment Detail	Value	Method Detail
Piperazine	Secondary Poisoning	4.6 mg/kg	Assessment Factors
	Fresh water	1.25 mg/l	Assessment Factors
	Marine	0.125 mg/l	Assessment Factors
	Fresh water sediment	0.98 mg/kg dwt	-
	Marine water sediment	0.098 mg/kg dwt	-
	Soil	8.9 mg/kg dwt	-
	Sewage Treatment Plant	54 mg/l	Assessment Factors

8.2 Exposure controls

SECTION 8: Exposure controls/personal protection

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

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: chemical splash goggles and/or face shield. If inhalation hazards exist, a full-face respirator may be required instead.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated. > 8 hours (breakthrough time): neoprene

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. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves. Refer to European Standard EN 1149 for further information on material and design requirements and test methods.

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. Recommended: neoprene Boots.

Respiratory protection : Use a properly fitted, particulate filter respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator. Recommended: ammonia filter (Type K) ammonia (Type K) and particulate filter

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Deliquescent crystals.]

Colour : Colourless.

Odour : Amine-like.

Odour threshold : Not available.

SECTION 9: Physical and chemical properties

pH	:	12 [Conc. (% w/w): 1%]
Melting point/freezing point	:	106°C
Initial boiling point and boiling range	:	147°C
Flash point	:	Not applicable.
Evaporation rate	:	Not available.
Flammability (solid, gas)	:	Highly flammable.
Burning time	:	Not available.
Burning rate	:	Not available.
Upper/lower flammability or explosive limits	:	Lower: 4% Upper: 14%
Vapour pressure	:	0.039 kPa [room temperature]
Vapour density	:	3 [Air = 1]
Relative density	:	Not available.
Solubility(ies)	:	
Solubility in water	:	150 g/l
Partition coefficient: n-octanol/ water	:	-1.24
Auto-ignition temperature	:	320°C
Decomposition temperature	:	Not available.
Viscosity	:	Not applicable.
Explosive properties	:	Not applicable.
Oxidising properties	:	None.

9.2 Other information

Density	:	1.1 g/cm³ [20°C]
Physical/chemical properties comments	:	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 : Keep away from sources of ignition - No smoking. aerosol or mist formation

10.5 Incompatible materials : Reactive or incompatible with the following materials: oxidizing materials, metals and acids.
Chlorinated hydrocarbon.

10.6 Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Piperazine	LD50 Dermal LD50 Oral	Rat Rat	8000 mg/kg 2600 mg/kg	- -

Conclusion/Summary : Dermal Not classified as dangerous
Oral No additional remark.
Inhalation Not classified as dangerous

Irritation/Corrosion

Conclusion/Summary

Skin : Corrosive to the skin.

Eyes : Corrosive to eyes.

Respiratory : No additional information.

Sensitisation

Product/ingredient name	Route of exposure	Species	Result
Piperazine	skin	Guinea pig	Sensitising

Conclusion/Summary

Skin : May cause skin sensitisation.

Respiratory : May cause sensitisation by inhalation.

Mutagenicity

Product/ingredient name	Test	Experiment	Result
Piperazine	-	Experiment: In vivo Subject: Mammalian-Animal Cell: Germ	Negative

Conclusion/Summary : No mutagenic effect.

Carcinogenicity

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

Reproductive toxicity

Product/ingredient name	Maternal toxicity	Fertility	Developmental toxin	Species	Dose	Exposure
Piperazine	- -	Positive -	- Positive	Rat - Male, Female Rabbit	Oral Oral	- -

Conclusion/Summary : Fertility NOAEL= 125 mg/kg bw/day
Developmental Toxicity: NOAEL= 42 mg/kg bw/day

Teratogenicity

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

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

SECTION 11: Toxicological information

Information on the likely routes of exposure : Routes of entry anticipated: Oral.

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : May give off gas, vapor or dust that is very irritating or corrosive to the respiratory system. May cause allergy or asthma symptoms or breathing difficulties if inhaled. Exposure to decomposition products may cause a health hazard. Serious effects may be delayed following exposure.

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

Ingestion : May cause burns to mouth, throat and stomach.

Symptoms related to the physical, chemical and toxicological characteristics

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

Inhalation : Adverse symptoms may include the following:
wheezing and breathing difficulties
asthma
reduced foetal weight
increase in foetal deaths
skeletal malformations

Skin contact : Adverse symptoms may include the following:
pain or irritation
redness
blistering may occur
reduced foetal weight
increase in foetal deaths
skeletal malformations

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

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : No specific data.

Potential delayed effects : No specific data.

Long term exposure

Potential immediate effects : No specific data.

Potential delayed effects : No specific data.

Potential chronic health effects

Product/ingredient name	Result	Species	Dose	Exposure
Piperazine	Sub-chronic NOAEL Oral	Rat	627 mg/kg	-

Conclusion/Summary : Neurotoxic effects and dermatitis.

General : 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.

SECTION 11: Toxicological information

Teratogenicity : Suspected of damaging the unborn child.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : Suspected of damaging fertility.

Absorption : gastrointestinal tract: Rapidly absorbed.

Elimination : Excreted via the urine.

Other information : No specific data.

SECTION 12: Ecological information

12.1 Toxicity

Product/ingredient name	Result	Species	Exposure
Piperazine	NOEC 540 mg/l Fresh water Acute EC50 21 mg/l Fresh water Acute LC50 1800 mg/l Fresh water Acute NOEC 1000 mg/l Fresh water Chronic NOEC 12.5 mg/l Fresh water	Micro-organism Daphnia Fish Algae Daphnia	- 48 hours 96 hours 72 hours 21 days

Conclusion/Summary : Not classified as dangerous
PNEC Intermittent release.= 1.25 mg/l

12.2 Persistence and degradability

Product/ingredient name	Test	Result	Dose	Inoculum
Piperazine	OECD 301A Ready Biodegradability - DOC Die-Away Test	96 % - Readily - 52 days	-	-

Conclusion/Summary : Readily biodegradable. not persistent. Not toxic. This substance is not expected to bioaccumulate through food chains in the environment.

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
Piperazine	-	-	Readily

12.3 Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
Piperazine	-1.24	<2000	high

12.4 Mobility in soil

Soil/water partition coefficient (K_{OC}) : 507

Mobility : No specific data.

12.5 Results of PBT and vPvB assessment

PBT : No.

vPvB : No.

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

SECTION 13: Disposal considerations

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

13.1 Waste treatment methods

Product

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.

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. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible.

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	UN2579	UN2579	UN2579	UN2579
14.2 UN proper shipping name	PIPERAZINE	PIPERAZINE	PIPERAZINE	Piperazine
14.3 Transport hazard class(es)	8 	8 	8 	8 
14.4 Packing group	III	III	III	III
14.5 Environmental hazards	No.	No.	No.	No.
Additional information	**Hazard identification number** 80 **Limited quantity** 5 kg **Tunnel code** (E)	-	**Emergency schedules (EmS)** F-A, S-B	**Passenger and Cargo Aircraft** Quantity limitation: 25 kg Packaging instructions: 860 **Cargo Aircraft Only** Quantity limitation: 100 kg Packaging instructions: 864 **Limited Quantities - Passenger Aircraft** Quantity limitation: 5 kg Packaging

SECTION 14: Transport information

				instructions: Y845 **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 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not available.

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

Substances of very high concern

None of the components are listed.

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

Other EU regulations

Europe inventory : All components are listed or exempted.

Product/ingredient name	Carcinogenic effects	Mutagenic effects	Developmental effects	Fertility effects
Piperazine	-	-	Repr. 2, H361d (Unborn child)	Repr. 2, H361f (Fertility)

Seveso II Directive

This product is not controlled under the Seveso II Directive.

Danger criteria

Category
C7b: Highly flammable (R11)

15.2 Chemical Safety Assessment : Complete.

15.3 Registration status : Applicable.

SECTION 16: Other information

Indicates information that has changed from previously issued version.

SECTION 16: Other information

Abbreviations and acronyms : ATE = Acute Toxicity Estimate
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
PBT = Persistent, Bioaccumulative and Toxic
PNEC = Predicted No Effect Concentration
RRN = REACH Registration Number
vPvB = Very Persistent and Very Bioaccumulative

Key literature references and sources for data : Regulation (EC) No. 1272/2008 [CLP]; European convention concerning international road transport of dangerous goods (ADR) done in Geneva on September 30, 1957 (Dz. U. no. 35/1975, pos. 189) plus amendments; Regulation for the transport of dangerous materials on the Rhine (ADN); Occupational exposure limits; International regulations

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

Classification	Justification
Flam. Sol. 1, H228	Expert judgment
Skin Corr. 1B, H314	Expert judgment
Eye Dam. 1, H318	Expert judgment
Resp. Sens. 1, H334	Expert judgment
Skin Sens. 1, H317	Expert judgment
Repr. 2, H361fd (Fertility and Unborn child)	Expert judgment

Full text of abbreviated H statements :

H228	Flammable solid.
H314	Causes severe skin burns and eye damage.
H317	May cause an allergic skin reaction.
H318	Causes serious eye damage.
H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled.
H361fd (Fertility and Unborn child)	Suspected of damaging fertility. Suspected of damaging the unborn child.

Full text of classifications [CLP/GHS] :

Eye Dam. 1, H318	SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 1
Flam. Sol. 1, H228	FLAMMABLE SOLIDS - Category 1
Repr. 2, H361fd (Fertility and Unborn child)	TOXIC TO REPRODUCTION (Fertility and Unborn child) - Category 2
Resp. Sens. 1, H334	RESPIRATORY SENSITIZATION - Category 1
Skin Corr. 1B, H314	SKIN CORROSION/IRRITATION - Category 1B
Skin Sens. 1, H317	SKIN SENSITIZATION - Category 1

Full text of abbreviated R phrases : R11- Highly flammable.
R62- Possible risk of impaired fertility.
R63- Possible risk of harm to the unborn child.
R34- Causes burns.
R42/43- May cause sensitisation by inhalation and skin contact.

Full text of classifications [DSD/DPD] : F - Highly flammable
Repr. Cat. 3 - Toxic to reproduction category 3
C - Corrosive

Training advice : Ensure operatives are trained to minimise exposures. Training staff on good practice.

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Notice to reader

SECTION 16: Other information

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.

Identification of the substance or mixture

Product definition	Mono-constituent substance
Product name	Piperazine anhydrous, PIP

Section 1: Title

Short title of the exposure scenario/List of use descriptors	**Identified use name:** Flaking of piperazine - Industrial **Process Category:** PROC03, PROC08b **Substance supplied to that use in form of:** As such **Sector of end use:** SU03 **Subsequent service life relevant for that use:** No. **Environmental Release Category:** ERC01

Section 2: Operational conditions and risk management measures

Section 2.1 Control of environmental exposure

Contributing scenario controlling environmental exposure for 0: Manufacture of substances

Amounts used:	18600 Tonnes/year
Fraction of EU tonnage used in region	100%
Regional use tonnage	Not available.
Fraction of Regional tonnage used locally	100%
Annual site tonnage	Not available.
Average Local Daily Tonnage (kg/day):	Not available.
Maximum daily site tonnage	Not available.
Frequency and duration of use:	
Emission Days (days/year)	365
Environment factors not influenced by risk management:	River flow rate: 18000 m³/d
Local freshwater dilution factor	Not available.
Local marine water dilution factor	Not available.
Other given operational conditions affecting environmental exposure:	
Release fraction to air from process (initial release prior to RMM)	0.1%
Release fraction to soil from process (initial release prior to RMM)	0.1%
Release fraction to wastewater from process (initial release prior to RMM)	0.2%
Release fraction to air from wide dispersive use (regional only)	Not available.
Release fraction to soil from wide dispersive use (regional only)	Not available.
Release fraction to wastewater from wide dispersive use	Not available.
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil:	Waste water to sewage treatment plant or Elimination via incineration Ion exchange
Treat air emission to provide a typical removal efficiency of	Not available.
Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of	Not available.
If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of	Not available.
Conditions and measures related to municipal sewage treatment plant:	Sewage treatment plant discharge: 2000000 L/day

Section 2.2 Control of worker exposure

Contributing scenario controlling worker exposure for 0: Use in closed batch process (synthesis or formulation)

Product characteristics:	Fugacity: low
Concentration of substance in product:	Covers percentage substance in the product up to 100%
Physical state:	Solid. Vapour pressure 44 Pa*s
Amounts used:	Not applicable.
Frequency and duration of use:	Exposure duration per day: >4 hours Frequency: =240 days per year
Human factors not influenced by risk management:	Exposed skin surfaces: Palm of one hand (240 cm2)
Other given operational conditions affecting workers exposure:	Indoor Industrial use
Technical conditions and measures at process level (source) to prevent release:	Closed system
Technical conditions and measures to control dispersion from source towards the worker:	Technical conditions of use: With local exhaust ventilation
Personal protection:	Wear suitable protective clothing and gloves. : 99%
Respiratory protection:	None.

Section 2.2 Control of worker exposure

Contributing scenario controlling worker exposure for 1: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities

Product characteristics:	Fugacity: low
Concentration of substance in product:	Covers percentage substance in the product up to 100%
Physical state:	Solid. Vapour pressure 44 Pa*s
Amounts used:	Not applicable.
Frequency and duration of use:	Exposure duration per day: >4 hours Frequency: =240 days per year
Human factors not influenced by risk management:	Exposed skin surfaces: Palm of both hands (480 cm2)
Other given operational conditions affecting workers exposure:	Indoor Industrial use
Technical conditions and measures at process level (source) to prevent release:	Use dedicated equipment. Closed system
Technical conditions and measures to control dispersion from source towards the worker:	Technical conditions of use: With local exhaust ventilation
Organisational measures to prevent/limit releases, dispersion and exposure:	Not relevant in ECETOC TRA
Personal protection:	Wear suitable protective clothing and gloves. : 99%
Respiratory protection:	None.

Section 3: Exposure estimation

Section 3.1 Environment - Exposure estimation

Contributing scenario controlling environmental exposure for 0: Manufacture of substances

	Release from point source (local exposure estimation) kg/day	Total release for regional exposure estimation kg/day	Justification
Waste water	Not applicable.	Not applicable.	Not applicable.
Surface water	Not applicable.	Not applicable.	Not applicable.
air (direct + STP)	Not applicable.	Not applicable.	Not applicable.
Soil (direct releases only)	Not applicable.	Not applicable.	Not applicable.

	Value	Justification
Concentration in sewage (PECstp) mg/l	Not applicable.	Not applicable.
Concentration in sewage sludge mg/kg dwt	Not applicable.	Not applicable.

	Local concentration	PEC aquatic (local+regional)	Justification
Fresh water mg/l	Not applicable.	Not applicable.	Not applicable.
Marine water mg/l	Not applicable.	Not applicable.	Not applicable.
Intermittent release. mg/l	Not applicable.	Not applicable.	Not applicable.

	Local concentration	PEC sediment (local+regional)	Justification
Fresh water sediment mg/kg dwt	Not applicable.	Not applicable.	Not applicable.
Marine water sediment mg/kg dwt	Not applicable.		Not applicable.

	Local concentration	PEC soil (local+regional)	Justification
Agricultural soil averaged mg/kg dwt	Not applicable.	Not applicable.	Not applicable.
Grassland averaged mg/kg dwt	Not applicable.	Not applicable.	Not applicable.
Groundwater mg/l	Not applicable.	Not applicable.	Not applicable.
	Local concentration	PEC air (local+regional)	Justification
During emission mg/m³	Not applicable.	Not applicable.	Not applicable.
Annual average mg/m³	Not applicable.	Not applicable.	Not applicable.
Annual deposition mg/m²/d	Not applicable.	Not applicable.	Not applicable.
	Local concentration	PEC aquatic (local+regional)	Justification
Micro-organism mg/l	Not applicable.	Not applicable.	Not applicable.

Section 3.2 Workers - Exposure estimation

Contributing scenario controlling worker exposure for 0: Use in closed batch process (synthesis or formulation)

Route of exposure	Contributing scenarios	Dose/Concentration	Justification
Long term exposure, Systemic, Dermal	Not applicable.	0.0003	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Inhalable	Not applicable.	0.211	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Inhalable	Not applicable.	0.211	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Short term exposure, Systemic, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Inhalable	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.

Section 3.2 Workers - Exposure estimation

Contributing scenario controlling worker exposure for 1: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities

Route of exposure	Contributing scenarios	Dose/Concentration	Justification
Long term exposure, Systemic, Dermal	Not applicable.	0.007	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Inhalable	Not applicable.	0.527	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Inhalable	Not applicable.	0.527	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Short term exposure, Systemic, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Inhalable	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.

Section 4: Guidance to check compliance with the exposure scenario

Environment	Not available.
Health	Not available.

Section 5. Remarks: Additional good practice advice beyond the REACH CSA

Environment	Not applicable.
Health	Not applicable.
Additional Good Practices	Not applicable.

Identification of the substance or mixture

Product definition	Mono-constituent substance
Product name	Piperazine anhydrous, PIP

Section 1: Title

Short title of the exposure scenario/List of use descriptors	**Identified use name:** Formulation - Industrial **Process Category:** PROC01, PROC08a, PROC08b, PROC15 **Substance supplied to that use in form of:** As such **Sector of end use:** SU10 **Subsequent service life relevant for that use:** No. **Environmental Release Category:** ERC02

Section 2: Operational conditions and risk management measures

Section 2.1 Control of environmental exposure

Contributing scenario controlling environmental exposure for 0: Formulation of preparations

Amounts used:	1600 Tonnes/year
Fraction of EU tonnage used in region	100%
Regional use tonnage	2418
Fraction of Regional tonnage used locally	100%
Annual site tonnage	604
Average Local Daily Tonnage (kg/day):	Not available.
Maximum daily site tonnage	2684
Frequency and duration of use:	
Emission Days (days/year)	225
Environment factors not influenced by risk management:	River flow rate: 18000 m³/d
Local freshwater dilution factor	Not available.
Local marine water dilution factor	Not available.
Other given operational conditions affecting environmental exposure:	
Release fraction to air from process (initial release prior to RMM)	2.5%
Release fraction to soil from process (initial release prior to RMM)	0
Release fraction to wastewater from process (initial release prior to RMM)	0
Release fraction to air from wide dispersive use (regional only)	Not available.
Release fraction to soil from wide dispersive use (regional only)	Not available.
Release fraction to wastewater from wide dispersive use	Not available.
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil:	Standard Temperature and Pressure
Treat air emission to provide a typical removal efficiency of	Not available.
Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of	No wastewater treatment required.
If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of	Not available.
Conditions and measures related to municipal sewage treatment plant:	Sewage treatment plant discharge: 2000000 L/day

Section 2.2 Control of worker exposure

Contributing scenario controlling worker exposure for 0: Use in closed process, no likelihood of exposure

Product characteristics:	Fugacity: low
Concentration of substance in product:	Covers percentage substance in the product up to 100%
Physical state:	Solid. or Flakes. Vapour pressure 44 Pa*s
Amounts used:	Not applicable.
Frequency and duration of use:	Exposure duration per day: >4 hours Frequency: =240 days per year
Human factors not influenced by risk management:	Exposed skin surfaces: Palm of one hand (240 cm2)
Other given operational conditions affecting workers exposure:	Indoor Industrial use
Technical conditions and measures at process level (source) to prevent release:	Closed system
Technical conditions and measures to control dispersion from source towards the worker:	Technical conditions of use: With local exhaust ventilation
Organisational measures to prevent/limit releases, dispersion and exposure:	Not relevant in ECETOC TRA
Personal protection:	Chemical-resistant gloves.: 99% Protective clothing
Respiratory protection:	None.

Section 2.2 Control of worker exposure

Contributing scenario controlling worker exposure for 1: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities

Product characteristics:	Fugacity: low
Concentration of substance in product:	Covers percentage substance in the product up to 100%
Physical state:	Liquid. Vapour pressure 44 Pa*s
Amounts used:	Not applicable.
Frequency and duration of use:	Exposure duration per day: <15 min Frequency: =240 days per year
Human factors not influenced by risk management:	Exposed skin surfaces: Palm of both hands (480 cm2)
Other given operational conditions affecting workers exposure:	Indoor/Outdoor use Industrial use
Technical conditions and measures at process level (source) to prevent release:	None.
Technical conditions and measures to control dispersion from source towards the worker:	Use the following local exhaust ventilation types: None.
Organisational measures to prevent/limit releases, dispersion and exposure:	Not relevant in ECETOC TRA
Personal protection:	Chemical-resistant gloves.: 99% Protective clothing
Respiratory protection:	Wear appropriate respiratory protection. with a minimum efficacy of 95%

Section 2.2 Control of worker exposure

Contributing scenario controlling worker exposure for 2: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities

Product characteristics:	Short term exposure: Fugacity: low Long term exposure 8 h (full shift).: Fugacity: low
Concentration of substance in product:	Short term exposure: Covers concentrations up to 100% Long term exposure 8 h (full shift).: Covers concentrations up to 60%
Physical state:	Short term exposure: liquid Vapour pressure 44 Pa*s Long term exposure 8 h (full shift).: solution Vapour pressure44 Pa*s
Dust:	Long term exposure 8 h (full shift).: Medium
Amounts used:	Not applicable.
Frequency and duration of use:	Short term exposure: Exposure duration per day:<15 min a day(s) Frequency: =240 days per year Long term exposure 8 h (full shift).: Exposure duration per day:>4 hours per day Frequency: =240 days per year
Human factors not influenced by risk management:	Short term exposure: Exposed skin surfaces: Palm of both hands (480 cm2) Long term exposure 8 h (full shift).: Exposed skin surfaces: Palm of both hands (480 cm2)
Other given operational conditions affecting workers exposure:	Short term exposure: Indoor Industrial use Long term exposure 8 h (full shift).: Indoor Industrial use

Technical conditions and measures at process level (source) to prevent release:	Short term exposure: None. Long term exposure 8 h (full shift).: Dedicated facility Closed system
Technical conditions and measures to control dispersion from source towards the worker:	Short term exposure: Technical conditions of use: With local exhaust ventilation Long term exposure 8 h (full shift).: Technical conditions of use: With local exhaust ventilation
Organisational measures to prevent/limit releases, dispersion and exposure:	Short term exposure: Not relevant in ECETOC TRA Long term exposure 8 h (full shift).: Not relevant in ECETOC TRA
Personal protection:	Short term exposure: Protective clothing Chemical-resistant gloves.: 99% Long term exposure 8 h (full shift).: Protective clothing Chemical-resistant gloves.: 99%
Respiratory protection:	Short term exposure: None. Long term exposure 8 h (full shift).: None.

Section 2.2 Control of worker exposure

Contributing scenario controlling worker exposure for 3: Use a laboratory reagent

Product characteristics:	Fugacity: low
Concentration of substance in product:	Covers percentage substance in the product up to 100%
Physical state:	Liquid. Vapour pressure 44 Pa*s
Amounts used:	Not applicable.
Frequency and duration of use:	Exposure duration per day: 15 min - 1 hours per day Frequency: =240 days per year
Human factors not influenced by risk management:	Exposed skin surfaces: Palm of one hand (240 cm2)
Other given operational conditions affecting workers exposure:	Indoor Industrial use
Technical conditions and measures at process level (source) to prevent release:	None.
Technical conditions and measures to control dispersion from source towards the worker:	Technical conditions of use: With local exhaust ventilation
Organisational measures to prevent/limit releases, dispersion and exposure:	Not relevant in ECETOC TRA
Personal protection:	Wear suitable protective clothing and gloves.: 99%
Respiratory protection:	None.

Section 3: Exposure estimation

Section 3.1 Environment - Exposure estimation

Contributing scenario controlling environmental exposure for 0: Formulation of preparations

	Release from point source (local exposure estimation) kg/day	**Total release for regional exposure estimation kg/day**	**Justification**
Waste water	Not applicable.	Not applicable.	Not applicable.
Surface water	Not applicable.	Not applicable.	Not applicable.
air (direct + STP)	Not applicable.	Not applicable.	Not applicable.
Soil (direct releases only)	Not applicable.	Not applicable.	Not applicable.

	Value	**Justification**
Concentration in sewage (PECstp) mg/l	Not applicable.	Not applicable.
Concentration in sewage sludge mg/kg dwt	Not applicable.	Not applicable.

	Local concentration	**PEC aquatic (local+regional)**	**Justification**
Fresh water mg/l	Not applicable.	PEC: 0.921; PNEC: 1.25; RCR - Water Compartment Driven: 0. 737	Not applicable.
Marine water mg/l	Not applicable.	PEC: 0.0921; PNEC: 0.130; RCR - Water Compartment Driven: 0.708	Not applicable.
Intermittent release. mg/l	Not applicable.	Not applicable.	Not applicable.

	Local concentration	**PEC sediment (local+regional)**	**Justification**
Fresh water sediment mg/kg dwt	Not applicable.	PEC: 0.720; PNEC: 0.980; RCR: 0.735	Not applicable.

Marine water sediment mg/kg dwt	Not applicable.	PEC: 0.0720; PNEC: 0.100;RCR: 0.720	Not applicable.
	Local concentration	**PEC soil (local+regional)**	**Justification**
Agricultural soil averaged mg/kg dwt	Not applicable.	PEC: 5.79E-03; PNEC: 8.86; RCR: 6.53E-04	Not applicable.
Grassland averaged mg/kg dwt	Not applicable.	PEC: 0.0111; PNEC: 8.86; RCR: 1.25E-03	Not applicable.
Groundwater mg/l	Not applicable.	Not applicable.	Not applicable.
	Local concentration	**PEC air (local+regional)**	**Justification**
During emission mg/m³	Not applicable.	Not applicable.	Not applicable.
Annual average mg/m³	Not applicable.	Not applicable.	Not applicable.
Annual deposition mg/m²/d	Not applicable.	Not applicable.	Not applicable.
	Local concentration	**PEC aquatic (local+regional)**	**Justification**
Micro-organism mg/l	Not applicable.	Not applicable.	Not applicable.

Section 3.2 Workers - Exposure estimation

Contributing scenario controlling worker exposure for 0: Use in closed process, no likelihood of exposure

Route of exposure	Contributing scenarios	Dose/Concentration	Justification
Long term exposure, Systemic, Dermal	Not applicable.	0.0003	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Inhalable	Not applicable.	0.035	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Inhalable	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.

Section 3.2 Workers - Exposure estimation

Contributing scenario controlling worker exposure for 1: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities

Route of exposure	Contributing scenarios	Dose/Concentration	Justification
Long term exposure, Systemic, Dermal	Not applicable.	0.0013	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Inhalable	Not applicable.	0.0448	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Inhalable	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.

Section 3.2 Workers - Exposure estimation

Contributing scenario controlling worker exposure for 2: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities

Route of exposure	Contributing scenarios	Dose/Concentration	Justification
Long term exposure, Systemic, Dermal	Not applicable.	0.004	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Inhalable	Not applicable.	0.047	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Inhalable	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.

Section 3.2 Workers - Exposure estimation

Contributing scenario controlling worker exposure for 3: Use a laboratory reagent

Route of exposure	Contributing scenarios	Dose/Concentration	Justification
Long term exposure, Systemic, Dermal	Not applicable.	0.0003	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Inhalable	Not applicable.	<0.030	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Inhalable	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.

Section 4: Guidance to check compliance with the exposure scenario

Environment	Not available.
Health	Not available.

Section 5. Remarks: Additional good practice advice beyond the REACH CSA

Environment	Not applicable.
Health	Not applicable.
Additional Good Practices	Not applicable.

Identification of the substance or mixture

Product definition	Mono-constituent substance
Product name	Piperazine anhydrous, PIP

Section 1: Title

Short title of the exposure scenario/List of use descriptors	**Identified use name:** Manufacture of substance - Industrial **Process Category:** PROC01, PROC08a, PROC08b, PROC15 **Substance supplied to that use in form of:** As such **Sector of end use:** SU03 **Subsequent service life relevant for that use:** No. **Environmental Release Category:** ERC01

Section 2: Operational conditions and risk management measures

Section 2.1 Control of environmental exposure

Contributing scenario controlling environmental exposure for 0: Manufacture of substances

Amounts used:	18600 Tonnes/year
Fraction of EU tonnage used in region	100%
Regional use tonnage	Not available.
Fraction of Regional tonnage used locally	100%
Annual site tonnage	Not available.
Average Local Daily Tonnage (kg/day):	Not available.
Maximum daily site tonnage	Not available.
Frequency and duration of use:	
Emission Days (days/year)	365
Environment factors not influenced by risk management:	River flow rate: 18000 m³/d
Local freshwater dilution factor	Not available.
Local marine water dilution factor	Not available.
Other given operational conditions affecting environmental exposure:	
Release fraction to air from process (initial release prior to RMM)	0.1%
Release fraction to soil from process (initial release prior to RMM)	0.1%
Release fraction to wastewater from process (initial release prior to RMM)	0.2%
Release fraction to air from wide dispersive use (regional only)	Not available.
Release fraction to soil from wide dispersive use (regional only)	Not available.
Release fraction to wastewater from wide dispersive use	Not available.
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil:	Waste water to sewage treatment plant or Elimination via incineration Ion exchange
Treat air emission to provide a typical removal efficiency of	Not available.
Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of	Not available.
If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of	Not available.
Conditions and measures related to municipal sewage treatment plant:	Sewage treatment plant discharge: 2000000 L/day

Section 2.2 Control of worker exposure

Contributing scenario controlling worker exposure for 0: Use in closed process, no likelihood of exposure

Product characteristics:	Fugacity: low
Concentration of substance in product:	Covers percentage substance in the product up to 100%
Physical state:	Liquid. Vapour pressure 44 Pa*s
Amounts used:	Not applicable.
Frequency and duration of use:	Exposure duration per day: >4 hours Frequency: =240 days per year
Human factors not influenced by risk management:	Exposed skin surfaces: Palm of one hand (240 cm2)
Other given operational conditions affecting workers exposure:	Indoor/Outdoor use Industrial use
Technical conditions and measures at process level (source) to prevent release:	None.
Technical conditions and measures to control dispersion from source towards the worker:	Use the following local exhaust ventilation types: None.
Personal protection:	Chemical-resistant gloves.: 99% burst time: >4 hours Protective clothing
Respiratory protection:	None.

Section 2.2 Control of worker exposure

Contributing scenario controlling worker exposure for 1: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities

Product characteristics:	Fugacity: low
Concentration of substance in product:	Covers percentage substance in the product up to 100%
Physical state:	Liquid. Vapour pressure 44 Pa*s
Amounts used:	Not applicable.
Frequency and duration of use:	Exposure duration per day: <15 min Frequency: =240 days per year
Human factors not influenced by risk management:	Exposed skin surfaces: Palm of both hands (480 cm2)
Other given operational conditions affecting workers exposure:	Outdoor Industrial use
Technical conditions and measures at process level (source) to prevent release:	None.
Technical conditions and measures to control dispersion from source towards the worker:	Use the following local exhaust ventilation types: None.
Organisational measures to prevent/limit releases, dispersion and exposure:	Not relevant in ECETOC TRA
Personal protection:	Chemical-resistant gloves.: 99% Protective clothing
Respiratory protection:	None.

Section 2.2 Control of worker exposure

Contributing scenario controlling worker exposure for 2: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities

Product characteristics:	Fugacity: low
Concentration of substance in product:	Covers percentage substance in the product up to 100%
Physical state:	Liquid. Vapour pressure 44 Pa*s
Amounts used:	Not applicable.
Frequency and duration of use:	Exposure duration per day: >4 hours Frequency: =240 days per year
Human factors not influenced by risk management:	Exposed skin surfaces: Palm of both hands (480 cm2)
Other given operational conditions affecting workers exposure:	Indoor Industrial use
Technical conditions and measures at process level (source) to prevent release:	None.
Technical conditions and measures to control dispersion from source towards the worker:	Use the following local exhaust ventilation types: None.
Organisational measures to prevent/limit releases, dispersion and exposure:	Not relevant in ECETOC TRA
Personal protection:	Chemical-resistant gloves.: 99% Protective clothing
Respiratory protection:	None.

Section 2.2 Control of worker exposure

Contributing scenario controlling worker exposure for 3: Use a laboratory reagent

Product characteristics:	Fugacity: low
Concentration of substance in product:	Covers percentage substance in the product up to 100%
Physical state:	Liquid. Vapour pressure 44 Pa*s
Amounts used:	Not applicable.
Frequency and duration of use:	Exposure duration per day: >4 hours Frequency: =240 days per year
Human factors not influenced by risk management:	Exposed skin surfaces: Palm of one hand (240 cm2)
Other given operational conditions affecting workers exposure:	Indoor Industrial use
Technical conditions and measures at process level (source) to prevent release:	None.
Technical conditions and measures to control dispersion from source towards the worker:	Technical conditions of use: With local exhaust ventilation
Organisational measures to prevent/limit releases, dispersion and exposure:	Not relevant in ECETOC TRA
Personal protection:	Wear suitable protective clothing and gloves.: 99%
Respiratory protection:	None.

Section 3: Exposure estimation

Section 3.1 Environment - Exposure estimation

Contributing scenario controlling environmental exposure for 0: Manufacture of substances

	Release from point source (local exposure estimation) kg/day	Total release for regional exposure estimation kg/day	Justification
Waste water	Not applicable.	Not applicable.	Not applicable.
Surface water	Not applicable.	Not applicable.	Not applicable.
air (direct + STP)	Not applicable.	Not applicable.	Not applicable.
Soil (direct releases only)	Not applicable.	Not applicable.	Not applicable.
	Value	**Justification**	
Concentration in sewage (PECstp) mg/l	Not applicable.	Not applicable.	
Concentration in sewage sludge mg/kg dwt	Not applicable.	Not applicable.	
	Local concentration	**PEC aquatic (local+regional)**	**Justification**
Fresh water mg/l	Not applicable.	0.645	Not applicable.
Marine water mg/l	Not applicable.	0.0645	Not applicable.
Intermittent release. mg/l	Not applicable.	Not applicable.	Not applicable.
	Local concentration	**PEC sediment (local+regional)**	**Justification**
Fresh water sediment mg/kg dwt	Not applicable.	0.505	Not applicable.
Marine water sediment mg/kg dwt	Not applicable.	0.0505	Not applicable.
	Local concentration	**PEC soil (local+regional)**	**Justification**
Agricultural soil averaged mg/kg dwt	Not applicable.	2.69E-03	Not applicable.
Grassland averaged mg/kg dwt	Not applicable.	5.17E-03	Not applicable.
Groundwater mg/l	Not applicable.	Not applicable.	Not applicable.
	Local concentration	**PEC air (local+regional)**	**Justification**
During emission mg/m³	Not applicable.	Not applicable.	Not applicable.
Annual average mg/m³	Not applicable.	Not applicable.	Not applicable.
Annual deposition mg/m²/d	Not applicable.	Not applicable.	Not applicable.
	Local concentration	**PEC aquatic (local+regional)**	**Justification**
Micro-organism mg/l	Not applicable.	Not applicable.	Not applicable.

Section 3.2 Workers - Exposure estimation

Contributing scenario controlling worker exposure for 0: Use in closed process, no likelihood of exposure

Route of exposure	Contributing scenarios	Dose/Concentration	Justification
Long term exposure, Systemic, Dermal	Not applicable.	0.003	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Inhalable	Not applicable.	0.035	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Inhalable	Not applicable.	0.035	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Short term exposure, Systemic, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Inhalable	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.

Section 3.2 Workers - Exposure estimation

Contributing scenario controlling worker exposure for 1: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities

Route of exposure	Contributing scenarios	Dose/Concentration	Justification
Long term exposure, Systemic, Dermal	Not applicable.	0.003	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Inhalable	Not applicable.	2.457	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Inhalable	Not applicable.	2.457	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Short term exposure, Systemic, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Inhalable	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.

Section 3.2 Workers - Exposure estimation

Contributing scenario controlling worker exposure for 2: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities

Route of exposure	Contributing scenarios	Dose/Concentration	Justification
Long term exposure, Systemic, Dermal	Not applicable.	0.007	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Inhalable	Not applicable.	0.527	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Inhalable	Not applicable.	0.527	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Short term exposure, Systemic, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Inhalable	Not applicable.	Not applicable.	Not applicable.

Short term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.

Section 3.2 Workers - Exposure estimation

Contributing scenario controlling worker exposure for 3: Use a laboratory reagent

Route of exposure	Contributing scenarios	Dose/Concentration	Justification
Long term exposure, Systemic, Dermal	Not applicable.	0.0003	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Inhalable	Not applicable.	1.053	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Inhalable	Not applicable.	1.053	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Short term exposure, Systemic, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Inhalable	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.

Section 4: Guidance to check compliance with the exposure scenario

Environment	Not available.
Health	Not available.

Section 5. Remarks: Additional good practice advice beyond the REACH CSA

Environment	Not applicable.
Health	Not applicable.
Additional Good Practices	Not applicable.

Identification of the substance or mixture

Product definition	Mono-constituent substance
Product name	Piperazine anhydrous, PIP

Section 1: Title

Short title of the exposure scenario/List of use descriptors	**Identified use name:** Use as an intermediate and in polymerisation - Industrial **Process Category:** PROC01, PROC08a, PROC08b, PROC15 **Substance supplied to that use in form of:** As such **Sector of end use:** SU03 **Subsequent service life relevant for that use:** No. **Environmental Release Category:** ERC06a, ERC06c

Section 2: Operational conditions and risk management measures

Section 2.1 Control of environmental exposure

Contributing scenario controlling environmental exposure for 0: Industrial use resulting in manufacture of another substance (use of intermediates)

Amounts used:	15000Tonnes/year
Fraction of EU tonnage used in region	10%
Regional use tonnage	Not available.
Fraction of Regional tonnage used locally	20%
Annual site tonnage	Not available.
Average Local Daily Tonnage (kg/day):	Not available.
Maximum daily site tonnage	Not available.
Frequency and duration of use:	
Emission Days (days/year)	220
Environment factors not influenced by risk management:	River flow rate: 18000 m³/d
Local freshwater dilution factor	1000
Local marine water dilution factor	Not applicable.
Other given operational conditions affecting environmental exposure:	
Release fraction to air from process (initial release prior to RMM)	0.01%
Release fraction to soil from process (initial release prior to RMM)	0.01%
Release fraction to wastewater from process (initial release prior to RMM)	0.7%
Release fraction to air from wide dispersive use (regional only)	Not available.
Release fraction to soil from wide dispersive use (regional only)	Not available.
Release fraction to wastewater from wide dispersive use	Not available.
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil:	Standard Temperature and Pressure
Treat air emission to provide a typical removal efficiency of	Not available.
Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of	Not available.
If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of	Not available.
Conditions and measures related to municipal sewage treatment plant:	Sewage treatment plant discharge: 2000000 L/day
Assumed on-site sewage treatment plant flow	2000

Section 2.1 Control of environmental exposure

Contributing scenario controlling environmental exposure for 1: Industrial use of monomers for manufacture of thermoplastics

Amounts used:	15000Tonnes/year
Fraction of EU tonnage used in region	100%
Regional use tonnage	Not available.
Fraction of Regional tonnage used locally	20%
Annual site tonnage	Not available.
Average Local Daily Tonnage (kg/day):	Not available.
Maximum daily site tonnage	Not available.
Frequency and duration of use:	
Emission Days (days/year)	220
Environment factors not influenced by risk management:	River flow rate: 18000 m³/d
Local freshwater dilution factor	Not available.
Local marine water dilution factor	Not available.
Other given operational conditions affecting environmental exposure:	
Release fraction to air from process (initial release prior to RMM)	0.01%
Release fraction to soil from process (initial release prior to RMM)	0.01%
Release fraction to wastewater from process (initial release prior to RMM)	0.7%
Release fraction to air from wide dispersive use (regional only)	Not available.
Release fraction to soil from wide dispersive use (regional only)	Not available.
Release fraction to wastewater from wide dispersive use	Not available.
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil:	Standard Temperature and Pressure
Treat air emission to provide a typical removal efficiency of	Not available.
Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of	Not available.
If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of	Not available.
Conditions and measures related to municipal sewage treatment plant:	Sewage treatment plant discharge: 2000000 L/day

Section 2.2 Control of worker exposure

Contributing scenario controlling worker exposure for 0: Use in closed process, no likelihood of exposure

Product characteristics:	Fugacity: low
Concentration of substance in product:	Covers percentage substance in the product up to 100%
Physical state:	Solid. or Flakes. Vapour pressure 44 Pa*s
Amounts used:	Not applicable.
Frequency and duration of use:	Exposure duration per day: >4 hours Frequency: =240 days per year
Human factors not influenced by risk management:	Exposed skin surfaces: Palm of one hand (240 cm2)
Other given operational conditions affecting workers exposure:	Indoor Industrial use
Technical conditions and measures at process level (source) to prevent release:	Closed system
Technical conditions and measures to control dispersion from source towards the worker:	Technical conditions of use: With local exhaust ventilation
Personal protection:	Chemical-resistant gloves.: 99% Protective clothing
Respiratory protection:	None.

Section 2.2 Control of worker exposure

Contributing scenario controlling worker exposure for 1: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities

Product characteristics:	Fugacity: low
Concentration of substance in product:	Covers percentage substance in the product up to 100%
Physical state:	Liquid. Vapour pressure 44 Pa*s
Amounts used:	Not applicable.
Frequency and duration of use:	Exposure duration per day: <15 min Frequency: =240 days per year
Human factors not influenced by risk management:	Exposed skin surfaces: Palm of both hands (480 cm2)
Other given operational conditions affecting workers exposure:	Indoor/Outdoor use Industrial use
Technical conditions and measures at process level (source) to prevent release:	None.
Technical conditions and measures to control dispersion from source towards the worker:	Use the following local exhaust ventilation types: None.
Organisational measures to prevent/limit releases, dispersion and exposure:	Not relevant in ECETOC TRA
Personal protection:	Chemical-resistant gloves.: 99% Protective clothing
Respiratory protection:	Wear appropriate respiratory protection. with a minimum efficacy of 95%

Section 2.2 Control of worker exposure

Contributing scenario controlling worker exposure for 2: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities

Product characteristics:	Fugacity: low
Concentration of substance in product:	Covers percentage substance in the product up to 100%
Physical state:	Liquid. Vapour pressure 44 Pa*s
Amounts used:	Not applicable.
Frequency and duration of use:	Exposure duration per day: <15 min Frequency: =240 days per year
Human factors not influenced by risk management:	Exposed skin surfaces: Palm of both hands (480 cm2)
Other given operational conditions affecting workers exposure:	Indoor Industrial use
Technical conditions and measures at process level (source) to prevent release:	None.
Technical conditions and measures to control dispersion from source towards the worker:	Technical conditions of use: With local exhaust ventilation
Organisational measures to prevent/limit releases, dispersion and exposure:	Not relevant in ECETOC TRA
Personal protection:	Chemical-resistant gloves.: 99% Protective clothing
Respiratory protection:	None.

Section 2.2 Control of worker exposure

Contributing scenario controlling worker exposure for 3: Use a laboratory reagent

Product characteristics:	Fugacity: low
Concentration of substance in product:	Covers percentage substance in the product up to 100%
Physical state:	Liquid. Vapour pressure 44 Pa*s
Amounts used:	Not applicable.
Frequency and duration of use:	Exposure duration per day: 15 min - 1 hours per day Frequency: =240 days per year
Human factors not influenced by risk management:	Exposed skin surfaces: Palm of one hand (240 cm2)
Other given operational conditions affecting workers exposure:	Indoor Industrial use
Technical conditions and measures at process level (source) to prevent release:	None.
Technical conditions and measures to control dispersion from source towards the worker:	Technical conditions of use: With local exhaust ventilation
Organisational measures to prevent/limit releases, dispersion and exposure:	Not relevant in ECETOC TRA
Personal protection:	Wear suitable protective clothing and gloves.: 99%
Respiratory protection:	None.

Section 3.1 Environment - Exposure estimation

Contributing scenario controlling environmental exposure for 0: Industrial use resulting in manufacture of another substance (use of intermediates)

	Release from point source (local exposure estimation) kg/day	Total release for regional exposure estimation kg/day	Justification
Waste water	Not applicable.	Not applicable.	Not applicable.
Surface water	Not applicable.	Not applicable.	Not applicable.
air (direct + STP)	Not applicable.	Not applicable.	Not applicable.
Soil (direct releases only)	Not applicable.	Not applicable.	Not applicable.
	Value	**Justification**	
Concentration in sewage (PECstp) mg/l	Not applicable.	Not applicable.	
Concentration in sewage sludge mg/kg dwt	Not applicable.	Not applicable.	
	Local concentration	**PEC aquatic (local+regional)**	**Justification**
Fresh water mg/l	Not applicable.	PEC: 0..604; PNEC: 1.25; RCR - Water Compartment Driven: 0. 483	Not applicable.
Marine water mg/l	Not applicable.	PEC: 0.0604; PNEC: 0.130; RCR - Water Compartment Driven: 0.465	Not applicable.
Intermittent release. mg/l	Not applicable.	Not applicable.	Not applicable.
	Local concentration	**PEC sediment (local+regional)**	**Justification**
Fresh water sediment mg/kg dwt	Not applicable.	PEC: 0.473; PNEC: 0.980; RCR - Water Compartment Driven: 0. 483	Not applicable.
Marine water sediment mg/kg dwt	Not applicable.	PEC: 0.0473; PNEC: 0.100; RCR - Water Compartment Driven: 0.473	Not applicable.
	Local concentration	**PEC soil (local+regional)**	**Justification**
Agricultural soil averaged mg/kg dwt	Not applicable.	PEC: 5.58E-05; PNEC: 8.86; RCR: 6.30E-06	Not applicable.
Grassland averaged mg/kg dwt	Not applicable.	PEC: 9.58E-05; PNEC: 8.86; RCR: 1.08E-05	Not applicable.
Groundwater mg/l	Not applicable.	Not applicable.	Not applicable.
	Local concentration	**PEC air (local+regional)**	**Justification**
During emission mg/m³	Not applicable.	Not applicable.	Not applicable.
Annual average mg/m³	Not applicable.	Not applicable.	Not applicable.
Annual deposition mg/m²/d	Not applicable.	Not applicable.	Not applicable.
	Local concentration	**PEC aquatic (local+regional)**	**Justification**
Micro-organism mg/l	Not applicable.	Not applicable.	Not applicable.

Section 3.1 Environment - Exposure estimation

Contributing scenario controlling environmental exposure for 1: Industrial use of monomers for manufacture of thermoplastics

	Release from point source (local exposure estimation) kg/day	Total release for regional exposure estimation kg/day	Justification
Waste water	Not applicable.	Not applicable.	Not applicable.
Surface water	Not applicable.	Not applicable.	Not applicable.
air (direct + STP)	Not applicable.	Not applicable.	Not applicable.
Soil (direct releases only)	Not applicable.	Not applicable.	Not applicable.
	Value	**Justification**	
Concentration in sewage (PECstp) mg/l	Not applicable.	Not applicable.	
Concentration in sewage sludge mg/kg dwt	Not applicable.	Not applicable.	
	Local concentration	**PEC aquatic (local+regional)**	**Justification**

Fresh water mg/l	Not applicable.	PEC: 0..604; PNEC: 1.25; RCR - Water Compartment Driven: 0. 483	Not applicable.
Marine water mg/l	Not applicable.	PEC: 0.0604; PNEC: 0.130; RCR - Water Compartment Driven: 0.465	Not applicable.
Intermittent release. mg/l	Not applicable.	Not applicable.	Not applicable.
	Local concentration	**PEC sediment (local+regional)**	**Justification**
Fresh water sediment mg/kg dwt	Not applicable.	PEC: 0.473; PNEC: 0.980; RCR - Water Compartment Driven: 0. 483	Not applicable.
Marine water sediment mg/kg dwt	Not applicable.	PEC: 0.0473; PNEC: 0.100; RCR - Water Compartment Driven: 0.473	Not applicable.
	Local concentration	**PEC soil (local+regional)**	**Justification**
Agricultural soil averaged mg/kg dwt	Not applicable.	PEC: 5.58E-05; PNEC: 8.86; RCR: 6.30E-06	Not applicable.
Grassland averaged mg/kg dwt	Not applicable.	PEC: 9.58E-05; PNEC: 8.86; RCR: 1.08E-05	Not applicable.
Groundwater mg/l	Not applicable.	Not applicable.	Not applicable.
	Local concentration	**PEC air (local+regional)**	**Justification**
During emission mg/m³	Not applicable.	Not applicable.	Not applicable.
Annual average mg/m³	Not applicable.	Not applicable.	Not applicable.
Annual deposition mg/m²/d	Not applicable.	Not applicable.	Not applicable.
	Local concentration	**PEC aquatic (local+regional)**	**Justification**
Micro-organism mg/l	Not applicable.	Not applicable.	Not applicable.

Section 3.2 Workers - Exposure estimation

Contributing scenario controlling worker exposure for 0: Use in closed process, no likelihood of exposure

Route of exposure	Contributing scenarios	Dose/Concentration	Justification
Long term exposure, Systemic, Dermal	Not applicable.	0.0003	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Inhalable	Not applicable.	0.035	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Inhalable	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.

Section 3.2 Workers - Exposure estimation

Contributing scenario controlling worker exposure for 1: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities

Route of exposure	Contributing scenarios	Dose/Concentration	Justification
Long term exposure, Systemic, Dermal	Not applicable.	0.0013	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Inhalable	Not applicable.	0.0448	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Dermal	Not applicable.	Not applicable.	Not applicable.

Short term exposure, Systemic, Inhalable	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.

Section 3.2 Workers - Exposure estimation

Contributing scenario controlling worker exposure for 2: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities

Route of exposure	Contributing scenarios	Dose/Concentration	Justification
Long term exposure, Systemic, Dermal	Not applicable.	0.004	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Inhalable	Not applicable.	0.047	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Inhalable	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.

Section 3.2 Workers - Exposure estimation

Contributing scenario controlling worker exposure for 3: Use a laboratory reagent

Route of exposure	Contributing scenarios	Dose/Concentration	Justification
Long term exposure, Systemic, Dermal	Not applicable.	0.0003	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Inhalable	Not applicable.	<0.030	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Inhalable	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.

Section 4: Guidance to check compliance with the exposure scenario

Environment	Not available.
Health	Not available.

Section 5. Remarks: Additional good practice advice beyond the REACH CSA

Environment	Not applicable.
Health	Not applicable.
Additional Good Practices	Not applicable.

Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition	Mono-constituent substance
Product name	Piperazine anhydrous, PIP

Section 1: Title

Short title of the exposure scenario/List of use descriptors	**Identified use name:** Use of gas - washer formulations, in scrubbers - Industrial **Process Category:** PROC01, PROC08b **Substance supplied to that use in form of:** In a mixture **Sector of end use:** SU03 **Subsequent service life relevant for that use:** No. **Environmental Release Category:** ERC04

Section 2: Operational conditions and risk management measures

Section 2.1 Control of environmental exposure

Contributing scenario controlling environmental exposure for 0: Industrial use of substances in closed systems

Amounts used:	2000 Tonnes/year
Fraction of EU tonnage used in region	100%
Regional use tonnage	Not available.
Fraction of Regional tonnage used locally	100%
Annual site tonnage	Not available.
Average Local Daily Tonnage (kg/day):	Not available.
Maximum daily site tonnage	Not available.
Frequency and duration of use:	
Emission Days (days/year)	35
Environment factors not influenced by risk management:	River flow rate: 18000 m³/d
Local freshwater dilution factor	Not available.
Local marine water dilution factor	Not available.
Other given operational conditions affecting environmental exposure:	
Release fraction to air from process (initial release prior to RMM)	0.1%
Release fraction to soil from process (initial release prior to RMM)	0%
Release fraction to wastewater from process (initial release prior to RMM)	100%
Release fraction to air from wide dispersive use (regional only)	Not available.
Release fraction to soil from wide dispersive use (regional only)	Not available.
Release fraction to wastewater from wide dispersive use	Not available.
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil:	Standard Temperature and Pressure Other Risk management measures: Incineration 99.8%
Treat air emission to provide a typical removal efficiency of	Not available.
Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of	Not available.
If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of	Not available.
Conditions and measures related to municipal sewage treatment plant:	Sewage treatment plant discharge: 2000000 L/day

Section 2.2 Control of worker exposure

Contributing scenario controlling worker exposure for 0: Use in closed process, no likelihood of exposure

Product characteristics:	Fugacity: low
Concentration of substance in product:	Covers concentrations up to 60%
Physical state:	liquid preparations Vapour pressure 44 Pa*s
Amounts used:	Not applicable.
Frequency and duration of use:	Exposure duration per day: >4 hours Frequency: =240 days per year
Human factors not influenced by risk management:	Exposed skin surfaces: Palm of one hand (240 cm2)
Other given operational conditions affecting workers exposure:	Indoor/Outdoor use Industrial use
Technical conditions and measures at process level (source) to prevent release:	Closed system
Technical conditions and measures to control dispersion from source towards the worker:	Use the following local exhaust ventilation types: None.
Personal protection:	Chemical-resistant gloves.: 99% Protective clothing
Respiratory protection:	None.

Section 2.2 Control of worker exposure

Contributing scenario controlling worker exposure for 1: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities

Product characteristics:	Fugacity: low
Concentration of substance in product:	Covers percentage substance in the product up to 100%
Physical state:	Liquid. Vapour pressure 44 Pa*s
Amounts used:	Not applicable.
Frequency and duration of use:	Exposure duration per day: <15 min Frequency: =240 days per year
Human factors not influenced by risk management:	Exposed skin surfaces: Palm of both hands (480 cm2)
Other given operational conditions affecting workers exposure:	Indoor Industrial use
Technical conditions and measures at process level (source) to prevent release:	None.
Technical conditions and measures to control dispersion from source towards the worker:	Technical conditions of use: With local exhaust ventilation
Organisational measures to prevent/limit releases, dispersion and exposure:	Not relevant in ECETOC TRA
Personal protection:	Chemical-resistant gloves.: 99% Protective clothing
Respiratory protection:	None.

Section 3: Exposure estimation

Section 3.1 Environment - Exposure estimation

Contributing scenario controlling environmental exposure for 0: Industrial use of substances in closed systems

	Release from point source (local exposure estimation) kg/day	Total release for regional exposure estimation kg/day	Justification
Waste water	Not applicable.	Not applicable.	Not applicable.
Surface water	Not applicable.	Not applicable.	Not applicable.
air (direct + STP)	Not applicable.	Not applicable.	Not applicable.
Soil (direct releases only)	Not applicable.	Not applicable.	Not applicable.

	Value	Justification
Concentration in sewage (PECstp) mg/l	Not applicable.	Not applicable.
Concentration in sewage sludge mg/kg dwt	Not applicable.	Not applicable.

	Local concentration	PEC aquatic (local+regional)	Justification
Fresh water mg/l	Not applicable.	PEC: 0.690; PNEC: 1.25; RCR - Water Compartment Driven: 0. 552	Not applicable.

Marine water mg/l	Not applicable.	PEC: 0.0690 ; PNEC: 0.130; RCR - Water Compartment Driven: 0.551	Not applicable.
Intermittent release. mg/l	Not applicable.	Not applicable.	Not applicable.
	Local concentration	**PEC sediment (local+regional)**	**Justification**
Fresh water sediment mg/kg dwt	Not applicable.	PEC: 0.540; PNEC: 0.980; RCR - Water Compartment Driven: 0.551	Not applicable.
Marine water sediment mg/kg dwt	Not applicable.	PEC: 0.0540; PNEC: 0.100; RCR - Water Compartment Driven: 0.540	Not applicable.
	Local concentration	**PEC soil (local+regional)**	**Justification**
Agricultural soil averaged mg/kg dwt	Not applicable.	PEC: 3.45E-04; PNEC: 8.86; RCR: 3.89E-05	Not applicable.
Grassland averaged mg/kg dwt	Not applicable.	PEC: 6.11E-04; PNEC: 8.86; RCR: 6.90E-05	Not applicable.
Groundwater mg/l	Not applicable.	Not applicable.	Not applicable.
	Local concentration	**PEC air (local+regional)**	**Justification**
During emission mg/m³	Not applicable.	Not applicable.	Not applicable.
Annual average mg/m³	Not applicable.	Not applicable.	Not applicable.
Annual deposition mg/m²/d	Not applicable.	Not applicable.	Not applicable.
	Local concentration	**PEC aquatic (local+regional)**	**Justification**
Micro-organism mg/l	Not applicable.	Not applicable.	Not applicable.

Section 3.2 Workers - Exposure estimation

Contributing scenario controlling worker exposure for 0: Use in closed process, no likelihood of exposure

Route of exposure	Contributing scenarios	Dose/Concentration	Justification
Long term exposure, Systemic, Dermal	Not applicable.	0.007	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Inhalable	Not applicable.	0.005	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Inhalable	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.

Section 3.2 Workers - Exposure estimation

Contributing scenario controlling worker exposure for 1: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities

Route of exposure	Contributing scenarios	Dose/Concentration	Justification
Long term exposure, Systemic, Dermal	Not applicable.	0.004	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Inhalable	Not applicable.	0.047	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.
Long term exposure, Systemic, Combined	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Inhalable	Not applicable.	Not applicable.	Not applicable.
	Not applicable.	Not applicable.	Not applicable.

Short term exposure, Systemic, Combined			
Short term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Local, Inhalable	Not applicable.	Not applicable.	Not applicable.

Section 4: Guidance to check compliance with the exposure scenario

Environment	Not available.
Health	Not available.

Section 5. Remarks: Additional good practice advice beyond the REACH CSA

Environment	Not applicable.
Health	Not applicable.
Additional Good Practices	Not applicable.