

SAFETY DATA SHEET



Piperazine anhydrous, PIP

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

1.1 Product identifier

Product name : Piperazine anhydrous, PIP
Index number : 612-057-01-1
EC number : 203-808-3
REACH Registration number

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

CAS number : 110-85-0
Product description : Not applicable
Product type : Solid.
Chemical formula : C₄H₁₀N₂

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.

1.3 Details of the supplier of the safety data sheet

DELAMINE B.V.
Barchman Wuytierslaan 10
3818 LH Amersfoort
Netherlands
Telephone number: +31-334676897
e-mail address of person responsible for this SDS : SDS.Delamine@delamine.com

1.4 Emergency telephone number

Supplier

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

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Product definition : Mono-constituent substance

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

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

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

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

SECTION 2: Hazards identification

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

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

2.2 Label elements

Hazard pictograms

:



Signal word

: Danger

Hazard statements

: Flammable solid.
Causes severe skin burns and eye damage.
May cause allergy or asthma symptoms or breathing difficulties if inhaled.
May cause an allergic skin reaction.
Suspected of damaging fertility. Suspected of damaging the unborn child.

Precautionary statements

Prevention

: Obtain special instructions before use. Wear protective gloves: > 8 hours (breakthrough time): neoprene. Wear eye or face protection. Wear protective clothing. Keep away from heat, 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

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

Hazardous ingredients

: Piperazine

Supplemental label elements

: Not applicable.

Annex XVII - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles

: Not applicable.

Special packaging requirements

Containers to be fitted with child-resistant fastenings

: Not applicable.

Tactile warning of danger

: Not applicable.

2.3 Other hazards

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

: No.

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

: No.

Other hazards which do not result in classification

:  Neurotoxic effects and dermatitis.

SECTION 3: Composition/information on ingredients

Substance/mixture : Mono-constituent substance

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

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

Type

[A] Constituent

[B] Impurity

[C] Stabilising additive

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

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

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

Inhalation

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

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.

SECTION 4: First aid measures

- Protection of first-aiders** : Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband. : 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

SECTION 5: Firefighting measures

Hazards from the substance or mixture : Flammable solid.

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

5.3 Advice for firefighters

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode. Clothing for fire-fighters (including helmets, protective boots and gloves) conforming to European standard EN 469 will provide a basic level of protection for chemical incidents.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures


For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.


For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

6.2 Environmental precautions

: Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

6.3 Methods and materials for containment and cleaning up

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

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

6.4 Reference to other sections

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

SECTION 7: Handling and storage

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

7.1 Precautions for safe handling


- Protective measures** : Put on appropriate personal protective equipment (see Section 8). Persons with a history of skin sensitisation problems or asthma, allergies or chronic or recurrent respiratory disease should not be employed in any process in which this product is used. Avoid exposure - obtain special instructions before use. Avoid exposure during pregnancy. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not ingest. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use only non-sparking tools. Empty containers retain product residue and can be hazardous. Do not reuse container.
- Advice on general occupational hygiene** : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

7.2 Conditions for safe storage, including any incompatibilities

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

Seveso II Directive - Reporting thresholds (in tonnes)

Danger criteria

| Category | Notification and MAPP threshold | Safety report threshold |
|--|---------------------------------|-------------------------|
|  7b: Highly flammable (R11) | 5000 | 50000 |

7.3 Specific end use(s)


- Recommendations** : No specific data.
- Industrial sector specific solutions** : No specific data.

SECTION 8: Exposure controls/personal protection

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

8.1 Control parameters

Occupational exposure limits

| Product/ingredient name | Exposure limit values |
|--|--|
|  Piperazine | EH40/2005 WELs (United Kingdom (UK), 12/2011). Skin sensitiser. Inhalation sensitiser. STEL: 0.3 mg/m ³ 15 minutes. TWA: 0.1 mg/m ³ 8 hours. |

SECTION 8: Exposure controls/personal protection

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

DNELs/DMELs

| Product/ingredient name | Type | Exposure | Value | Population | Effects |
|-------------------------|------|-----------------------|-----------------------|------------|----------|
| Piperazine | DNEL | Short term Dermal | 0.042 mg/kg bw/day | Workers | Systemic |
| | DNEL | Short term Inhalation | 0.3 mg/m ³ | Workers | Systemic |
| | DNEL | Short term Inhalation | 0.3 mg/m ³ | Workers | Local |
| | DNEL | Long term Dermal | 0.014 mg/kg bw/day | Workers | Systemic |
| | DNEL | Long term Inhalation | 0.1 mg/m ³ | Workers | Systemic |
| | DNEL | Long term Inhalation | 0.1 mg/m ³ | Workers | Local |
| | DNEL | Long term Oral | 1.5 mg/kg bw/day | Consumers | Systemic |

PNECs

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

8.2 Exposure controls

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.

SECTION 8: Exposure controls/personal protection

- Eye/face protection** : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles and/or face shield. If inhalation hazards exist, a full-face respirator may be required instead.
- Skin protection**
- Hand protection** : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated. > 8 hours (breakthrough time): neoprene
- Body protection** : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves. Refer to European Standard EN 1149 for further information on material and design requirements and test methods.
- Other skin protection** : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Recommended: neoprene Boots.
- Respiratory protection** : Use a properly fitted, particulate filter respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator. Recommended: ammonia filter (Type K) ammonia (Type K) and particulate filter
- Environmental exposure controls** : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

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

- Physical state** : Solid. [Deliquescent crystals.]
- Colour** : Colourless.
- Odour** : Amine-like.
- Odour threshold** : Not available.
- 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%

SECTION 9: Physical and chemical properties

| | |
|--|--------------------------------|
| Vapour pressure | : 0.039 kPa [room temperature] |
| Vapour density | : 3 [Air = 1] |
| Relative density | : Not available. |
| Solubility(ies) | : |
| Solubility in water | : 150 g/l |
| Partition coefficient: n-octanol/ water | : -1.24 |
| Auto-ignition temperature | : 320°C |
| Decomposition temperature | : Not available. |
| Viscosity | : Not applicable. |
| Explosive properties | : Not applicable. |
| Oxidising properties | : None. |

9.2 Other information

| | |
|--|--------------------------------|
| Density | : 1.1 g/cm ³ [20°C] |
| Physical/chemical properties comments | : No additional information. |

SECTION 10: Stability and reactivity

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

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

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

SECTION 11: Toxicological information**Sensitisation**

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

Conclusion/Summary**Skin** : May cause skin sensitisation.**Respiratory** : May cause sensitisation by inhalation.**Mutagenicity**

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

Conclusion/Summary : No mutagenic effect.**Carcinogenicity****Conclusion/Summary** : No data available for this end-point, hence this classification is not considered to be applicable.**Reproductive toxicity**

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

Conclusion/Summary : Fertility NOAEL= 125 mg/kg bw/day
Developmental Toxicity: NOAEL= 42 mg/kg bw/day**Teratogenicity****Conclusion/Summary** : No known significant effects or critical hazards.**Specific target organ toxicity (single exposure)**

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Routes of entry anticipated: Oral.**Potential acute health effects****Eye contact** : Causes serious eye damage.**Inhalation** : May give off gas, vapor or dust that is very irritating or corrosive to the respiratory system. May cause allergy or asthma symptoms or breathing difficulties if inhaled. Exposure to decomposition products may cause a health hazard. Serious effects may be delayed following exposure.**Skin contact** : Causes severe burns. May cause an allergic skin reaction.**Ingestion** : May cause burns to mouth, throat and stomach.**Symptoms related to the physical, chemical and toxicological characteristics****Eye contact** : Adverse symptoms may include the following:
pain
watering
redness

SECTION 11: Toxicological information

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

Delayed and immediate effects and also chronic effects from short and long term exposure**Short term exposure****Potential immediate effects** : No specific data.**Potential delayed effects** : No specific data.**Long term exposure****Potential immediate effects** : No specific data.**Potential delayed effects** : No specific data.**Potential chronic health effects**

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

Conclusion/Summary : Neurotoxic effects and dermatitis.**General** : Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.**Carcinogenicity** : No known significant effects or critical hazards.**Mutagenicity** : No known significant effects or critical hazards.**Teratogenicity** : Suspected of damaging the unborn child.**Developmental effects** : No known significant effects or critical hazards.**Fertility effects** : Suspected of damaging fertility.**Absorption** : gastrointestinal tract: Rapidly absorbed.**Elimination** : Excreted via the urine.**Other information** : No specific data.**SECTION 12: Ecological information****12.1 Toxicity**

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

SECTION 12: Ecological information

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

12.2 Persistence and degradability

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

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

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

12.3 Bioaccumulative potential

| Product/ingredient name | LogP _{ow} | BCF | Potential |
|-------------------------|--------------------|-------|-----------|
| Piperazine | -1.24 | <2000 | high |

12.4 Mobility in soil

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

Mobility : No specific data.

12.5 Results of PBT and vPvB assessment

PBT : No.

vPvB : No.

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

SECTION 13: Disposal considerations

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

13.1 Waste treatment methods**Product**

Methods of disposal : The generation of waste should be avoided or minimised wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction.

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





Packaging

Methods of disposal : The generation of waste should be avoided or minimised wherever possible. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible.

SECTION 13: Disposal considerations

Special precautions : This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

SECTION 14: Transport information

| | ADR/RID | ADN | IMDG | IATA |
|--|---|--|---|--|
| 14.1 UN number | UN2579 | UN2579 | UN2579 | UN2579 |
| 14.2 UN proper shipping name | PIPERAZINE | PIPERAZINE | PIPERAZINE | Piperazine |
| 14.3 Transport hazard class(es) | 8  | 8  | 8  | 8  |
| 14.4 Packing group | III | III | III | III |
| 14.5 Environmental hazards | No. | No. | No. | No. |
| Additional information | Hazard identification number 80 Limited quantity 5 kg Tunnel code (E) | - | Emergency schedules (EmS) F-A, S-B | Passenger and Cargo Aircraft Quantity limitation: 25 kg Packaging instructions: 860 Cargo Aircraft Only Quantity limitation: 100 kg Packaging instructions: 864 Limited Quantities - Passenger Aircraft Quantity limitation: 5 kg Packaging instructions: Y845 Special provisions A803 |

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

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

SECTION 15: Regulatory information**15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture****EU Regulation (EC) No. 1907/2006 (REACH)****Annex XIV - List of substances subject to authorisation****Substances of very high concern**

None of the components are listed.

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

Other EU regulations**Europe inventory** : All components are listed or exempted.

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

Seveso II Directive

This product is not controlled under the Seveso II Directive.

Danger criteria

| Category |
|----------------------------|
| 7b: Highly flammable (R11) |

15.2 Chemical Safety Assessment : Complete.

15.3 Registration status : Applicable.

SECTION 16: Other information

Indicates information that has changed from previously issued version.

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

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

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

SECTION 16: Other information

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

| | |
|---|---|
| Full text of abbreviated H statements | : H228 Flammable solid. H314 Causes severe skin burns and eye damage. H317 May cause an allergic skin reaction. H318 Causes serious eye damage. H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled. H361fd Suspected of damaging fertility. Suspected of damaging the unborn child. (Fertility and Unborn child) |
| Full text of classifications [CLP/GHS] | : Eye Dam. 1, H318 SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 1 Flam. Sol. 1, H228 FLAMMABLE SOLIDS - Category 1 Repr. 2, H361fd (Fertility and Unborn child) TOXIC TO REPRODUCTION (Fertility and Unborn child) - Category 2 Resp. Sens. 1, H334 RESPIRATORY SENSITIZATION - Category 1 Skin Corr. 1B, H314 SKIN CORROSION/IRRITATION - Category 1B Skin Sens. 1, H317 SKIN SENSITIZATION - Category 1 |
| Full text of abbreviated R phrases | : R11- Highly flammable. R62- Possible risk of impaired fertility. R63- Possible risk of harm to the unborn child. R34- Causes burns. R42/43- May cause sensitisation by inhalation and skin contact. |
| Full text of classifications [DSD/DPD] | : F - Highly flammable Repr. Cat. 3 - Toxic to reproduction category 3 C - Corrosive |
| Training advice | : Ensure operatives are trained to minimise exposures. Training staff on good practice. |
| Date of issue/ Date of revision | : 08/04/2014 |
| Date of previous issue | : 07/09/2012 |
| Version | : 8 |

Notice to reader

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

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

Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

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

Section 1:: Title

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

Section 2:: Operational conditions and risk management measures

Section 2.1: Control of environmental exposure

Contributing scenario controlling environmental exposure for 0: Manufacture of substances

Amounts used: 18600 Tonnes/year
Fraction of EU tonnage used in region: 100%
Regional use tonnage (tonnes/year): Not available.
Fraction of Regional tonnage used locally: 100%
Annual site tonnage (tonnes/year): Not available.
Average Local Daily Tonnage (kg/day): Not available.
Maximum daily site tonnage (kg/day): Not available.

Frequency and duration of use:
Emission Days (days/year): 365

Environment factors not influenced by risk management: River flow rate: 18000 m³/d
Local freshwater dilution factor: Not available.
Local marine water dilution factor: Not available.

Other given operational conditions affecting environmental exposure:

Release fraction to air from process (initial release prior to RMM): 0.1%
Release fraction to soil from process (initial release prior to RMM): 0.1%
Release fraction to wastewater from process (initial release prior to RMM): 0.2%
Release fraction to air from wide dispersive use (regional only): Not available.
Release fraction to soil from wide dispersive use (regional only): Not available.
Release fraction to wastewater from wide dispersive use: Not available.

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil: Waste water to sewage treatment plant or Elimination via incineration Ion Exchange
Treat air emission to provide a typical removal efficiency of (%) Not available.
Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of ³ (%) Not available.
If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of ³ (%) Not available.

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

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

Section 2.2: Control of worker exposure

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

| | |
|---|--|
| Product characteristics: | Fugacity: low |
| Concentration of substance in product: | Covers percentage substance in the product up to 100% |
| Physical state: | Solid. Vapour pressure 44 Pa*s |
| Amounts used: | Not applicable. |
| Frequency and duration of use: | Exposure duration per day: >4 hours Frequency: =240 days per year |
| Human factors not influenced by risk management: | Exposed skin surfaces: Palm of one hand (240 cm ²) |
| Other given operational conditions affecting workers exposure: | Indoor. Industrial use |
| Technical conditions and measures at process level (source) to prevent release: | Closed system |
| Technical conditions and measures to control dispersion from source towards the worker: | Technical conditions of use: with local exhaust ventilation |
| Personal protection: | Wear suitable protective clothing and gloves. : 99% |
| Respiratory protection: | None. |

Section 2.2: Control of worker exposure

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

| | |
|---|--|
| Product characteristics: | Fugacity: low |
| Concentration of substance in product: | Covers percentage substance in the product up to 100% |
| Physical state: | Solid. Vapour pressure 44 Pa*s |
| Amounts used: | Not applicable. |
| Frequency and duration of use: | Exposure duration per day: >4 hours Frequency: =240 days per year |
| Human factors not influenced by risk management: | Exposed skin surfaces: Palm of both hands (480 cm ²) |
| Other given operational conditions affecting workers exposure: | Indoor. Industrial use |
| Technical conditions and measures at process level (source) to prevent release: | Use dedicated equipment. Closed system |
| Technical conditions and measures to control dispersion from source towards the worker: | Technical conditions of use: with local exhaust ventilation |
| Organisational measures to prevent/limit releases, dispersion and exposure: | Not relevant in ECETOC TRA |
| Personal protection: | Wear suitable protective clothing and gloves. : 99% |
| Respiratory protection: | None. |

Section 3:: Exposure estimation

Section 3.1 Environment - Exposure estimation

Contributing scenario controlling environmental exposure for 0: Manufacture of substances

| | Release from point source (local exposure estimation) kg/day | Total release for regional exposure estimation kg/day | Justification |
|--|--|---|-----------------|
| Waste water | Not applicable. | Not applicable. | Not applicable. |
| Surface water | Not applicable. | Not applicable. | Not applicable. |
| air (direct + STP) | Not applicable. | Not applicable. | Not applicable. |
| Soil (direct releases only) | Not applicable. | Not applicable. | Not applicable. |
| | Value | Justification | |
| Concentration in sewage (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. | Not applicable. |
| | Local concentration | PEC soil (local+regional) | Justification |

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

| | | | |
|--|----------------------------|-------------------------------------|----------------------|
| 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 3.2 Workers - Exposure estimation

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

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

Section 3.2 Workers - Exposure estimation

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

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

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

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: 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

Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

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

Section 1:: Title

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

Section 2:: Operational conditions and risk management measures

Section 2.1: Control of environmental exposure

Contributing scenario controlling environmental exposure for 0: Formulation of preparations*

Amounts used: 1600 Tonnes/year
Fraction of EU tonnage used in region: 100%
Regional use tonnage (tonnes/year): 2418
Fraction of Regional tonnage used locally: 100%
Annual site tonnage (tonnes/year): 604
Average Local Daily Tonnage (kg/day): Not available.
Maximum daily site tonnage (kg/day): 2684
Frequency and duration of use:
Emission Days (days/year): 225
Environment factors not influenced by risk management: River flow rate: 18000 m³/d
Local freshwater dilution factor: Not available.
Local marine water dilution factor: Not available.
Other given operational conditions affecting environmental exposure:
Release fraction to air from process (initial release prior to RMM): 2.5%
Release fraction to soil from process (initial release prior to RMM): 0
Release fraction to wastewater from process (initial release prior to RMM): 0
Release fraction to air from wide dispersive use (regional only): Not available.
Release fraction to soil from wide dispersive use (regional only): Not available.
Release fraction to wastewater from wide dispersive use: Not available.
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil: Standard Temperature and Pressure
Treat air emission to provide a typical removal efficiency of (%) Not available.
Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of ³ (%) No wastewater treatment required.
If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of ³ (%) Not available.
Conditions and measures related to municipal sewage treatment plant: Sewage treatment plant discharge: 2000000 L/day

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

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

Section 2.2: Control of worker exposure**Contributing scenario controlling worker exposure for 1: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities**

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

Section 2.2: Control of worker exposure**Contributing scenario controlling worker exposure for 2: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities**

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

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

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

Section 2.2: Control of worker exposure

Contributing scenario controlling worker exposure for 3: Use 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 cm2) |
| Other given operational conditions affecting workers exposure: | Indoor. Industrial use |
| Technical conditions and measures at process level (source) to prevent release: | None. |
| Technical conditions and measures to control dispersion from source towards the worker: | Technical conditions of use: with local exhaust ventilation |
| Organisational measures to prevent/limit releases, dispersion and exposure: | Not relevant in ECETOC TRA |
| Personal protection: | Wear suitable protective clothing and gloves.: 99% |
| Respiratory protection: | None. |

Section 3:: Exposure estimation

Section 3.1 Environment - Exposure estimation

Contributing scenario controlling environmental exposure for 0: Formulation of preparations*

| | Release from point source (local exposure estimation) kg/day | Total release for regional exposure estimation kg/day | Justification |
|---|---|---|----------------------|
| Waste water | Not applicable. | Not applicable. | Not applicable. |
| Surface water | Not applicable. | Not applicable. | Not applicable. |
| air (direct + STP) | Not applicable. | Not applicable. | Not applicable. |
| Soil (direct releases only) | Not applicable. | Not applicable. | Not applicable. |
| | Value | Justification | |
| Concentration in sewage (PECstp) mg/l | Not applicable. | Not applicable. | |
| Concentration in sewage sludge mg/kg dwt | Not applicable. | Not applicable. | |
| | Local concentration | PEC aquatic (local+regional) | Justification |
| Fresh water mg/l | Not applicable. | PEC: 0.921; PNEC: 1.25; RCR - Water Compartment Driven: 0.737 | Not applicable. |
| Marine water mg/l | Not applicable. | PEC: 0.0921; PNEC: 0.130; RCR - Water Compartment Driven: 0.708 | Not applicable. |
| Intermittent release. mg/l | Not applicable. | Not applicable. | Not applicable. |
| | Local concentration | PEC sediment (local+regional) | Justification |
| Fresh water sediment mg/kg dwt | Not applicable. | PEC: 0.720; PNEC: 0.980; RCR: 0.735 | Not applicable. |
| Marine water sediment mg/kg dwt | Not applicable. | PEC: 0.0720; PNEC: 0.100;RCR: 0.720 | Not applicable. |

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

| | 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/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 3:2 Workers - Exposure estimation

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

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

Section 3:2 Workers - Exposure estimation

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

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

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 3:2 Workers - Exposure estimation**Contributing scenario controlling worker exposure for 2: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities**

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

Section 3:2 Workers - Exposure estimation**Contributing scenario controlling worker exposure for 3: Use as laboratory reagent**

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

Section 4:: Guidance to check compliance with the exposure scenario

| | |
|-------------|----------------|
| Environment | Not available. |
| Health | Not available. |

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

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

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

Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

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

Section 1:: Title

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

Section 2:: Operational conditions and risk management measures

Section 2.1: Control of environmental exposure

Contributing scenario controlling environmental exposure for 0: Manufacture of substances

Amounts used: 18600 Tonnes/year

Fraction of EU tonnage used in region: 100%

Regional use tonnage (tonnes/year): Not available.

Fraction of Regional tonnage used locally: 100%

Annual site tonnage (tonnes/year): Not available.

Average Local Daily Tonnage (kg/day): Not available.

Maximum daily site tonnage (kg/day): Not available.

Frequency and duration of use:

Emission Days (days/year): 365

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

Local freshwater dilution factor: Not available.

Local marine water dilution factor: Not available.

Other given operational conditions affecting environmental exposure:

Release fraction to air from process (initial release prior to RMM): 0.1%

Release fraction to soil from process (initial release prior to RMM): 0.1%

Release fraction to wastewater from process (initial release prior to RMM): 0.2%

Release fraction to air from wide dispersive use (regional only): Not available.

Release fraction to soil from wide dispersive use (regional only): Not available.

Release fraction to wastewater from wide dispersive use: Not available.

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil: Waste water to sewage treatment plant or Elimination via incineration Ion Exchange

Treat air emission to provide a typical removal efficiency of (%) Not available.

Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of ³ (%) Not available.

If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of ³ (%) Not available.

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

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

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

Section 2.2: Control of worker exposure**Contributing scenario controlling worker exposure for 1: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities**

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

Section 2.2: Control of worker exposure**Contributing scenario controlling worker exposure for 2: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities**

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

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 2.2: Control of worker exposure**Contributing 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: >4 hours

Frequency: =240 days per year

Human factors not influenced by risk management:

Exposed skin surfaces: Palm of one hand (240 cm2)

Other given operational conditions affecting workers exposure:

Indoor. Industrial use

Technical conditions and measures at process level (source) to prevent release:

None.

Technical conditions and measures to control dispersion from source towards the worker:

Technical conditions of use: with local exhaust ventilation

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

Not relevant in ECETOC TRA

Personal protection:

Wear suitable protective clothing and gloves.: 99%

Respiratory protection:

None.

Section 3:: Exposure estimation**Section 3.:1 Environment - Exposure estimation****Contributing scenario controlling environmental exposure for 0: Manufacture of substances**

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

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 3:2 Workers - Exposure estimation**Contributing scenario controlling worker exposure for 0: Use in closed process, no likelihood of exposure**

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

Section 3:2 Workers - Exposure estimation**Contributing scenario controlling worker exposure for 1: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities**

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

Section 3:2 Workers - Exposure estimation**Contributing scenario controlling worker exposure for 2: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities**

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

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

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

Section 3:2 Workers - Exposure estimation

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

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

Section 4:: Guidance to check compliance with the exposure scenario

| | |
|-------------|----------------|
| Environment | Not available. |
| Health | Not available. |

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

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

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

Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

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

Section 1:: Title

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

Section 2:: Operational conditions and risk management measures

Section 2.1: Control of environmental exposure

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

Amounts used: 15000Tonnes/year
Fraction of EU tonnage used in region: 10%
Regional use tonnage (tonnes/year): Not available.
Fraction of Regional tonnage used locally: 20%
Annual site tonnage (tonnes/year): Not available.
Average Local Daily Tonnage (kg/day): Not available.
Maximum daily site tonnage (kg/day): Not available.

Frequency and duration of use:

Emission Days (days/year): 220

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

Local freshwater dilution factor: 1000

Local marine water dilution factor: Not applicable.

Other given operational conditions affecting environmental exposure:

Release fraction to air from process (initial release prior to RMM): 0.01%

Release fraction to soil from process (initial release prior to RMM): 0.01%

Release fraction to wastewater from process (initial release prior to RMM): 0.7%

Release fraction to air from wide dispersive use (regional only): Not available.

Release fraction to soil from wide dispersive use (regional only): Not available.

Release fraction to wastewater from wide dispersive use: Not available.

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil: Standard Temperature and Pressure

Treat air emission to provide a typical removal efficiency of (%): Not available.

Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of ³ (%): Not available.

If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of ³ (%): Not available.

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

Assumed on-site sewage treatment plant flow (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

Section 2.1: Control of environmental exposure**Contributing scenario controlling environmental exposure for 1: Industrial use of monomers for manufacture of thermoplastics**

| | |
|--|---|
| Amounts used: | 15000Tonnes/year |
| Fraction of EU tonnage used in region: | 100% |
| Regional use tonnage (tonnes/year): | Not available. |
| Fraction of Regional tonnage used locally: | 20% |
| Annual site tonnage (tonnes/year): | Not available. |
| Average Local Daily Tonnage (kg/day): | Not available. |
| Maximum daily site tonnage (kg/day): | Not available. |
| Frequency and duration of use: | |
| Emission Days (days/year): | 220 |
| Environment factors not influenced by risk management: | River flow rate: 18000 m³/d |
| Local freshwater dilution factor: | Not available. |
| Local marine water dilution factor: | Not available. |
| Other given operational conditions affecting environmental exposure: | |
| Release fraction to air from process (initial release prior to RMM): | 0.01% |
| Release fraction to soil from process (initial release prior to RMM): | 0.01% |
| Release fraction to wastewater from process (initial release prior to RMM): | 0.7% |
| Release fraction to air from wide dispersive use (regional only): | Not available. |
| Release fraction to soil from wide dispersive use (regional only): | Not available. |
| Release fraction to wastewater from wide dispersive use: | Not available. |
| Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil: | Standard Temperature and Pressure |
| Treat air emission to provide a typical removal efficiency of (%) : | Not available. |
| Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of ³ (%) : | Not available. |
| If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of ³ (%) : | Not available. |
| Conditions and measures related to municipal sewage treatment plant: | Sewage treatment plant discharge: 2000000 L/day |

Section 2.2: Control of worker exposure**Contributing scenario controlling worker exposure for 0: Use in closed process, no likelihood of exposure**

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

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

| | |
|--|---|
| Section 2.2: Control of worker exposure | |
| Contributing scenario controlling worker exposure for 1: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities | |
| Product characteristics: | Fugacity: low |
| Concentration of substance in product: | Covers percentage substance in the product up to 100% |
| Physical state: | Liquid. Vapour pressure 44 Pa*s |
| Amounts used: | Not applicable. |
| Frequency and duration of use: | Exposure duration per day: <15 min Frequency: =240 days per year |
| Human factors not influenced by risk management: | Exposed skin surfaces: Palm of both hands (480 cm2) |
| Other given operational conditions affecting workers exposure: | Indoor/Outdoor use. Industrial use |
| Technical conditions and measures at process level (source) to prevent release: | None. |
| Technical conditions and measures to control dispersion from source towards the worker: | Use the following local exhaust ventilation types: None. |
| Organisational measures to prevent/limit releases, dispersion and exposure: | Not relevant in ECETOC TRA |
| Personal protection: | Chemical-resistant gloves.: 99% Protective clothing |
| Respiratory protection: | Wear appropriate respiratory protection. with a minimum efficacy of 95% |

| | |
|--|---|
| Section 2.2: Control of worker exposure | |
| Contributing scenario controlling worker exposure for 2: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities | |
| Product characteristics: | Fugacity: low |
| Concentration of substance in product: | Covers percentage substance in the product up to 100% |
| Physical state: | Liquid. Vapour pressure 44 Pa*s |
| Amounts used: | Not applicable. |
| Frequency and duration of use: | Exposure duration per day: <15 min Frequency: =240 days per year |
| Human factors not influenced by risk management: | Exposed skin surfaces: Palm of both hands (480 cm2) |
| Other given operational conditions affecting workers exposure: | Indoor. Industrial use |
| Technical conditions and measures at process level (source) to prevent release: | None. |
| Technical conditions and measures to control dispersion from source towards the worker: | Technical conditions of use: with local exhaust ventilation |
| Organisational measures to prevent/limit releases, dispersion and exposure: | Not relevant in ECETOC TRA |
| Personal protection: | Chemical-resistant gloves.: 99% Protective clothing |
| Respiratory protection: | None. |

| | |
|--|--|
| Section 2.2: Control of worker exposure | |
| Contributing scenario controlling worker exposure for 3: Use 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 cm2) |
| Other given operational conditions affecting workers exposure: | Indoor. Industrial use |
| Technical conditions and measures at process level (source) to prevent release: | None. |
| Technical conditions and measures to control dispersion from source towards the worker: | Technical conditions of use: with local exhaust ventilation |
| Organisational measures to prevent/limit releases, dispersion and exposure: | Not relevant in ECETOC TRA |
| Personal protection: | Wear suitable protective clothing and gloves.: 99% |
| Respiratory protection: | None. |

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

Section 3.1 Environment - Exposure estimation

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

| | Release from point source (local exposure estimation) kg/ day | Total release for regional exposure estimation kg/day | Justification |
|---|---|---|----------------------|
| Waste water | Not applicable. | Not applicable. | Not applicable. |
| Surface water | Not applicable. | Not applicable. | Not applicable. |
| air (direct + STP) | Not applicable. | Not applicable. | Not applicable. |
| Soil (direct releases only) | Not applicable. | Not applicable. | Not applicable. |
| | Value | Justification | |
| Concentration in sewage (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: 0.604; 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/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 3.1 Environment - Exposure estimation

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

| | Release from point source (local exposure estimation) kg/ day | Total release for regional exposure estimation kg/day | Justification |
|---|---|--|----------------------|
| Waste water | Not applicable. | Not applicable. | Not applicable. |
| Surface water | Not applicable. | Not applicable. | Not applicable. |
| air (direct + STP) | Not applicable. | Not applicable. | Not applicable. |
| Soil (direct releases only) | Not applicable. | Not applicable. | Not applicable. |
| | Value | Justification | |
| Concentration in sewage (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: 0.604; PNEC: 1.25; RCR - Water Compartment Driven: 0.483 | 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

| | | | |
|--|-----------------|---|---|
| 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. |
| Fresh water sediment mg/kg dwt | Not applicable. | PEC sediment (local+regional) PEC: 0.473; PNEC: 0.980; RCR - Water Compartment Driven: 0.483 | Justification Not applicable. |
| Marine water sediment mg/kg dwt | Not applicable. | PEC: 0.0473; PNEC: 0.100; RCR - Water Compartment Driven: 0.473 | Not applicable. |
| Agricultural soil averaged mg/kg dwt | Not applicable. | PEC soil (local+regional) PEC: 5.58E-05; PNEC: 8.86; RCR: 6.30E-06 | Justification 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. |
| During emission mg/m ³ | Not applicable. | PEC air (local+regional) Not applicable. | Justification 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. |
| Micro-organism mg/l | Not applicable. | PEC aquatic (local+regional) Not applicable. | Justification Not applicable. |

Section 3:.2 Workers - Exposure estimation

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

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

Section 3:.2 Workers - Exposure estimation

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

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

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, Local, Dermal | Not applicable. | Not applicable. | Not applicable. |
| Short term exposure, Local, Inhalable | Not applicable. | Not applicable. | Not applicable. |
| Section 3:2 Workers - Exposure estimation | | | |
| Contributing scenario controlling worker exposure for 2: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities | | | |
| Route of exposure | Contributing scenarios | Dose/Concentration | Justification |
| Long term exposure, Systemic, Dermal | Not applicable. | 0.004 | The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. |
| Long term exposure, Systemic, Inhalable | Not applicable. | 0.047 | The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. |
| Long term exposure, Systemic, Combined | Not applicable. | Not applicable. | Not applicable. |
| Long term exposure, Local, Dermal | Not applicable. | Not applicable. | Not applicable. |
| Long term exposure, Local, Inhalable | Not applicable. | Not applicable. | Not applicable. |
| Short term exposure, Systemic, Dermal | Not applicable. | Not applicable. | Not applicable. |
| Short term exposure, Systemic, Inhalable | Not applicable. | Not applicable. | Not applicable. |
| Short term exposure, Systemic, Combined | Not applicable. | Not applicable. | Not applicable. |
| Short term exposure, Local, Dermal | Not applicable. | Not applicable. | Not applicable. |
| Short term exposure, Local, Inhalable | Not applicable. | Not applicable. | Not applicable. |

| | | | |
|---|-------------------------------|---------------------------|---|
| Section 3:2 Workers - Exposure estimation | | | |
| Contributing scenario controlling worker exposure for 3: Use as laboratory reagent | | | |
| Route of exposure | Contributing scenarios | Dose/Concentration | Justification |
| Long term exposure, Systemic, Dermal | Not applicable. | 0.0003 | The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. |
| Long term exposure, Systemic, Inhalable | Not applicable. | <0.030 | The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. |
| Long term exposure, Systemic, Combined | Not applicable. | Not applicable. | Not applicable. |
| Long term exposure, Local, Dermal | Not applicable. | Not applicable. | Not applicable. |
| Long term exposure, Local, Inhalable | Not applicable. | Not applicable. | Not applicable. |
| Short term exposure, Systemic, Dermal | Not applicable. | Not applicable. | Not applicable. |
| Short term exposure, Systemic, Inhalable | Not applicable. | Not applicable. | Not applicable. |
| Short term exposure, Systemic, Combined | Not applicable. | Not applicable. | Not applicable. |
| Short term exposure, Local, Dermal | Not applicable. | Not applicable. | Not applicable. |
| Short term exposure, Local, Inhalable | Not applicable. | Not applicable. | Not applicable. |

Section 4:: Guidance to check compliance with the exposure scenario

| | |
|-------------|----------------|
| Environment | Not available. |
| Health | Not available. |

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

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

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

Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

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

Section 1:: Title

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

Section 2:: Operational conditions and risk management measures

Section 2.1: Control of environmental exposure

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

Amounts used: 2000 Tonnes/year

Fraction of EU tonnage used in region: 100%

Regional use tonnage (tonnes/year): Not available.

Fraction of Regional tonnage used locally: 100%

Annual site tonnage (tonnes/year): Not available.

Average Local Daily Tonnage (kg/day): Not available.

Maximum daily site tonnage (kg/day): Not available.

Frequency and duration of use:

Emission Days (days/year): 35

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

Local freshwater dilution factor: Not available.

Local marine water dilution factor: Not available.

Other given operational conditions affecting environmental exposure:

Release fraction to air from process (initial release prior to RMM): 0.1%

Release fraction to soil from process (initial release prior to RMM): 0%

Release fraction to wastewater from process (initial release prior to RMM): 100%

Release fraction to air from wide dispersive use (regional only): Not available.

Release fraction to soil from wide dispersive use (regional only): Not available.

Release fraction to wastewater from wide dispersive use: Not available.

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil: Standard Temperature and Pressure
Other Risk management measures: Incineration 99.8%

Treat air emission to provide a typical removal efficiency of (%) Not available.

Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of ³ (%) Not available.

If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of ³ (%) Not available.

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

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

Section 2.2: Control of worker exposure

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

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

Section 2.2: Control of worker exposure

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

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

Section 3:: Exposure estimation

Section 3.1 Environment - Exposure estimation

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

| | Release from point source (local exposure estimation) kg/ day | Total release for regional exposure estimation kg/day | Justification |
|---|---|--|-----------------|
| Waste water | Not applicable. | Not applicable. | Not applicable. |
| Surface water | Not applicable. | Not applicable. | Not applicable. |
| air (direct + STP) | Not applicable. | Not applicable. | Not applicable. |
| Soil (direct releases only) | Not applicable. | Not applicable. | Not applicable. |
| | Value | Justification | |
| Concentration in sewage (PECstp) mg/l | Not applicable. | Not applicable. | |
| Concentration in sewage sludge mg/kg dwt | Not applicable. | Not applicable. | |
| | Local concentration | PEC aquatic (local+regional) | Justification |
| Fresh water mg/l | Not applicable. | PEC: 0.690; PNEC: 1.25; RCR - Water Compartment Driven: 0.552 | Not applicable. |
| Marine water mg/l | Not applicable. | PEC: 0.0690 ; PNEC: 0.130; RCR - Water Compartment Driven: 0.551 | Not applicable. |

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

| | | | |
|--|----------------------------|---|----------------------|
| 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/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 3:2 Workers - Exposure estimation

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

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

Section 3:2 Workers - Exposure estimation

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

| Route of exposure | Contributing scenarios | Dose/Concentration | Justification |
|--|------------------------|--------------------|---|
| Long term exposure, Systemic, Dermal | Not applicable. | 0.004 | The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. |
| Long term exposure, Systemic, Inhalable | Not applicable. | 0.047 | The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. |
| Long term exposure, Systemic, Combined | Not applicable. | Not applicable. | Not applicable. |
| Long term exposure, Local, Dermal | Not applicable. | Not applicable. | Not applicable. |
| Long term exposure, Local, Inhalable | Not applicable. | Not applicable. | Not applicable. |
| Short term exposure, Systemic, Dermal | Not applicable. | Not applicable. | Not applicable. |
| Short term exposure, Systemic, Inhalable | Not applicable. | Not applicable. | Not applicable. |
| 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: Use of gas - washer formulations, in scrubbers - Industrial

Process Category: PROC01, PROC08b

Substance supplied to that use in form of: In a mixture

Sector of end use: SU03

Subsequent service life relevant for that use: No.

Environmental Release Category: ERC04

Section 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