# SIBUR-NEFTEKHIM JSC

# SAFETY DATA SHEET

According to Regulations (EC) 1907/2006 (REACH), (EC) 1272/2008 (CLP) & (EU) 2015/830

# ACRYLIC ACID

Version: 1.2
Created: 18/11/2020

## SECTION 1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY/UNDERTAKING

### 1.1. Product identifier

| | |
|---|---|
| NAME OF SUBSTANCE: | acrylic acid |
| SYNONYMS: | 2-propenoic acid |
| TRADE NAMES: | acrylic acid |
| Index No (CLP) | 607-061-00-8 |
| CAS #: | 79-10-7 |
| EC #: | 201-177-9 |
| REGISTRATION #: | 01-2119452449-31-0072 |

### 1.2. Relevant identified uses of the substance

Most common technical function of substance:
- Intermediates

For the detailed identified uses of the product see Annex I.
The use of the substance should be limited to those specified in Annex I.

### 1.3. Details of the safety data sheet supplier

**SUPPLIER**

| | |
|---|---|
| Company name: | SIBUR-NEFTEKHIM JSC |
| Address: | 390, Eastern Industrial area, Dzerzhinsk, Nizhniy Novgorod region, 606000, Russian Federation |
| Contact Telephone: | +7 8313 27-59-09 |
| Fax: | +7 8313 27-59-99 |
| Email Address: | infosnh@snh.sibur.ru<br>techservice@sibur.ru |
| Emergency Telephone: | +7 8313 27-52-98 (office hours only, GMT+3) |

**ONLY REPRESENTATIVE**

| | |
|---|---|
| Company name: | Gazprom Marketing and Trading France |
| Address: | 68 avenue des Champs-Elysées, Paris, 75008, France |
| Contact phone: | +33 1 42 99 73 50 |
| Fax: | +33 1 42 99 73 99 |
| Email address: | didier.lebout@gazprom-mt.com |

### 1.4. Emergency phone in the country of delivery:

112 (Please note that emergency numbers may vary depending upon the country of delivery though 112 remains valid as universal number)

## SECTION 2. HAZARDS IDENTIFICATION

### 2.1. Classification according to Regulation (EC) No 1272/2008 (CLP)

Physical/Chemical Hazards

Flam. Liquid 3. H226: Flammable liquid and vapour.

Health Hazards

Acute Tox. 4. H302: Harmful if swallowed.
Acute Tox. 4. H312: Harmful in contact with skin.
Acute Tox. 4. H332: Harmful if inhaled.
Skin Corr. 1A. H314: Causes severe skin burns and eye damage.
STOT Single Exp. 3. H335: May cause respiratory irritation. Specific target organ toxicity - single (affected organs: respiratory tract).

Environmental hazards

Aquatic Acute 1. H400: Very toxic to aquatic life.

### 2.2. Classification according to Regulation (EC) No 1272/2008 (CLP) + self-classification

Physical/Chemical Hazards

Flam. Liquid 3. H226: Flammable liquid and vapour.

Health Hazards

Acute Tox. 4. H302: Harmful if swallowed.
Acute Tox. 4. H312: Harmful in contact with skin.
Acute Tox. 4. H332: Harmful if inhaled.
Skin Corr. 1A. H314: Causes severe skin burns and eye damage.
STOT Single Exp. 3. H335: May cause respiratory irritation. Specific target organ toxicity - single (affected organs: respiratory tract).

Environmental hazards

Aquatic Acute 1. H400: Very toxic to aquatic life.
Aquatic Chronic 2. H411: Toxic to aquatic life with long lasting effects.

### 2.3. Labelling according to Regulation (EC) No 1272/2008 (CLP)

Self-classification doesn't lead to additional labelling

**Signal word**

**Danger**

**Hazard pictogram**

**GHS02: flame**

**GHS05: corrosion**

**GHS07: exclamation mark**

**GHS09: environment**

### 2.4. Precautionary statements:

P210 Keep away from heat/sparks/open flames/hot surfaces. – No smoking.
P233 Keep container tightly closed.
P240 Ground/bond container and receiving equipment.
P241 Use explosion-proof electrical/ventilating/lighting/equipment.
P242 Use only non-sparking tools.
P243 Take precautionary measures against static discharge.
P260 Do not breath dust/fume/gas/mist/vapours/spray.
P261 Avoid breathing dust/fume/gas/mist/vapours/spray.
P264 Wash thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P271 Use only outdoors or in a well-ventilated area.

P273 Avoid release to the environment.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P301+P312 IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell.
P301+P330+P331 IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
P302+P352 IF ON SKIN: Wash with plenty of soap and water.
P303 + P361 + P353 If on skin (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340+P312 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310 Immediately call a POISON CENTER or doctor/physician.
P312 Call a POISON CENTER or doctor/physician if you feel unwell.
P330 Rinse mouth.
P363 Wash contaminated clothing before reuse.
P391 Collect spillage.
P403 + P235 Store in a well-ventilated place. Keep cool.
P405 Store locked up.
P501 Dispose of contents/container to hazardous or special waste collection point.

**2.5. Other hazards**

Assessment PBT / vPvB:
According to Annex XIII of Regulation (EC) No.1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH):
- not fulfilling PBT (persistent/bioaccumulative/toxic) criteria;
- not fulfilling vPvB (very persistent/very bioaccummulative) criteria.

**SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS**

| **Name EC No** | **EC No** | **CAS No** | **Content (w/w) %** | **Classification Regulation (EC) No 1272/2008 (CLP)** |
|---|---|---|---|---|
| Acrylic acid<br>*Index No(CLP):*<br>*607-061-00-8* | 201-177-9 | 79-10-7 | 98.3 – 99.99 | H226; H302; H312; H332; H314; H335; H400; H411 |
| The product does not contain impurities or additives that could affect product labelling and classification according to Regulation (EC) No 1272/2008 (CLP) in the concentration ranges specified (none Classification): | | | | |
| propionic acid<br>*Index No(CLP):*<br>607-089-00-0 | 201-176-3 | 79-09-4 | 0 - 0.1 | H314 |
| acetic acid<br>*Index No(CLP):*<br>607-002-00-6 | 200-580-7 | 64-19-7 | 0 - 0.1 | H226; H314 |
| isobutyl acrylate<br>*Index No(CLP):*<br>*607-115-00-0* | 203-417-8 | 106-63-8 | 0 - 0.05 | H226; H315; H332; H312; H317 |
| water<br>*Index No(CLP):*<br>*None* | 231-791-2 | 7732-18-5 | 0.01 - 0.1 | none |

| Name EC No | EC No | CAS No | Content (w/w) % | Classification Regulation (EC) No 1272/2008 (CLP) |
|---|---|---|---|---|
| 2-carboxyethyl acrylate<br>*Index No(CLP): None* | 246-359-9 | 24615-84-7 | 0 - 1.5 | none |
| **Additives** (this stabilizer inhibit the polymerization of acrylic acid): | | | | |
| Mequinol<br>*Index No(CLP): 604-044-00-7* | 205-769-8 | 150-76-5 | 180-220 ppm | H302; H317; H319 |

Specific Conc. Limits (CLP): >= 1.0% (STOT SE3 / H335)
M-factor: none.

## SECTION 4. FIRST-AID MEASURES

### 4.1. General Advice

First aid personnel should pay attention to their own safety. If the patient is likely to become unconscious, place and transport in stable sideways position (recovery position). Immediately remove contaminated clothing.

**If inhaled**

Whilst protecting yourself remove the casualty from the hazardous area. Lay the casualty down in a quiet place and protect him against hypothermia. Provide fresh air, seek medical advice if necessary. Monitor breathing. In case of breathing difficulties have the casualty inhale oxygen. If the casualty is unconscious but breathing lay him in a stable manner on his side. Arrange medical treatment.

**Skin contact**

Relocate the casualty away from the source of danger. Take off all contaminated clothing immediately while protecting yourself. Immediately wash off and cleanse affected skin areas with plenty of water. Following massive, extensive contact, immediately place the casualty under the emergency shower, wash off with plenty of water and only then remove clothes. Seek medical advice independent of skin damage.

**Contact with eyes**

Rinse affected eye with widely spread lid for 15 minutes. Transport the casualty immediately to an eye doctor or into hospital. Continue eye bath during transportation.

**Ingestion**

Rinse mouth with water and spit fluids out. Drink afterwards plenty of water in sips. Do not induce vomiting. Arrange medical treatment.

### 4.2. Most important symptoms and effects, both acute and delayed

Symptoms: acute -eye damage, skin irritation, allergic skin reaction, delayed – allergic reactions
Hazards: Symptoms can appear later.

### 4.3. Note to physician

Indication of any immediate medical attention and special treatment needed.

## SECTION 5. FIRE-FIGHTING MEASURES

### 5.1. Extinguishing media

Suitable extinguishing media: Water spray, foam, CO2, dry powder. Fight large fire with alcohol resistant foam or water spray.
Unsuitable extinguishing media: Do not use high volume water jet.

### 5.2. Special hazards
Cool surrounding containers with water spray. If possible, take container out of dangerous zone. Heating causes a rise in pressure, risk of bursting and explosion. Spontaneous polymerization. Shut off sources of ignition. Beware of backfire. Stay on upwind side.

### 5.3. Special protective equipment
Wear self-contained breathing apparatus. Wear suitable, tightly sealed protective clothing. Full protective suit.

### 5.4. Advice for fire-fighters
Wear a self-contained breathing apparatus.

### 5.5. Fire safety measures
No data available.

### 5.6. Further information
Dispose of fire debris and contaminated extinguishing water in accordance with official regulations. The degree of risk is governed by the burning substance and the fire conditions.

## SECTION 6. ACCIDENTAL RELEASE MEASURES

### 6.1. Personal precautions
Wear personal protective equipment (respiratory protection, eye protection, hand protection, body protection. Ensure sufficient ventilation. The hazardous area can only be entered once suitable protective measures are implemented.

### 6.2. Methods and material for containment and cleaning up
Use mechanical handling equipment. Pump off larger quantities. Dilute smaller quantities with plenty of water, neutralize if necessary with calcium carbamate or absorb spilt liquid with an absorbent (e.g. diatomite, vermiculite, sand). Fill into marked, sealable containers. Dispose according to regulations. Afterwards ventilate area and wash spill site. Inform responsible authorities if necessary.

### 6.3. Environmental precautions
Shut off all ignition sources. Evacuate area and warn affected surroundings. Do not allow entrance in soil, stretches of water, ground water, drainage systems, and surface water.

### 6.4 Additional information
No data available.

### 6.5. Reference to other sections
Information regarding exposure controls/personal protection and disposal considerations can be found in section 8 and 13.

## SECTION 7. HANDLING AND STORAGE

### 7.1. Handling
Precautions for safe handling: Use leak-proof equipment with exhaust for filling, refilling or transfer. Do not leave containers open. Avoid splashing. Fill into labelled container only. Use acid resistant utensils. Avoid skin and eye contact. Do not breathe in vapor or aerosols. Unintended, spontaneous polymerization can occur by overheating (especially local overheating), photo-initiation (UV light), contamination, corrosion (Fe), stabilizer depletion and stabilizer deactivation (via oxygen depletion). Thawing of frozen product with tempered water between 15 °C and 28 °C only.
Vent waste air to atmosphere only through suitable separators. Check the condition of seals and connector screw threads. Do not open warm or swollen product containers. Remove persons to safety and alert fire brigade**.**
Protect against heat. Protect from direct sunlight. Protect contents from the effects of light.
Ensure adequate inhibitor and dissolved oxygen level.

### 7.2. Protection against fire and explosion

Product can form explosive mixture with air. Ground all transfer equipment properly to prevent electrostatic discharge. Containers should be grounded against electrostatic charge. It is recommended that all conductive parts of the machinery are grounded. Avoid all sources of ignition: heat, sparks, open flame. Vapours may form explosive mixture with air. Ignitable mixtures can be formed in the emptied container.

Heated containers should be cooled to prevent polymerization. If exposed to fire, keep containers cool by spraying with water. Emergency cooling must be provided for the eventuality of a fire in the vicinity.

Sealed containers should be protected against heat as these results in pressure build-up. Avoid influence of heat.

### 7.3. Storage

Protect from exposure to sunlight, from overheating/heating up or freezing. Recommended storage temperatures 15°C (min) – 25°C (max.).

Keep under atmospheric oxygen (air), never use inert atmosphere: stabilizer is only effective in presence of oxygen.

Observe max. shelf life of water free product.

Suitable materials are: stainless steel, aluminium, polyethylene.

Unsuitable materials are: iron, carbon-less (mild) steel, copper, brass and their alloys.

Do not store with less than 10 % headspace above liquid.

Recommended inhibitor level is: 180 to 220 ppm.

### 7.4. Storage stability

The product is stabilized, the shelf life should be noted. Avoid prolonged storage.

Storage temperature: < 25°C.

### 7.5. Further information on storage conditions

Vessels should be well protected from penetration of other materials/substances. Provide designated lines for product loading and discharge. Pipelines design should avoid product stagnation.

## SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

### 8.1. Control parameters

#### 8.1.1. Occupational Exposure Limits

For acrylic acid (EC#201-177-9; CAS #79-10-7): International Limit Values[1)]

| Country | LTEL 8 hr TWA ppm | LTEL 8 hr TWA mg/m$^3$ | STEL ppm | STEL mg/m$^3$ | Note |
|---|---|---|---|---|---|
| Austria | 2 | 5.9 | | | |
| Belgium | 2 | 6.0 | | | |
| Denmark | 2 | 5.9 | 4 | 11.8 | |
| Finland | 2 | 6 | 15 (1) | 45 (1) | (1) 15 minutes average value |
| France | 2 | 6 | 10 | 30 | |
| Germany (AGS) | 10 | 30 | 10 (1) | 30 (1) | (1) 15 minutes average value. |
| Germany (DFG) | 10 | 30 | 10 | 30 | STV 15 minutes average value |
| Ireland | 2 | 6 | | | |

| | | | | | |
|---|---|---|---|---|---|
| Latvia | | 5 | | | |
| People's Republic of China | | 6 | | | |
| Poland | | 20 | | 50 | |
| Spain | 2 | 6 | | | Skin |
| Sweden | 10 | 30 | 15 (1) | 45 (1) | (1) Short-term value, 15 minutes average value. |
| Switzerland | 10 | 30 | 10 | 30 | |
| United Kingdom | [10] | [30] | [20] | [60] | The UK Advisory Committee on Toxic Substances has expressed concern that, for the OELs shown in parentheses, health may not be adequately protected because of doubts that the limit was not soundly-based. These OELs were included in the published UK 2002 list and its 2003 supplement, but are omitted from the published 2005 list |
| 1) GESTIS International Limit values: (http://limitvalue.ifa.dguv.de/) | | | | | |

**8.1.2. DNEL/ PNEC values**

**DN(M)ELs for workers**

Long-term exposure systemic DNELs were not calculated because of the lack of long-term systemic effects. Dose-level selection for long-term studies was limited by severity of local effects on the upper respiratory tract.

| Exposure pattern | Route | DNEL / DMEL | Most sensitive endpoint | Justification |
|---|---|---|---|---|
| Acute - systemic effects | Dermal | - | - | No DNEL considered necessary. Justification: see discussion. |
| Acute - systemic effects | Inhalation | - | - | |
| Acute - local effects | Dermal | - | skin irritation/corrosion | |
| Acute - local effects | Inhalation | - | irritation (respiratory tract) | |
| Long-term - systemic effects | Dermal | - | - | |
| Long-term - systemic effects | Inhalation | - | - | |
| Long-term - local effects | Dermal | - | - | |
| Long-term - local effects | Inhalation | - | irritation (respiratory tract) | |

**DN(M)ELs for the general population**

| Exposure pattern | Route | DNEL / DMEL | Most sensitive endpoint | Justification |
|---|---|---|---|---|
| Acute - systemic effects | Dermal | - | - | No DNEL proposed; see discussion chapters above and below. |
| Acute - systemic effects | Inhalation | - | - | No DNEL proposed; see discussion chapters above and below. |

| | | | | |
|---|---|---|---|---|
| Acute - systemic effects | Oral | - | - | No DNEL proposed; see discussion chapters above and below. |
| Acute - local effects | Dermal | DNEL: 1 mg/cm² | skin irritation/ corrosion | |
| Acute - local effects | Inhalation | DNEL: 3.6 mg/m³ | irritation (respiratory tract) | |
| Long-term - systemic effects | Dermal | - | - | No DNEL proposed; see discussion chapters above and below. |
| Long-term - systemic effects | Inhalation | - | - | No DNEL proposed; see discussion chapters above and below. |
| Long-term - systemic effects | Oral | - | - | No DNEL proposed; see discussion chapter above and below. |
| Long-term - local effects | Dermal | - | - | No DNEL proposed; see discussion chapters above and below. |
| Long-term - local effects | Inhalation | DNEL: 3.6 mg/m³ | irritation (respiratory tract) | |

**PNEC water**

| PNEC | Assessment factor | Remarks/Justification |
|---|---|---|
| PNEC aqua (freshwater): 0.003 mg/L | 10 | Extrapolation method: assessment factor.<br>For growth rate reduction, the lowest EC10 value derived in two tests (BASF AG, 1994; Huels, 1995) was 0.03 mg/L for Scenedesmus subspicatus. |
| PNEC aqua (marine water): 0.0003 mg/L | 100 | Extrapolation method: assessment factor.<br>For growth rate reduction, the lowest EC10 value derived in two tests (BASF AG, 1994; Huels, 1995) was 0.03 mg/L for Scenedesmus subspicatus. |
| PNEC aqua (intermittent releases): 0.0013 mg/L | 100 | PNEC aqua (intermittent releases): 0.0013 mg/L<br>Extrapolation method: assessment factor.<br>Taking all available short-term tests with freshwater and saltwater species into consideration, the most sensitive species is Scenedesmus subspicatus with an EC50 of 0.13 mg/L. |

**PNEC sediments**

| PNEC | Assessment factor | Remarks/Justification |
|---|---|---|
| PNEC sediment (freshwater): 0.0236 mg/kg sediment dw | - | Extrapolation method: partition coefficient.<br>Since no experimental data were available for sediment dwelling organisms, the PNEC sed was estimated using the equilibrium partitioning method as recommended by the Technical Guidance Document for Risk Assessment (ECB, 2003) and Guidance on information requirements and chemical safety assessment, Chapter R.10 (ECHA, May 2008).<br>PNEC sediment in mg/kg sediment ww = 0.00514 |

| PNEC | Assessment factor | Remarks/Justification |
|---|---|---|
| PNEC sediment (marine water): 0.002346 mg/kg sediment dw | 10 | Extrapolation method: assessment factor.<br>Derived from PNEC sediment (freshwater), applying an assessment factor of 10. |

**PNEC soil**

| PNEC | Assessment factor | Remarks/Justification |
|---|---|---|
| PNEC soil:<br>1 mg/kg soil dw | 100 | Extrapolation method: assessment factor.<br>A short-term test in Eisenia fetida with an LC50 > 1000 mg/kg dw and one long-term toxicity test with a NOEC of 100 mg/kg soil dw based on soil micro-flora (carbon-cycle) are available. An assessment factor of 100 is proposed by the Guidance on information requirements and chemical safety assessment, Chapter R.10 (ECHA, May 2008). The resulting PNEC soil is 1 mg/kg soil dw. |

**PNEC sewage treatment plant**

| Value | Assessment factor | Remarks/Justification |
|---|---|---|
| PNEC STP:<br>0.9 mg/L | 1 | Extrapolation method: assessment factor.<br>An assessment factor of 100 was applied to this value leading to a PNEC STP of 9 mg/L. But the most sensitive microorganism to acrylic acid was the protozoan Chilomonas paramaecium with a 48-hour TT of 0.9 mg/L. |

**PNEC oral (secondary poisoning)**

| PNEC | Assessment factor | Remarks/Justification |
|---|---|---|
| PNEC oral:<br>0.03 g/kg food | 30 | The NOAEL (systemic) was 40 mg/kg bw corresponding to a NOEC (food) = 8E-04 kg/kg food. The assessment factor for a 12-months study in mammals is 30 resulting in a PNEC oral (mammal) = 2.7E-05 kg/kg food. |

### 8.2. Exposure Controls

**Personal protective equipment**

**Eye protection**

In order to satisfy general industrial hygiene rules safety glasses with side-shields (e.g. EN 166) are recommended.

**Respiratory protection**

Wear respiratory protection if ventilation is inadequate. Gas filter for gases/vapours of organic compounds (boiling point > 65 °C, e. g. EN 14387 Type A).

**Hand protection**

Suitable materials also with prolonged, direct contact (Recommended: Protective index 6 corresponding > 480 minutes of permeation time according to EN 374):
fluoroelastomer (FKM) - 0.7mm coating thickness
nitrile rubber (NBR) - 0.4mm coating thickness

**Body protection**

Body protection must be chosen depending on activity and possible exposure, e.g. apron, protecting boots, chemical-protection suit (according to EN 14605 in case of splashes or EN ISO 13982 in case of dust).

**General safety and hygiene measures**
Avoid contact with skin. Avoid inhalation of vapour.

## SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

### 9.1. Information on basic physical and chemical properties

| Property | Value | Remarks |
|---|---|---|
| Physical state at 20 °C and 101.3 kPa | Liquid<br>Colour: colourless | |
| Melting / freezing point at 101.3 kPa | 13 °C | |
| Boiling point | 141 °C at 1013 hPa | |
| Relative density | 1.05 (d20/4) | |
| Vapour pressure | 5.29 hPa at 25° C | |
| Surface tension | Not surface active | |
| Water solubility | 1000 g/l at 25 °C | |
| Partition coefficient n-octanol/water (log value) | 0.46 at 25 °C | |
| Flash point | 48.5 °C at 1013 hPa | |
| Flammability | Flammable liquid cat. 3<br>The substance has no pyrophoric properties and does not liberate flammable gases on contact with water. | Substance is a flammable liquid cat.: 3 (EU GHS) because the flash point is > 23 °C and < 60 °C.<br>Flammability derived from flash point (and boiling point).<br>Based on chemical structure pyrophoric properties and flammability in contact with water are not to be expected. |
| Explosive properties | Non explosive | There are no chemical groups associated with explosive properties present in the molecule. |
| Autoflammability/self-ignition temperature at 1013 hPa | 438 °C | |
| Oxidising properties | No oxidising properties | The Substance is incapable of reacting exothermically with combustible materials on the basis of the chemical structure. |
| Granulometry | Not applicable | In accordance with column 2 of REACH Annex VII, the particle size distribution (Granulometrie) study does not need to be performed as the substance is marketed or used in a non solid or granular form. |
| Stability in organic solvents and identity of relevant degradation products | Not applicable | The stability of the substance is not considered as critical. |
| Dissociation constant | 4.26 at 25 °C | |

| | | |
|---|---|---|
| Viscosity | 1.149 mPa s (dynamic) at 25 °C | |

**9.2. Other information**

| | |
|---|---|
| Self-accelerating polymerisation temperature (SAPT) | > 50 °C at the inhibitor level 180 - 220 ppm |

## SECTION 10. STABILITY AND REACTIVITY

**10.1. Chemical stability**

Stable under recommended storage and handling conditions.
Polymerization can occur. Contains the following stabilizer: mequinol (EC no.: 205-769-8) 180-220 ppm.

**10.2. Reactivity**

Slightly corrosive in presence of steel, of aluminum, of zinc, of copper. Non-corrosive in presence of glass.

**10.3. Possibility of hazardous reactions**

Reacts violently in contact with acids, amines, driers, polymerisation accelerators and easily oxidized materials. Risk of polymerization.

**10.4. Conditions to avoid**

Avoid heat. Avoid UV-light and other radiation with high energy. Avoid direct sunlight. Avoid prolonged storage. Avoid inhibitor loss. Avoid excessive temperatures.
Avoid storing the ether near highly oxidized substances, hyperoxides, substances, which can self-ignite or polymerize when in contact with each other or when mixed with ether.
Avoid heat, flames and sparks.

**10.5. Incompatible materials**

Substances/materials to avoid: strong bases, acids, concentrated mineral acids, acid anhydrides, acid chlorides, oxidizing agents, reducing agents, radical formers, free radical initiators, peroxides, mercaptans, nitro-compounds, perborates, azides, ether, ketones, aldehydes, amines, nitrates, nitrites, metal salts, inert gas.

**10.6. Hazardous decomposition products**

No hazardous decomposition products if stored and handled as prescribed/indicated.

## SECTION 11. TOXICOLOGICAL INFORMATION

| **Property** | **Results** | **Remarks** |
|---|---|---|
| **Acute toxicity:** No adverse effect observed. | | |
| Oral | LD50 (oral): 1500 mg/kg or 146-1405 mg/kg bw (rat) | depending on the concentration tested<br>experimental result<br>DOW Chemical Company (1980), BASF AG (1958a) |
| Inhalation | LC50 (4 h, inhalation): > 5.1 mg/L (rat, vapour saturated atmosphere) | key study, experimental result<br>BASF AG (1980) |
| Dermal | LD50 (dermal): > 2000 mg/kg bw (rabbit, occlusive) | key study, experimental result<br>Product Safety Labs (2011) |

| | | |
|---|---|---|
| **Irritation/Corrosivity:** Acrylic acid is highly corrosive to skin and eyes. Acrylic acid may be irritating/corrosive to the respiratory tract.<br>GHS classification (GHS UN rev.3, 2009):<br>- Skin corrosion/irritation: Category 1A<br>- Specific target organ toxicity, Single exposure: Category 3 (May cause respiratory irritation). | | |
| Eye irritant | corrosive<br>rabbit (Vienna White), BASF-Test | key study, experimental result<br>BASF AG (1958b) |
| Skin irritant | highly corrosive<br>rabbit (New Zealand White) | BASF AG (1998) |
| Respiratory tract | Based on the available data corrosion to the respiratory tract cannot be excluded. | (BASF AG 1980, BAMM 1988) Silver et al. (1981) |
| **Sensitization:** GHS classification (GHS UN rev.3, 2009): no classification required | | |
| Skin sensitization | Acrylic acid does not have a skin sensitizing potential in animal studies.<br>not sensitising<br>guinea pig (Hartley) male<br>No. with positive reactions:<br>1st reading: 0 out of 10 (test group); 24 h after chall.; dose: 0.1 ml<br>1st reading: 7 out of 10 (positive control); 24 h after chall.; dose: no data | Rao K. S., Betso J. E., Olson K. J. (1981)<br>Positive test results obtained with commercial grade samples of the compound were caused by the presence of the impurity DAPA. |
| Respiratory system | not sensitizing | There is no information available on the potential of acrylic acid to produce respiratory sensitisation in animals. |
| **Repeated dose toxicity:** GHS classification: Specific Target Organ Toxicity/ Repeated Exposure: no classification required. | | |
| Oral | NOAEL: 83 mg/kg bw/day (nominal) (male/female)<br>LOAEL: 250 mg/kg bw/day (nominal) (male/female) (Diet and water consumption, body and organ weight changes and abnormal clinical chemical and urine analysis parameters) | key study, experimental result<br>Bushy Run Research Center (1980)<br>DePass LR et al. (1983)<br>DePass LR et al. (1981)<br>BASF Corp. (1981a) |

| | | |
|---|---|---|
| Inhalation | NOAEC: 0.074 mg/L air (analytical) (male/female) (Local effects)<br>NOAEC: 0.221 mg/L air (analytical) (male/female) (Systemic toxicity)<br>LOAEC: 0.221 mg/L air (analytical) (male/female) (Local effects: focal degeneration of the olfactory epithelium) | key study, experimental result<br>Dow Chemical Company (1979)<br>Miller RR et al. (1981a)<br>Miller RR et al. (1981b)<br>BASF Corp. (1979b)<br>BASF Corp. (1981b)<br>Dow Chemicals Corp. (1979a)<br>Dow Chemicals Corp. (1979b)<br>Hoechst Celanese Corp. (1981a) |
| Dermal | no NOAEL identified | key study, experimental result<br>TEGERIS LABORATORIES, INC. (1987)<br>McLaughlin JE et al. (1995)<br>Tegeris AS et al. (1988) |
| **Mutagenicity:** Negative. GHS classification (GHS UN rev.3, 2009): no classification required. | | |
| In vitro data | negative<br>(Chinese hamster Ovary (CHO)) | key study, experimental result<br>Microbiological Associates Inc. (1988)<br>McCarthy KL et al. (1992) |
| In vivo data | negative<br>rat, genotoxicity | key study, experimental result<br>Microbiological Associates, Inc. (1986a)<br>McCarthy KL et al. (1992)<br>McCarthy KL et al. (1988)<br>Microbiological Associates, Inc. (1986b) |
| **Carcinogenicity:** No carcinogenic effects. GHS classification (GHS UN rev.3, 2009): no classification required. | | |
| Oral | NOAEL (carcinogenicity): >= 78 mg/kg bw/day (actual dose received) (male/female) | key study, experimental result<br>BASF AG (1989b)<br>BASF AG (1993a)<br>Hellwig J et al. (1993) |
| Dermal | Neoplastic effects: no effects<br>NOAEL (carcinogenicity): > 10 mg/kg bw/day (nominal) (male) | key study, experimental result<br>Bushy Run Research Center (1982)<br>DePass LR et al. (1984)<br>Rohm & Haas Co. (1986)<br>BASF Corp. (1979c)<br>BASF Corp. (1981c)<br>Hoechst Celanese Corp. (1981b) |
| **Toxicity for reproduction:** GHS classification (GHS UN rev.3, 2009): no classification required. | | |
| Effects on fertility | NOAEL (P and F1): 460 mg/kg bw/day (male/female) (fertility) | key study, experimental result<br>BASF AG (1994a)<br>Hellwig J. et al. (1997) |

| | | |
|---|---|---|
| Developmental toxicity | NOAEC (teratogenicity, fetotoxicity): >= 1.08 mg/L air (nominal), rat<br><br>NOAEC (teratogenicity, fetotoxicity): >= 0.673 mg/L air (nominal), rabbits | Inhalation: key study, experimental result<br>BASF AG (1983)<br>Klimisch H-J and Hellwig J (1991)<br>Proctor NH et al. (1988)<br><br>Bushy Run Research Center, Union Carbide (1993)<br>Neeper-Bradley TL at al. (1997) |
| **Toxicokinetics (absorption, metabolism, distribution and elimination)** | Following oral administration of [$^{14}$C]-Acrylic acid in rats and mice, a high percentage of the radiolabel (60 – 80 %) was rapidly absorbed and eliminated as $^{14}CO_2$ within 24 hours by both species. Excretion in urine and faeces accounted for 1-4 %, respectively. In rats, about 19-25 % of the acrylic acid-derived radioactivity remained in the tissues examined after 72 hr, mostly in adipose tissue and muscle. High-performance liquid chromatography (HPLC) analysis of rat urine and rat and mouse tissues indicated that absorbed AA was rapidly metabolized by the ß-oxidation pathway of propionate catabolism. No unchanged AA was detected; however, several metabolites that were more polar than AA were measured, including 3-hydroxypropionate.<br>The presented results are consistent with the incorporation of AA into a secondary pathway for propionic acid metabolism in which 3 - hydroxypropionate is an intermediate. In this pathway, AA is first converted to acrylyl-CoA which is subsequently oxidized to 3 - hydroxypropionate. 3 -Hydroxypropionate is, in turn, metabolized to acetate and $CO_2$ via malonic semialdehyde. The resultant acetate is then incorporated into intermediary metabolism. This pathway has been reported to be a major pathway for the metabolism of propionic acid in various insect and plant species, but is a secondary pathway in mammals. On the other hand, reaction with reduced glutathion does not play a major role in the detoxification and metabolism of acrylic acid. | |
| **Other effects** | none | |

## SECTION 12. ECOLOGICAL INFORMATION

| Property | Value | Remarks |
|---|---|---|
| **AQUATIC TOXICITY** | | |
| **Fish** | | |
| Short-term toxicity<br>*Salmo gairdneri*<br><br>*Brachydanio rerio*<br>*Cyprinodon variegatus* | LC50 (96 h, flow through) = 27 mg/L<br><br>LC50 (96 h, semi-static) = 222 mg/L<br>LC50 (96 h, flow through) = 236 mg/L | key study, experimental result<br>Analytical Bio-Chemistry Laboratories, Inc. (1990)<br>European Chemicals Bureau (2002)<br><br>Huels AG (1995b)<br>Wildlife International Ltd. (1995)<br>Staples et al. (2000) |

| | | |
|---|---|---|
| Long-term toxicity to fish: Not applicable.<br>In accordance with section 3 of REACH Annex XI, the study does not need to be conducted. The use of n-butyl acrylate as a monomer, almost exclusively in closed systems for the production of polymers, indicates that environmental exposure would be limited. The volatility of n-butyl acrylate provides for volatilization of any releases to the air. n-Butyl acrylate is slowly photodegradable and readily biodegradable, and accidental releases to the environment would not result in accumulation or persistence. The relatively high water solubility and corresponding low log Kow indicate that no bioaccumulation potential exists. | | |
| **Aquatic invertebrates** | | |
| Short-term toxicity (*Daphnia Magna)* | EC50 (48 h): 95 mg/L<br>test mat. based on mobility | key study, experimental result<br>Analytical Biochemistry Laboratories, Inc (1990)<br>Basic Acrylic Monomer Manufacturers (1990b)<br>Staples CA et al. (2000b)<br>European Chemicals Bureau (2002) |
| Long-term toxicity (*Daphnia Magna)* | NOEC (reproduction) = 19 mg/L | key study, experimental result<br>ABC Laboratories California (1996)<br>Staples CA et al. (2000a) |
| Algae and aquatic plants *(Scenedesmus subspicatus) (algae)* | EC50 (72 h, growth rate) = 0.13 mg/L<br>EC50 (72 h, growth rate) = 0.205 mg/L<br><br><br><br>EC50 (96 h, cell number) = 0.17 mg/L | experimental result<br>BASF AG (1994c)<br>Sverdrup LE et al. (2001a)<br>European Chemicals Bureau (2002)<br>ABC Laboratories California (1990)<br>European Chemicals Bureau (2002) |
| Toxicity to aquatic micro-organisms | EC20 (30 min) = 900 mg/L<br>(domestic activated sludge) | key study, experimental result<br>BASF AG (1993b)<br>European Chemicals Bureau (2002) |
| **Sediment organisms:** Not available. A PNEC can be estimated based on the equilibrium partitioning method. | | |
| **Toxicity to soil macro-organisms** (*Eisenia foetida foetida*) | LC50 (14 d): > 1000 mg/kg soil dw test mat. (nominal) based on: mortality | key study, experimental result<br>Huels AG (1995f) |
| **Toxicity to soil micro-organisms** (*Sandy loam soil*) | EC100 (28 d): ca. 1000 mg/kg soil dw test mat. (nominal) based on: respiration rate<br>EC0 (28 d): ca. 100 mg/kg soil dw test mat. (nominal) based on: respiration rate | key study, experimental result<br>Research Centre Ltd. (1992) |
| **Toxicity to terrestrial plants**: Not applicable.<br>In accordance with section 3 of REACH Annex XI, the study does not need to be conducted. Since n-butyl acrylate is readily biodegradable and no direct releases to soil from point sources are known, no significant exposure of the terrestrial compartment is expected. | | |

| | | |
|---|---|---|
| **Toxicity to birds**: Not applicable.<br>In accordance with section 1 and 3 of REACH Annex XI, the study does not need to be conducted. Since no exposure of birds is expected, testing of birds is not required. | | |
| **DEGRADATION** | | |
| **Abiotic degradation**: substance is readily degradable. | | |
| Hydrolysis | Hydrolysis as a Function of pH at 25°C: t1/2 (pH 7): > 1 yr at 25 °C ($^{14}$C acrylic acid was stable to hydrolysis) | key study<br>Basic Acrylic Monomer Manufacturers (1990a) |
| Phototransformation/ photolysis in air | Half-life (DT50):<br>39.6 h (24-h day) | key study, calculated<br>BASF SE (2008a)<br>SRC AOP v1.92 |
| Phototransformation in water | No data on phototransformation in water are available. | |
| Phototransformation in soil | No data on phototransformation in water are available. | |
| **Biodegradation:** substance is readily biodegradable. | | |
| Biodegradation in water | readily biodegradable<br>% Degradation of test substance:<br>> 75 after 56 d (CH4 evolution) | experimental result<br>Shelton DR & Tiedje JM (1984) |
| Biodegradation in soil | readily biodegradable<br>Half-life (DT50):<br>0 — 1 d | key study<br>Huntingdon research Centre Ltd. (1992) |
| **ENVIRONMENTAL DISTRIBUTION** | | |
| Adsorption/desorption<br>Study type: adsorption (soil) | Adsorption coefficient:<br>Koc: 6-134<br>log Koc: 0.78-2.14 | key study, experimental results<br>Ricerca, Inc. (1991)<br>Staples CA et al. (2000a) |
| Volatilization | Henry's Law constant H:<br>0.029 Pa m³/mol at 25 °C<br>From the water surface the substance will not evaporate into the atmosphere | key study, estimated by calculation<br>SRC HENRYWIN v3.10<br>BASF AG (2008b) |
| Environmental distribution | Acrylic Acid will preferentially be distributed into the compartment water.<br>Percent distribution in media:<br>Air (%): 1.3<br>Water (%): 98.7<br>Soil (%): 0.02<br>Sediment (%): 0.02<br>Susp. sediment (%): 0<br>Biota (%): 0<br>Aerosol (%): 0 | key study, estimated by calculation<br>Calculation according to Mackay, Level I<br>BASF AG (2009a) |
| **BIOACCUMULATION:** Based on the calculated logPow of 0.46 (25 °C) and the calculated BCF of 3.16 accumulation in organisms is not to be expected. | | |
| Aquatic bioaccumulation | BCF: 3.162<br>log Pow of 0.46 (25 °C) | key study, estimated by calculation<br>BASF SE (2009b) |

| | |
|---|---|
| Secondary poisoning | Based on a log Kow value of 0.46, no bioaccumulation of acrylic acid in organisms is expected. Hence, secondary poisoning will not be an important factor in the hazard assessment. |
| Emission Characterisation | Because the substance does not fulfil the PBT and vPvB criteria, no emission characterisation is performed. |
| **PBT/vPvB Properties** | Regarding all available data on biotic and abiotic degradation, bioaccumulation and toxicity it can be stated that the substance does not fulfill the PBT criteria (not PBT) and not the vPvB criteria (not vPvB). |

## SECTION 13. DISPOSAL CONSIDERATIONS

**13.1. General information:**

Do not allow spilled product and waste water to enter the sewage and open surface water. Avoid groundwater pollution.

**13.2. Waste treatment methods**

Incinerate in suitable incineration plant, observing local authority regulations.

**13.3. Contaminated packaging**

Uncontaminated packaging can be re-used.
Packs that cannot be cleaned should be disposed of in the same manner as the contents.
EPA Hazardous. Waste Number: U008 (Acrylic acid (I)).
Disposal should be in accordance with applicable regional, national, and local laws and regulations. Local regulations may be more stringent than regional or national requirements and must be complied with.

## SECTION 14. TRANSPORT INFORMATION

**14.1. Land transport (ADR/RID)**

| | |
|---|---|
| ID number: | UN 2218 |
| Chemical name | Acrylic acid, stabilized |
| Hazard class: | 8 |
| Packing group: | II |
| Hazard label: | 8; 3 EHSM |

**14.2. Marine transport (IMDG)**

| | |
|---|---|
| ID number: | UN 2218 |
| Chemical name | Acrylic acid, stabilized |
| Hazard class: | 8 |
| Packing group: | II |
| Labels: | 8; 3 EHSM |
| Marine pollutant: | YES |

**Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**

Not applicable.

**14.3. Air transport (IATA/ICAO)**

| | |
|---|---|
| ID number: | UN 2218 |
| Chemical name | Acrylic acid, stabilized |
| Hazard class: | 8 |
| Labels: | 8; 3 |
| Packing group: | II |

## SECTION 15. REGULATORY INFORMATION

**REGULATORY**

Chemical Safety Report has been developed for acrylic acid.
APPENDIX II to the e-SDS: Exposure scenarios.

**KEY LITERATURE REFERENCES AND SOURCES**

Documents, provided by consortium Acrylates: chemical safety report (CAS 79-10-7)

**EU DIRECTIVES**

REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC.
Regulation (EC) No 1272/2008 REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006.
Regulations. Commission regulation (EU) no 453/2010 of 20 May 2010 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH).
DIRECTIVE 1999/45/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 31 May 1999 concerning the approximation of the laws, regulations and administrative provisions of the Member States relating to the classification, packaging and labelling of dangerous preparations
Directive 67/548/EEC on the approximation of the laws, regulations and administrative provisions relating to the classification, packaging and labeling of dangerous substances.
COMMISSION DECISION of 16 January 2001 amending Decision 2000/532/EC as regards the list of wastes (notified under document number (2001/118/EC).
UK REGULATORY REFERENCES
Chemicals (Hazard Information & Packaging) Regulations. The Control of Substances Hazardous to Health Regulations 1988. Health and Safety at Work Act 1974.
ENVIRONMENTAL LISTING
Control of Pollution Act 1974.
STATUTORY INSTRUMENTS
Notification of New Substances Regulations (NONS) 1993. The Export and Import of Dangerous Chemicals Regulations 2005 number 928.
APPROVED CODE OF PRACTICE
Classification and Labelling of Substances and Preparations Dangerous for Supply (EU 2001/59/EC). Safety Data Sheets for Substances and Preparations (REACH).
GUIDANCE NOTES
Workplace Exposure Limits EH40. Introduction to Local Exhaust Ventilation HS(G)37. CHIP for everyone HSG(108).
NATIONAL REGULATIONS
The Chemicals (Hazard Information and Packaging for Supply) Regulations 2002. No. 1689.
Workplace Exposure Limits 2005 (EH40).
The Carriage of Dangerous Goods and use of transportable pressure equipment regulations 2004.
Control of Substances hazardous to health regulations 2002 (as amended).
NATIONAL REGULATIONS (GERMANY)
Major Accident Hazard Legislation 82/501/EWG.

## SECTION 16. OTHER INFORMATION

### 16.1. Indication of changes

| VERSION | Date of change | Section | Description of changes |
|---|---|---|---|
| 1.0 | 10/05/2016 | All | Initially issued. |
| 1.1 | 22/02/2019 | 9 | Physical and chemical properties were updated. |
| 1.2 | 18/11/2020 | 3 | Composition parameters were updated. |

### 16.2. Abbreviations and acronyms

| | |
|---|---|
| ADR | European Agreement concerning the International Carriage of Dangerous Goods by Road |
| AGS | The German Committee on Hazardous Substances (Ausschuss für Gefahrstoffe – AGS) |
| DFG | Germany Research Foundation |
| DNEL | Derived No Effect Level |
| IMDG | International Maritime Dangerous Goods |
| ICAO-TI | Technical Instructions for the Safe Transport of Dangerous Goods by Air |
| $K_{oc}$ | Adsorption coefficient |
| Kow | Octanol-water partition coefficient |
| LC50 | Lethal Concentration to 50 % of a test population |
| LD50 | Lethal Dose to 50% of a test population (Median Lethal Dose) |
| LOAEC | Lowest Observable Adverse Effect Concentration |
| LTEL | Long Term Exposure Limit |
| NIOSH | National Institute for Occupational Safety and Health *(USA CDC)* |
| NOEC | No Observed Effect Concentration |
| NOAEL | No Observed Adverse Effect Level |
| OECD | Organization for Economic Co-operation and Development |
| OSHA | Occupational Safety & Health Administration *(USA)* |
| PNEC | Predicted No Effect Concentration |
| PBT | Persistent, bioaccumulative, toxic chemical |
| vPvB | Very Persistent, Very Bioaccumulative |
| RID | Regulations concerning the International Carriage of Dangerous Goods by Rail |
| STEL | Short Term Exposure Limit |
| STOT | Specific Target Organ Toxicity |
| (STOT) RE | Repeated Exposure |
| (STOT) SE | Single Exposure |
| TWA | Time Weighted Average |
| UN | United Nations |

### 16.3. List of ES (exposure scenario) given in Annex I to the extended SDS

(#1: ES 1) Manufacture and distribution of the substance

(#5: ES5) Use of substance as a laboratory agent

(#3: ES3) Polymerization at production sites of substance (on-site) and at downstream user sites (off-site): superabsorber polymers and other polyacrylates

(#4: ES4) Other uses of substance as intermediate

(#2: ES2) Manufacture of intermediates at production sites of substance (on-site) and at downstream user sites (off-site): esterification

*DISCLAIMER*

*This information is based on our current level of knowledge. This information may be subject to revision as new knowledge and experience becomes available, and SIBUR makes no warranties and assumes no liability in connection with any use of this information. Since SIBUR cannot be aware of all aspects of your business and the impact the REACH Regulation has for your company, SIBUR strongly encourages you to get familiar with the REACH Regulation in order to comply with its requirements and timelines.*

## Annex I
## Relevant identified uses of the substance

**Manufacture**

| Identifiers | Use descriptors | Other information |
|---|---|---|
| #1: ES 1: Manufacture and distribution of the substance | **Environmental release category (ERC):**<br>ERC 1: Manufacture of substances<br>**Process category (PROC):**<br>PROC 1: Use in closed process, no likelihood of exposure<br>PROC 2: Use in closed, continuous process with occasional controlled exposure<br>PROC 3: Use in closed batch process (synthesis or formulation)<br>PROC 8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities<br>PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities<br>PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) | Remarks: Acrylic acid (AA) is used as intermediate to produce esters (esterification reaction, AA used as substance) and as monomer to produce polyacrylates (AA used as monomer). AA is also used as laboratory chemical e.g. for analyses at production sites. |
| #5: ES5: Use of substance as a laboratory agent | **Environmental release category (ERC):**<br>ERC 1: Manufacture of substances<br>**Process category (PROC):**<br>PROC 15: Use as laboratory reagent | Remarks: Acrylic acid is used as intermediate to produce esters (esterification reaction, AA used as substance) and as monomer to produce polyacrylates (AA used as monomer). AA is also used as laboratory chemical e.g. for analyses at production sites. |

**Uses at industrial sites**

| Identifiers | Use descriptors | Other information |
|---|---|---|
| #3: ES3: Polymerization at production sites of substance (on-site) and at downstream user sites (off-site): superabsorber polymers and other polyacrylates | **Environmental release category (ERC):**<br>ERC 6c: Industrial use of monomers for manufacture of thermoplastics<br>ERC 6d: Industrial use of process regulators for polymerisation processes in production of resins, rubbers, polymers<br>**Process category (PROC):**<br>PROC 1: Use in closed process, no likelihood of exposure<br>PROC 2: Use in closed, continuous process with occasional controlled exposure | Substance supplied to that use:<br>As such<br>Subsequent service life relevant for that use: no<br>Remarks:<br>Acrylic acid is used as intermediate to produce esters (esterification reaction, AA used as substance) and as monomer to produce polyacrylates |

| Identifiers | Use descriptors | Other information |
|---|---|---|
| | PROC 3: Use in closed batch process (synthesis or formulation)<br>PROC 4: Use in batch and other process (synthesis) where opportunity for exposure arises<br>PROC 5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)<br>PROC 8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities<br>PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities<br>PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)<br>**Product Category used:**<br>PC 19: Intermediate<br>PC 32: Polymer preparations and compounds<br>**Sector of end use:**<br>SU 8: Manufacture of bulk, large scale chemicals (including petroleum products)<br>SU 9: Manufacture of fine chemicals<br>SU 12: Manufacture of plastics products, including compounding and conversion<br>**Technical function of the substance during formulation:**<br>Intermediates<br>Laboratory chemicals | (AA used as monomer). AA is also used as laboratory chemical e.g. for analyses at production sites. |
| #4: ES4: Other uses of substance as intermediate | **Environmental release category (ERC):**<br>ERC 6a: Industrial use resulting in manufacture of another substance (use of intermediates)<br>**Process category (PROC):**<br>PROC 1: Use in closed process, no likelihood of exposure<br>PROC 2: Use in closed, continuous process with occasional controlled exposure<br>PROC 3: Use in closed batch process (synthesis or formulation)<br>PROC 4: Use in batch and other process (synthesis) where opportunity for exposure arises<br>PROC 5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)<br>PROC 8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities | Substance supplied to that use:<br>As such<br>Subsequent service life relevant for that use: no<br>Remarks:<br>Acrylic acid is used as intermediate to produce esters (esterification reaction, AA used as substance) and as monomer to produce polyacrylates (AA used as monomer). AA is also used as laboratory chemical e.g. for analyses at production sites. |

| Identifiers | Use descriptors | Other information |
|---|---|---|
| | PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities<br>PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)<br>**Product Category used:**<br>PC 19: Intermediate<br>PC 32: Polymer preparations and compounds<br>**Sector of end use:**<br>SU 8: Manufacture of bulk, large scale chemicals (including petroleum products)<br>SU 9: Manufacture of fine chemicals<br>**Technical function of the substance during formulation:**<br>Intermediates<br>Laboratory chemicals | |
| #2: ES2: Manufacture of intermediates at production sites of substance (on-site) and at downstream user sites (off-site): esterification | **Environmental release category (ERC):**<br>ERC 6a: Industrial use resulting in manufacture of another substance (use of intermediates)<br>**Process category (PROC):**<br>PROC 1: Use in closed process, no likelihood of exposure<br>PROC 2: Use in closed, continuous process with occasional controlled exposure<br>PROC 3: Use in closed batch process (synthesis or formulation)<br>PROC 4: Use in batch and other process (synthesis) where opportunity for exposure arises<br>PROC 5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)<br>PROC 8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities<br>PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities<br>PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)<br>**Product Category used:**<br>PC 19: Intermediate<br>**Sector of end use:**<br>SU 8: Manufacture of bulk, large scale chemicals (including petroleum products)<br>SU 9: Manufacture of fine chemicals | Substance supplied to that use:<br>As such<br>Subsequent service life relevant for that use: no<br>Remarks:<br>Acrylic acid is used as intermediate to produce esters (esterification reaction, AA used as substance) and as monomer to produce polyacrylates (AA used as monomer). AA is also used as laboratory chemical e.g. for analyses at production sites. |

| Identifiers | Use descriptors | Other information |
|---|---|---|
| | **Technical function of the substance during formulation:**<br>Intermediates<br>Laboratory chemicals | |

# Annex II
# Exposure scenario

## 1. EXPOSURE ASSESSMENT

**Table 1: Short description of all exposure scenarios with their use descriptors and life cycle stage**

| Number (ES) | Short description of exposure scenario | Product Category (PC) | Life cycle stage covered by ES | | | | | | Sector of use (SU) | Process category (PROC) | Article Category (AC) | Environmental release category (ERC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Manufacture | Formulation | End use | | | Service Life | | | | |
| | | | | | Industrial | Professional | Consumer | | | | | |
| 1 | Manufacture and distribution of the substance | 19 | X | - | X | - | - | - | 8, 9 | 1, 2, 3, 8a, 8b, 9 | - | 1 |
| 2 | Manufacture of intermediates at production sites of substance (on-site) and at downstream user sites (off-site): Esterification | 19 | - | - | X | - | - | - | 8, 9 | 1, 2, 3, 4, 5, 8a, 8b, 9 | - | 6a |
| 3 | Polymerization at production sites of substance (on-site) and at downstream user sites (off-site): Superabsorber Polymers and other Polyacrylates | 19, 32 | - | - | X | - | - | - | 8, 9, 12 | 1, 2, 3, 4, 5, 8a, 8b, 9 | - | 6c, 6d |
| 4 | Other uses of substance as intermediate | 19, 32 | - | - | X | | - | - | 8, 9 | 1, 2, 3, 4, 5, 8a, 8b, 9 | - | 6a |
| 5 | Use of substance as a laboratory agent | 19, 21 | - | - | X | | - | - | 8, 9, 24 | 15 | - | 1 |

### Regional PECs:

**Table 2: PECs Regional**

| Compartment | PEC | Unit |
|---|---|---|
| Surface water | 0.000451 | mg L-1 |
| Seawater | 0.0000542 | mg L-1 |
| Air | 0.0000669 | mg m-3 |
| Agricultural soil | 0.000313 | mg kgwwt-1 |
| Pore water of agricultural soil | 0.000359 | mg L-1 |
| Natural soil | 0.0006 | mg kgwwt-1 |
| Industrial soil | 0.0314 | mg kgwwt-1 |
| Sediment | 0.000702 | mg kgwwt-1 |
| Seawater sediment | 0.0000839 | mg kgwwt-1 |

Total daily intake (regional) for humans was estimated to be 0.0000507 mg/kg body weight/day.

## 1.1. Manufacture and distribution of the substance

### 1.1.1. Exposure Scenario 1

**Table 3: Description of the ES 1**

| **1.1.1.1. Title** | |
|---|---|
| **Reference number** | 1 |
| **Free short title** | **Manufacture and distribution of the substance** |
| **Systematic title based on use descriptor** | SU 8 and 9; PROC 1, 2, 3, 8a, 8b, and 9; ERC 1 |
| **Processes, tasks, activities covered** | PROC1: Use in closed process, no likelihood of exposure; Industrial setting.<br>PROC2: Use in closed, continuous process with occasional controlled exposure (e.g. sampling); Industrial setting.<br>PROC3: Use in closed batch process (synthesis or formulation); Industrial setting.<br>PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non -dedicated facilities; Industrial setting.<br>PROC8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities; Industrial setting.<br>PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing); Industrial setting. |
| **Environment characteristic covered** | ERC1: Manufacture of substances. |
| **1.1.1.2. Operational conditions and risk management measures** | |
| Manufacture of the substance is limited to 6 production sites in Europe. | |
| **1.1.1.2.1. Control of workers exposure for PROC 1** | |
| **Title information related to contributing scenario** | |
| **Workers related free short title** | Use in closed process, no likelihood of exposure. |
| **Use descriptor covered** | PROC 1 |
| **Processes, tasks, activities covered** | Use of the substance in high integrity contained system where little potential exists for exposures, e.g. closed sampling systems. |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications |

| | | | |
|---|---|---|---|
| **Product characteristic** | | | |
| Physical state | liquid | | |
| Concentration of substance | 100% | | |
| **Amounts used** | | | |
| This information is not relevant for assessment of worker's exposure. | | | |
| **Operational conditions affecting workers exposure** | | | |
| Location | Indoors[1)] | | |
| Domain | Industrial | | |
| **Frequency and duration of use/exposure** | | | |
| Duration of exposure | > 4 hours/day | | |
| Frequency of exposure | ≤ 240 days/year | | |
| **Human factors not influenced by risk management** | | | |
| Exposed skin surface | Palm of one hand (240 cm²) | | |
| **Technical conditions and measures at process level (source) to prevent release** | | | |
| Not relevant – closed system | | | |
| **Technical conditions and measures to control dispersion from source towards the worker** | | | |
| Not relevant – closed system | | | |
| **Organisational measures to prevent /limit releases, dispersion and exposure** | | | |
| Not relevant | | | |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | | | |
| Not relevant | | | |
| **1.1.1.2.2. Control of workers exposure for PROC 2** | | | |
| **Title information related to contributing scenario** | | | |
| **Workers related free short title** | Use in closed, continuous process with occasional controlled exposure (e.g. sampling). | | |
| **Use descriptor covered** | PROC 2 | | |
| **Processes, tasks, activities covered** | Continuous process but where the design philosophy is not specifically aimed at minimizing emissions.<br>It is not high integrity and occasional exposure will arise e.g. through maintenance, sampling and equipment braking. | | |
| Assessment Method | ECETOC TRA Worker v2.0 with modifications | | |
| **Scenario** | **1** | **2** | **3** |
| **Product characteristic** | | | |
| Physical state | liquid | liquid | liquid |
| Concentration of substance | 100% | 100% | 100% |
| **Amounts used** | | | |
| This information is not relevant for assessment of worker's exposure. | | | |
| **Operational conditions affecting workers exposure** | | | |
| Location | Indoors[1)] | Indoors[1)] | Indoors[1)] |
| Domain | Industrial | Industrial | Industrial |
| **Frequency and duration of use/exposure** | | | |
| Duration of exposure | > 4 hours/day | > 4 hours/day | 1-4 hours/day |
| Frequency of exposure | ≤ 240 days/year | ≤ 240 days/year | ≤ 240 days/year |

| | | | |
|---|---|---|---|
| **Human factors not influenced by risk management** | | | |
| Exposed skin surface | Palm of both hands (480 cm²) | Palm of both hands (480 cm²) | Palm of both hands (480 cm²) |
| **Technical conditions and measures at process level (source) to prevent release** | | | |
| Not relevant – closed system | | | |
| **Technical conditions and measures to control dispersion from source towards the worker** | | | |
| Local exhaust ventilation[2)] | yes (90% Effectiveness) | no | no |
| **Organisational measures to prevent /limit releases, dispersion and exposure** | | | |
| Not relevant – closed system | | | |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | | | |
| Suitable respiratory protection | no | 90% | no |
| Gloves[3)] | yes | yes | yes |

**1.1.1.2.3. Control of workers exposure for PROC 3**

| | | | |
|---|---|---|---|
| **Title information related to contributing scenario** | | | |
| **Workers related free short title** | Use in closed batch process (synthesis or formulation); Industrial setting. | | |
| **Use descriptor covered** | PROC 3 | | |
| **Processes, tasks, activities covered** | Batch manufacture of a chemical or formulation where the predominant handling is in a contained manner, but where some opportunity for contact with chemicals occurs (e.g. through sampling). | | |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications | | |
| **Product characteristic** | | | |
| **Scenario** | **1** | **2** | **3** |
| Physical state | liquid | liquid | liquid |
| Concentration of substance | 100% | 100% | 100% |
| **Amounts used** | | | |
| This information is not needed for assessment of worker's exposure. | | | |
| **Operational conditions affecting workers exposure** | | | |
| Location | Indoors[1)] | Indoors[1)] | Indoors[1)] |
| Domain | Industrial | Industrial | Industrial |
| **Frequency and duration of use/exposure** | | | |
| Duration of exposure | > 4 hours/day | > 4 hours/day | 15 mins -1 hour |
| Frequency of exposure | ≤ 240 days/year | ≤ 240 days/year | ≤ 240 days/year |
| **Human factors not influenced by risk management** | | | |
| Exposed skin surface | Palm of one hand (240 cm²) | | |
| **Technical conditions and measures at process level (source) to prevent release** | | | |
| Not relevant | | | |
| **Technical conditions and measures to control dispersion from source towards the worker** | | | |
| Local exhaust ventilation[2)] | Yes (Effectiveness: 90 %) | no | no |
| **Organisational measures to prevent /limit releases, dispersion and exposure** | | | |
| Not relevant | | | |

| | | | |
|---|---|---|---|
| **Conditions and measures related to personal protection, hygiene and health evaluation** | | | |
| Suitable respiratory protection | no | 90% | no |
| Gloves[3)] | yes | yes | yes |
| **1.1.1.2.4. Control of workers exposure for PROC 8a** | | | |
| **Title information related to contributing scenario** | | | |
| **Workers related free short title** | PROC 8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities; Industrial or non-industrial setting. | | |
| **Use descriptor covered** | PROC 8a | | |
| **Processes, tasks, activities covered** | PROC 8a: Sampling, loading, filling, transfer, dumping, bagging in non dedicated facilities. Exposure related to dust, vapour, aerosols or spillage, and cleaning of equipment to be expected. | | |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications | | |
| **Scenario** | **1** | **2** | **3** |
| **Product characteristic** | | | |
| Physical state | liquid | liquid | liquid |
| Concentration of substance | 100% | 100% | 100% |
| **Amounts used** | | | |
| Not relevant | | | |
| **Operational conditions affecting workers exposure** | | | |
| Location | Indoors[1)] | Indoors[1)] | Indoors[1)] |
| Domain | Industrial | Industrial | Industrial |
| **Frequency and duration of use/exposure** | | | |
| Duration of exposure | > 4 hours/day | > 4 hours/day | < 15 mins |
| Frequency of exposure | ≤ 240 days/year | ≤ 240 days/year | ≤ 240 days/year |
| **Human factors not influenced by risk management** | | | |
| Exposed skin surface | both hands (960 cm²) | both hands (960 cm²) | both hands (960 cm²) |
| **Technical conditions and measures at process level (source) to prevent release** | | | |
| Not relevant. | | | |
| **Technical conditions and measures to control dispersion from source towards the worker** | | | |
| Local exhaust ventilation[2)] | Yes Effectiveness: 90% | no | no |
| **Organisational measures to prevent /limit releases, dispersion and exposure** | | | |
| Not relevant. | | | |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | | | |
| Suitable respiratory protection | no | 90% | no |
| Gloves[3)] | yes | yes | yes |
| **1.1.1.2.5. Control of workers exposure for PROC 8b** | | | |
| **Title information related to contributing scenario** | | | |
| **Workers related free short title** | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities; Industrial or non-industrial setting. | | |

| | | | |
|---|---|---|---|
| **Use descriptor covered** | PROC 8b | | |
| **Processes, tasks, activities covered** | Sampling, loading, filling, transfer, dumping, bagging in dedicated facilities. Exposure related to dust, vapour, aerosols or spillage, and cleaning of equipment to be expected. | | |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications | | |
| **Scenario** | **1** | **2** | **3** |
| **Product characteristic** | | | |
| Physical state | liquid | liquid | liquid |
| Concentration of substance | 100% | 100% | 100% |
| **Amounts used** | | | |
| Not relevant | | | |
| **Operational conditions affecting workers exposure** | | | |
| Location | Indoors[1)] | Indoors[1)] | Indoors[1)] |
| Domain | Industrial | Industrial | Industrial |
| **Frequency and duration of use/exposure** | | | |
| Duration of exposure | > 4 hours/day | > 4 hours/day | < 15 mins |
| Frequency of exposure | ≤ 240 days/year | ≤ 240 days/year | ≤ 240 days/year |
| **Human factors not influenced by risk management** | | | |
| Exposed skin surface | Palm of both hands (480 cm²) | Palm of both hands (480 cm²) | Palm of both hands (480 cm²) |
| **Technical conditions and measures at process level (source) to prevent release** | | | |
| Not relevant. | | | |
| **Technical conditions and measures to control dispersion from source towards the worker** | | | |
| Local exhaust ventilation[2)] | Yes<br>Effectiveness: 90 % | no | no |
| **Organisational measures to prevent /limit releases, dispersion and exposure** | | | |
| Not relevant. | | | |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | | | |
| Suitable respiratory protection | no | 90% | no |
| Gloves[3)] | yes | yes | yes |
| **1.1.1.2.6. Control of workers exposure for PROC 9** | | | |
| **Title information related to contributing scenario** | | | |
| **Workers related free short title** | PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing); Industrial setting. | | |
| **Use descriptor covered** | PROC 9 | | |
| **Processes, tasks, activities covered** | PROC 9: Filling lines specifically designed for both, capturing vapour and aerosol emissions and minimise spillage. | | |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications | | |
| **Scenario** | **1** | **2** | **3** |
| **Product characteristic** | | | |
| Physical state | liquid | liquid | liquid |
| Concentration of substance | 100% | 100% | 100% |

| | | | |
|---|---|---|---|
| **Amounts used** | | | |
| Not relevant | | | |
| **Operational conditions affecting workers exposure** | | | |
| Location | Indoors[1)] | Indoors[1)] | Indoors[1)] |
| Domain | Industrial | Industrial | Industrial |
| **Frequency and duration of use/exposure** | | | |
| Duration of exposure | > 4 hours/day | > 4 hours/day | < 15 mins |
| Frequency of exposure | ≤ 240 days/year | ≤ 240 days/year | ≤ 240 days/year |
| **Human factors not influenced by risk management** | | | |
| Exposed skin surface | Palm of both hands (480 cm²) | Palm of both hands (480 cm²) | Palm of both hands (480 cm²) |
| **Technical conditions and measures at process level (source) to prevent release** | | | |
| Not relevant. | | | |
| **Technical conditions and measures to control dispersion from source towards the worker** | | | |
| Local exhaust ventilation[2)] | Yes Effectiveness:90% | no | no |
| **Organisational measures to prevent /limit releases, dispersion and exposure** | | | |
| Not relevant. | | | |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | | | |
| Suitable respiratory protection | no | 90% | no |
| Gloves[3)] | yes | yes | yes |

**1.1.1.2.7. Control of environmental exposure for ERC 1**

| | | |
|---|---|---|
| **Free short title** | Production of chemical. | |
| **Use descriptor covered** | ERC 1 | |
| **Description** | Production of organic and inorganic substances in chemical, petrochemical, primary metals and minerals industry including intermediates, monomers using continuous processes or batch processes applying dedicated or multi-purpose equipment, either technically controlled or operated by manual interventions. | |
| **Assessment Method** | EUSES v2.1 | |
| **Product characteristics** | | |
| Physical state | liquid | |
| Concentration of substance | 100% | |
| **Amounts used** | | |
| **Maximum daily use at a site** | ≤ 960 tons/day (produced, largest producer, site1) | |
| **Maximum annual use at a site** | ≤ 288,000 tons/year (produced, largest producer, site1) | |
| **Fraction of the main local source** | 1 | |
| **Frequency and duration of use** | 300 days (no. of emission days/year) | |
| **Pattern of release to the environment** | Continuous | |
| **Environment factors not influenced by risk management** | | |
| **Receiving surface water flow rate** | ≥ 18000 $m^3$/d (default) | |
| **Other given operational conditions affecting environmental exposure** | | |
| Industry category | 3: Chemical industry: chemicals used in synthesis | |
| Use category | 33: Intermediates | |

| | | |
|---|---|---|
| Main category production | Ia: Non-isolated intermediates. | |
| Main category industrial use | Ib: Continuous production process | |
| Extra details on use category | Wet process | |
| Emission tables | Special “3/33-combination”: A1.2, B1.6; | |
| Indoor use. | | |
| | Production | Industrial Use |
| Release fraction to air from process | 1E-05 (default) | 1E-05 (default) |
| Release fraction to wastewater from process | 3E-03 (default) | 5E-04 (default) |
| Release fraction to soil from process | 0 (default) | 1E-04 (default) |
| **Technical conditions and measures at process level (source) to prevent release** | | |
| Fraction connected to sewer system | 100% | |
| **Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil** | | |
| Dry sludge application to agricultural soil | no | |
| **Organizational measures to prevent/limit release from site** | | |
| Fraction of EU tonnage for region (private use) | 0% | |
| **Conditions and measures related to municipal sewage treatment plant** | | |
| **Municipal Sewage Treatment Plant (STP)** | Yes (freshwater and marine assessment) | |
| **Discharge rate of the Municipal STP** | ≥ 2000 m3/d (default) | |
| **Incineration of the sludge of the Municipal STP** | default | |
| **Concentration of chemical in untreated waste water (largest AA production site)** | 1.68 x $10^3$ mg/L (EUSES output) | |
| **Concentration of chemical (total) in the STP effluent** | 10 µg/L (based on analytical results) | |
| **Conditions and measures related to external treatment of waste for disposal** | | |
| Not relevant. | | |
| **Conditions and measures related to external recovery of waste** | | |
| Not relevant. | | |

[1)] Indoors: "Indoors without LEV" covers as a worst-case scenario also "Outdoor" uses.
[2)] The LEV exposure modifying factors for dermal exposure implemented in the ECETOC TRA v2.0 are not considered.
[3)] Gloves were implemented as an additional RMM. The following effectiveness values are assumed: Use of suitable gloves: 80%; Use of suitable gloves in combination with basic employee training: 90%; Use of suitable gloves in combination with specific activity training: 95%; Use of suitable gloves in combination with intensive management supervision controls: 98%.
Suitable gloves are: butyl rubber gloves (0.7mm thickness, >480 min resistance against Acrylic acid).

## 1.1.2. Exposure Estimation ES 1

**Table 4: Estimated exposure for workers / PROC 1**

| **Route of exposure** | **Concentrations** Value | | | | **Justification** |
|---|---|---|---|---|---|
| Technical conditions and measures | Scenario 1 | Scenario 2 | Scenario 3 | Unit | |
| Long-term exposure, local, dermal | 100.0 | not required | not required | µg/cm² | NA |
| Long-term exposure, local, inhalative | 0.0300 | not required | not required | mg/m³ | NA |
| Short-term exposure, local, dermal | 100.0 | not required | not required | µg/cm² | NA |

NA = Not applicable;
Scenario 1: Indoor, LEV, no respirator, duration of activity > 4 hours

**Table 5: Estimated exposure for workers / PROC 2**

| **Route of exposure** | **Concentrations** Value | | | | **Justification** |
|---|---|---|---|---|---|
| Technical conditions and measures | Scenario 1 | Scenario 2 | Scenario 3 | Unit | |
| Long-term exposure, local, dermal | 40.0 | 40.0 | 40.0 | µg/cm² | NA |
| Long-term exposure, local, inhalative | 3.004 | 3.004 | 18.025 | mg/m³ | NA |
| Short-term exposure, local, dermal | 40.0 | 40.0 | 40.0 | µg/cm² | NA |

NA = Not applicable
Scenario 1: Indoor, LEV, no respirator, duration of activity > 4hrs.
Scenario 2: Indoor, no LEV, respirator (TRA 90% efficiency), duration of activity > 4hrs
Scenario 3: Indoor, no LEV, no respirator, duration of activity 1-4hrs

**Table 6: Estimated exposure for workers / PROC 3**

| **Route of exposure** | **Concentrations** Value | | | | **Justification** |
|---|---|---|---|---|---|
| Technical conditions and measures | Scenario 1 | Scenario 2 | Scenario 3 | Unit | |
| Long-term exposure, local, dermal | 20.0 | 20.0 | 20.0 | µg/cm² | NA |
| Long-term exposure, local, inhalative | 7.510 | 7.510 | 15.021 | mg/m³ | NA |

| | | | | | |
|---|---|---|---|---|---|
| Short-term exposure, local, dermal | 20.0 | 20.0 | 20.0 | µg/cm² | NA |

NA = Not applicable
Scenario 1: Indoor, LEV, no respirator, duration of activity > 4hrs.
Scenario 2: Indoor, no LEV, respirator (TRA 90% efficiency), duration of activity > 4hrs
Scenario 3: Indoor, no LEV, no respirator, duration of activity 15mins-1hr

**Table 7: Estimated exposure for workers / PROC 8a**

| **Route of exposure** | **Concentrations** Value | | | | **Justification** |
|---|---|---|---|---|---|
| Technical conditions and measures | Scenario 1 | Scenario 2 | Scenario 3 | Unit | |
| Long-term exposure, local, dermal | 200.0 | 200.0 | 200.0 | µg/cm² | NA |
| Long-term exposure, local, inhalative | 15.021 | 15.021 | 15.021 | mg/m$^3$ | NA |
| Short-term exposure, local, dermal | 200.0 | 200.0 | 200.0 | µg/cm² | NA |

NA = Not applicable
Scenario 1: Indoor, LEV, no respirator, duration of activity > 4hrs.
Scenario 2: Indoor, no LEV, respirator (TRA 90% efficiency), duration of activity > 4hrs
Scenario 3: Indoor, no LEV, no respirator, duration of activity <15mins

**Table 8: Estimated exposure for workers / PROC 8b**

| **Route of exposure** | **Concentrations** Value | | | | **Justification** |
|---|---|---|---|---|---|
| Technical conditions and measures | Scenario 1 | Scenario 2 | Scenario 3 | Unit | |
| Long-term exposure, local, dermal | 200.0 | 200.0 | 200.0 | µg/cm² | NA |
| Long-term exposure, local, inhalative | 4.506 | 15.021 | 15.021 | mg/m$^3$ | NA |
| Short-term exposure, local, dermal | 200.0 | 200.0 | 200.0 | µg/cm² | NA |

NA = Not applicable
Scenario 1: Indoor, LEV, no respirator, duration of activity > 4hrs.
Scenario 2: Indoor, no LEV, respirator (TRA 90% efficiency), duration of activity > 4hrs
Scenario 3: Indoor, no LEV, no respirator, duration of activity < 15mins

**Table 9: Estimated exposure for workers / PROC 9**

| **Route of exposure** | **Concentrations** Value | | | | **Justification** |
|---|---|---|---|---|---|
| Technical conditions and measures | Scenario 1 | Scenario 2 | Scenario 3 | Unit | |
| Long-term exposure, local, dermal | 200.0 | 200.0 | 200.0 | µg/cm² | NA |
| Long-term exposure, local, inhalative | 15.021 | 15.021 | 15.021 | mg/m³ | NA |
| Short-term exposure, local, dermal | 200.0 | 200.0 | 200.0 | µg/cm² | NA |

NA = Not applicable
Scenario 1: Indoor, LEV, no respirator, duration of activity > 4hrs.
Scenario 2: Indoor, no LEV, respirator (TRA 90% efficiency), duration of activity > 4hrs
Scenario 3: Indoor, no LEV, no respirator, duration of activity < 15mins

**Table 10: Estimated exposure for the environment / Production (ERC 1)**

| **Compartment** | **PEC / TDI** | **Unit** | **Remark** |
|---|---|---|---|
| STP | 0.01 | mg L-1 | |
| Freshwater (emission period) | 0.00145 | mg L-1 | |
| Freshwater sediment | 0.00248 | mg kgwwt-1 | |
| Soil (grass land) | 0.214 | mg kgwwt-1 | Only results from the largest producer are reported. |
| Marine water (emission period) | 0.000154 | mg L-1 | |
| Marine water sediment | 0.000264 | mg kgwwt-1 | |
| Total daily intake man via the environment | 0.00229 | mg.kgbw-1.d-1 | |

| **Compartment** | **PEC** | **Unit** | **Remark** |
|---|---|---|---|
| Air (annual average) | 0.00445 | mg.m-3 | Only results from the largest producer (site 1) are reported. |

NA = Not applicable

# 1.2. Manufacture of Intermediates at Production Sites of Substance (on-site) and at Downstream User Sites (off-site): Esterification

## 1.2.1. Exposure Scenario 2

Exposure Scenario 2 covers esterifications, the most common use (wet), where the substance is used as intermediate resulting in a monomer (downstream use).
Esterification reactions result in Acrylic esters (Acrylates). These downstream uses can occur either on-site or off-site (with regard where the substance is produced). They can be captive or merchant use of the substance.
Based on identical use descriptors, the various esterifications can be described with a common Exposure Scenario.

**Table 11: Description of the ES 2**

| | |
|---|---|
| **1.2.1.1. Title** | |
| **Reference number** | 2 |
| **Free short title** | Manufacture of intermediates at production sites of substance (on-site) and at other sites (off-site): e.g. Esterification. |
| **Systematic title based on use descriptor** | SU 8 and 9; PROC 1, 2, 3, 4, 5, 8a, 8b, and 9; ERC 6a |
| **Processes, tasks, activities covered** | PROC1: Use in closed process, no likelihood of exposure; Industrial setting.<br>PROC2: Use in closed, continuous process with occasional controlled exposure (e.g. sampling); Industrial setting.<br>PROC3: Use in closed batch process (synthesis or formulation); Industrial setting.<br>PROC4: Use in batch and other processes (synthesis) where opportunity for exposure arises; Industrial setting.<br>PROC5: Mixing and blending in batch processes for formulation of preparations and articles (multistage and/or significant contact); Industrial setting.<br>PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non dedicated facilities; Industrial setting.<br>PROC8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities; Industrial setting.<br>PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing); Industrial setting. |
| **Environment characteristic covered** | ERC 6a: Industrial use of intermediates. |
| **1.2.1.2. Operational conditions and risk management measures** | |
| Use of Acrylic acid as intermediate to produce Acrylic acid esters (Acrylates) either at the production site of the substance (on-site) or at other locations (off-site). Most of the Acrylic acid producers are downstream integrated; so the majority of the substance is captive use. | |
| **1.2.1.2.1. Control of workers exposure for PROC 1** | |
| **Title information related to contributing scenario** | |
| **Workers related free short title** | Use in closed process, no likelihood of exposure. |
| **Use descriptor covered** | PROC 1 |
| **Processes, tasks, activities covered** | Use of the substance in high integrity contained system where little potential exists for exposures, e.g. any sampling via closed loop systems. |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications |
| | |
| **1.2.1.2.2. Control of workers exposure for PROC 2** | |
| **Title information related to contributing scenario** | |
| **Workers related free short title** | Use in closed, continuous process with occasional controlled exposure (e.g. sampling). |
| **Use descriptor covered** | PROC 2 |
| **Processes, tasks, activities covered** | Continuous process but where the design philosophy is not specifically aimed at minimizing emissions.<br>It is not high integrity and occasional exposure will arise e.g. through maintenance, sampling and equipment breakings. |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications |
| | |

| **1.2.1.2.3. Control of workers exposure for PROC 3** | | | |
|---|---|---|---|
| **Title information related to contributing scenario** | | | |
| **Workers related free short title** | Use in closed batch process (synthesis or formulation); Industrial setting. | | |
| **Use descriptor covered** | PROC 3 | | |
| **Processes, tasks, activities covered** | Batch manufacture of a chemical or formulation where the predominant handling is in a contained manner, but where some opportunity for contact with chemicals occurs (e.g. through sampling). | | |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications | | |
| | | | |
| **1.2.1.2.4. Control of workers exposure for PROC 4** | | | |
| **Title information related to contributing scenario** | | | |
| **Workers related free short title** | Use in batch and other process (synthesis) where opportunity for exposure arises; Industrial setting. | | |
| **Use descriptor covered** | PROC 4 | | |
| **Processes, tasks, activities covered** | Use in batch manufacture of a chemical where significant opportunity for exposure arises, e.g. during the charging, the sampling or discharge of material, and when the nature of the design is likely to result in exposure. | | |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications | | |
| **Scenario** | **1** | **2** | **3** |
| **Product characteristic** | | | |
| Physical state | liquid | liquid | liquid |
| Concentration of substance | 100% | 100% | 100% |
| **Amounts used** | | | |
| Not relevant | | | |
| **Operational conditions affecting workers exposure** | | | |
| Location | Indoors[1)] | Indoors[1)] | Indoors[1)] |
| Domain | Industrial | Industrial | Industrial |
| **Frequency and duration of use/exposure** | | | |
| Duration of exposure | > 4 hours/day | > 4 hours/day | 15 mins – 1 hour |
| Frequency of exposure | ≤ 240 days/year | ≤ 240 days/year | ≤ 240 days/year |
| **Human factors not influenced by risk management** | | | |
| Exposed skin surface | Palm of both hands (480 cm²) | Palm of both hands (480 cm²) | Palm of both hands (480 cm²) |
| **Technical conditions and measures at process level (source) to prevent release** | | | |
| Not relevant. | | | |
| **Technical conditions and measures to control dispersion from source towards the worker** | | | |
| Local exhaust ventilation[2)] | Yes<br>Effectiveness: 90% | no | no |
| **Organisational measures to prevent /limit releases, dispersion and exposure** | | | |
| Not relevant. | | | |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | | | |
| Suitable respiratory protection | no | 90% | no |
| Gloves[3)] | yes | yes | yes |

| **1.2.1.2.5. Control of workers exposure for PROC 5** | | | |
|---|---|---|---|
| **Title information related to contributing scenario** | | | |
| **Workers related free short title** | Mixing and blending in batch processes for formulation of preparations and articles (multistage and/or significant contact); Industrial setting. | | |
| **Use descriptor covered** | PROC 5 | | |
| **Processes, tasks, activities covered** | Manufacture or formulation of chemical products or articles using technologies related to mixing and blending of solid or liquid materials, and where the process is in stages and provides the opportunity for significant contact at any stage. | | |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications | | |
| **Product characteristic** | Industrial | | |
| Physical state | liquid | liquid | liquid |
| Concentration of substance | 100% | 100% | 100% |
| **Amounts used** | | | |
| Not relevant | | | |
| **Operational conditions affecting workers exposure** | | | |
| Location | Indoors[1)] | Indoors[1)] | Indoors[1)] |
| Domain | Industrial | Industrial | Industrial |
| **Frequency and duration of use/exposure** | | | |
| Duration of exposure | > 4 hours/day | > 4 hours/day | < 15 mins |
| Frequency of exposure | ≤ 240 days/year | ≤ 240 days/year | ≤ 240 days/year |
| **Human factors not influenced by risk management** | | | |
| Exposed skin surface | Palm of both hands (480 cm²) | Palm of both hands (480 cm²) | Palm of both hands (480 cm²) |
| **Technical conditions and measures at process level (source) to prevent release** | | | |
| Not relevant. | | | |
| **Technical conditions and measures to control dispersion from source towards the worker** | | | |
| Local exhaust ventilation[2)] | Yes<br>Effectiveness: 90% | no | no |
| **Organisational measures to prevent /limit releases, dispersion and exposure** | | | |
| Not relevant. | | | |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | | | |
| Suitable respiratory protection | no | 90% | no |
| Gloves[3)] | yes | yes | yes |
| **1.2.1.2.6. Control of workers exposure for PROC 8a** | | | |
| **Title information related to contributing scenario** | | | |
| **Workers related free short title** | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities; Industrial or non-industrial setting. | | |
| **Use descriptor covered** | PROC 8a | | |
| **Processes, tasks, activities covered** | Sampling, loading, filling, transfer, dumping, bagging in non dedicated facilities. Exposure related to dust, vapour, aerosols or spillage, and cleaning of equipment to be expected. | | |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications | | |
| | | | |

| **1.2.1.2.7. Control of workers exposure for PROC 8b** | |
|---|---|
| **Title information related to contributing scenario** | |
| **Workers related free short title** | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities; Industrial or non-industrial setting. |
| **Use descriptor covered** | PROC 8b |
| **Processes, tasks, activities covered** | Sampling, loading, filling, transfer, dumping, bagging in non dedicated facilities. Exposure related to dust, vapour, aerosols or spillage, and cleaning of equipment to be expected. |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications |

| **1.2.1.2.8. Control of workers exposure for PROC 9** | |
|---|---|
| **Title information related to contributing scenario** | |
| **Workers related free short title** | Transfer of substance or preparation into small containers (dedicated filling line, including weighing); Industrial setting. |
| **Use descriptor covered** | PROC 9 |
| **Processes, tasks, activities covered** | Filling lines specifically designed to for both, capturing vapour and aerosol emissions and minimise spillage. |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications |

| **1.2.1.2.9. Control of environmental exposure for ERC 6a** | |
|---|---|
| **Free short title** | Industrial use of intermediates. |
| **Use descriptor covered** | ERC 6a |
| **Description** | Use of intermediates in primarily the chemical industry using continuous processes or batch processes applying dedicated or multi-purpose equipment, either technically controlled or operated by manual interventions, for the synthesis (manufacture) of other substances. |
| **Assessment Method** | EUSES v2.1 |
| **Product characteristics** | |
| Physical state | liquid |
| Concentration of substance | 100% |
| **Amounts used** | |
| **Maximum daily use at a site** | ≤ 214 tons/day |
| **Maximum annual use at a site** | ≤ 64,318 tons/year |
| **Fraction of the main local source** | 0.15 |
| **Frequency and duration of use** | 300 days (no. of emission days/year) |
| **Pattern of release to the environment** | Continuous |
| **Environment factors not influenced by risk management** | |
| **Receiving surface water flow rate** | ≥ 18,000 $m^3$/d (default) |
| **Other given operational conditions affecting environmental exposure** | |
| Industry category | 3: Chemical industry: chemicals used in synthesis |
| Use category | 33: Intermediates |
| Main category industrial use | Ib Continuous production process |
| Extra details on use category | Wet process |
| Emission tables | Industrial use: A3.3, B3.2 |
| Indoor use. | |
| Release fraction to air from process | 1E-05 (default) |

| | |
|---|---|
| Release fraction to wastewater from process | 5E-04 (default) |
| Release fraction to soil from process | 1E-04 (default) |
| **Technical conditions and measures at process level (source) to prevent release** | |
| Fraction connected to sewer system | 100% |
| Not relevant | |
| **Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil** | |
| Dry sludge application to agricultural soil | no |
| **Organizational measures to prevent/limit release from site** | |
| Fraction of EU tonnage for region (private use) | 0% |
| **Conditions and measures related to municipal sewage treatment plant** | |
| **Municipal Sewage Treatment Plant (STP)** | Yes (freshwater and marine assessment) |
| **Discharge rate of the Municipal STP** | ≥ 2000 $m^3$/d (default) |
| **Incineration of the sludge of the Municipal STP** | default |
| **Concentration of chemical in untreated wastewater** | 53.6 mg/L (based on EUSES output) |
| **Concentration of chemical (total) in the STP effluent** | 10 µg/L (based on analytical results) |
| **Conditions and measures related to external treatment of waste for disposal** | |
| Not relevant | |
| **Conditions and measures related to external recovery of waste** | |
| Not relevant | |

**1)** Indoors: "Indoors without LEV" covers as a worst-case scenario also "Outdoor" uses.

**2)** The LEV exposure modifying factors for dermal exposure implemented in the ECETOC TRA v2.0 are not considered.

**3)** Gloves were implemented as an additional RMM. The following effectiveness values are assumed: Use of suitable gloves: 80%; Use of suitable gloves in combination with basic employee training: 90%; Use of suitable gloves in combination with specific activity training: 95%; Use of suitable gloves in combination with intensive management supervision controls: 98%.
Suitable gloves are: butyl rubber gloves (0.7mm thickness, >480 min resistance against Acrylic acid).

## 1.2.2. Exposure Estimation

For the estimated exposure for workers / PROC 1 see Table 4
For the estimated exposure for workers / PROC 2 see Table 5
For the estimated exposure for workers / PROC 3 see Table 6
For the estimated exposure for workers / PROC 8a see Table 7
For the estimated exposure for workers / PROC 8b see Table 8
For the estimated exposure for workers / PROC 9 see Table 9

**Table 12: Estimated exposure for workers / PROC 4**

| **Route of exposure** | **Concentrations** Value | | | | **Justification** |
|---|---|---|---|---|---|
| Technical conditions and measures | Scenario 1 | Scenario 2 | Scenario 3 | Unit | |
| Long-term exposure, local, dermal | 200.0 | 200.0 | 200.0 | µg/cm² | NA |

| | | | | | |
|---|---|---|---|---|---|
| Long-term exposure, local, inhalative | 6.008 | 6.008 | 12.017 | mg/m³ | NA |
| Short-term exposure, local, dermal | 200.0 | 200.0 | 100.0 | µg/cm² | NA |

NA = Not applicable
Scenario 1: Indoor, LEV, No respirator, duration of activity: >4 hrs
Scenario 2: Indoor, no LEV, respirator (TRA 90% efficiency), duration of activity > 4 hrs
Scenario 3: Indoor, no LEV, no respirator, duration of activity 15mins – 1 hr.

**Table 13: Estimated exposure for workers / PROC 5**

| **Route of exposure** | **Concentrations** Value | | | | **Justification** |
|---|---|---|---|---|---|
| Technical conditions and measures | Scenario 1 | Scenario 2 | Scenario 3 | Unit | |
| Long-term exposure, local, dermal | 400.0 | 400.0 | 400.0 | µg/cm² | NA |
| Long-term exposure, local, inhalative | 15.021 | 15.021 | 15.021 | mg/m³ | NA |
| Short-term exposure, local, dermal | 400.0 | 400.0 | 400.0 | µg/cm² | NA |

NA = Not applicable
Scenario 1: Indoor, LEV, No respirator, duration of activity: >4 hrs
Scenario 2: Indoor, no LEV, respirator (TRA 90% efficiency), duration of activity > 4 hrs
Scenario 3: Indoor, no LEV, no respirator, duration of activity < 15 mins

**Table 14: Estimated exposure for the environment / Manufacture of intermediates on-site / off-site (ERC 6a)**

| **Compartment** | **PEC / TDI** | | **Unit** | **Remark** |
|---|---|---|---|---|
| | Esterification on-site | Esterification off-site | | |
| STP | 0.01 | 0.01 | mg L-1 | NA |
| Freshwater (emission period) | 0.00145 | 0.00145 | mg L-1 | |
| Freshwater sediment | 0.00248 | 0.00248 | mg kgwwt-1 | |
| Soil (grass land) | 0.0075 | 0.00199 | mg kgwwt-1 | |
| Marine water (emission period) | 0.000154 | 0.000154 | mg L-1 | |
| Marine water sediment | 0.000264 | 0.000264 | mg kgwwt-1 | |
| Total daily intake man via the environment | 0.000326 | 0.00013 | mg.kgbw-1.d-1 | |

| **Compartment** | **PEC** | | **Unit** | **Remark** |
|---|---|---|---|---|
| Air (annual average) | 0.000557 | 0.000166 | mg.m-3 | NA |

NA = Not applicable

# 1.3. Polymerization at Production Sites of Substance (on-site) and at Downstream User Sites (off-site): Superabsorber Polymers and other Polyacrylates

## 1.3.1. Exposure Scenario 3

Exposure Scenario 3 covers all polymerizations (wet), where the substance is used as monomer (downstream use).
The respective polymerizations of Acrylic acid are manufacture of Superabsorber Polymers (on-site and off-site, with regard where the substance is produced) and Polyacrylates (on-site and off-site).
On-, off-site polymerizations can be captive or merchant use of the substance.
Based on identical use descriptors, these processes can be described with a common Exposure Scenario.

**Table 15: Description of the ES 3**

| **1.3.1.1. Title** | |
|---|---|
| **Reference number** | 3 |
| **Free short title** | Wet polymerization at Acrylic Acid production sites (on-site) or off-site |
| **Systematic title based on use descriptor** | SU 8, 9 and 12; PROC 1, 2, 3, 4, 5, 8a, 8b, 9; ERC 6c and 6d |
| **Processes, tasks, activities covered** | PROC1: Use in closed process, no likelihood of exposure; Industrial setting.<br>PROC2: Use in closed, continuous process with occasional controlled exposure (e.g. sampling); Industrial setting.<br>PROC3: Use in closed batch process (synthesis or formulation); Industrial setting.<br>PROC4: Use in batch and other processes (synthesis) where opportunity for exposure arises; Industrial setting.<br>PROC5: Mixing and blending in batch processes for formulation of preparations and articles (multistage and/or significant contact); Industrial setting.<br>PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non dedicated facilities; Industrial setting.<br>PROC8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities; Industrial setting.<br>PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing); Industrial setting. |
| **Environment characteristic covered** | ERC 6c: Industrial use of monomers for polymerization<br>ERC 6d: Industrial use of process regulators for polymerisation processes in production of resins, rubbers, polymers. |
| **1.3.1.2. Operational conditions and risk management measures** | |
| Polymerization of Acrylic acid at either the sites where the substance is produced (on-site) or off-site. Most Acrylic acid producers have downstream applications; the amount of the substance used by non-acid producers is minor. | |
| Polymerization processes, where the manufacturer of the substance is also operating on- or offsite polymerizations, are limited to the 5 production sites in EU. | |
| **1.3.1.2.1. Control of workers exposure for PROC 1** | |
| **Title information related to contributing scenario** | |
| **Workers related free short title** | Use in closed process, no likelihood of exposure. |
| **Use descriptor covered** | PROC 1 |
| **Processes, tasks, activities covered** | Use of the substance in high integrity contained system where little potential exists for exposures, e.g. any sampling via closed loop systems. |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications |
| | |

| **1.3.1.2.2. Control of workers exposure for PROC 2** | |
|---|---|
| **Title information related to contributing scenario** | |
| **Workers related free short title** | Use in closed, continuous process with occasional controlled exposure (e.g. sampling). |
| **Use descriptor covered** | PROC 2 |
| **Processes, tasks, activities covered** | Continuous process but where the design philosophy is not specifically aimed at minimizing emissions.<br>It is not high integrity and occasional exposure will arise e.g. through maintenance, sampling and equipment breakings. |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications |
| | |
| **1.3.1.2.3. Control of workers exposure for PROC 3** | |
| **Title information related to contributing scenario** | |
| **Workers related free short title** | Use in closed batch process (synthesis or formulation); Industrial setting. |
| **Use descriptor covered** | PROC 3 |
| **Processes, tasks, activities covered** | Batch manufacture of a chemical or formulation where the predominant handling is in a contained manner, but where some opportunity for contact with chemicals occurs (e.g. through sampling). |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications |
| | |
| **1.3.1.2.4. Control of workers exposure for PROC 4** | |
| **Title information related to contributing scenario** | |
| **Workers related free short title** | Use in batch and other process (synthesis) where opportunity for exposure arises; Industrial setting. |
| **Use descriptor covered** | PROC 4 |
| **Processes, tasks, activities covered** | Use in batch manufacture of a chemical where significant opportunity for exposure arises, e.g. during the charging, the sampling or discharge of material, and when the nature of the design is likely to result in exposure. |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications |
| | |
| **1.3.1.2.5. Control of workers exposure for PROC 5** | |
| **Title information related to contributing scenario** | |
| **Workers related free short title** | Mixing and blending in batch processes for formulation of preparations and articles (multistage and/or significant contact); Industrial setting. |
| **Use descriptor covered** | PROC 5 |
| **Processes, tasks, activities covered** | Manufacture or formulation of chemical products or articles using technologies related to mixing and blending of solid or liquid materials, and where the process is in stages and provides the opportunity for significant contact at any stage. |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications |
| | |

| **1.3.1.2.6. Control of workers exposure for PROC 8a** | |
|---|---|
| **Title information related to contributing scenario** | |
| **Workers related free short title** | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities; Industrial or non-industrial setting. |
| **Use descriptor covered** | PROC 8a |

| | |
|---|---|
| **Processes, tasks, activities covered** | Sampling, loading, filling, transfer, dumping, bagging in non dedicated facilities. Exposure related to dust, vapour, aerosols or spillage, and cleaning of equipment to be expected. |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications |
| | |
| **1.3.1.2.7. Control of workers exposure for PROC 8b** | |
| **Title information related to contributing scenario** | |
| **Workers related free short title** | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities; Industrial or non-industrial setting. |
| **Use descriptor covered** | PROC 8b |
| **Processes, tasks, activities covered** | Sampling, loading, filling, transfer, dumping, bagging in non dedicated facilities. Exposure related to dust, vapour, aerosols or spillage, and cleaning of equipment to be expected. |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications |
| | |
| **1.3.1.2.8. Control of workers exposure for PROC 9** | |
| **Title information related to contributing scenario** | |
| **Workers related free short title** | Transfer of substance or preparation into small containers (dedicated filling line, including weighing); Industrial setting. |
| **Use descriptor covered** | PROC 9 |
| **Processes, tasks, activities covered** | Filling lines specifically designed to for both, capturing vapour and aerosol emissions and minimise spillage. |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications |
| | |

| | |
|---|---|
| **1.3.1.2.9. Control of environmental exposure for ERC 6c and ERC 6d** | |
| **Free short title** | Industrial use of monomers for polymerization |
| **Use descriptor covered** | ERC 6c, 6d |
| **Description** | ERC 6c: Industrial use of monomers in the production of plastics (thermoplastics), polymerization processes. For example the use of vinyl chloride in the production of PVC.<br>ERC 6d: Industrial use of chemicals (cross-linking agents, curing agents) in the production of thermosets and rubbers, polymer processing. For instance the use of styrene in polyester production or vulcanization agents in the production of rubbers. |
| **Assessment Method** | EUSES v2.1 |
| **Product characteristics** | |
| Physical state | liquid |
| Concentration of substance | 100% |
| **Amounts used** | |
| **Maximum daily use at a site** | SAP on-site ≤ 54 tons/day<br>SAP off-site ≤ 39 tons/day<br>Polyacrylates on-site ≤ 11 tons/day<br>Polyacrylates off-site ≤ 11 tons/day |
| **Maximum annual use at a site** | SAP on-site ≤ 16,250 tons/year<br>SAP off-site ≤ 11,700 tons/year<br>Polyacrylates on-site ≤ 3,250 tons/year<br>Polyacrylates off-site ≤ 3,250 tons/year |

| | |
|---|---|
| **Fraction of the main local source** | 0.05 (default) |
| **Frequency and duration of use** | 300 days (no. of emission days/year) |
| **Pattern of release to the environment** | Continuous |
| **Environment factors not influenced by risk management** | |
| **Receiving surface water flow rate** | ≥ 18,000 $m^3$/d (default) |
| **Other given operational conditions affecting environmental exposure** | |
| Industry category | 11: Polymers industry |
| Use category | 43: Process regulators |
| Main category industrial use | III Non-dispersive use |
| Extra details on use category | Wet: monomers |
| Emission tables | Industrial use: A3.10, B3.9 |
| Indoor use. | |
| Release fraction to air from process | SAP: 1E-04 (default)<br>Polyacrylates : 1E-02 (default) |
| Release fraction to wastewater from process | SAP: 1E-02 (default)<br>Polyacrylates : 1E-02 (default) |
| Release fraction to soil from process | SAP: 0 (default)<br>Polyacrylates : 0 (default) |
| **Technical conditions and measures at process level (source) to prevent release** | |
| Fraction connected to sewer system | 100% |
| **Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil** | |
| Dry sludge application to agricultural soil | no |
| **Organizational measures to prevent/limit release from site** | |
| Fraction of EU tonnage for region (private use) | 0% |
| **Conditions and measures related to municipal sewage treatment plant** | |
| **Municipal Sewage Treatment Plant (STP)** | Yes (freshwater and marine assessment) |
| **Discharge rate of the Municipal STP** | ≥ 2,000 $m^3$/d (default) |
| **Incineration of the sludge of the Municipal STP** | default |
| **Concentration of chemical in untreated wastewater (Superabsorber production on-site as largest user)** | 271 mg/L (based on EUSES output) |
| **Concentration of chemical (total) in the STP effluent** | 10 µg/L (based on analytical results) |
| **Conditions and measures related to external treatment of waste for disposal** | |
| Not relevant | |
| **Conditions and measures related to external recovery of waste** | |
| Not relevant | |

## 1.3.2. Exposure Estimation

For the estimated exposure for workers / PROC 1 see Table 4
For the estimated exposure for workers / PROC 2 see Table 5
For the estimated exposure for workers / PROC 3 see Table 6
For the estimated exposure for workers / PROC 4 see Table 12
For the estimated exposure for workers / PROC 5 see Table 13

For the estimated exposure for workers / PROC 8a see Table 7
For the estimated exposure for workers / PROC 8b see Table 8
For the estimated exposure for workers / PROC 9 see Table 9

**Table 16: Estimated exposure for the environment / Wet polymerization (ERC 6c and ERC 6d)**

| Compartment | PEC / TDI | | | | Unit | Remark |
|---|---|---|---|---|---|---|
| | SAP on-site | SAP off-site | P-Acrylates (on-site) | P-Acrylates (off-site) | | |
| STP | 0.01 | 0.01 | 0.01 | 0.01 | mg L-1 | |
| Freshwater (emission period) | 0.00145 | 0.00145 | 0.00145 | 0.00145 | mg L-1 | |
| Freshwater sediment | 0.00248 | 0.00248 | 0.00248 | 0.00248 | mg kgwwt-1 | |
| Soil (grass land) | 0.0351 | 0.0255 | 0.0139 | 0.0139 | mg kgwwt-1 | |
| Marine water (emission period) | 0.000154 | 0.000154 | 0.000154 | 0.000154 | mg L-1 | |
| Marine water sediment | 0.000264 | 0.000264 | 0.000264 | 0.000264 | mg kgwwt-1 | |
| Total daily intake man via the environment | 0.000701 | 0.000527 | 0.0126 | 0.0126 | mg.kgbw-1.d-1 | |

| Compartment | PEC | | | | Unit | Remark |
|---|---|---|---|---|---|---|
| Air (annual average) | SAP on-site | SAP off-site | P-Acrylates (on-site) | P-Acrylates (off-site) | mgc.m-3 | |
| | 0.0013 | 0.000958 | 0.0248 | 0.0248 | | |

NA = Not applicable

# 1.4. Other Uses of Substance as Intermediate

## 1.4.1. Exposure Scenario ES 4

Exposure Scenario 4 covers applications where the substance is used as intermediate forming another substance or monomer (e.g. reaction at the double bond, alkylations etc.).

**Table 17: Description of the ES 4**

| **1.4.1.1. Title** | |
|---|---|
| **Reference number** | 4 |
| **Free short title** | Manufacture of intermediates at production sites of substance (on-site) and at other sites (off-site): e.g. Esterification. |
| **Systematic title based on use descriptor** | SU 8 and 9; PROC 1, 2, 3, 4, 5, 8a, 8b, and 9; ERC 6a |
| **Processes, tasks, activities covered** | PROC1: Use in closed process, no likelihood of exposure; Industrial setting.<br>PROC2: Use in closed, continuous process with occasional controlled exposure (e.g. sampling); Industrial setting.<br>PROC3: Use in closed batch process (synthesis or formulation); Industrial setting.<br>PROC4: Use in batch and other processes (synthesis) where opportunity for exposure arises; Industrial setting.<br>PROC5: Mixing and blending in batch processes for formulation of preparations and articles (multistage and/or significant contact); Industrial setting.<br>PROC8a: Transfer of substance or preparation (charging/discharging) |

| | |
|---|---|
| | from/to vessels/large containers at non dedicated facilities; Industrial setting.<br>PROC8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities; Industrial setting.<br>PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing); Industrial setting. |
| **Environment characteristic covered** | ERC 6a: Industrial use of intermediates. |
| **1.4.1.2. Operational conditions and risk management measures** | |
| Use of Acrylic acid as an intermediate at either the sites where the substance is produced (on-site) or off-site. Most Acrylic acid producers have downstream applications; the amount of the substance used by non-acid producers is minor. | |
| **1.4.1.2.1. Control of workers exposure for PROC 1** | |
| **Title information related to contributing scenario** | |
| **Workers related free short title** | Use in closed process, no likelihood of exposure. |
| **Use descriptor covered** | PROC 1 |
| **Processes, tasks, activities covered** | Use of the substance in high integrity contained system where little potential exists for exposures, e.g. any sampling via closed loop systems. |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications |
| | |
| **1.4.1.2.2. Control of workers exposure for PROC 2** | |
| **Title information related to contributing scenario** | |
| **Workers related free short title** | Use in closed, continuous process with occasional controlled exposure (e.g. sampling). |
| **Use descriptor covered** | PROC 2 |
| **Processes, tasks, activities covered** | Continuous process but where the design philosophy is not specifically aimed at minimizing emissions.<br>It is not high integrity and occasional exposure will arise e.g. through maintenance, sampling and equipment breakings. |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications |
| | |
| **1.4.1.2.3. Control of workers exposure for PROC 3** | |
| **Title information related to contributing scenario** | |
| **Workers related free short title** | Use in closed batch process (synthesis or formulation); Industrial setting. |
| **Use descriptor covered** | PROC 3 |
| **Processes, tasks, activities covered** | Batch manufacture of a chemical or formulation where the predominant handling is in a contained manner, but where some opportunity for contact with chemicals occurs (e.g. through sampling). |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications |
| | |
| **1.4.1.2.4. Control of workers exposure for PROC 4** | |
| **Title information related to contributing scenario** | |
| **Workers related free short title** | Use in batch and other process (synthesis) where opportunity for exposure arises; Industrial setting. |
| **Use descriptor covered** | PROC 4 |
| **Processes, tasks, activities covered** | Use in batch manufacture of a chemical where significant opportunity for exposure arises, e.g. during the charging, the sampling or discharge of material, and when the nature of the design is likely to result in exposure. |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications |
| | |

| **1.4.1.2.5. Control of workers exposure for PROC 5** | |
|---|---|
| **Title information related to contributing scenario** | |
| **Workers related free short title** | Mixing and blending in batch processes for formulation of preparations and articles (multistage and/or significant contact); Industrial setting. |
| **Use descriptor covered** | PROC 5 |
| **Processes, tasks, activities covered** | Manufacture or formulation of chemical products or articles using technologies related to mixing and blending of solid or liquid materials, and where the process is in stages and provides the opportunity for significant contact at any stage. |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications |
| | |
| **1.4.1.2.6. Control of workers exposure for PROC 8a** | |
| **Title information related to contributing scenario** | |
| **Workers related free short title** | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities; Industrial or non-industrial setting. |
| **Use descriptor covered** | PROC 8a |
| **Processes, tasks, activities covered** | Sampling, loading, filling, transfer, dumping, bagging in non dedicated facilities. Exposure related to dust, vapour, aerosols or spillage, and cleaning of equipment to be expected. |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications |
| | |
| **1.4.1.2.7. Control of workers exposure for PROC 8b** | |
| **Title information related to contributing scenario** | |
| **Workers related free short title** | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities; Industrial or non-industrial setting. |
| **Use descriptor covered** | PROC 8b |
| **Processes, tasks, activities covered** | Sampling, loading, filling, transfer, dumping, bagging in non dedicated facilities. Exposure related to dust, vapour, aerosols or spillage, and cleaning of equipment to be expected. |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications |
| | |
| **1.4.1.2.8. Control of workers exposure for PROC 9** | |
| **Title information related to contributing scenario** | |
| **Workers related free short title** | Transfer of substance or preparation into small containers (dedicated filling line, including weighing); Industrial setting. |
| **Use descriptor covered** | PROC 9 |
| **Processes, tasks, activities covered** | Filling lines specifically designed to for both, capturing vapour and aerosol emissions and minimise spillage. |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications |
| | |
| **1.4.1.2.9. Control of environmental exposure for ERC 6a** | |
| **Free short title** | Industrial use of intermediates. |
| **Use descriptor covered** | ERC 6a |
| **Description** | Use of intermediates in primarily the chemical industry using continuous processes or batch processes applying dedicated or multi-purpose equipment, either technically controlled or operated by manual interventions, for the |

| | |
|---|---|
| | synthesis (manufacture) of other substances. |
| **Assessment Method** | EUSES v2.1 |
| | |

### 1.4.2. Exposure Estimation

For the estimated exposure for workers / PROC 1 see Table 4
For the estimated exposure for workers / PROC 2 see Table 5
For the estimated exposure for workers / PROC 3 see Table 6
For the estimated exposure for workers / PROC 4 see Table 12
For the estimated exposure for workers / PROC 5 see Table 13
For the estimated exposure for workers / PROC 8a see Table 7
For the estimated exposure for workers / PROC 8b see Table 8
For the estimated exposure for workers / PROC 9 see Table 9
For the estimated environmental exposure / ERC 6a see Table 14

## 1.5. Use of Substance as laboratory reagent

### 1.5.1. Exposure Scenario ES 5

**Table 18: Description of the ES 5**

| **1.5.1.1. Title** | | | |
|---|---|---|---|
| **Reference number** | 5 | | |
| **Free short title** | Use as laboratory reagent | | |
| **Systematic title based on use descriptor** | SU 8 , 9, 24; PROC 15; ERC 1 | | |
| **Processes, tasks, activities covered** | PROC15: Use a laboratory reagent; Non-industrial setting. | | |
| **Environment characteristic covered** | ERC1: Production of chemicals. | | |
| **1.5.1.2. Operational conditions and risk management measures** | | | |
| Use as laboratory agent at the 6 production sites in Europe. | | | |
| **1.5.1.2.1. Control of workers exposure for PROC 15** | | | |
| **Title information related to contributing scenario** | | | |
| **Workers related free short title** | Use a laboratory reagent; Non-industrial setting. | | |
| **Use descriptor covered** | PROC 15 | | |
| **Processes, tasks, activities covered** | Use of substances at small scale laboratory (< 1 L or 1 kg). Larger laboratories and R+D installations should be treated as industrial processes. | | |
| **Assessment Method** | ECETOC TRA Worker v2.0 with modifications | | |
| **Scenario** | **1** | **2** | **3** |
| **Product characteristic** | | | |
| Physical state | liquid | liquid | liquid |
| Concentration of substance | 100% | 100% | 100% |
| **Amounts used** | | | |
| This information is not needed for assessment of worker's exposure. | | | |
| **Operational conditions affecting workers exposure** | | | |
| Location | Indoors[1)] | Indoors[1)] | Indoors[1)] |
| Domain | Industrial | Industrial | Industrial |
| **Frequency and duration of use/exposure** | | | |

| | | | |
|---|---|---|---|
| Duration of exposure | > 4 hours | > 4 hours | 1 – 4 hours |
| Frequency of exposure | ≤ 240 days/year | ≤ 240 days/year | ≤ 240 days/year |
| **Human factors not influenced by risk management** | | | |
| Exposed skin surface | Palm of one hand (240 cm²) | Palm of one hand (240 cm²) | Palm of one hand (240 cm²) |
| **Technical conditions and measures at process level (source) to prevent release** | | | |
| Not relevant. | | | |
| **Technical conditions and measures to control dispersion from source towards the worker** | | | |
| Local exhaust ventilation[2)] | Yes Effectiveness: 90% | no | no |
| **Organisational measures to prevent /limit releases, dispersion and exposure** | | | |
| Not relevant. | | | |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | | | |
| Suitable respiratory protection | no | 90% | no |
| Gloves[3)] | yes | yes | yes |

| | |
|---|---|
| **1.5.1.2.2. Control of environmental exposure for ERC 1** | |
| **Free short title** | Production of chemical. |
| **Use descriptor covered** | ERC 1 |
| **Description** | Production of organic and inorganic substances in chemical, petrochemical, primary metals and minerals industry including intermediates, monomers using continuous processes or batch processes applying dedicated or multi-purpose equipment, either technically controlled or operated by manual interventions. |
| **Assessment Method** | EUSES v2.1 |
| | |

1) Indoors: "Indoors without LEV" covers as a worst-case scenario also "Outdoor" uses.

2) The LEV exposure modifying factors for dermal exposure implemented in the ECETOC TRA v2.0 are not considered.

3) Gloves were implemented as an additional RMM. The following effectiveness values are assumed: Use of suitable gloves: 80%; Use of suitable gloves in combination with basic employee training: 90%; Use of suitable gloves in combination with specific activity training: 95%; Use of suitable gloves in combination with intensive management supervision controls: 98%. Suitable gloves are: butyl rubber gloves (0.7mm thickness, >480 min resistance against Acrylic acid).

## 1.5.2. Exposure Estimation

**Table 19: Estimated exposure for workers, Industrial Settings/ PROC 15**

| **Route of exposure**<br>**Industrial** | **Concentrations**<br>Value | | | | **Justification** |
|---|---|---|---|---|---|
| Technical conditions and measures | Scenario 1 | Scenario 2 | Scenario 3 | Unit | |
| Long-term exposure, local, dermal | 20.0 | 20.0 | 20.0 | µg/cm² | NA |

| | | | | | |
|---|---|---|---|---|---|
| Long-term exposure, local, inhalative | 3.004 | 3.004 | 18.025 | mg/m$^3$ | NA |
| Short-term exposure, local, dermal | 20.0 | 20.0 | 20.0 | µg/cm² | NA |

NA = Not applicable
Scenario 1: Indoor with LEV, No respirator, duration of activity: > 4 hrs
Scenario 2: Indoor, no LEV, Respirator (TRA 90% efficiency, duration of activity: > 4 hrs
Scenario 3: Indoor, no LEV, no respirator, duration of activity: 1-4 hrs

For the estimated exposure for workers / PROC 1 see Table 4
For the estimated exposure for workers / PROC 2 see Table 5
For the estimated exposure for workers / PROC 3 see Table 6
For the estimated exposure for workers / PROC 4 see Table 12
For the estimated exposure for workers / PROC 5 see Table 13
For the estimated exposure for workers / PROC 8a see Table 7
For the estimated exposure for workers / PROC 8b see Table 8
For the estimated exposure for workers / PROC 9 see Table 9
For the estimated exposure for the environment / ERC 1 see Table 10

# 2. RISK CHARACTERIZATION

**General remarks**

Human health – Industrial Worker

- Risk characterization for systemic inhalative effects:
  As discussed in the hazard assessment, Acrylic acid does not exert long-term systemic toxicity at doses below local irritation effects on the upper respiratory tract and the proposed local DNEL for inhalation is considered to be protective also from systemic toxicity. Thus the exposure scenarios for which a RCR < 1 can be demonstrated comparing the exposure valued with the local inhalative DNEL also cover systemic effects.
  Since the risk characterization is solely based on local effects, no RCR combined which applies only to systemic effects, was calculated.
- Risk characterization for short-term effects:
  For risk characterization of short-term effects, only the dermal route was taken into consideration. As stated before, local irritation effects on the upper respiratory tract are the most critical effects observed after short-term or long-term exposure via inhalation determining the DNEL. Long-term exposure scenarios for which a RCR < 1 can be demonstrated comparing the exposure valued with the local inhalative DNEL also cover short-term exposure.
- The risk assessment covers the life cycle of the substance as monomer until the polymerization reaction and as intermediate forming a new substance or new monomer. The unreacted residual monomer in a polymer is to be regarded as impurity (<1000 ppm) that need not to be critically addressed in the exposure assessment.

Environment

- Releases of Acrylic acid into the environment are to be expected during production of Acrylic acid and processing (esterification resulting in a new monomer and polymerization of Acrylic acid as monomer) mainly via wastewater and to a lesser extent via exhaust gases.
  The risk assessment covers the life cycle of the substance (monomer) until the polymerization reaction and as intermediate forming a new substance or new monomer. The unreacted residual monomer in a polymer is to be regarded as impurity (<1000 ppm) that need not to be critically addressed in the risk assessment.

## 2.1. Manufacture and Distribution of the Substance

### 2.1.1. Human Health

#### 2.1.1.1. Worker

**Table 20: Risk characterization – Worker / PROC 1**

| | Exposure estimate | | | DNEL | RCR per route | | | Safe use |
|---|---|---|---|---|---|---|---|---|
| **Exposure** | Scenario 1 | Scenario 2 | Scenario 3 | | Scenario 1 | Scenario 2 | Scenario 3 | |
| Long-term exposure, local, inhalative | 0.030 mg/m³ | Not required | Not required | 30,0 mg/m³ | 0.001 | Not required | Not required | **yes** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Long-term exposure, local, dermal | 100.0 µg/cm² | Not required | Not required | 1000µg/cm² | 0.10 | Not required | Not required | **yes** |
| Short-term exposure, local, dermal | 100.0 µg/cm² | Not required | Not required | 1000µg/cm² | 0.10 | Not required | Not required | **yes** |

Scenario 1: Indoors, LEV, no respirator, duration of activity > 4hrs.
Scenario 2: Indoors, no LEV, respirator (90% efficiency), max. tolerable duration of activity
Scenario 3: Indoors, no LEV, no respirator, max. tolerable duration of activity

**Table 21: Risk characterization – Worker / PROC 2**

| | **Exposure estimate** | | | **DNEL** | **RCR per route** | | | **Safe use** |
|---|---|---|---|---|---|---|---|---|
| **Exposure** | Scenario 1 | Scenario 2 | Scenario 3 | | Scenario 1 | Scenario 2 | Scenario 3 | |
| Long-term exposure, local, inhalative | 3.004 mg/m³ | 3.004 mg/m³ | 18.025 mg/m³ | 30,0 mg/m³ | 0.10 | 0.1001 | 0.6008 | **yes** |
| Long-term exposure, local, dermal | 40.0 µg/cm² | 40.0 µg/cm² | 40.0 µg/cm² | 1000 µg/cm² | 0.04 | 0.04 | 0.04 | **yes** |
| Short-term exposure, local, dermal | 40.0 µg/cm² | 40.0 µg/cm² | 40.0 µg/cm² | 1000 µg/cm² | 0.04 | 0.1429 | 0.1429 | **yes** |

Scenario 1: Indoors, LEV, no respirator, duration of activity > 4hrs.
Scenario 2: Indoors, no LEV, respirator (90 % efficiency), duration of activity >4hrs
Scenario 3: Indoors, no LEV, no respirator, duration of activity 1-4hrs

**Table 22: Risk characterization – Worker / PROC 3**

| | **Exposure estimate** | | | **DNEL** | **RCR per route** | | | **Safe use** |
|---|---|---|---|---|---|---|---|---|
| **Exposure** | Scenario 1 | Scenario 2 | Scenario 3 | | Scenario 1 | Scenario 2 | Scenario 3 | |
| Long-term exposure, local, inhalative | 7.510 mg/m³ | 7.510 mg/m³ | 15.021 mg/m³ | 30,0 mg/m³ | 0.25 | 0.25 | 0.5 | **yes** |
| Long-term exposure, local, dermal | 20.0 µg/cm² | 20.0 µg/cm² | 20.0 µg/cm² | 1000µg/cm² | 0.02 | 0.02 | 0.02 | **yes** |
| Short-term exposure, local, dermal | 20.0 µg/cm² | 20.0 µg/cm² | 20.0 µg/cm² | 1000 µg/cm² | 0.02 | 0.02 | 0.02 | **yes** |

Scenario 1: Indoors, LEV, no respirator, duration of activity > 4hrs.
Scenario 2: Indoors, no LEV, respirator (90% efficiency), duration of activity >4hrs
Scenario 3: Indoors, no LEV, no respirator, duration of activity 15mins-1hr

**Table 23: Risk characterization – Worker / PROC 8a**

| | Exposure estimate | | | DNEL | RCR per route | | | Safe use |
|---|---|---|---|---|---|---|---|---|
| **Exposure** | Scenario 1 | Scenario 2 | Scenario 3 | | Scenario 1 | Scenario 2 | Scenario 3 | |
| Long-term exposure, local, inhalative | 15.021 mg/m³ | 15.021 mg/m³ | 15.021 mg/m³ | 30,0 mg/m³ | 0.501 | 0.501 | 0.501 | **yes** |
| Long-term exposure, local, dermal | 200.0 µg/cm² | 200.0 µg/cm² | 200.0 µg/cm² | 1000µg/cm² | 0.2 | 0.2 | 0.2 | **yes** |
| Short-term exposure, local, dermal | 200.0 µg/cm² | 200.0 µg/cm² | 200.0 µg/cm² | 1000 µg/cm² | 0.2 | 0.2 | 0.2 | **yes** |

Scenario 1: Indoors, LEV, no respirator, duration of activity > 4hrs.
Scenario 2: Indoors, no LEV, respirator (90% efficiency), duration of activity >4hrs
Scenario 3: Indoors, no LEV, no respirator, duration of activity <15mins

**Table 24: Risk characterization – Worker / PROC 8b**

| | Exposure estimate | | | DNEL | RCR per route | | | Safe use |
|---|---|---|---|---|---|---|---|---|
| **Exposure** | Scenario 1 | Scenario 2 | Scenario 3 | | Scenario 1 | Scenario 2 | Scenario 3 | |
| Long-term exposure, local, inhalative | 4.506 mg/m³ | 15.021 mg/m³ | 15.021 mg/m³ | 30,0 mg/m³ | 0.15 | 0.501 | 0.501 | **yes** |
| Long-term exposure, local, dermal | 200.0 µg/cm² | 200.0 µg/cm² | 200.0 µg/cm² | 1000µg/cm² | 0.20 | 0.20 | 0.20 | **yes** |
| Short-term exposure, local, dermal | 200.0 µg/cm² | 200.0 µg/cm² | 200.0 µg/cm² | 1000 µg/cm² | 0.20 | 0.20 | 0.20 | **yes** |

Scenario 1: Indoors, LEV, no respirator, duration of activity > 4hrs.
Scenario 2: Indoors, no LEV, respirator (90% efficiency), duration of activity >4hrs
Scenario 3: Indoors, no LEV, no respirator, duration of activity <15mins

**Table 25: Risk characterization – Worker / PROC 9**

| | Exposure estimate | | | DNEL | RCR per route | | | Safe use |
|---|---|---|---|---|---|---|---|---|
| **Exposure** | Scenario 1 | Scenario 2 | Scenario 3 | | Scenario 1 | Scenario 2 | Scenario 3 | |
| Long-term exposure, local, inhalative | 15.021 mg/m³ | 15.021 mg/m³ | 15.021 mg/m³ | 30,0 mg/m³ | 0.501 | 0.501 | 0.501 | **yes** |
| Long-term exposure, local, dermal | 200.0 µg/cm² | 200.0 µg/cm² | 200.0 µg/cm² | 1000µg/cm² | 0.20 | 0.20 | 0.20 | **yes** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Short-term exposure, local, dermal | 200.0 µg/cm$^2$ | 200.0 µg/cm$^2$ | 200.0 µg/cm$^2$ | 1000 µg/cm$^2$ | 0.20 | 0.20 | 0.20 | **yes** |

Scenario 1: Indoors, LEV, no respirator, duration of activity > 4hrs.
Scenario 2: Indoors, no LEV, respirator (90% efficiency), duration of activity >4hrs
Scenario 3: Indoors, no LEV, no respirator, duration of activity <15mins

**2.1.1.2. Consumer**
Not relevant.

### *2.1.1.3. Indirect Exposure to Humans via the Environment*

Indirect exposure to humans via the environment was calculated on a local scale and on a regional scale.
Input data for estimating the RCR:
DNEL (consumer) = 3.6 mg/m$^3$ (corresponding to approx. 1.029 mg/kg bw/d)
The DNEL (consumer) was converted according to the equation:
DNEL (mg/kg bw/d) = DNEL (mg/m$^3$) x 20 m$^3$ air/person / 70 kg bw

**Table 26: Risk characterization – Humans via the environment / Production (ERC 1)**

| TDI local [mg/kg bw/d] | TDI regional [mg/kg bw/d] | DNEL [mg/kg bw/d] | MOS local | MOS regional | RCR local | RCR regional | Safe use |
|---|---|---|---|---|---|---|---|
| 0.00229* | 0.0000507 | 1.029 | 1.75 x 10$^4$ | 7.89 x 10$^5$ | 0.0022 | 0.0000493 | **yes** |

* Highest TDI local reported as worst case (largest site)
TDI: Total daily intake
MOS: margin of safety; MOS local/regional values from EUSES 2.1 calculations as MOS total exposure
RCR: TDI / DNEL

The risk characterization was performed by calculating the MOS, i.e. the ratio between the total daily intake and the relevant exposure parameter, which is the oral N(L)OAEL from repeated dose toxicity studies. It is assumed that man is exposed throughout his or her lifetime. Additionally, the air concentration to which man is estimated to be exposed can be compared to the inhalatory N(L)OAEL for these endpoints.
The margin of safety (MOS) estimated by EUSES 2.1 was high confirming a safe use on a local and regional scale.
According to the Guidance on information requirements and chemical safety assessment, Chapter R.16 (ECHA 2008), the total daily human doses (local and regional) are to be compared with the DNEL value for external exposure. The resulting RCR (TDI: DNEL-ratio) is < 1, indicating safe use.
Based on the calculated exposure estimates as compared to the respective NOAELs and DNEL, the total daily intake for humans via the environment does not present a potential risk.

## 2.1.2. Environment

The Msafe was calculated manually according to the equation:
$M_{safe} = M_{used}$ x PNEC / $PEC_{local}$
(with $M_{used}$ = use rate of the substance as defined in the exposure scenario in kg/d
- 288,000 t/a as documented in production step 1, largest site, EUSES v2.1; divided by 300 production days = **960,000 kg/d**)

#### 2.1.2.1. Aquatic compartment (incl. sediment)

**Table 27: Risk characterization – Aquatic Environment / Production (ERC 1)**

| Compartment | Concentrations | | | RCR[2] | Msafe[3] | Safe use |
|---|---|---|---|---|---|---|
| | PEC[1] | PNEC | Unit | | | |
| Freshwater | 0.00145 | 0.003 | mg L-1 | 0.483 | 1,986,207 | **yes** |
| Freshwater sediment | 0.00248 | 0.00514 | mg kgwwt-1 | 0.483 | 1,989,677 | **yes** |
| Marine water | 0.000154 | 0.0003 | mg L-1 | 0.514 | 1,870,130 | **yes** |
| Marine water sediment | 0.000264 | 0.000514 | mg kgwwt-1 | 0.514 | 1,869,091 | **yes** |

[1] Highest PEC local reported as worst case (largest site)
[2] RCR as given by EUSES v2.1 calculations
[3] Rounded values reported.

The estimated local concentrations of acrylic acid do not present a potential risk for the respective biota (worst case scenario – largest site). This is supported by the ready biodegradability of acrylic acid as demonstrated in the OECD studies on biodegradation as well as by the results of the sewage treatment plant monitoring program revealing degradation rates of 99.9 % in municipal as well as industrial sewage treatment plants.

#### 2.1.2.2. Terrestrial compartment

**Table 28: Risk characterization – Soil / Production (ERC 1)**

| Compartment | Concentrations | | | RCR[2] | Msafe[3] | Safe use |
|---|---|---|---|---|---|---|
| | PEC[1] | PNEC | Unit | | | |
| Soil | 0.214 | 1 | mg kgwwt-1 | 0.00136 | 4,485,981 | **yes** |

[1] Highest PEC local reported as worst case (largest site)
[2] RCR as given by EUSES v2.1 calculations
[3] Rounded values reported.

The PEC local for soil was estimated to be 0.214 mg/kg wwt for grassland at the largest site (worst case soil grassland according to EUSES 2.1 calculations and largest site). Compared to the PNEC for soil organisms of 1 mg/kg the exposure to the estimated local soil concentrations does not present a potential risk. Furthermore, acrylic acid is readily biodegradable in OECD biodegradation studies. According to the EU RAR (2002), study results also suggest rapid degradation in soil. Due to its inherent physico-chemical properties, fugacity models showed that 99 % of acrylic acid emissions have to be expected in the water compartment [EU RAR 2002].

#### 2.1.2.3. Atmospheric Compartment

The PEC local for air (annual average) was estimated to be 0.00445 mg/m$^3$. Compared to the DNEL (consumer) of 3.6 mg/m$^3$, human inhalatory exposure to the estimated local air concentrations does not present a potential risk. The PEC local for air cannot be compared with the PNEC for air (e.g. plant PNEC) since the latter is not available.
The continental concentration of acrylic acid in the atmosphere was estimated to be 0.0000015 mg/m$^3$ and the regional concentration was estimated to be 0.0000669 mg/m$^3$.

According to Q(SAR) data using SRC AOPWIN v1.92a (June 2008) of EPI Suite v.4.0, acrylic acid will be slowly degraded by photochemical processes after exposure to the air reacting with the photo chemically produced hydroxyl radicals and with ozone (calculated half-life for a 12-hour day and an overall OH rate constant of 9.7250 x $10^{-12}$ $cm^3$/molecule-sec is 13.198 hours [1.5 x $10^6$ OH/$cm^3$] and a calculated half-life with an overall ozone rate constant of 0.175000 x $10^{-17}$ cm3/molecule-sec of 6.549 days at 7 x $10^{11}$ mol/$cm^3$).

Acrylic acid is thought to make no contribution to the stratospheric ozone depletion of the atmosphere due to lack of Cl, Br or F substituents. The test substance is not listed in Annex I of Regulation (EC) 2037/2000 on substances that deplete the ozone layer. It also does not belong to the substances listed in Annex I of Directive 67/548/EEC which are classified with R59.
The test substance does not belong to the green house gases listed in P Foster, PV Ramaswamy et al. Changes in Atmospheric Constituents and in Radiative Forcing. In: Climate Change 2007: The Physical Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

It is not likely that acrylic acid will significantly contribute to photochemical ozone formation in the troposphere. There are no indications that acrylic acid will play a role in acidification due to lack of Cl, F, N or S substituents.

**2.1.2.4. Microbiological activity in Sewage Treatment Systems**
**Table 29: Risk characterization – STP / Production (ERC 1)**

| Compartment | Concentrations | | | RCR[2] | Msafe[3] | Safe use |
|---|---|---|---|---|---|---|
| | PEC[1] | PNEC | Unit | | | |
| STP | 0.01 | 0.9 | mg L-1 | 0.0111 | 86,400,000 | **yes** |

[1] Highest PEC local reported as worst case (largest site)
[2] RCR as given by EUSES v2.1 calculations
[3] Rounded values reported.

The PEC local for sewage treatment plants (STP) was estimated to be 0.01 mg/L at the largest site (worst case). Compared to the PNEC for STP micro-organisms of 0.9 mg/L the exposure to the estimated local STP concentrations of acrylic acid does not present a potential risk.

The PEC / PNEC values and their ratios, expressed as Risk Characterisation Ratios (RCRs), clearly demonstrate that manufacture and distribution of acrylic acid as described does not present a risk neither for the environment nor for human health through environmental exposure. This is also suggested by the $M_{safe}$ values, which exceed the $M_{used}$ values by far.

## 2.2. Manufacture of Intermediates of Substance

Risk characterization covers esterifications, the most common use, where the substance is used as intermediate resulting in a monomer. Esterification reactions can occur either on-site or off-site (with regard where the substance is produced). They can be captive or merchant use of the substance.

## 2.2.1. Human Health

### 2.2.1.1. Workers

For the RCRs Worker / PROC 1 see Table 20
For the RCRs Worker / PROC 2 see Table 21
For the RCRs Worker / PROC 3 see Table 22
For the RCRs Worker / PROC 8a see Table 23
For the RCRs Worker / PROC 8b see Table 24
For the RCRs Worker / PROC 9 see Table 25

**Table 30: Risk characterization - Worker / PROC 4**

| | Exposure estimate | | | DNEL | RCR per route | | | Safe use |
|---|---|---|---|---|---|---|---|---|
| **Exposure** | Scenario 1 | Scenario 2 | Scenario 3 | | Scenario 1 | Scenario 2 | Scenario 3 | |
| Long-term exposure, local, inhalative | 6.008 mg/m³ | 6.008 mg/m³ | 12.017 mg/m³ | 30,0 mg/m³ | 0.20 | 0.20 | 0.401 | **yes** |
| Long-term exposure, local, dermal | 200.0 µg/cm² | 200.0 µg/cm² | 200.0 µg/cm² | 1000µg/cm² | 0.20 | 0.20 | 0.20 | **yes** |
| Short-term exposure, local, dermal | 200.0 µg/cm² | 200.0 µg/cm² | 200.0 µg/cm² | 1000 µg/cm² | 0.20 | 0.20 | 0.20 | **yes** |

Scenario 1: Indoors, LEV, no respirator, duration of activity > 4hrs.
Scenario 2: Indoors, no LEV, respirator (90% efficiency), duration of activity >4hrs
Scenario 3: Indoors, no LEV, no respirator, duration of activity 15mins-1hr

**Table 31: Risk characterization - Worker / PROC 5**

| | Exposure estimate | | | DNEL | RCR per route | | | Safe use |
|---|---|---|---|---|---|---|---|---|
| **Exposure** | Scenario 1 | Scenario 2 | Scenario 3 | | Scenario 1 | Scenario 2 | Scenario 3 | |
| Long-term exposure, local, inhalative | 15.021 mg/m³ | 15.021 mg/m³ | 15.021 mg/m³ | 30,0 mg/m³ | 0.501 | 0.501 | 0.501 | **yes** |
| Long-term exposure, local, dermal | 400.0 µg/cm² | 400.0 µg/cm² | 400.0 µg/cm² | 1000µg/cm² | 0.40 | 0.40 | 0.40 | **yes** |
| Short-term exposure, local, dermal | 400.0 µg/cm² | 400.0 µg/cm² | 400.0 µg/cm² | 1000 µg/cm² | 0.40 | 0.40 | 0.40 | **yes** |

Scenario 1: Indoors, LEV, no respirator, duration of activity > 4hrs.
Scenario 2: Indoors, no LEV, respirator (90% efficiency), duration of activity >4hrs
Scenario 3: Indoors, no LEV, no respirator, duration of activity <15mins

#### 2.2.1.2. Consumers

Not relevant.

#### 2.2.1.3. Indirect exposure to humans via the environment

Indirect exposure to humans via the environment was calculated on a local scale and on a regional scale.

Input data for estimating the RCR:

DNEL (consumer) = 3.6 mg/$m^3$ (corresponding to approx. 1.029 mg/kg bw/d)

The DNEL (consumer) was converted according to the equation:

DNEL (mg/kg bw/d) = DNEL (mg/$m^3$) x 20 $m^3$ air/person / 70 kg bw

**Table 32: Risk characterization – Humans via the environment / Manufacture of intermediates (ERC 6a)**

| TDI local [mg/kg bw/d] | TDI regional [mg/kg bw/d] | DNEL [mg/kg bw/d] | MOS local | MOS regional | RCR local | RCR regional | Safe use |
|---|---|---|---|---|---|---|---|
| 0.000326* | 0.0000507 | 1.029 | 1.23 x$10^5$ | 7.89 x $10^5$ | 0.000317 | 0.0000493 | **yes** |

* Highest TDI local reported as worst case (based on volume of largest life cycle step Esterification on-site)
TDI: Total daily intake
MOS: margin of safety; MOS local/regional values from EUSES 2.1 calculations as MOS total exposure
RCR: TDI / DNEL

The risk characterization was performed by calculating the MOS, i.e. the ratio between the total daily intake and the relevant exposure parameter, which is the oral N(L)OAEL from repeated dose toxicity studies. It is assumed that man is exposed throughout his or her lifetime. Additionally, the air concentration to which man is estimated to be exposed can be compared to the inhalatory N(L)OAEL for these endpoints.

The margin of safety (MOS) estimated by EUSES 2.1 was high confirming a safe use on a local and regional scale.

According to the Guidance on information requirements and chemical safety assessment, Chapter R.16 (ECHA 2008), the total daily human doses (local and regional) are to be compared with the DNEL value for external exposure. The resulting RCR (TDI : DNEL-ratio) is < 1, indicating safe use. Based on the calculated exposure estimates as compared to the respective NOAELs and DNEL, the total daily intake for humans via the environment does not present a potential risk.

### 2.2.2. Environment

The Msafe was calculated manually according to the equation:

$M_{safe} = M_{used}$ x PNEC / $PEC_{local}$

(with $M_{used}$ = use rate of the substance as defined in the exposure scenario in kg/d – 429.000 t/a as documented in life cycle step 7, esterification on-site, EUSES v2.1; divided by 300 production days = 1,430,000 kg/d, divided by 6.67 = **214,393 kg/d** [based EUSES default estimation fraction of the main local source of 0.15])

#### 2.2.2.1. Aquatic compartment (incl. sediment)

**Table 33: Risk characterization – Aquatic Environment / Manufacture of intermediates (ERC 6a)**

| Compartment | Concentrations | | | RCR[2] | Msafe[3] | Safe use |
|---|---|---|---|---|---|---|
| | PEC[1] | PNEC | Unit | | | |
| Freshwater | 0.00145 | 0.003 | mg L-1 | 0.483 | 443,572 | **yes** |
| Freshwater sediment | 0.00248 | 0.00514 | mg kgwwt-1 | 0.483 | 443,347 | **yes** |
| Marine water | 0.000154 | 0.0003 | mg L-1 | 0.514 | 417,649 | **yes** |
| Marine water sediment | 0.000264 | 0.000514 | mg kgwwt-1 | 0.514 | 417,417 | **yes** |

[1] Highest PEC local reported as worst case (largest life cycle step)
[2] RCR as given by EUSES v2.1 calculations
[3] Rounded values reported.

The estimated local concentrations of acrylic acid do not present a potential risk for the respective biota (worst case scenario – largest site). This is supported by the ready biodegradability of acrylic acid as demonstrated in the OECD studies on biodegradation as well as by the results of the sewage treatment plant monitoring program revealing degradation rates of 99.9 % in municipal as well as industrial sewage treatment plants.

#### 2.2.2.2. Terrestrial compartment

**Table 34: Risk characterization – Soil / Manufacture of intermediates (ERC 6a)**

| Compartment | Concentrations | | | RCR[2] | Msafe[3] | Safe use |
|---|---|---|---|---|---|---|
| | PEC[1] | PNEC | Unit | | | |
| Soil | 0.0075 | 1 | mg kgwwt-1 | 0.0075 | 28,585,733 | **yes** |

[1] Highest PEC local reported as worst case (largest life cycle step)
[2] RCR as given by EUSES v2.1 calculations
[3] Rounded values reported.

The PEC local for soil was estimated to be 0.0075 mg/kg wwt for grassland for the largest life cycle step (worst case soil grassland according to EUSES 2.1 calculations and largest life cycle step). Compared to the PNEC for soil organisms of 1 mg/kg the exposure to the estimated local soil concentrations does not present a potential risk. Furthermore, acrylic acid is readily biodegradable in OECD biodegradation studies. According to the EU RAR (2002), study results also suggest rapid degradation in soil. Due to its inherent physico-chemical properties, fugacity models showed that 99 % of acrylic acid emissions have to be expected in the water compartment [EU RAR 2002].

#### 2.2.2.3. Atmospheric compartment

The PEC local for air (annual average) was estimated to be 0.000557 mg/m$^3$. Compared to the DNEL (consumer) of 3.6 mg/m$^3$, human inhalatory exposure at the estimated local air concentrations does not present a potential risk. The PEC local for air cannot be compared with the PNEC for air (e.g. plant PNEC) since the latter is not available.
The continental concentration of acrylic acid in the atmosphere was estimated to be 0.0000015 mg/m$^3$ and the regional concentration was estimated to be 0.0000669 mg/m$^3$.

According to Q(SAR) data using SRC AOPWIN v1.92a (June 2008) of EPI Suite v.4.0, acrylic acid will be slowly degraded by photochemical processes after exposure to the air reacting with the photo chemically produced hydroxyl radicals and with ozone (calculated half-life for a 12-hour day and an overall OH rate constant of 9.7250 x $10^{-12}$ $cm^3$/molecule-sec is 13.198 hours [1.5 x $10^6$ OH/$cm^3$] and a calculated half-life with an overall ozone rate constant of 0.175000 x $10^{-17}$ cm3/molecule-sec of 6.549 days at 7 x $10^{11}$ mol/$cm^3$).

Acrylic acid is thought to make no contribution to ozone depletion in the atmosphere due to lack of Cl, Br or F substituents. The test substance does not belong to the green house gases listed in P Foster, PV Ramaswamy et al. Changes in Atmospheric Constituents and in Radiative Forcing. In: Climate Change 2007: The Physical Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

Since the substance has an atmospheric lifetime of far less than a year, no potential for stratospheric ozone depletion is expected. The test substance is not listed in Annex I of Regulation (EC) 2037/2000 on substances that deplete the ozone layer. It also does not belong to the substances listed in Annex I of Directive 67/548/EEC which are classified with R59.

It is not likely to make a significant contribution to photochemical ozone formation in the troposphere. There are no indications that acrylic acid will play a role in acidification due to lack of Cl, F, N or S substituents.

**2.2.2.4. Microbiological activity in Sewage Treatment Systems**

**Table 35: Risk characterization – STP / Manufacture of intermediates (ERC 6a)**

| Compartment | Concentrations | | | RCR[2] | Msafe[3] | Safe use |
|---|---|---|---|---|---|---|
| | PEC[1] | PNEC | Unit | | | |
| STP | 0.01 | 0.9 | mg L-1 | 0.0111 | 19,295,370 | **yes** |

[1] Highest PEC local reported as worst case (largest life cycle step)
[2] RCR as given by EUSES v2.1 calculations
[3] Rounded values reported.

The PEC local for sewage treatment plants (STP) was estimated to be 0.01 mg/L at the largest site (worst case). Compared to the PNEC for STP micro-organisms of 0.9 mg/L the exposure to the estimated local STP concentrations of acrylic acid does not present a potential risk.

The PEC / PNEC values and their ratios, expressed as Risk Characterisation Ratios (RCRs), clearly demonstrate that manufacture of intermediates of substance (esterification) of acrylic acid as described does not present a risk neither for the environment nor for human health through environmental exposure. This is also suggested by the $M_{safe}$ values, which exceed the $M_{used}$ values by far.

## 2.3. Polymerization of Substance

The following risk characterization covers all polymerizations (wet), where the substance is used as monomer (downstream use).

Polymerizations of Acrylic acids are manufacture of Superabsorber Polymers (on-site and off-site, with regard where the substance is produced) and Polyacrylates (on-site and off-site). On-, off-site polymerizations can be captive or merchant use of the substance.

## 2.3.1. Human Health

### 2.3.1.1. Workers

For the RCRs Worker / PROC 1 see Table 20
For the RCRs Worker / PROC 2 see Table 21
For the RCRs Worker / PROC 3 see Table 22
For the RCRs Worker / PROC 4 see Table 30
For the RCRs Worker / PROC 5 see Table 31
For the RCRs Worker / PROC 8a see Table 23
For the RCRs Worker / PROC 8b see Table 24
For the RCRs Worker / PROC 9 see Table 25

### 2.3.1.2. Consumers

Not relevant.

### 2.3.1.3. Indirect exposure to humans via the environment

Indirect exposure to humans via the environment was calculated on a local scale and on a regional scale.

Input data for estimating the RCR:

DNEL (consumer) = 3.6 mg/$m^3$ (corresponding to approx. 1.029 mg/kg bw/d)
The DNEL (consumer) was converted according to the equation:
DNEL (mg/kg bw/d) = DNEL (mg/$m^3$) x 20 $m^3$ air/person / 70 kg bw

**Table 36: Risk characterization – Humans via the environment / Polymerization of substance on-site / off-site (ERC 6c and ERC 6d)**

| TDI local [mg/kg bw/d] | TDI regional [mg/kg bw/d] | DNEL [mg/kg bw/d] | MOS local | MOS regional | RCR local | RCR regional | Safe use |
|---|---|---|---|---|---|---|---|
| 0.000701* | 0.0000507 | 1.029 | 3.17 x $10^3$ | 7.89 x $10^5$ | 0.000681 | 0.0000493 | **yes** |

* Highest TDI local reported as worst case (based on volume of largest life cycle step superabsorber on-site)
TDI: Total daily intake
MOS: margin of safety; MOS local/regional values from EUSES 2.1 calculations as MOS total exposure
RCR: TDI / DNEL

The risk characterization was performed by calculating the MOS, i.e. the ratio between the total daily intake and the relevant exposure parameter, which is the oral N(L)OAEL from repeated dose toxicity studies. It is assumed that man is exposed throughout his or her lifetime. Additionally, the air concentration to which man is estimated to be exposed can be compared to the inhalatory N(L)OAEL for these endpoints.
The margin of safety (MOS) estimated by EUSES 2.1 was high confirming a safe use on a local and regional scale.
According to the Guidance on information requirements and chemical safety assessment, Chapter R.16 (ECHA 2008), the total daily human doses (local and regional) are to be compared with the DNEL value for external exposure. The resulting RCR (TDI: DNEL-ratio) is < 1, indicating safe use.

Based on the calculated exposure estimates as compared to the respective NOAELs and DNEL, the total daily intake for humans via the environment does not present a potential risk.

## 2.3.2. Environment

The Msafe was calculated manually according to the equation:
$M_{safe} = M_{used}$ x PNEC / $PEC_{local}$
(with $M_{used}$ = use rate of the substance as defined in the exposure scenario in kg/d– 325.000 t/a as documented in life cycle step 9, Superabsorber on-site, EUSES v2.1; divided by 300 production days = 1,083,333 kg/d, divided by 20 = **54,167 kg/d** [based EUSES default estimation fraction of the main local source of 0.05])

### 2.3.2.1. Aquatic compartment (incl. sediment)

**Table 37: Risk characterization – Aquatic Environment Polymerization of substance on-site / off-site (ERC 6c)**

| Compartment | Concentrations | | | RCR[2] | Msafe[3] | Safe use |
|---|---|---|---|---|---|---|
| | PEC[1] | PNEC | Unit | | | |
| Freshwater | 0.00145 | 0.003 | mg L-1 | 0.483 | 112,070 | **yes** |
| Freshwater sediment | 0.00248 | 0.00514 | mg kgwwt-1 | 0.483 | 112,265 | **yes** |
| Marine water | 0.000154 | 0.0003 | mg L-1 | 0.514 | 105,520 | **yes** |
| Marine water sediment | 0.000264 | 0.000514 | mg kgwwt-1 | 0.514 | 105,462 | **yes** |

[1] Highest PEC local reported as worst case (largest life cycle step)
[2] RCR as given by EUSES v2.1 calculations
[3] Rounded values reported.

The estimated local concentrations of acrylic acid do not present a potential risk for the respective biota (worst case scenario – largest site). This is supported by the ready biodegradability of acrylic acid as demonstrated in the OECD studies on biodegradation as well as by the results of the sewage treatment plant monitoring program revealing degradation rates of 99.9 % in municipal as well as industrial sewage treatment plants.

### 2.3.2.2. Terrestrial compartment

**Table 38: Risk characterization – Soil / Polymerization of substance on-site / off-site (ERC 6c)**

| Compartment | Concentrations | | | RCR[2] | Msafe[3] | Safe use |
|---|---|---|---|---|---|---|
| | PEC[1] | PNEC | Unit | | | |
| Soil | 0.0351 | 1 | mg kgwwt-1 | 0.0351 | 1,543,219 | **yes** |

[1] Highest PEC local reported as worst case (largest life cycle step)
[2] RCR as given by EUSES v2.1 calculations
[3] Rounded values reported.

The PEC local for soil was estimated to be 0.0351 mg/kg wwt for grassland for the largest life cycle step (worst case soil grassland according to EUSES 2.1 calculations and largest life cycle step). Compared to the PNEC for soil organisms of 1 mg/kg the exposure to the estimated local soil concentrations does not present a potential risk. Furthermore, acrylic acid is readily biodegradable in OECD biodegradation studies. According to the EU RAR (2002), study results also suggest rapid

degradation in soil. Due to its inherent physico-chemical properties, fugacity models showed that 99 % of acrylic acid emissions have to be expected in the water compartment [EU RAR 2002].

#### 2.3.2.3. Atmospheric compartment

The PEC local for air (annual average) was estimated to be 0.0013 mg/$m^3$. Compared to the DNEL (consumer) of 3.6 mg/$m^3$, human inhalatory exposure at the estimated local air concentrations does not present a potential risk. The PEC local for air cannot be compared with the PNEC for air (e.g. plant PNEC) since the latter is not available.
The continental concentration of acrylic acid in the atmosphere was estimated to be 0.0000015 mg/$m^3$ and the regional concentration was estimated to be 0.0000669 mg/$m^3$.

According to Q(SAR) data using SRC AOPWIN v1.92a (June 2008) of EPI Suite v.4.0, acrylic acid will be slowly degraded by photochemical processes after exposure to the air reacting with the photo chemically produced hydroxyl radicals and with ozone (calculated half-life for a 12-hour day and an overall OH rate constant of 9.7250 x $10^{-12}$ $cm^3$/molecule-sec is 13.198 hours [1.5 x $10^6$ OH/$cm^3$] and a calculated half-life with an overall ozone rate constant of 0.175000 x $10^{-17}$ cm3/molecule-sec of 6.549 days at 7 x $10^{11}$ mol/$cm^3$).

Acrylic acid is thought to make no contribution to ozone depletion in the atmosphere due to lack of Cl, Br or F substituents. The test substance does not belong to the green house gases listed in P Foster, PV Ramaswamy et al. Changes in Atmospheric Constituents and in Radiative Forcing. In: Climate Change 2007: The Physical Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

Since the substance has an atmospheric lifetime of far less than a year, no potential for stratospheric ozone depletion is expected. The test substance is not listed in Annex I of Regulation (EC) 2037/2000 on substances that deplete the ozone layer. It also does not belong to the substances listed in Annex I of Directive 67/548/EEC which are classified with R59.

It is not likely to make a significant contribution to photochemical ozone formation in the troposphere. There are no indications that acrylic acid will play a role in acidification due to lack of Cl, F, N or S substituents.

#### 2.3.2.4. Microbiological activity in Sewage Treatment Systems

**Table 39: Risk characterization – STP / Polymerization of substance on-site / off-site (ERC 6c)**

| Compartment | Concentrations | | | RCR[2] | Msafe[3] | Safe use |
|---|---|---|---|---|---|---|
| | PEC[1] | PNEC | Unit | | | |
| STP | 0.01 | 0.9 | mg L-1 | 0.011 | 4,875,030 | **yes** |

[1] Highest PEC local reported as worst case (largest life cycle step)
[2] RCR as given by EUSES v2.1 calculations
[3] Rounded values reported.

The PEC local for sewage treatment plants (STP) was estimated to be 0.01 mg/L at the largest site (worst case). Compared to the PNEC for STP micro-organisms of 0.9 mg/L the exposure to the estimated local STP concentrations of acrylic acid does not present a potential risk.

The PEC / PNEC values and their ratios, expressed as Risk Characterisation Ratios (RCRs), clearly demonstrate that Polymerisation of substance (Superabsorber) of acrylic acid as described does not present a risk neither for the environment nor for human health through environmental exposure. This is also suggested by the $M_{safe}$ values, which exceed the $M_{used}$ values by far.

## 2.4. Other Uses of Substance as Intermediate

### 2.4.1. Human Health

#### 2.4.1.1. Workers

For the RCRs Worker / PROC 1 see Table 20
For the RCRs Worker / PROC 2 see Table 21
For the RCRs Worker / PROC 3 see Table 22
For the RCRs Worker / PROC 4 see Table 30
For the RCRs Worker / PROC 5 see Table 31
For the RCRs Worker / PROC 8a see Table 23
For the RCRs Worker / PROC 8b see Table 24
For the RCRs Worker / PROC 9 see Table 25

#### 2.4.1.2. Consumers

Not relevant.

#### 2.4.1.3. Indirect exposure to humans via the environment

Indirect exposure to humans via the environment was calculated on a local scale and on a regional scale.
Input data for estimating the RCR:
DNEL (consumer) = 3.6 mg/$m^3$ (corresponding to approx. 1.029 mg/kg bw/d)
The DNEL (consumer) was converted according to the equation:
DNEL (mg/kg bw/d) = DNEL (mg/$m^3$) x 20 $m^3$ air/person / 70 kg bw)

**Table 40: Risk characterization – Humans via the environment / other uses of substance as intermediate (ERC 6a)**

| TDI local [mg/kg bw/d] | TDI regional [mg/kg bw/d] | DNEL [mg/kg bw/d] | MOS local | MOS regional | RCR local | RCR regional | Safe use |
|---|---|---|---|---|---|---|---|
| 0.000147 | 0.0000507 | 1.029 | 2.71 x $10^5$ | 7.89 x $10^5$ | 0.000143 | 0.00000493 | **yes** |

TDI: Total daily intake
MOS: margin of safety; MOS local/regional values from EUSES 2.1 calculations as MOS total exposure
RCR: TDI / DNEL

The risk characterization was performed by calculating the MOS, i.e. the ratio between the total daily intake and the relevant exposure parameter, which is the oral N(L)OAEL from repeated dose toxicity studies. It is assumed that man is exposed throughout his or her lifetime. Additionally, the air concentration to which man is estimated to be exposed can be compared to the inhalatory N(L)OAEL for these endpoints.
The margin of safety (MOS) estimated by EUSES 2.1 was high confirming a safe use on a local and regional scale.
According to the Guidance on information requirements and chemical safety assessment, Chapter R.16 (ECHA 2008), the total daily human doses (local and regional) are to be compared with the

DNEL value for external exposure. The resulting RCR (TDI : DNEL-ratio) is < 1, indicating safe use.
Based on the calculated exposure estimates as compared to the respective NOAELs and DNEL, the total daily intake for humans via the environment does not present a potential risk.

## 2.4.2. Environment

The Msafe was calculated manually according to the equation:
$M_{safe} = M_{used}$ x PNEC / $PEC_{local}$
(with $M_{used}$ = use rate of the substance as defined in the exposure scenario in kg/d– 117,000 t/a as documented in life cycle step 13, Other applications, EUSES v2.1; divided by 300 production days = 390,000 kg/d, divided by 6.67 = **58,470 kg/d** [based EUSES default estimation fraction of the main local source of 0.15])

### 2.4.2.1. Aquatic compartment (incl. sediment)

**Table 41: Risk characterization – Aquatic Environment / Other uses of substance as intermediate (ERC 6a)**

| Compartment | Concentrations | | | RCR[1] | Msafe[2] | Safe use |
|---|---|---|---|---|---|---|
| | PEC | PNEC | Unit | | | |
| Freshwater | 0.00145 | 0.003 | mg L-1 | 0.483 | 120,972 | **yes** |
| Freshwater sediment | 0.00248 | 0.00514 | mg kgwwt-1 | 0.483 | 121,184 | **yes** |
| Marine water | 0.000154 | 0.0003 | mg L-1 | 0.514 | 113,903 | **yes** |
| Marine water sediment | 0.000264 | 0.000514 | mg kgwwt-1 | 0.514 | 113,839 | **yes** |

[1] RCR as given by EUSES v2.1 calculations
[2] Rounded values reported.

The estimated local concentrations of acrylic acid do not present a potential risk for the respective biota (worst case scenario – largest site). This is supported by the ready biodegradability of acrylic acid as demonstrated in the OECD studies on biodegradation as well as by the results of the sewage treatment plant monitoring program revealing degradation rates of 99.9 % in municipal as well as industrial sewage treatment plants.

### 2.4.2.2. Terrestrial compartment

**Table 42: Risk characterization – Soil / Other uses of substance as intermediate (ERC 6a)**

| Compartment | Concentrations | | | RCR[1] | Msafe[2] | Safe use |
|---|---|---|---|---|---|---|
| | PEC | PNEC | Unit | | | |
| Soil | 0.00248 | 1 | mg kgwwt-1 | 0.00248 | 23,576,613 | **yes** |

[1] RCR as given by EUSES v2.1 calculations
[2] Rounded values reported.

The PEC local for soil was estimated to be 0.00248 mg/kg wwt for grassland (worst case soil grassland according to EUSES 2.1 calculations). Compared to the PNEC for soil organisms of 1 mg/kg the exposure to the estimated local soil concentrations does not present a potential risk. Furthermore, acrylic acid is readily biodegradable in OECD biodegradation studies. According to

the EU RAR (2002), study results also suggest rapid degradation in soil. Due to its inherent physico-chemical properties, fugacity models showed that 99 % of acrylic acid emissions have to be expected in the water compartment [EU RAR 2002].

#### 2.4.2.3. Atmospheric compartment

The PEC local for air (annual average) was estimated to be 0.000201 mg/m$^3$. Compared to the DNEL (consumer) of 3.6 mg/m$^3$, human inhalatory exposure at the estimated local air concentrations does not present a potential risk. The PEC local for air cannot be compared with the PNEC for air (e.g. plant PNEC) since the latter is not available.
The continental concentration of acrylic acid in the atmosphere was estimated to be 0.0000015 mg/m$^3$ and the regional concentration was estimated to be 0.0000669 mg/m$^3$.

According to Q(SAR) data using SRC AOPWIN v1.92a (June 2008) of EPI Suite v.4.0, acrylic acid will be slowly degraded by photochemical processes after exposure to the air reacting with the photo chemically produced hydroxyl radicals and with ozone (calculated half-life for a 12-hour day and an overall OH rate constant of 9.7250 x $10^{-12}$ cm$^3$/molecule-sec is 13.198 hours [1.5 x $10^6$ OH/cm$^3$] and a calculated half-life with an overall ozone rate constant of 0.175000 x $10^{-17}$ cm3/molecule-sec of 6.549 days at 7 x $10^{11}$ mol/cm$^3$).

Acrylic acid is thought to make no contribution to ozone depletion in the atmosphere due to lack of Cl, Br or F substituents. The test substance does not belong to the green house gases listed in P Foster, PV Ramaswamy et al. Changes in Atmospheric Constituents and in Radiative Forcing. In: Climate Change 2007: The Physical Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

Since the substance has an atmospheric lifetime of far less than a year, no potential for stratospheric ozone depletion is expected. The test substance is not listed in Annex I of Regulation (EC) 2037/2000 on substances that deplete the ozone layer. It also does not belong to the substances listed in Annex I of Directive 67/548/EEC which are classified with R59.

It is not likely to make a significant contribution to photochemical ozone formation in the troposphere. There are no indications that acrylic acid will play a role in acidification due to lack of Cl, F, N or S substituents.

#### 2.4.2.4. Microbiological activity in Sewage Treatment Systems

**Table 43: Risk characterization – STP / Other uses of substance as intermediate (ERC 6a)**

| Compartment | Concentrations | | | RCR[1] | Msafe[2] | Safe use |
|---|---|---|---|---|---|---|
| | PEC | PNEC | Unit | | | |
| STP | 0.01 | 0.9 | mg L-1 | 0.011 | 5,262,300 | **yes** |

[1] RCR as given by EUSES v2.1 calculations
[2] Rounded values reported.

The PEC local for sewage treatment plants (STP) was estimated to be 0.01 mg/L at the largest site (worst case). Compared to the PNEC for STP micro-organisms of 0.9 mg/L the exposure to the estimated local STP concentrations of acrylic acid does not present a potential risk.

The PEC / PNEC values and their ratios, expressed as Risk Characterisation Ratios (RCRs), clearly demonstrate that laboratory applications of acrylic acid as described does not present a risk neither for the environment nor for human health through environmental exposure. This is also suggested by the $M_{safe}$ values, which exceed the $M_{used}$ values by far.

## 2.5. Use as a laboratory reagent

### 2.5.1. Human Health

#### 2.5.1.1. Workers

**Table 44: Risk characterization - Worker / PROC 15**

| | Exposure estimate | | | DNEL | RCR per route | | | Safe use |
|---|---|---|---|---|---|---|---|---|
| **Exposure** | Scenario 1 | Scenario 2 | Scenario 3 | | Scenario 1 | Scenario 2 | Scenario 3 | |
| Long-term exposure, local, inhalative | 3.004 mg/m³ | 3.004 mg/m³ | 18.025 mg/m³ | 30,0 mg/m³ | 0.10 | 0.10 | 0.60 | **yes** |
| Long-term exposure, local, dermal | 20.0 µg/cm² | 20.0 µg/cm² | 20.0 µg/cm² | 1000µg/cm² | 0.02 | 0.02 | 0.02 | **yes** |
| Short-term exposure, local, dermal | 20.0 µg/cm² | 20.0 µg/cm² | 20.0 µg/cm² | 1000 µg/cm² | 0.02 | 0.02 | 0.02 | **yes** |

Scenario 1: Indoors, LEV, no respirator, duration of activity > 4hrs.
Scenario 2: Indoors, no LEV, respirator (90% efficiency), duration of activity >4hrs
Scenario 3: Indoors, no LEV, no respirator, duration of activity 1-4hrs

#### 2.5.1.2. Consumers

Not relevant.

#### 2.5.1.3. Indirect exposure to humans via the environment

Indirect exposure to humans via the environment was calculated on a local scale and on a regional scale.

Input data for estimating the RCR:

DNEL (consumer) = 3.6 mg/m³ (corresponding to approx. 1.029 mg/kg bw/d)

The DNEL (consumer) was converted according to the equation:

DNEL (mg/kg bw/d) = DNEL (mg/m³) x 20 m³ air/person / 70 kg bw)

**Table 45: Risk characterization – Humans via the environment / Use as a laboratory agent (ERC 1)**

| TDI local [mg/kg bw/d] | TDI regional [mg/kg bw/d] | DNEL [mg/kg bw/d] | MOS local | MOS regional | RCR local | RCR regional | Safe use |
|---|---|---|---|---|---|---|---|
| 0.00229* | 0.0000507 | 1.029 | $1.75 \times 10^4$ | $7.89 \times 10^5$ | 0.0022 | 0.0000493 | **yes** |

Values used from scenario 1 manufacture and distribution of substance as laboratories are either associated with the production sites or will be operated accordingly.
* Highest TDI local reported as worst case (largest site)
TDI: Total daily intake
MOS: margin of safety; MOS local/regional values from EUSES 2.1 calculations as MOS total exposure
RCR: TDI / DNEL

The risk characterization was performed by calculating the MOS, i.e. the ratio between the total daily intake and the relevant exposure parameter, which is the oral N(L)OAEL from repeated dose toxicity studies. It is assumed that man is exposed throughout his or her lifetime. Additionally, the air concentration to which man is estimated to be exposed can be compared to the inhalatory N(L)OAEL for these endpoints.
The margin of safety (MOS) estimated by EUSES 2.1 was high confirming a safe use on a local and regional scale.
According to the Guidance on information requirements and chemical safety assessment, Chapter R.16 (ECHA 2008), the total daily human doses (local and regional) are to be compared with the DNEL value for external exposure. The resulting RCR (TDI: DNEL-ratio) is < 1, indicating safe use.
Based on the calculated exposure estimates as compared to the respective NOAELs and DNEL, the total daily intake for humans via the environment does not present a potential risk.

### 2.5.2. Environment
See **2.1.2. Environment**

## 2.6. Overall Exposure (combined for all exposure routes)
### 2.6.1. Human Health (combined for all exposure routes)
Based on the risk assessment, the substance Acrylic acid is considered as safe (no risk) for workers at any time of the production and processing (esterification, polymerization) end use. The unreacted residual monomer content in a polymer is to be regarded as impurity (<1000ppm) that need not to be critically addressed in the risk assessment.

### 2.6.2. Environment (combined for all emission sources)
Based on the risk assessment, the substance Acrylic acid is considered as safe (no risk) for the environment at any time of the production and processing (esterification, polymerization) end use. The unreacted residual monomer content in a polymer is to be regarded as impurity (<1000ppm) that need not to be critically addressed in the risk assessment.

**END OF SDS**