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

1.1 Product identifier

Trade name: Chlorendic Anhydride PE1+
REACH registration No.: 01-2119911956-30-0000
CAS-Number: 115-27-5
EC-number: 204-077-3
EU-number: 607-101-00-4

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

1.2.1 Relevant identified uses:

Industrial applications: Hardener for epoxy resins, paints, and coatings.
Other non-specified industry: Flame retardant in unsaturated polyester resins.

1. Receipt and storage of raw materials
   SU 10; PROC 1, 3, 8b; PC 32; ERC 2
2. Blending or dissolving or dispersion
   SU 10; PROC 2, 4, 5; PC 32; AC 32; ERC 2
3. Filtering and filling
   SU 10; PROC 8a, 9; PC 32; ERC 2
4. Waste management
   SU 23; PROC 3, 8b; ERC 2
5. Use in closed batch process (synthesis or formulation)
   SU 3; PROC 3; PC 32; ERC 2
6. Mixing or blending in batch processes for formulation of preparations and articles multistage and/or significant contact)
   SU 3; PROC 5; PC 32
7. Transfer of substance or preparation (charging/discharging) from/to vessels/large ontainers at dedicated facilities
   PROC 8b, 9; PC 32; ERC 2
8. Research and development
   PROC 15; PC 32; ERC 2

1.2.2 Uses advised against:

No specific uses advised against have been identified.

1.3 Details of the supplier of the safety data sheet

Company name: Velsicol Chemical Ireland Ltd
Charter House
Street/POB-No.: 5 Pembroke Row
Postal Code, city: Dublin 2
Republic of Ireland
WWW: www.velsicol.com
E-mail: sfriedman@velsicol.com
Telephone: 00353 1 477 3143
Telefax: 00353 1 402 9587
Dept. responsible for information: sfriedman@velsicol.com

1.4 Emergency telephone number

Telephone: +49 51 92 98970 (08:00–17:00 CET) or
CHEMTREC, Telephone: +1 703 527 3887 (24h; from USA: 1-800-424-9300)
SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to EC regulation 1272/2008 (CLP)

- Skin Irrit. 2; H315 Causes skin irritation.
- Eye Irrit. 2; H319 Causes serious eye irritation.
- Skin Sens. 1; H317 May cause an allergic skin reaction.
- Carc. 2; H351 Suspected of causing cancer.
- STOT SE 3; H335 May cause respiratory irritation.
- Chron. 3; H412 Harmful to aquatic life with long lasting effects.

2.2 Label elements

Labelling (CLP)

Signal word: Warning

Hazard statements:

- H315 Causes skin irritation.
- H317 May cause an allergic skin reaction.
- H319 Causes serious eye irritation.
- H335 May cause respiratory irritation.
- H351 Suspected of causing cancer.
- H412 Harmful to aquatic life with long lasting effects.

Safety precautions:

- P260 Do not breathe dust.
- P273 Avoid release to the environment.
- P280 Wear protective gloves/protective clothing/eye protection/face protection.
- P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- P304+P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
- P309+P311 IF exposed or if you feel unwell: Call a POISON CENTER or doctor/physician.
- P403+P233 Store in a well-ventilated place. Keep container tightly closed.

Special labelling

To avoid risks to human health and the environment, comply with the instructions for use.

2.3 Other hazards

No risks worthy of mention.

SECTION 3: Composition / information on ingredients

3.1 Substances

Chemical characterization: C9 H2 Cl6 O3
Chemical name: 1,4,5,6,7-Hexachlorobicyclo [2,2,1]hept-5-ene-2,3-dicarboxylic anhydride
CAS-Number: 115-27-5
EC-number: 204-077-3
EU-number: 607-101-00-4
Purity: >95%
### Hazardous impurities

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Common name and synonyms</th>
<th>EC number</th>
<th>% by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicyclo[2.2.1]hept-5-ene-2,3-dicarboxylic acid, 1,4,5,6,7,7-hexachloro-</td>
<td>Chlorendic Acid</td>
<td>204-078-9</td>
<td>&lt;3.0</td>
</tr>
<tr>
<td>Maleic anhydride</td>
<td>2,5-Furandione</td>
<td>203-571-6</td>
<td>&lt;1.0</td>
</tr>
<tr>
<td>Chlorobenzene</td>
<td>Benzene, chloro-</td>
<td>203-628-5</td>
<td>&lt;5.0</td>
</tr>
</tbody>
</table>

### 3.2. Mixtures

No a mixture

### SECTION 4: First aid measures

#### 4.1 Description of first aid measures

**4.1.1 General information:**
Inhalation and skin contact are expected to be the primary routes of occupational exposure to chlorendic anhydride. This material is irritating to the eyes, skin and respiratory tract.

**4.1.2 Following inhalation:**
Remove to under fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

**4.1.3 Following skin contact:**
Immediately wash skin with soap and plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Destroy contaminated shoes.

**4.1.4 Following eye contact:**
Immediately flush with plenty of water for at least 15 minutes. Get medical attention immediately.

**4.1.5 Following ingestion:**
Get medical attention. Inducing vomiting as directed by medical personnel. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON.

**4.1.6 Self-protection of the first aider:**
Wear protective gloves/protective clothing/eye protection/face protection. Do not get in eyes, on skin, or on clothing. Contaminated work clothing should not be allowed out of the workplace. Get medical attention immediately.

**4.1.7 Notes for the doctor:**
Not available.

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

Severely irritate to eyes. May cause damage to lungs, stomach, heart and liver through prolonged or repeated exposure to oral, dermal and inhalation. Suspected of causing cancer though oral exposure.

#### 4.3 Indication of any immediate medical attention and special treatment needed

Treat symptomatically

### SECTION 5: Firefighting measures

#### 5.1 Extinguishing media

- Flammability Properties: Non-flammable.
- Suitable extinguishing media: Extinguishing is to be in accordance with the surrounding fire.
- Unsuitable extinguishing media: Not applicable.

#### 5.2 Special hazards arising from the substance or mixture

Fine dust.
This product contains up to 5% occluded Chlorobenzene, which can present a fire hazard if sufficient oxygen and a source of ignition is present.

5.3 Advice for firefighters
- Special protective equipment for firefighters:
  - Advice for fire-fighters: Wear self-contained breathing apparatus, protective clothing and rubber boots.
- Additional information:
  - Non-flammable; No explosion
  - Do not allow fire water to penetrate into surface or ground water.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Use suitable personal protective equipment to protect skin and eyes. Ventilate affected area. Avoid generation of dust.

6.2 Environmental precautions
Do not allow to enter into ground-water, surface water or drains.
In case of entry into waterways, soil or drains, inform the responsible authorities.

6.3 Methods and material for containment and cleaning up
Stop leak if safe to do so.
Collect in closed and suitable containers for disposal. Dispose of this material and its container to hazardous or special waste collection point.
Avoid generation of dust.
Remove residual product with water and detergent.

6.4 Reference to other sections
Refer additionally to chapter 8 and 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling
- **Recommendations for safe handling**
  - Protective measures: Do not handle until all safety precautions have been read and understood. Wear suitable protective clothing, gloves and eye/face protection.
  - Protective measures at Dust formation: Provide good ventilation. Do not breathe dust/fume/gas/mist/vapours/spray.
  - Environmental measures: Avoid release to the environment.
- **Advices on general occupational hygiene**
  - Avoid contact with skin and eyes. Change contaminated clothing. When using do not eat, drink or smoke. Wash hands before breaks and after work.

7.2 Conditions for safe storage, including any incompatibilities
- **Requirements for storerooms and containers**
  - Store at room temperature in a dry and well ventilated area. Keep container tightly closed.
  - Keep away from food, drink and animal feeding stuffs.
  - This product contains up to 5% occluded Chlorobenzene, which can present a fire hazard if
sufficient oxygen and a source of ignition is present. Ground containers and equipment to avoid static charge accumulation and/or use an inert atmosphere to prevent combustion.

7.2.2 Storage Class
Protect from humidity and water.

7.3 Specific end use(s)

<table>
<thead>
<tr>
<th>End use name</th>
<th>Substance supplied to that use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receipt and storage of raw materials</td>
<td>as such (substance itself)</td>
</tr>
<tr>
<td>Blending / dissolving of dispersion</td>
<td>as such (substance itself)</td>
</tr>
<tr>
<td>Filtering and filling</td>
<td>in a mixture</td>
</tr>
<tr>
<td>Waste management</td>
<td>in a mixture</td>
</tr>
<tr>
<td>Use in closed batch process</td>
<td>as such (substance itself)</td>
</tr>
<tr>
<td>Mixing or blending batches</td>
<td>as such (substance itself)</td>
</tr>
<tr>
<td>Transfer of substance</td>
<td>in a mixture</td>
</tr>
<tr>
<td>Research and development</td>
<td>as such (substance itself)</td>
</tr>
</tbody>
</table>

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

8.1.1 The national occupational exposure limit values

Chlorendic Anhydride:
contains no occupational exposure limit values.

Chlorobenzene:
Exposure Limits: TWA: 10 (ppm) or 46 (mg/m³).

Maleic anhydride:
United Kingdom, WEL - TWA: 1 mg/m³ TWA, WEL - STEL: 3 mg/m³ STEL
United States: TWA: 0.25 ppm from OSHA/NIOSH; TWA: 0.25 ppm from ACGIH.

8.1.2 Recommended monitoring procedures
N/A

8.1.3 Air contaminants occupational exposure limit values
N/A

8.1.4 The relevant DNELs and PNECs

<table>
<thead>
<tr>
<th>Exposure pattern</th>
<th>Route</th>
<th>DNEL / DMEL</th>
<th>(Corrected) Dose descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute - systemic effects</td>
<td>Dermal</td>
<td>43 mg/kg bw/day</td>
<td>NOAEL: 1,290 mg/kg bw/day (based on AF of 30)</td>
</tr>
<tr>
<td>Acute - systemic effects</td>
<td>Inhalation</td>
<td>299 mg/m³</td>
<td>NOAEC: 8,970 mg/m³ (based on AF of 30)</td>
</tr>
<tr>
<td>Acute - local effects</td>
<td>Dermal</td>
<td>1 mg/cm²</td>
<td>LOAEL: 50 mg/cm² (based on AF of 50)</td>
</tr>
<tr>
<td>Acute - local effects</td>
<td>Inhalation</td>
<td>299 mg/m³</td>
<td>NOAEL: 8,970 mg/m³ (based on AF of 30)</td>
</tr>
<tr>
<td>Long-term - systemic effects</td>
<td>Dermal</td>
<td>3.7 mg/kg bw/day</td>
<td>NOAEL: 1,110.0 mg/kg bw/day (based on AF of 300)</td>
</tr>
<tr>
<td>Long-term - systemic effects</td>
<td>Inhalation</td>
<td>15 mg/m³</td>
<td>NOAEC: 4,500 mg/m³ (based on AF of 300)</td>
</tr>
<tr>
<td>Long-term - local effects</td>
<td>Dermal</td>
<td>0.56 mg/cm²</td>
<td>NOAEL: 100.80 mg/cm² (based on AF of 180)</td>
</tr>
<tr>
<td>Long-term - local effects</td>
<td>Inhalation</td>
<td>33.23 mg/m³</td>
<td>NOAEC: 9,969.00 mg/m³ (based on AF of 300)</td>
</tr>
</tbody>
</table>

DN(M)ELs for the general population

<table>
<thead>
<tr>
<th>Exposure pattern</th>
<th>Route</th>
<th>DNEL / DMEL</th>
<th>(Corrected) Dose descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute - systemic effects</td>
<td>Dermal</td>
<td>21 mg/kg bw/day</td>
<td>NOAEL: 1,260 mg/kg bw/day (based on AF of 60)</td>
</tr>
</tbody>
</table>
Acute - systemic effects 
Inhalation 149 mg/m³ NOAEC: 8,940 mg/m³ (based on AF of 60)

Acute - systemic effects 
Oral 21 mg/kg bw/day NOAEL: 1,260 mg/kg bw/day (based on AF of 60)

Acute - local effects 
Dermal 0.5 mg/cm² LOAEL: 50.0 mg/cm² (based on AF of 100)

Acute - local effects 
Inhalation 0.042 mg/m³ NOAEC: 50.400 mg/m³ (based on AF of 1200)

Long-term - systemic effects 
Dermal 3 mg/kg bw/day NOAEL: 1,080 mg/kg bw/day (based on AF of 360)

Long-term - systemic effects 
Inhalation 12 mg/m³ NOAEC: 4,320 mg/m³ (based on AF of 360)

Long-term - systemic effects 
Oral 1.1 mg/kg bw/day NOAEL: 396.0 mg/kg bw/day (based on AF of 360)

Long-term - local effects 
Dermal 0.28 mg/cm² NOAEL: 100.80 mg/cm² (based on AF of 360)

Long-term - local effects 
Inhalation 16.62 mg/m³ NOAEL: 9,972.00 mg/m³ (based on AF of 600)

<table>
<thead>
<tr>
<th>Environmental protection target</th>
<th>PNEC</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh water</td>
<td>0.097 mg/L</td>
<td>Extrapolation method: assessment factor</td>
</tr>
<tr>
<td>Marine water</td>
<td>0.0007 mg/L</td>
<td></td>
</tr>
<tr>
<td>Intermittent release</td>
<td>0.97 mg/L</td>
<td>The LC50 from Acute toxicity to Algae, 97.2 mg/l, was used. This is the worst-case scenario for aquatic toxicity.</td>
</tr>
<tr>
<td>Sediment (fresh water)</td>
<td>0.097 mg/kg dw</td>
<td></td>
</tr>
<tr>
<td>Sediment (marine water)</td>
<td>0.0097 mg/kg dw</td>
<td></td>
</tr>
<tr>
<td>Soil (Terrestrial)</td>
<td>0.106 mg/kg dw</td>
<td>Extrapolation method: partition coefficient</td>
</tr>
<tr>
<td>Food chain (Oral, mammals)</td>
<td>2.51 mg/kg food</td>
<td>The endpoint used was 90 day sub-acute oral toxicity to rats which gave a result of 226 mg/kg bw/day and has an assessment factor of 90.</td>
</tr>
<tr>
<td>Sewage treatment</td>
<td>16.23 mg/L</td>
<td>Extrapolation method: assessment factor</td>
</tr>
</tbody>
</table>

DN(M)EL: Derived No(Minimal) Effect Level; NOAEL(C): No-observed-adverse-effect level (concentration), PNEC: Predicted No-Effect Concentration; AF: Assessment Factor

8.2 Exposure controls

8.2.1 Appropriate engineering controls:
Provide ventilation if necessary to minimize exposure. If practical use local mechanical exhaust ventilation at sources of air contamination such as open process equipment.

8.2.2 Personal protective measures:
Do not eat, drink, or smoke whilst working. Keep away from foodstuffs, beverages and feed. Remove all contaminated clothing. Wash hands before breaks and at the end of work.

Respiratory protection
A full-face piece respirator with dual organic vapour and particulate matter cartridge is recommended.

Hand Protection
Chemical resistant coveralls, gloves and boot covers. If gloves are damaged during use, remove immediately and wash hands before replacing with new gloves.

Eye and face protection
Safety glasses should be worn when handling this substance.

Skin protection
Aprons or coveralls are recommended. These should be changed after use or if contaminated. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

8.2.3 Environmental exposure controls:
Avoid release to the environment.
SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

- **Appearance:** Physical state: Solid, Crystalline
- **Colour:** White
- **Odour:** Strong odour of aromatic hydrocarbons
- **Odour threshold:** Unknown
- **pH:** Not available
- **Boiling point/range:** 266.5 - 322 °C
- **Melting point/ range:** 235 - 239 °C
- **Flash point:** Not applicable
- **Flammability:** Non-flammable
- **Autoflammability:** Use as flame retardant.
- **Explosive properties:** Not explosive
- **Vapour pressure:** at 25 °C: 0,00268 Pa
- **Vapour density:** no data available
- **Density:** at 20 °C: 1,76 g/cm³ (Pyknometer)
- **Solubility:** Easily soluble in: Acetone; Soluble in: Methanol, diethyl ether, n-octanol
- **Water solubility:** at 20 °C: <= 0,0025 g/L
- **Partition coefficient n-octanol/water:** at 20 °C: 1,76 log Kow (Chlorendic acid)
- **Auto-ignition temperature:** use as flame retardant.
- **Thermal decomposition:** no data available
- **Viscosity, dynamic:** no data available
- **Viscosity, kinematic:** not applicable
- **Explosive properties:** no data available
- **Oxidizing characteristics:** no data available
- **Dissociation Constant:** Chlorendic Anhydride readily hydrolyses

9.2 Other information

- **Molecular weight:** approx. 371 g/mol
- **Particle size distribution (median value):** 0,1% w/w < 10 µm
- **Evaporation rate:** Not applicable
- **Decomposition temperature:** Not available
- **Oxidising properties:** Not oxidising
- **Vapour density:** not available
- **Surface tension:** 72 mN/m (20°C, 450 mg/L aqueous solution). The product hydrolyses quickly in the presence of water to: Chlorendic acid

SECTION 10: Stability and reactivity

10.1 Reactivity

Not a reactive substance and no reactive hazards are expected.
No hazardous reaction when handled and stored according to provisions.

10.2 Chemical stability

Product is stable under normal storage conditions.
The product hydrolyses quickly in the presence of water to: Chlorendic acid

10.3 Possibility of hazardous reactions
No dangerous reactions are known.

10.4 Conditions to avoid
Protect from moisture contamination. Protect from heat and direct sunlight.

10.5 Incompatible materials
Oxidizing or reducing agents, strong bases, acids.

10.6 Hazardous decomposition products
No decomposition when used properly.

SECTION 11: Toxicological information

11.1 Information on toxicological effects
115-27-5, Chlorendic Anhydride:

(a) Acute toxicity
This substance is not classified as acute toxic for all exposure route listed below:

<table>
<thead>
<tr>
<th>Acute Toxicity</th>
<th>Effect Dos /Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Oral Toxicity</td>
<td>LD50: 2562 mg/kg bw (male)</td>
</tr>
<tr>
<td></td>
<td>LD50: 2130 mg/kg bw (female)</td>
</tr>
<tr>
<td>Acute dermal toxicity</td>
<td>LD50: 10000 - 20000 mg/kg bw</td>
</tr>
<tr>
<td>Acute inhalative toxicity (dust/mist)</td>
<td>LC50: &gt; 203 mg/l</td>
</tr>
</tbody>
</table>

(b) Skin corrosion/irritation
Causes skin irritation

(c) Serious eye damage/irritation
Causes serious eye irritation

<table>
<thead>
<tr>
<th>Irritation parameter</th>
<th>Basis</th>
<th>Time point</th>
<th>Score</th>
<th>Max. score</th>
<th>Reversibility</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>overall irritation</td>
<td>mean</td>
<td>14 days</td>
<td>16.4</td>
<td>17.3</td>
<td>no data</td>
<td>Rabbit</td>
</tr>
</tbody>
</table>

(d) Respiratory/skin sensitisation
May cause an allergic skin reaction

(e) Germ cell mutagenicity
Chlorendic Anhydride is not classified as genetically toxic as all study results are negative.

(f) Carcinogenicity
Suspected of causing cancer though oral exposure
Chlorendic anhydride will rapidly hydrolyse to chlorendic acid in the presence of water. The National Toxicology Program (NTP) has concluded that there is clear evidence of carcinogenicity (cancer) in a feeding study of rats and mice using chlorendic acid. International Agency for Research on Cancer (IARC) has given chlorendic acid an overall evaluation of 2B (possibly carcinogenic).

(g) Reproductive toxicity
Chlorendic anhydride is not classified as toxic to reproduction as negative results were obtained in the reproductive and spermatogenetic studies in animals.
Adverse effects on sexual function and fertility:

<table>
<thead>
<tr>
<th>Species</th>
<th>Result /Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>NOEL (Fetal mortality): &gt; 223 mg/kg bw/day (actual dose received)</td>
</tr>
</tbody>
</table>

Adverse effects on developmental toxicity:

<table>
<thead>
<tr>
<th>Species</th>
<th>Result / Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rats</td>
<td>NOEL: 400 mg/kg bw/day (actual dose received); NOEL (maternal toxicity): 100 mg/kg bw/day (nominal)</td>
</tr>
</tbody>
</table>

(h) STOT-single exposure
May cause respiratory irritation

(i) STOT-repeated exposure
Not classified

(j) Aspiration hazard
This substance is a solid.

108-31-6, Maleic anhydride in RTECS (#ON3675000):
- Dermal, guinea pig: LD50 = >20 gm/kg;
- Draize test, rabbit, eye: 1% Severe;
- Oral, mouse: LD50 = 465 mg/kg;
- Oral, rabbit: LD50 = 875 mg/kg;
- Oral, rat: LD50 = 400 mg/kg;
- Skin, rabbit: LD50 = 2620 mg/kg.

115-28-6, Chlorendic Acid in RTECS (#RB9000000):
- Draize test, rabbit, eye: 250 ug/24H Severe;
- Draize test, rabbit, skin: 500 mg/24H Mild.

The National Toxicology Program (NTP) has concluded that there is clear evidence of carcinogenicity (cancer) in a feeding study of rats and mice using Chlorendic acid. International Agency for Research on Cancer (IARC) has given Chlorendic acid an overall evaluation of 2B (possibly carcinogenic).

108-90-7, Chlorobenzene:
- Oral, LD50, Rat: 1110 mg/kg;
- Oral, LD50, Mouse: 2300 mg/kg.

SECTION 12: Ecological information

12.1 Toxicity
Aquatic toxicity: Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Acute (short-term) fish toxicity:
- LC50 Oncorhynchus mykiss: 422.7 mg/L/96h (EU Method C.1)
- LC50 Lepomis macrochirus (Bluegill): 422.7 mg/L/96h (EU Method C.1)
- LC50 (freshwater fish): 422.7 mg/L
Acute Daphnia toxicity:
- EC50 Daphnia magna (Big water flea): 110.7 mg/L/48h (EU Method C.2)

Acute (short-term) toxicity to crustacea:
- EC50/LC50: 110.7 mg/L/48h

Algae toxicity (acute):
- EC50/LC50: 97.2 mg/L/72h (Algal Inhibition test)
- EC10/LC10 or NOEC: 48.4 mg/L/72h (Algal Inhibition test)

Algae toxicity (chronic):
- EC50: >97.2 mg/L

Water Hazard Class: 2 = hazardous to water

| Predicted No Effect Concentration (PNEC) |
|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| Fresh water             | Marine water            | Intermittent release    | Sediment (fresh water)  | Sediment (marine water) | Soil (Terrestrial)      |
| 0.097 mg/L              | 0.0097 mg/L             | 0.97 mg/L               | 0.097 mg/kg dw          | 0.0097 mg/kg dw         | 0.106 mg/kg dw          |
|                         |                         |                         |                         |                         | 16.23 mg/L              |
|                         |                         |                         |                         |                         | 2.51 mg/kg food         |

12.2 Persistence and degradability

Further details:
Abiotic degradation:
- Chlorendic Anhydride hydrolyzed with water (Product: Chlorendic acid). - Water solubility (Chlorendic acid): 0.499 mg/L.

Biodegradation:
- Chlorendic Anhydride: Not bio-degradable.
- Chlorendic acid: Potentially biologically degradable.

12.3 Bioaccumulative potential

Partition coefficient n-octanol/water: 1.39 log Kow; No accumulation
Partition coefficient n-octanol/water: at 20 °C: 1.76 log Kow (Chlorendic acid)

Appreciable bio-accumulation is not to be expected (log Po/w 1-3).

12.4 Mobility in soil

Chlorendic Anhydride hydrolyzed with water (Product: Chlorendic acid) log Koc = 0.92 (Chlorendic acid)

12.5 Results of PBT and vPvB assessment

This substance does not meet the PBT/vPvB criteria of REACH, annex XIII.

12.6 Other adverse effects

General information: Do not allow to penetrate into soil, waterbodies or drains.

SECTION 13: Disposal considerations

13.1 Waste treatment methods Product

Waste key number: 07 01 99 = Wastes from the manufacture, formulation, supply and use (MFSU) of basic organic chemicals: Wastes not otherwise specified
MFSU = manufacture, formulation, supply and use

Recommendation: Ensure all waste water is collected and treated via a waste water system
treatment plant.
Alternative: Incinerate according to applicable local, state and federal regulations.

**Contaminated packaging**
Recommendation: Dispose of waste according to applicable legislation.

### SECTION 14: Transport information

14.1 UN number
Not applicable

14.2 UN proper shipping name
ADR/RID, IMDG, IATA: Not restricted

14.3 Transport hazard class(es)
Not applicable

14.4 Packing group
Not applicable

14.5 Environmental hazards
Marine pollutant - IMDG: No

14.6 Special precautions for user
No dangerous good in sense of these transport regulations.

14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC code
No data available

### SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

**National regulations - EC member states**

Labelling of packaging with <= 125mL content
Hazard statements:
H317 May cause an allergic skin reaction.
H351 Suspected of causing cancer.
H412 Harmful to aquatic life with long lasting effects.

Safety precautions:
P201 Obtain special instructions before use.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P309+P311 IF exposed or if you feel unwell: Call a POISON CENTER or doctor/physician.

**National regulations - USA**

TSCA Inventory: listed, active
TSCA H PVC: not listed

NFPA Hazard Rating:
- Health: 3 (Serious), Fire: 0 (Minimal), Reactivity: 0 (Minimal)

HMIS Version III Rating:
- Health: 3 (Serious) - Chronic effects, Flammability: 0 (Minimal), Physical Hazard: 0 (Minimal)
- Personal Protection: X = Consult your supervisor
15.2 Chemical Safety Assessment

For this substance a chemical safety assessment has been carried out.

**SECTION 16: Other information**

16.1 Indication of changes

- 2011-08-23, Section 2, 16
- 2017-09-20, Section 2,11, and 16:
  - Delete H373, STOT SE 3, add H335, STOT SE 3
  - Delete DSD Classification and Labeling in sections 2 and 16

- 2019-03-27, updated annex I, II and III
- 2019-04-12 Major update: change format on most sections of SDS.

16.2 Key literature references and sources for data

- Dossier and Chemical Safety Report (CSR) submitted to ECHA under REACH
- Hazardous Substance Data Bank (HSDB), National library of Medicine, #2920
- Product Data Sheet and SDS information from manufacturer.

For abbreviations and acronyms, see: ECHA Guidance on information requirements and chemical safety assessment, chapter R.20 (Table of terms and abbreviations).

16.3 Contact Information

<table>
<thead>
<tr>
<th>SDS or Regulatory information, contact:</th>
<th>Technical or Product Support Information, contact:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dawei Li</td>
<td>Sherman Friedman</td>
</tr>
<tr>
<td>Velsicol Chemical LLC</td>
<td>Velsicol Chemical LLC</td>
</tr>
<tr>
<td>1199 Warford Street</td>
<td>10400 W. Higgins Road</td>
</tr>
<tr>
<td>Memphis, TN 38108</td>
<td>Rosemont, IL  60018 U.S.A.</td>
</tr>
<tr>
<td>Phone: 901-323-6226, ext. 124</td>
<td>Phone:  847-635-3486</td>
</tr>
<tr>
<td>Fax: 901-324-5897</td>
<td>Fax:  847-298-9018</td>
</tr>
<tr>
<td><a href="mailto:dli@velsicol.com">dli@velsicol.com</a></td>
<td>Email: <a href="mailto:sfriedman@velsicol.com">sfriedman@velsicol.com</a></td>
</tr>
</tbody>
</table>

16.4 Further information: Notice to Reader

The information in this data sheet has been established to our best knowledge and was up-to-date at time of revision.

It does not represent a guarantee for the properties of the product described in terms of the legal warranty regulations.
### Annex I. Identified Uses (IU) of Chlorendic anhydride

<table>
<thead>
<tr>
<th>IU number</th>
<th>Identified Use (IU) name</th>
<th>Substance supplied to that use</th>
<th>Use descriptors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Receipt and storage of raw materials as such (substance itself)</td>
<td><strong>Process category (PROC):</strong>&lt;br&gt;PROC 1: Use in closed process, no likelihood of exposure&lt;br&gt;PROC 3: Use in closed batch process (synthesis or formulation)&lt;br&gt;PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities</td>
<td><strong>Market sector by type of chemical product:</strong>&lt;br&gt;PC 32: Polymer preparations and compounds&lt;br&gt;&lt;br&gt;<strong>Environmental release category (ERC):</strong>&lt;br&gt;ERC 2: Formulation of preparations&lt;br&gt;ERC 6d: Manufacture of uncured polyester resin&lt;br&gt;&lt;br&gt;<strong>Sector of end use (SU):</strong>&lt;br&gt;SU 10: Formulation [mixing] of preparations and/or re-packaging (excluding alloys)&lt;br&gt;&lt;br&gt;<strong>Subsequent service life relevant for that use?:</strong> no&lt;br&gt;&lt;br&gt;<strong>Article category related to subsequent service life (AC):</strong>&lt;br&gt;AC 0: Other: Not applicable</td>
</tr>
<tr>
<td>2</td>
<td>Blending / dissolving of dispersion as such (substance itself)</td>
<td><strong>Process category (PROC):</strong>&lt;br&gt;PROC 2: Use in closed, continuous process with occasional controlled exposure&lt;br&gt;PROC 4: Use in batch and other process (synthesis) where opportunity for exposure arises&lt;br&gt;PROC 5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)</td>
<td><strong>Market sector by type of chemical product:</strong>&lt;br&gt;PC 32: Polymer preparations and compounds&lt;br&gt;&lt;br&gt;<strong>Environmental release category (ERC):</strong>&lt;br&gt;ERC 2: Formulation of preparations&lt;br&gt;ERC 6d: Manufacture of uncured polyester resin&lt;br&gt;&lt;br&gt;<strong>Sector of end use (SU):</strong>&lt;br&gt;SU 10: Formulation [mixing] of preparations and/or re-packaging (excluding alloys)&lt;br&gt;&lt;br&gt;<strong>Subsequent service life relevant for that use?:</strong> no&lt;br&gt;&lt;br&gt;<strong>Article category related to subsequent service life (AC):</strong>&lt;br&gt;AC 0: Other: Not applicable&lt;br&gt;AC 32: Scented eraser</td>
</tr>
<tr>
<td>3</td>
<td>Filtering and filling in a mixture</td>
<td><strong>Process category (PROC):</strong>&lt;br&gt;PROC 8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities&lt;br&gt;PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Use in closed batch process</td>
<td>as such (substance itself)</td>
<td>Process category (PROC):</td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------</td>
<td>---------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PROC 3: Use in closed batch process (synthesis or formulation)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PROC 5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PROC 8b: Transfer of substance or preparation (charging /discharging) from/to vessels/large containers at dedicated facilities</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PROC 3: Use in closed batch process (synthesis or formulation)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PROC 8b: Transfer of substance or preparation (charging /discharging) from/to vessels/large containers at dedicated facilities</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PROC 3: Use in closed batch process (synthesis or formulation)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PROC 8b: Transfer of substance or preparation (charging /discharging) from/to vessels/large containers at dedicated facilities</td>
</tr>
</tbody>
</table>

**Market sector by type of chemical product:**
- PC 32: Polymer preparations and compounds

**Environmental release category (ERC):**
- ERC 2: Formulation of preparations
- ERC 6d: Manufacture of uncured polyester resin

**Sector of end use (SU):**
- SU 10: Formulation [mixing] of preparations and/or re-packaging (excluding alloys)
- SU 23: Electricity, steam, gas water supply and sewage treatment
- SU 3: Industrial uses

**Subsequent service life relevant for that use?**
- no

**Article category related to subsequent service life (AC):**
- AC 0: Other: Not applicable

**Waste management**

**Process category (PROC):**
- PROC 3: Use in closed batch process (synthesis or formulation)
- PROC 8b: Transfer of substance or preparation (charging /discharging) from/to vessels/large containers at dedicated facilities

**Market sector by type of chemical product:**
- PC 0: Other: Not applicable

**Environmental release category (ERC):**
- ERC 2: Formulation of preparations
- ERC 6d: Manufacture of uncured polyester resin

**Sector of end use (SU):**
- SU 10: Formulation [mixing] of preparations and/or re-packaging (excluding alloys)
- SU 23: Electricity, steam, gas water supply and sewage treatment

**Subsequent service life relevant for that use?**
- no

**Article category related to subsequent service life (AC):**
- AC 0: Other: Not applicable
<table>
<thead>
<tr>
<th></th>
<th>Process category (PROC):</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Transfer of substance in a mixture</td>
</tr>
<tr>
<td></td>
<td>PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities</td>
</tr>
<tr>
<td></td>
<td>PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)</td>
</tr>
<tr>
<td></td>
<td>Market sector by type of chemical product:</td>
</tr>
<tr>
<td></td>
<td>PC 32: Polymer preparations and compounds</td>
</tr>
<tr>
<td></td>
<td>Environmental release category (ERC):</td>
</tr>
<tr>
<td></td>
<td>ERC 2: Formulation of preparations</td>
</tr>
<tr>
<td></td>
<td>ERC 6d: Manufacture of uncured polyester resin</td>
</tr>
<tr>
<td></td>
<td>Sector of end use (SU):</td>
</tr>
<tr>
<td></td>
<td>SU 0: Other: Industrial uses</td>
</tr>
<tr>
<td></td>
<td>Subsequent service life relevant for that use?: no</td>
</tr>
<tr>
<td></td>
<td>Article category related to subsequent service life (AC):</td>
</tr>
<tr>
<td></td>
<td>AC 0: Other: Not applicable</td>
</tr>
<tr>
<td>8</td>
<td>Research and development. as such (substance itself)</td>
</tr>
<tr>
<td></td>
<td>Process category (PROC):</td>
</tr>
<tr>
<td></td>
<td>PROC 15: Use as laboratory reagent</td>
</tr>
<tr>
<td></td>
<td>Market sector by type of chemical product:</td>
</tr>
<tr>
<td></td>
<td>PC 32: Polymer preparations and compounds</td>
</tr>
<tr>
<td></td>
<td>Environmental release category (ERC):</td>
</tr>
<tr>
<td></td>
<td>ERC 2: Formulation of preparations</td>
</tr>
<tr>
<td></td>
<td>ERC 6d: Manufacture of uncured polyester resin</td>
</tr>
<tr>
<td></td>
<td>Sector of end use (SU):</td>
</tr>
<tr>
<td></td>
<td>SU 0: Other: n/a</td>
</tr>
<tr>
<td></td>
<td>Subsequent service life relevant for that use?: no</td>
</tr>
<tr>
<td></td>
<td>Article category related to subsequent service life (AC):</td>
</tr>
<tr>
<td></td>
<td>AC 0: Other: n/a</td>
</tr>
</tbody>
</table>
Annex II. Short description of all exposure scenarios for Chlorendic anhydride

Short description of all exposure scenarios with their use descriptors and life cycle chain:

<table>
<thead>
<tr>
<th>IU No.</th>
<th>Name of ES</th>
<th>Volume (T/annum)</th>
<th>Identified uses</th>
<th>Life cycle stage</th>
<th>Sector of Use (SU)</th>
<th>Product Category (PC)</th>
<th>Article category (AC)</th>
<th>Environmental Release Category (ERC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IU 1</td>
<td>Manufacture of uncured resins</td>
<td>1200</td>
<td>X X --</td>
<td>-- --</td>
<td>SU 3, 10</td>
<td>PC 32</td>
<td>PROC 1, 2, 3, 4, 5, 8a, 8b, 9, 15.</td>
<td>ERC 2, 6d</td>
</tr>
</tbody>
</table>

A total of 1200T/annum is to be imported, the environmental assessment was calculated with a 0.1 default for release to environment, the volume per formulation / polymerization is taken as 20T.

Annex III. Use at industrial sites; Polymer Preparations and Compounds

1.1. Title section

ES name: Manufacture of uncured resins  
Product category: Polymer Preparations and Compounds (PC 32)

<table>
<thead>
<tr>
<th>Environment</th>
<th>Worker</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Manufacture of uncured polyester resin using chlorendic anhydride</td>
<td>ERC 6d</td>
</tr>
<tr>
<td>2: Synthesis of uncured resin using chlorendic anhydride</td>
<td>PROC 1</td>
</tr>
<tr>
<td>3: Charging of chlorendic anhydride to reactor vessel.</td>
<td>PROC 8b</td>
</tr>
<tr>
<td>4: Analysis and research in laboratory situation.</td>
<td>PROC 15</td>
</tr>
</tbody>
</table>

1.2. Conditions of use affecting exposure

1.2.1. Control of environmental exposure: Manufacture of uncured polyester resin using chlorendic anhydride (ERC 6d)

- Daily amount per site <= 20.0 tonnes/day
- Annual amount per site <= 250.0 tonnes/year
- Municipal sewage treatment plant is assumed.
- Assumed domestic sewage treatment plant flow >= 2000 m3/day
- Dedicated recollection infrastructure required for waste
- Receiving surface water flow >= 18000 m3/day

1.2.2. Control of worker exposure: Synthesis of uncured resin using chlorendic anhydride (PROC 1)

- Covers concentrations up to 1.0 %
- Solid, low dustiness
- Covers use up to 8.0 h/day
- Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision.
- Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
### 1.2.3. Control of worker exposure: Charging of chlorendic anhydride to reactor vessel. (PROC 8b)

<table>
<thead>
<tr>
<th>Covers concentrations up to 100.0 %</th>
<th>Solid, low dustiness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covers use up to 0.25 h/day</td>
<td>Assumed that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision.</td>
</tr>
<tr>
<td>Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).</td>
<td>Local exhaust ventilation; Inhalation - minimum efficiency of 95.0 %</td>
</tr>
<tr>
<td>Wear suitable respiratory protection.; Inhalation - minimum efficiency of 90.0 %; For further specification, refer to section 8 of the SDS.</td>
<td></td>
</tr>
<tr>
<td>Indoor use</td>
<td>Assumes process temperature up to 40.0 °C</td>
</tr>
</tbody>
</table>

### 1.2.4. Control of worker exposure: Analysis and research in laboratory situation. (PROC 15)

<table>
<thead>
<tr>
<th>Covers concentrations up to 100.0 %</th>
<th>Solid, low dustiness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covers use up to 8.0 h/day</td>
<td>Assumed that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision.</td>
</tr>
<tr>
<td>Provide a good standard of controlled ventilation (5 to 10 air changes per hour).</td>
<td>Local exhaust ventilation; Inhalation - minimum efficiency of 90.0 %</td>
</tr>
<tr>
<td>Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.</td>
<td></td>
</tr>
<tr>
<td>Indoor use</td>
<td>Assumes process temperature up to 40.0 °C</td>
</tr>
</tbody>
</table>

### 1.3. Exposure estimation and reference to its source

#### 1.3.1. Environmental release and exposure: Manufacture of uncured polyester resin using chlorendic anhydride (ERC 6d)

<table>
<thead>
<tr>
<th>Release route</th>
<th>Release rate</th>
<th>Release estimation method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>0.4 kg/day</td>
<td>Estimated release factor</td>
</tr>
<tr>
<td>Air</td>
<td>1 kg/day</td>
<td>Estimated release factor</td>
</tr>
</tbody>
</table>
**Extended Safety Data Sheet**

### Protection target

<table>
<thead>
<tr>
<th>Protection target</th>
<th>Exposure estimate</th>
<th>RCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh water</td>
<td>0.02 mg/L (EUSES 2.1.2)</td>
<td>0.206</td>
</tr>
<tr>
<td>Sediment (freshwater)</td>
<td>0.075 mg/kg dw (EUSES 2.1.2)</td>
<td>0.774</td>
</tr>
<tr>
<td>Marine water</td>
<td>2E-3 mg/L (EUSES 2.1.2)</td>
<td>0.206</td>
</tr>
<tr>
<td>Sediment (marine water)</td>
<td>7.51E-3 mg/kg dw (EUSES 2.1.2)</td>
<td>0.774</td>
</tr>
<tr>
<td>Sewage Treatment Plant</td>
<td>0.2 mg/L (EUSES 2.1.2)</td>
<td>0.03</td>
</tr>
<tr>
<td>Agricultural soil</td>
<td>3.7E-3 mg/kg dw (EUSES 2.1.2)</td>
<td>0.035</td>
</tr>
<tr>
<td>Predator’s prey (freshwater)</td>
<td>4.84E-4 mg/kg ww (EUSES 2.1.2)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Predator’s prey (marine water)</td>
<td>4.84E-5 mg/kg ww (EUSES 2.1.2)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Top predator’s prey (marine water)</td>
<td>9.67E-6 mg/kg ww (EUSES 2.1.2)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Predator’s prey (terrestrial)</td>
<td>4.06E-4 mg/kg ww (EUSES 2.1.2)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Man via environment - Inhalation</td>
<td>9.52E-6 mg/m³ (EUSES 2.1.2)</td>
<td>0.033</td>
</tr>
<tr>
<td>Man via environment - Oral</td>
<td>5.77E-5 mg/kg bw/day (EUSES 2.1.2)</td>
<td>0.345</td>
</tr>
</tbody>
</table>

### 1.3.2. Worker exposure: *Synthesis of uncured resin using chlorendic anhydride (PROC 1)*

<table>
<thead>
<tr>
<th>Route of exposure and type of effects</th>
<th>Exposure estimate</th>
<th>RCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhalation, systemic, long term</td>
<td>7E-4 mg/m³ (TRA Workers 3.0)</td>
<td>0.017</td>
</tr>
<tr>
<td>Inhalation, systemic, acute</td>
<td>2.8E-3 mg/m³ (TRA Workers 3.0)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Inhalation, local, long term</td>
<td>7E-4 mg/m³ (TRA Workers 3.0)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Inhalation, local, acute</td>
<td>2.8E-3 mg/m³ (TRA Workers 3.0)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Dermal, systemic, long term</td>
<td>6.8E-4 mg/kg bw/day (TRA Workers 3.0)</td>
<td>0.058</td>
</tr>
<tr>
<td>Dermal, systemic, acute</td>
<td>6.8E-4 mg/kg bw/day (ECETOC TRA Workers)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Dermal, local, long term</td>
<td>1.98E-4 mg/cm² (TRA Workers 3.0)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Dermal, local, acute</td>
<td>1.98E-4 mg/cm² (TRA Workers 3.0)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Combined, systemic, acute</td>
<td>&lt; 0.01</td>
<td></td>
</tr>
</tbody>
</table>

### 1.3.3. Worker exposure: *Charging of chlorendic anhydride to reactor vessel. (PROC 8b)*

<table>
<thead>
<tr>
<th>Route of exposure and type of effects</th>
<th>Exposure estimate</th>
<th>RCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhalation, systemic, long term</td>
<td>3.5E-5 mg/m³ (TRA Workers 3.0)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Inhalation, systemic, acute</td>
<td>1.4E-3 mg/m³ (TRA Workers 3.0)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Inhalation, local, long term</td>
<td>3.5E-5 mg/m³ (TRA Workers 3.0)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Inhalation, local, acute</td>
<td>1.4E-3 mg/m³ (TRA Workers 3.0)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Dermal, systemic, long term</td>
<td>3.43E-3 mg/kg bw/day (TRA Workers 3.0)</td>
<td>0.293</td>
</tr>
<tr>
<td>Dermal, systemic, acute</td>
<td>3.4E-3 mg/kg bw/day (ECETOC TRA Workers)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Dermal, local, long term</td>
<td>2.5E-4 mg/cm² (TRA Workers 3.0)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Dermal, local, acute</td>
<td>2.5E-4 mg/cm² (TRA Workers 3.0)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Combined, systemic, acute</td>
<td>&lt; 0.01</td>
<td></td>
</tr>
</tbody>
</table>
1.3.4. Worker exposure: *Analysis and research in laboratory situation.* (PROC 15)

<table>
<thead>
<tr>
<th>Route of exposure and type of effects</th>
<th>Exposure estimate</th>
<th>RCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhalation, systemic, long term</td>
<td>3E-3 mg/m³ (TRA Workers 3.0)</td>
<td>0.073</td>
</tr>
<tr>
<td>Inhalation, systemic, acute</td>
<td>0.012 mg/m³ (TRA Workers 3.0)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Inhalation, local, long term</td>
<td>3E-3 mg/m³ (TRA Workers 3.0)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Inhalation, local, acute</td>
<td>0.012 mg/m³ (TRA Workers 3.0)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Dermal, systemic, long term</td>
<td>3.4E-3 mg/kg bw/day (TRA Workers 3.0)</td>
<td>0.291</td>
</tr>
<tr>
<td>Dermal, systemic, acute</td>
<td>3.4E-4 mg/kg bw/day (ECETOC TRA Workers)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Dermal, local, long term</td>
<td>9.92E-4 mg/cm² (TRA Workers 3.0)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Dermal, local, acute</td>
<td>9.92E-4 mg/cm² (TRA Workers 3.0)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Combined, systemic, acute</td>
<td></td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

1.4. **Guidance to DU to evaluate whether he works inside the boundaries set by the ES**

Guidance: If different operating conditions or risk management measures to those in this exposure scenario they must be equivalent or better in efficacy. This can be shown by use of exposure modelling software or by direct measurement of exposure.