

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
01-2119480384-39-0001	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
The Netherlands
Tel.:31-334676897

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

1.4 Emergency telephone number

Supplier

Telephone number : AkzoNobel Chemicals-Deventer-NLT +31 570 679211 (24hours/7days)
F +31 570 679801

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]**

Flam. Sol. 1, H228

Skin Corr. 1B, H314

Eye Dam. 1, H318

Resp. Sens. 1, H334

Skin Sens. 1, H317

Repr. 2, H361fd

Piperazine anhydrous, PIP

SECTION 2: Hazards identification

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 or 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, sparks, open flames and hot surfaces. - No smoking.

Response

: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISON CENTER or physician. IF SWALLOWED: Immediately call a POISON CENTER or physician. Do NOT induce vomiting. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. Immediately call a POISON CENTER or physician. IF IN EYES: Immediately call a POISON CENTER or physician.

Storage

: Store locked up.

Disposal

: Not applicable.

Supplemental label elements

: Not applicable.

2.3 Other hazards

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.

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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	REACH #: 01-2119480384-39 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 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.

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.

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SECTION 4: First aid measures

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

Notes to physician : In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Specific treatments : No specific treatment.

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media : Use dry chemical, CO₂, water spray (fog) or foam. Dry sand or other suitable absorbent. Use dry chemical, CO₂, 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.

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SECTION 5: Firefighting measures

Hazardous combustion products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
nitrogen oxides

5.3 Advice for firefighters

Special precautions 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 materials for containment and cleaning up

Small spill : Move containers from spill area. Vacuum or sweep up material and place in a designated, labelled waste container. Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labelled waste container. Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor. Note: see section 1 for emergency contact information and section 13 for waste disposal.

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.

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SECTION 7: Handling and storage

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.

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), 8/2007). Skin sensitiser. STEL: 0.3 mg/m ³ 15 minute(s). TWA: 0.1 mg/m ³ 8 hour(s).

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 European Standard EN 689 for methods for the assessment of exposure by inhalation to chemical agents and national guidance documents for methods for the determination of hazardous substances.

Derived effect levels

Product/ingredient name	Type	Exposure	Value	Population	Effects
Piperazine	DNEL	Short term Dermal	0.14 mg/kg bw/day	Workers	Systemic
	DNEL	Short term Inhalation	1 mg/m ³	Workers	Systemic
	DNEL	Short term Inhalation	1 mg/m ³	Workers	Local
	DNEL	Long term Dermal	0.04 mg/kg bw/day	Workers	Systemic
	DNEL	Long term Inhalation	0.3 mg/m ³	Workers	Systemic
	DNEL	Long term Inhalation	0.3 mg/m ³	Workers	Local
	DNEL	Long term Oral	1.5 mg/kg	Consumers	Systemic

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SECTION 8: Exposure controls/personal protection

			bw/day		
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Predicted effect concentrations

Product/ingredient name	Type	Compartment Detail	Value	Method Detail
Piperazine	PNEC	Secondary Poisoning	4600 mg/kg	Assessment Factors
	PNEC	Fresh water	1.25 mg/l	Assessment Factors
	PNEC	Marine	0.125 mg/l	Assessment Factors
	PNEC	Fresh water sediment	0.98 mg/kg dwt	-
	PNEC	Marine water sediment	0.098 mg/kg dwt	-
	PNEC	Soil	8.9 mg/kg dwt	-
	PNEC	Sewage Treatment Plant	54 mg/l	Assessment Factors

8.2 Exposure controls

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

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. >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.

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, air-purifying or air-fed 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.
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 [20°C]
Vapour density	: 3 [Air = 1]
Relative density	: 1.1
Solubility(ies)	: 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

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.
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.

Piperazine anhydrous, PIP**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.

Sensitiser

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.

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

Potential acute health effects

SECTION 11: Toxicological information

- 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.
- Ingestion** : May cause burns to mouth, throat and stomach.
- Skin contact** : Causes severe burns. May cause an allergic skin reaction.
- Eye contact** : Causes serious eye damage.

Symptoms related to the physical, chemical and toxicological characteristics

- Inhalation** : Adverse symptoms may include the following:
wheezing and breathing difficulties
asthma
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
- Skin contact** : Adverse symptoms may include the following:
pain or irritation
redness
blistering may occur
reduced foetal weight
increase in foetal deaths
skeletal malformations
- Eye contact** : Adverse symptoms may include the following:
pain
watering
redness

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.
- 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.

Piperazine anhydrous, PIP**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 Chronic NOEC 12.5 mg/l Fresh water	Micro-organism Daphnia Fish Daphnia	- 48 hours 96 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. Significant quantities of waste product residues should not be disposed of via the foul sewer but processed in a suitable effluent treatment plant. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. 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.

Hazardous waste : The classification of the product may meet the criteria for a hazardous waste.

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SECTION 13: Disposal considerations**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/ADNR	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.
14.6 Special precautions for user	Not available.	Not available.	Not available.	Not available.
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 instructions: Y845

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 : Not applicable.
**on the manufacture,
 placing on the market and
 use of certain dangerous
 substances, mixtures and
 articles**

Other EU regulations

Europe inventory : This material is listed or exempted.

Black List Chemicals : Not listed

Priority List Chemicals : Listed

**Integrated pollution
 prevention and control
 list (IPPC) - Air** : Not listed

**Integrated pollution
 prevention and control
 list (IPPC) - Water** : Not listed

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

International regulations

**Chemical Weapons
 Convention List Schedule I
 Chemicals** : Not listed

**Chemical Weapons
 Convention List Schedule II
 Chemicals** : Not listed

**Chemical Weapons
 Convention List Schedule III
 Chemicals** : Not listed

**15.2 Chemical Safety
 Assessment** : Complete.

15.3 Registration status : Applicable.

SECTION 16: Other information

Indicates information that has changed from previously issued version.

**Abbreviations and
 acronyms** : ATE = Acute Toxicity Estimate
 CLP = Classification, Labelling and Packaging Regulation [Regulation (EC) No. 1272/2008]
 DNEL = Derived No Effect Level
 EUH statement = CLP-specific Hazard statement
 PNEC = Predicted No Effect Concentration
 RRN = REACH Registration Number

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

Classification	Justification

Piperazine anhydrous, PIP**SECTION 16: Other information**

Flam. Sol. 1, H228 Skin Corr. 1B, H314 Eye Dam. 1, H318 Resp. Sens. 1, H334 Skin Sens. 1, H317 Repr. 2, H361fd	Expert judgment Expert judgment Expert judgment Expert judgment Expert judgment Expert judgment
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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 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 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
Date of issue/ Date of revision	: 25 February 2011
Date of previous issue	: 05/11/2010
Version	: 6

Notice to reader

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

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

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	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
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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
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Section 2: Operational conditions and risk management measures

Section 2.1 Control of worker exposure

Contributing exposure 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 cm ²)
Other operational conditions affecting worker 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 2.1 Control of worker exposure

Contributing exposure 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 cm ²)
Other operational conditions affecting worker 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 2.2: Control of environmental exposure**Contributing exposure scenario controlling environmental exposure for 0: Manufacture of substances****Product Characteristics:****Concentration of substance in mixture or article:**

Amounts used: 18600 Tonnes/year

Fraction of EU tonnage used in region: 100%

Fraction of Regional tonnage used locally: 100%

Frequency and duration of use:

Emission Days (days/year): 365

Environmental factors not influenced by risk management: River flow rate: 18000 m³/d

Other operational conditions of use 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%

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

Conditions and measures related to municipal sewage treatment plant: Sewage treatment plant discharge: 2000000 L/day

Section 3: Exposure estimation**Section 3.1 Workers Exposure estimation****Contributing exposure 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	Monitoring methods and references: Not applicable
Long term exposure, Systemic, Inhalable	Not applicable.	Not applicable.	0.211
Long term exposure, Systemic, Combined	Monitoring methods and references <0.02: mg/m³	Not applicable.	Not applicable.
Long term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Inhalable	Not applicable.	0.211	Monitoring methods and references: <0.02 mg/m³
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 3.1 Workers Exposure estimation**Contributing exposure 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.	0.002	Monitoring methods and references: Not applicable
Long term exposure, Systemic, Inhalable	Not applicable.	Not applicable.	0.527
Long term exposure, Systemic, Combined	Monitoring methods and references <0.02: mg/m³	Not applicable.	Not applicable.
Long term exposure, Local, Dermal	Not applicable.	Not applicable.	Not applicable.
Long term exposure, Local, Inhalable	Not applicable.	0.527	Monitoring methods and references: <0.02 mg/m³
Short term exposure, Systemic, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Inhalable	Not applicable.	Not applicable.	Not applicable.

Piperazine anhydrous, PIP

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

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 Environment Exposure estimation

Contributing exposure 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 (PEC _{stp}) 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/m ³	Not applicable.	Not applicable.	Not applicable.
Annual average mg/m ³	Not applicable.	Not applicable.	Not applicable.
Annual deposition mg/m ² /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 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	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
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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
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Section 2: Operational conditions and risk management measures

Section 2.1 Control of worker exposure

Contributing exposure 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 cm ²)
Other operational conditions affecting worker 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 2.1 Control of worker exposure

Contributing exposure 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 cm ²)
Other operational conditions affecting worker 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 2.1 Control of worker exposure**Contributing exposure 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 pressure 44 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 cm ²)
	Long term exposure 8 h (full shift): Exposed skin surfaces: Palm of both hands (480 cm ²)
Other operational conditions affecting worker 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 2.1 Control of worker exposure**Contributing exposure scenario controlling worker exposure for 3: Use as 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 cm ²)
Other operational conditions affecting worker 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 2.2: Control of environmental exposure**Contributing exposure scenario controlling environmental exposure for 0: Formulation of preparations***

Product Characteristics:	
Concentration of substance in mixture or article:	
Amounts used:	1600 Tonnes/year
Fraction of EU tonnage used in region:	100%
Regional use tonnage (tonnes/year):	2418
Fraction of Regional tonnage used locally:	100%
Annual site tonnage (tonnes/year):	604
Maximum daily site tonnage (kg/day):	2684

Piperazine anhydrous, PIP

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

Frequency and duration of use:	225
Emission Days (days/year):	
Environmental factors not influenced by risk management:	River flow rate: 18000 m³/d
Other operational conditions of use 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
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil:	Standard Temperature and Pressure
Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of ³ (%):	No wastewater treatment required.
Conditions and measures related to municipal sewage treatment plant:	Sewage treatment plant discharge: 2000000 L/day

Section 3: Exposure estimation

Section 3.1 Workers Exposure estimation

Contributing exposure 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	Not applicable
Long term exposure, Systemic, Inhalable	Not applicable.	0.004	Not applicable
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.	0.004	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 3.1 Workers Exposure estimation

Contributing exposure 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.	0.019	Not applicable
Long term exposure, Systemic, Inhalable	Not applicable.	0.123	Not applicable
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.	0.123	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.

Piperazine anhydrous, PIP

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 3.1 Workers Exposure estimation**Contributing exposure 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.	Sampling: 0.0004 ; Packaging:0.0004	Not applicable
Long term exposure, Systemic, Inhalable	Not applicable.	Sampling: 0.053 Packaging :0.316	Monitoring methods and references: Packaging: <0.1 mg/m³
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.	Sampling: 0.053 ; Packaging :0.316	Monitoring methods and references: Packaging:<0.1 mg/m³
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 3.1 Workers Exposure estimation**Contributing exposure scenario controlling worker exposure for 3: Use as laboratory reagent**

Route of exposure	Contributing scenarios	Dose/Concentration	Justification
Long term exposure, Systemic, Dermal	Not applicable.	0.0003	Not applicable
Long term exposure, Systemic, Inhalable	Not applicable.	0.351	Monitoring methods and references: <0.1 mg/m³
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.	0.004	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 Environment Exposure estimation**Contributing exposure 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 (PEC _{stp}) 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.

Piperazine anhydrous, PIP

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

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 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	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
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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
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Section 2: Operational conditions and risk management measures

Section 2.1 Control of worker exposure

Contributing exposure 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 cm ²)
Other operational conditions affecting worker 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 2.1 Control of worker exposure

Contributing exposure 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 cm ²)
Other operational conditions affecting worker 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 2.1 Control of worker exposure**Contributing exposure scenario controlling worker exposure for 2: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities****Product Characteristics:****Concentration of substance in product:****Physical state:**

Fugacity: low

Covers percentage substance in the product up to 100%

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 operational conditions affecting worker 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 2.1 Control of worker exposure**Contributing exposure scenario controlling worker exposure for 3: Use as laboratory reagent****Product Characteristics:****Concentration of substance in product:****Physical state:**

Fugacity: low

Covers percentage substance in the product up to 100%

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 operational conditions affecting worker 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 2.2: Control of environmental exposure**Contributing exposure scenario controlling environmental exposure for 0: Manufacture of substances****Product Characteristics:****Concentration of substance in mixture or article:****Amounts used:**

18600 Tonnes/year

Fraction of EU tonnage used in region:

100%

Fraction of Regional tonnage used locally:

100%

Frequency and duration of use:**Emission Days (days/year):**

365

Environmental factors not influenced by risk management:River flow rate: 18000 m³/d**Other operational conditions of use 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%

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

Conditions and measures related to municipal sewage treatment plant:

Sewage treatment plant discharge: 2000000 L/day

Section 3: Exposure estimation

Section 3.1 Workers Exposure estimation

Contributing exposure 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.	0.02	Monitoring methods and references: Not applicable
Long term exposure, Systemic, Inhalable	Not applicable.	0.025	Monitoring methods and references: <100 µg/m³
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.	0.025	Monitoring methods and references: <100 µg/m³
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 3.1 Workers Exposure estimation

Contributing exposure 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.	0.01	Monitoring methods and references: Not applicable
Long term exposure, Systemic, Inhalable	Not applicable.	2.457	Monitoring methods and references: <100 µg/m³
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	Monitoring methods and references: <100 µg/m³
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 3.1 Workers Exposure estimation

Contributing exposure 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.	0.02	Monitoring methods and references: Not applicable
Long term exposure, Systemic, Inhalable	Not applicable.	0.527	Monitoring methods and references: <100 µg/m³
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	Monitoring methods and references: <100 µg/m³
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.

Piperazine anhydrous, PIP

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 3.1 Workers Exposure estimation**Contributing exposure scenario controlling worker exposure for 3: Use as laboratory reagent**

Route of exposure	Contributing scenarios	Dose/Concentration	Justification
Long term exposure, Systemic, Dermal	Not applicable.	0.0003	Monitoring methods and references: Not applicable
Long term exposure, Systemic, Inhalable	Not applicable.	1.053	Monitoring methods and references: <100 µg/m³
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	Monitoring methods and references: <100 µg/m³
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 Environment Exposure estimation**Contributing exposure 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 (PEC _{stp}) 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 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.

Piperazine anhydrous, PIP

*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*

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	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
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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
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Section 2: Operational conditions and risk management measures

Section 2.1 Control of worker exposure

Contributing exposure 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 cm ²)
Other operational conditions affecting worker 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 2.1 Control of worker exposure

Contributing exposure 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 cm ²)
Other operational conditions affecting worker 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 2.1 Control of worker exposure**Contributing exposure 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 cm ²)
Other operational conditions affecting worker 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 2.1 Control of worker exposure**Contributing exposure scenario controlling worker exposure for 3: Use as 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 cm ²)
Other operational conditions affecting worker 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 2.2: Control of environmental exposure**Contributing exposure scenario controlling environmental exposure for 0: Industrial use resulting in manufacture of another substance (use of intermediates)**

Product Characteristics:	
Concentration of substance in mixture or article:	
Amounts used:	15000Tonnes/year
Fraction of EU tonnage used in region:	10%
Fraction of Regional tonnage used locally:	20%
Frequency and duration of use:	
Emission Days (days/year):	220
Environmental factors not influenced by risk management:	River flow rate: 18000 m ³ /d
Local marine water dilution factor:	Not applicable.
Other operational conditions of use 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%
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil:	Standard Temperature and Pressure
Conditions and measures related to municipal sewage treatment plant:	Sewage treatment plant discharge: 2000000 L/day
Assumed domestic sewage treatment plant flow (m³/d):	2000

Piperazine anhydrous, PIP

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

Contributing exposure scenario controlling environmental exposure for 1: Industrial use of monomers for manufacture of thermoplastics**Product Characteristics:****Concentration of substance in mixture or article:****Amounts used:** 15000Tonnes/year**Fraction of EU tonnage used in region:** 100%**Fraction of Regional tonnage used locally:** 20%**Frequency and duration of use:****Emission Days (days/year):** 220**Environmental factors not influenced by risk management:** River flow rate: 18000 m³/d**Other operational conditions of use 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%**Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil:** Standard Temperature and Pressure**Conditions and measures related to municipal sewage treatment plant:** Sewage treatment plant discharge: 2000000 L/day**Section 3: Exposure estimation****Section 3.1Workers Exposure estimation****Contributing exposure 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	Monitoring methods and references: Not applicable
Long term exposure, Systemic, Inhalable	Not applicable.	0.004	Monitoring methods and references: Not applicable
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.	0.004	Monitoring methods and references: 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 3.1Workers Exposure estimation**Contributing exposure 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.	0.01	Monitoring methods and references: Not applicable
Long term exposure, Systemic, Inhalable	Not applicable.	0.123	Monitoring methods and references: Not applicable
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.	0.123	Monitoring methods and references: Not applicable
Short term exposure, Systemic, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Inhalable	Not applicable.	Not applicable.	Not applicable.

Piperazine anhydrous, PIP**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

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 3.1 Workers Exposure estimation Contributing exposure 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.	0.002	Monitoring methods and references: Not applicable
Long term exposure, Systemic, Inhalable	Not applicable.	0.176	Monitoring methods and references: Not applicable
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.	0.176	Monitoring methods and references: 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 3.1 Workers Exposure estimation Contributing exposure scenario controlling worker exposure for 3: Use as laboratory reagent			
Route of exposure	Contributing scenarios	Dose/Concentration	Justification
Long term exposure, Systemic, Dermal	Not applicable.	0.0003	Monitoring methods and references: Not applicable
Long term exposure, Systemic, Inhalable	Not applicable.	0.351	Monitoring methods and references: <0.1 mg/m³
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.	0.351	Monitoring methods and references: <0.1 mg/m³
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 Environment Exposure estimation

Contributing exposure 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

Piperazine anhydrous, PIP

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

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 Environment Exposure estimation

Contributing exposure 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.

Piperazine anhydrous, PIP

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

	Local concentration	PEC aquatic (local+regional)	Justification
Micro-organism mg/l	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	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
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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
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Section 2: Operational conditions and risk management measures

Section 2.1 Control of worker exposure

Contributing exposure 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 cm ²)
Other operational conditions affecting worker 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 2.1 Control of worker exposure

Contributing exposure 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 cm ²)
Other operational conditions affecting worker 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 environmental exposure

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

Product Characteristics:

Concentration of substance in mixture or article:

Amounts used: 2000 Tonnes/year

Fraction of EU tonnage used in region: 100%

Fraction of Regional tonnage used locally: 100%

Frequency and duration of use:

Emission Days (days/year): 35

Environmental factors not influenced by risk management: River flow rate: 18000 m³/d

Other operational conditions of use 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%

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%

Conditions and measures related to municipal sewage treatment plant: Sewage treatment plant discharge: 2000000 L/day

Section 3: Exposure estimation

Section 3.1 Workers Exposure estimation

Contributing exposure 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	Not applicable
Long term exposure, Systemic, Inhalable	Not applicable.	0.003	Not applicable
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.	0.105	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 3.1 Workers Exposure estimation

Contributing exposure 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.	0.0041	Not applicable
Long term exposure, Systemic, Inhalable	Not applicable.	0.105	Not applicable
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.	0.105	Not applicable
Short term exposure, Systemic, Dermal	Not applicable.	Not applicable.	Not applicable.
Short term exposure, Systemic, Inhalable	Not applicable.	Not applicable.	Not applicable.

Piperazine anhydrous, PIP

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

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 Environment Exposure estimation

Contributing exposure 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 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.

Piperazine anhydrous, PIP

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