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

Product identifier
Product Name 1,4-Dioxane
Product Code SC-208794

Recommended use of the chemical and restrictions on use
For research use only. Not intended for diagnostic or therapeutic use.

2. HAZARDS IDENTIFICATION

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification
Serious eye damage/eye irritation Category 2A
Carcinogenicity Category 1B
Specific target organ toxicity (single exposure) Category 3
Flammable liquids Category 2

Label elements
Signal word Danger
Hazard statements May be harmful if inhaled
Causes serious eye irritation
May cause cancer
May cause respiratory irritation
Highly flammable liquid and vapor

Precautionary Statements - Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Avoid breathing dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Keep away from heat/sparks/open flames/hot surfaces. — No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Use only non-sparking tools
Take precautionary measures against static discharge
Keep cool

Emergency telephone number
Chemtrec
1.800.424.9300 (Within USA)
+1.703.527.3887 (Outside USA)
Precautionary Statements - Response
IF exposed or concerned: Get medical advice/attention
IF IN EYES: Rinse cautiously with water for several minutes.
Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
In case of fire: Use CO2, dry chemical, or foam for extinction

Precautionary Statements - Storage
Store locked up Store in a well-ventilated place. Keep container tightly closed

Precautionary Statements - Disposal
Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)
Hazards not otherwise classified (HNOC) Not applicable

Other Information

3. COMPOSITION/INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Chemical name</th>
<th>CAS No.</th>
<th>Weight-%</th>
<th>Oral LD50</th>
<th>Dermal LD50</th>
<th>Inhalation LC50</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,4-Dioxane</td>
<td>123-91-1</td>
<td>&gt;98</td>
<td>= 4200 mg/kg ( Rat ) = 5170 mg/kg ( Rat )</td>
<td>= 7600 mg/kg ( Rabbit )</td>
<td>= 46 mg/L ( Rat ) 2 h</td>
</tr>
</tbody>
</table>

4. FIRST AID MEASURES

First Aid Measures
General advice Consult a physician if necessary. Remove to fresh air.
Eye contact Wash with plenty of water.
Skin Contact Wash skin with soap and water.
Inhalation Remove to fresh air If breathing is difficult, give oxygen If not breathing, give artificial respiration
Ingestion Never give anything by mouth to an unconscious person. Clean mouth with water.

Most important symptoms and effects, both acute and delayed
Symptoms No information available.

Indication of any immediate medical attention and special treatment needed
Note to physicians Treat symptomatically.

5. FIRE-FIGHTING MEASURES
Suitable Extinguishing Media
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable Extinguishing Media
No information available.

Specific hazards arising from the chemical
No information available.

Hazardous combustion products
Carbon oxides.

Explosion data
No information available.

Protective equipment and precautions for firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures
Ensure adequate ventilation, especially in confined areas.

Environmental precautions
See Section 12 for additional Ecological Information.

Methods and material for containment and cleaning up
Prevent further leakage or spillage if safe to do so.

Pick up and transfer to properly labeled containers.

7. HANDLING AND STORAGE

Precautions for safe handling
Noxious vapor/odor. Ensure adequate ventilation, especially in confined areas.

Conditions for safe storage, including any incompatibilities
Protect from moisture. Store at room temperature.

None known based on information supplied.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters
Vacated limits revoked by the Court of Appeals decision in AFL-CIO v. OSHA, 965 F.2d 962 (11th Cir., 1992).

<table>
<thead>
<tr>
<th>Chemical name</th>
<th>ACGIH TLV</th>
<th>OSHA PEL</th>
<th>NIOSH IDLH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,4-Dioxane</td>
<td>TWA: 20 ppm S* TWA: 100 ppm TWA: 360 mg/m³ (vacated) TWA: 25 ppm (vacated) TWA: 90 mg/m³ (vacated) S*</td>
<td>IDLH: 500 ppm Ceiling: 1 ppm 30 min Ceiling: 3.6 mg/m³ 30 min</td>
<td></td>
</tr>
</tbody>
</table>
NIOSH IDLH  Immediately Dangerous to Life or Health

Appropriate engineering controls
Engineering Controls  Ensure adequate ventilation, especially in confined areas

Individual protection measures, such as personal protective equipment
Eye/face protection  Wear safety glasses with side shields (or goggles).
Skin and Body Protection  Wear protective gloves and protective clothing.
Respiratory protection  If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.

General Hygiene Considerations  Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State  liquid
Appearance  No information available
Odor  No information available

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>No information available</td>
</tr>
<tr>
<td>Melting point/freezing point</td>
<td>10 °C</td>
</tr>
<tr>
<td>Boiling point</td>
<td>100 °C</td>
</tr>
<tr>
<td>Flash point</td>
<td>12 °C CC (closed cup)</td>
</tr>
<tr>
<td>Liquid Density</td>
<td>No information available</td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>No information available</td>
</tr>
<tr>
<td>Upper flammability limits</td>
<td>No information available</td>
</tr>
<tr>
<td>Lower flammability limit</td>
<td>No information available</td>
</tr>
<tr>
<td>Vapor pressure</td>
<td>No information available</td>
</tr>
<tr>
<td>Vapor density</td>
<td>No information available</td>
</tr>
<tr>
<td>Specific gravity</td>
<td>No information available</td>
</tr>
<tr>
<td>Water solubility</td>
<td>No information available</td>
</tr>
<tr>
<td>Solubility in other solvents</td>
<td>No information available</td>
</tr>
<tr>
<td>Partition coefficient</td>
<td>No information available</td>
</tr>
<tr>
<td>Autoignition temperature</td>
<td>No information available</td>
</tr>
<tr>
<td>Decomposition temperature</td>
<td>No information available</td>
</tr>
<tr>
<td>Kinematic viscosity</td>
<td>No information available</td>
</tr>
<tr>
<td>Explosive properties</td>
<td>No information available</td>
</tr>
<tr>
<td>Oxidizing properties</td>
<td>No information available</td>
</tr>
</tbody>
</table>

10. STABILITY AND REACTIVITY

Reactivity  Not applicable

Chemical stability  Stable under recommended storage conditions.
Possibility of Hazardous Reactions  None under normal processing.
Hazardous polymerization  No information available.
Conditions to avoid  Exposure to air or moisture over prolonged periods.
Incompatible materials  Strong oxidizing agents.
Hazardous Decomposition Products  Carbon oxides.

11. TOXICOLOGICAL INFORMATION
Information on likely routes of exposure

Inhalation: No data available.
Eye contact: No data available.
Skin Contact: No data available.
Ingestion: No data available.

Information on toxicological effects

Symptoms: No information available.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Chronic Toxicity: May cause adverse liver effects.
Target Organ Effects: Eyes, Respiratory system, Kidney, Liver, Nasal Cavities, Lungs, Skin.
Carcinogenicity: The table below indicates whether each agency has listed any ingredient as a carcinogen.

<table>
<thead>
<tr>
<th>Chemical name</th>
<th>ACGIH</th>
<th>IARC</th>
<th>NTP</th>
<th>OSHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,4-Dioxane</td>
<td>A3</td>
<td>Group 2B</td>
<td>Reasonably Anticipated</td>
<td>X</td>
</tr>
</tbody>
</table>

ACGIH (American Conference of Governmental Industrial Hygienists) A3 - Animal Carcinogen
IARC (International Agency for Research on Cancer) Group 2B - Possibly Carcinogenic to Humans
NTP (National Toxicology Program) Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen
OSHA (Occupational Safety and Health Administration of the US Department of Labor) X - Present

Numerical measures of toxicity - Product Information

Unknown acute toxicity: No information available.
The following values are calculated based on chapter 3.1 of the GHS document.

ATEmixture (dermal) 7600 mg/kg
ATEmixture (inhalation-dust/mist) 23 mg/l

12. ECOLOGICAL INFORMATION

Ecotoxicity: May cause long lasting harmful effects to aquatic life

<table>
<thead>
<tr>
<th>Chemical name</th>
<th>Algae/aquatic plants</th>
<th>Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Crustacea</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,4-Dioxane</td>
<td>123-91-1</td>
<td>10000: 96 h Lepomis macrochirus mg/L LC50 static 10000: 96 h Lepomis macrochirus mg/L LC50 semi-static 9850: 96 h Pimephales promelas mg/L LC50 10306 - 14742: 96 h Pimephales promelas mg/L LC50 flow-through</td>
<td>163: 48 h water flea mg/L EC50 Static</td>
<td></td>
</tr>
</tbody>
</table>

0% of the mixture consists of components(s) of unknown hazards to the aquatic environment.

Persistence and degradability: No information available.
Bioaccumulation: No information available.
Mobility: No information available.

<table>
<thead>
<tr>
<th>Chemical name</th>
<th>Partition coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,4-Dioxane</td>
<td>123-91-1</td>
</tr>
<tr>
<td></td>
<td>-0.42</td>
</tr>
</tbody>
</table>

13. DISPOSAL CONSIDERATIONS
Disposal of wastes
Disposal should be in accordance with applicable regional, national and local laws and regulations.

Contaminated packaging
Do not reuse container.

California Hazardous Waste Status
This product contains one or more substances that are listed with the State of California as a hazardous waste.

<table>
<thead>
<tr>
<th>Chemical name</th>
<th>California Hazardous Waste Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,4-Dioxane</td>
<td>Toxic</td>
</tr>
<tr>
<td>123-91-1</td>
<td>Ignitable</td>
</tr>
<tr>
<td></td>
<td>Reactive</td>
</tr>
</tbody>
</table>

14. TRANSPORT INFORMATION

DOT
UN/ID no: UN1165
Hazard Class: 3
Packing Group: II
Proper shipping name: Dioxane
Reportable Quantity (RQ): (1,4-Dioxane: RQ (kg)= 45.40)
Description: UN1165, Dioxane, 3, II
Emergency Response Guide Number: 127

IMDG
UN/ID no: UN1165
Hazard Class: 3
Packing Group: II
Proper shipping name: Dioxane
Description: UN1165, Dioxane, 3, II, (12°C c.c.)
EmS-No: F-E, S-D

IATA
UN/ID no: UN1165
Hazard Class: 3
Packing Group: II
Proper shipping name: Dioxane
Description: UN1165, Dioxane, 3, II
ERG Code: 3L

15. REGULATORY INFORMATION

International Inventories
All of the components in the product are on the following Inventory lists
TSCA (United States): Canada (DSL/NDSL) Europe (EINECS/ELINCS/NLP) Australia (AICS) South Korea (KECL): China (IECSC) ENCS (Japan): Philippines (PICCS)

<table>
<thead>
<tr>
<th>Chemical name</th>
<th>TSCA</th>
<th>DSL</th>
<th>NDSL</th>
<th>EINECS</th>
<th>ELINCS</th>
<th>ENCS</th>
<th>IECSC</th>
<th>KECL</th>
<th>PICCS</th>
<th>AICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,4-Dioxane</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

X - Listed
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances

US Federal Regulations
Santa Cruz Biotechnology, Inc.  www.scbt.com
SARA 313
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311/312 Hazard Categories
Acute health hazard  Yes
Chronic Health Hazard  Yes
Fire hazard  Yes
Sudden release of pressure hazard  No
Reactive hazard  No

CWA (Clean Water Act)
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

US State Regulations
California Proposition 65
This product contains the following Proposition 65 chemicals.

<table>
<thead>
<tr>
<th>Chemical name</th>
<th>California Proposition 65</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,4-Dioxane - 123-91-1</td>
<td>Carcinogen</td>
</tr>
</tbody>
</table>

U.S. State Right-to-Know Regulations

<table>
<thead>
<tr>
<th>Chemical name</th>
<th>New Jersey</th>
<th>Massachusetts</th>
<th>Pennsylvania</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,4-Dioxane</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>123-91-1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

16. OTHER INFORMATION

Revision note  No information available

Disclaimer
The information provided in this Material Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

End of Safety Data Sheet