1. PRODUCT AND COMPANY IDENTIFICATION

Product name: 1,4-Dioxane
Product Number: 29539
Brand: Sigma-Aldrich
Supplier: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63113
USA
Telephone: +1 800-325-5032
Fax: +1 636-329-5062
Emergency Phone # (For both supplier and manufacturer): (314) 778-6555
Preparation Information: Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8950

2. HAZARDS IDENTIFICATION

Emergency Overview
OSHA Hazards
Flammable liquid. Target Organ Effect, Irritant, Carcinogen. May form explosive peroxides.

Flammable liquid, Carcinogen, Target Organ Effect, Irritant

Target Organs
Liver, Kidney, Central nervous system

Other hazards which do not result in classification
May form explosive peroxides.

GHS Classification
Flammable liquids (Category 2)
Acute toxicity, Oral (Category 3)
Acute toxicity, Inhalation (Category 3)
Eye irritation (Category 2A)
Carcinogenicity (Category 2)
Specific target organ toxicity—single exposure (Category 3)
Chronic aquatic toxicity (Category 4)

GHS Label elements, including precautionary statements

Signal word: Danger
Hazard statement(s)
H228 Highly flammable liquid and vapor.
H303 + H333 May be harmful if swallowed or if inhaled.
H318 Causes serious eye irritation.
H335 May cause respiratory irritation.
H351 Suspected of causing cancer.

3. COMPOSITION INFORMATION ON INGREDIENTS

Synonyms: Dioxane
Formula: C₄H₈O₂
Molecular Weight: 88.11 g/mol

<table>
<thead>
<tr>
<th>Component</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,4-Dioxane</td>
<td></td>
</tr>
<tr>
<td>CAS-No.</td>
<td>123-91-1</td>
</tr>
<tr>
<td>EC-No.</td>
<td>204-681-8</td>
</tr>
<tr>
<td>Index-No.</td>
<td>600-024-09-5</td>
</tr>
</tbody>
</table>

4. FIRST AID MEASURES

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If Inhaled
If breathed in, move person to fresh air. If not breathing, give artificial respiration. Consult a physician.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Conditions of flammability
Flammable in the presence of a source of ignition when the temperature is above the flash point. Keep away from heat, sparks, open flame, hot surface. No smoking.
Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters
Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products
Hazardous decomposition products formed under fire conditions. - Carbon oxides

Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions
Use personal protective equipment. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet brushing and place in container for disposal according to local regulations (see section 15).

7. HANDLING AND STORAGE

Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. Use explosion-proof equipment. Keep away from sources of ignition - no smoking. Take measures to prevent the build up of electrostatic charge.

Conditions for safe storage
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resaled and kept upright to prevent leakage.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

<table>
<thead>
<tr>
<th>Components</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,4-Bis(acryloyloxyethoxy) ethane</td>
<td>123-91-1</td>
<td>TWA</td>
<td>20 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td><strong>Remarks</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liver damage. Confirmed animal carcinogen with unknown relevance to humans. Dosage of tentative absorption</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>25 ppm</td>
<td>USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>90 mg/m3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>100 ppm</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>360 mg/m3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skin irritation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td></td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
<td></td>
</tr>
</tbody>
</table>

Potential Occupational Carcinogen See Appendix A 30 minute ceiling value

Personal protective equipment

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type BBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Eye protection
Face shield and safety glasses. Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166 (EU).

Skin and body protection
Complete suit protecting against chemicals. Flame retardant anti-static protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures
Hands in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

<table>
<thead>
<tr>
<th>Form</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>liquid</td>
<td>colourless</td>
</tr>
</tbody>
</table>

Safety data

| pH | 6.0 - 8.0 at 500 g/l at 20 °C (68 °F) |
| Melting point/Range | 10 - 12 °C (50 - 54 °F) - it. |
| Flash point | 12 °C (54 °F) - closed cup |
| Ignition temperature | 180 °C (356 °F) |
| Autoplagiation temperature | no data available |
| Lower explosion limit | 2 % (V) |
| Upper explosion limit | 22 % (V) |
| Vapour pressure | 26 hPa (77 mmHg) at 20 °C (68 °F) |
| Density | 1,034 g/cm3 at 25 °C (77 °F) |
| Water solubility | completely miscible |
| Partition coefficients | log P ow/water: -0.27 |
| Relative vapour density | 3.04 (Air = 1.0) |
| Odour | no data available |
| Odour threshold | no data available |
| Evaporation rate | no data available |
10. STABILITY AND REACTIVITY

Chemical stability
Stable under recommended storage conditions.

Possibility of hazardous reactions
Vapours may form explosive mixture with air.

Conditions to avoid
Heat, flames and sparks. Extreme of temperature and direct sunlight.

Materials to avoid
Oxygen, Oxidizing agents, Halogens, Reducing agents, Perchlorates, Trimethylaluminum

Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides
Often decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50
LD50 Oral - rat = 4,200 mg/kg

Inhalation LC50
LC50 Inhalation - rat = 2 h - 46,000 mg/m3
Remarks: Sense Organs and Special Senses (Nose, eye, Ear, and Taste):Eye/Other.

Dermal LD50
LD50 Dermal - rabbit = 7,858 mg/kg

Other information on acute toxicity
no data available

Skin corrosion/irritation
Skin - Human -
Remarks: Chronic exposure causes drying effect on the skin and eczema.
Skin - rabbit - No skin irritation

Serious eye damage/eye irritation
Eyes - rabbit - Eye irritation - 24 h

Respiratory or skin sensitization
no data available

Germ cell mutagenicity
Laboratory experiments have shown mutagenic effects.

Carcinogenicity
This product is not contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.

Limited evidence of carcinogenicity in animal studies

IARC: 2B - Group 2B: Possibly carcinogenic to humans (1,4-Dioxane)
NTP: Reasonably anticipated to be a human carcinogen (1,4-Dioxane)
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
no data available

Teratogenicity
no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)
May cause respiratory irritation.

Specific target organ toxicity - repeated exposure (Globally Harmonized System)
no data available

Aspiration hazard
no data available

Potential health effects

Inhalation
May be harmful if inhaled. Causes respiratory tract irritation.

Ingestion
May be harmful if swallowed.

Skin
May be harmful if absorbed through skin. Causes skin irritation.

Eyes
Causes eye irritation.

Signs and Symptoms of Exposure
Nausea, Vomiting, Weakness, Dizziness, Vertigo, Headache, Sweating, loss of appetite, Kidney injury may occur., Liver injury may occur.

Synergistic effects
no data available

Additional information
RTECS: JG625000

12. ECOLOGICAL INFORMATION

Toxicity

Toxicity to fish
LC50 - Pinneaphila promelas (fathead minnow) - 985 mg/l - 68 h

Toxicity to daphnia and other aquatic invertebrates
EC50 - Daphnia magna (Water flea) - 6,450 mg/l - 24 h

Toxicity to algae
EC50 - Desmodesmus subspicatus (green algae) - > 550 mg/l - 72 h

Persistence and degradability
Biodegradability: Result: < 5% - Not readily biodegradable.

Bioaccumulative potential
Does not bioaccumulate.

Mobility in soil
no data available

PBT and vPvB assessment
no data available

Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
13. DISPOSAL CONSIDERATIONS

Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Disposal of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1165 Class: 3 Packing group: II
Proper shipping name: Dioxide
Reported Quantity (PQ): 100 lats
Marine pollutant: No
Pilot Inflamadon Hazard: No

IMDG
UN number: 1165 Class: 3 Packing group: II EMS-No: F-E, S-D
Proper shipping name: DIOXANE Marine pollutant: No

IATA
UN number: 1165 Class: 3 Packing group: II
Proper shipping name: Dioxide

15. REGULATORY INFORMATION

OSHA Hazards
Flammable liquid, Target Organ Effect, Irritant. Carcinogenic, May form explosive peroxides. Flammable liquid, Carcinogenic, Target Organ Effect, Irritant

SARA 302 Components
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

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SARA 311/312 Hazards
Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

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Pennsylvania Right To Know Components

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New Jersey Right To Know Components

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California Prop. 65 Components

<table>
<thead>
<tr>
<th>WARNING! This product contains a chemical known to the State of California to cause cancer.</th>
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<td>1,4-Dioxane</td>
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