1. PRODUCT AND COMPANY IDENTIFICATION

Product name: Tetrahydrofuran
Product Number: 401757
Brand: Sigma-Aldrich
Supplier: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103 USA
Telephone: +1 800-325-5832
Fax: +1 800-325-5052
Emergency Phone #: (314) 776-6555
Preparation Information: Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards
Flammable liquid, Target Organ Effect, Irritant, Carcinogen

Target Organs
Central nervous system, Liver, Kidney

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

GHS Classification
Flammable liquids (Category 2)
Acute toxicity, Oral (Category 5)
Skin irritation (Category 3)
Eye irritation (Category 2A)
Carcinogenicity (Category 2)
Specific target organ toxicity - single exposure (Category 3), Respiratory system

GHS Label elements, including precautionary statements

Signal word: Danger

Hazard statement(s)
H225 Highly flammable liquid and vapour.
H303 May be harmful if swallowed.
H316 Causes mild skin irritation.
H319 Causes serious eye irritation.
H335 May cause respiratory irritation.
H351 Suspected of causing cancer.

Precautionary statement(s)
P210 Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P261 Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P281 Use personal protective equipment as required.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Other hazards
May form explosive peroxides.

HMIS Classification
- Health hazard: 2
- Chronic Health Hazard: *
- Flammability: 3
- Physical hazards: 0

NFPA Rating
- Health hazard: 2
- Fire: 3
- Reactivity Hazard: 0

Potential Health Effects
- Inhalation May be harmful if inhaled. Causes respiratory tract irritation.
- Skin May be harmful if absorbed through skin. Causes skin irritation.
- Eyes Causes eye irritation.
- Ingestion May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms: THF
Formula: C₄H₈O
Molecular Weight: 72.11 g/mol

<table>
<thead>
<tr>
<th>Component</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetrahydrofuran</td>
<td>90 - 100 %</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>EC-No.</th>
<th>Index-No.</th>
<th>Registration number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetrahydrofuran</td>
<td>109-99-9</td>
<td>203-726-8</td>
<td>603-025-00-0</td>
<td>01-2119444314-46-XXXX</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 into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and 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 vapours, 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.

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 13).

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 resealed 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>Tetrahydrofuran</td>
<td>109-99-9</td>
<td>TWA</td>
<td>50 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
</tbody>
</table>

Remarks: Central Nervous System impairment Upper Respiratory Tract irritation Kidney damage Confirmed animal carcinogen with unknown relevance to humans Danger of cutaneous absorption

| STEL               | 100 ppm | USA. ACGIH Threshold Limit Values (TLV) |

<table>
<thead>
<tr>
<th>STEL</th>
<th>250 ppm</th>
<th>USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWA</td>
<td>200 ppm</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
</tbody>
</table>

The value in mg/m3 is approximate.

<table>
<thead>
<tr>
<th>TWA</th>
<th>200 ppm</th>
<th>USA. NIOSH Recommended Exposure Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST</td>
<td>250 ppm</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td>TWA</td>
<td>200 ppm</td>
<td>USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000</td>
</tr>
</tbody>
</table>
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 AXBEK (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.

Splash contact
Material: butyl-rubber
Minimum layer thickness: 0.3 mm
Break through time: 18 min
Material tested:Butoject® (KCL 897 / Aldrich Z677647, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

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 antistatic 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
Handle 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
Form liquid, clear
Colour colourless

Safety data
pH no data available
Melting point/freezing point -108.0 °C (-162.4 °F)
Boiling point 65.0 - 67.0 °C (149.0 - 152.6 °F)
Flash point -17.0 °C (1.4 °F) - closed cup
Ignition temperature 321 °C (610 °F)
Auto-ignition temperature 321.0 °C (609.8 °F)
Lower explosion limit 1.8 % (V)
Upper explosion limit 11.8 % (V)
Vapour pressure 152.0 hPa (114.0 mmHg) at 15.0 °C (59.0 °F)
190.7 hPa (143.0 mmHg) at 20.0 °C (68.0 °F)
213.3 hPa (160.0 mmHg) at 25.0 °C (77.0 °F)
373.3 hPa (280.0 mmHg) at 38.0 °C (100.4 °F)
Density 0.89 g/cm³
Water solubility soluble
Partition coefficient: n-octanol/water log Pow: < 1
Viscosity, kinematic 0.512 mm²/s at 25 °C (77 °F)
0.403 mm²/s at 50 °C (122 °F)
Relative vapour density no data available
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. Extremes of temperature and direct sunlight.

Materials to avoid
Oxidizing agents, Oxygen

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

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD₅₀
LD₅₀ Oral - rat - 2,050 - 2,850 mg/kg

Inhalation LC₅₀
LC₅₀ Inhalation - rat - 4 h - 54 mg/l

Dermal LD₅₀
LD₅₀ Dermal - rat - > 2,000 mg/kg

Other information on acute toxicity
no data available

Skin corrosion/irritation
Skin - rabbit - Mild skin irritation - Draize Test

Serious eye damage/eye irritation
Eyes - rabbit - Risk of serious damage to eyes. - Draize Test

Respiratory or skin sensitisation
Guinea pig - Did not cause sensitisation on laboratory animals.

Germ cell mutagenicity
In vivo tests did not show mutagenic effects

Genotoxicity in vitro - Ames test - S. typhimurium - negative

Carcinogenicity
Suspected human carcinogens
IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

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 toxicity to reproduction

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)
May cause drowsiness or dizziness. - Nervous system
May cause respiratory irritation.

Specific target organ toxicity - repeated exposure (Globally Harmonized System)
The substance or mixture is not classified as specific target organ toxicant, repeated exposure.

Aspiration hazard
No aspiration toxicity classification

Potential health effects

<table>
<thead>
<tr>
<th>Exposure</th>
<th>Effect</th>
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<tbody>
<tr>
<td>Inhalation</td>
<td>May be harmful if inhaled. Causes respiratory tract irritation.</td>
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<td>Ingestion</td>
<td>May be harmful if swallowed.</td>
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<tr>
<td>Skin</td>
<td>May be harmful if absorbed through skin. Causes skin irritation.</td>
</tr>
<tr>
<td>Eyes</td>
<td>Causes eye irritation.</td>
</tr>
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</table>

Signs and Symptoms of Exposure
Central nervous system depression, Cough, chest pain, Difficulty in breathing, Exposure to high airborne concentrations can cause anesthetic effects., To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Synergistic effects
no data available

Additional Information
RTECS: LU5950000

12. ECOLOGICAL INFORMATION

Toxicity

<table>
<thead>
<tr>
<th>Toxicity to</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>fish</td>
<td>LC50 - Pimephales promelas (fathead minnow) - 2,160 mg/l - 96 h</td>
</tr>
<tr>
<td>daphnia and other aquatic invertebrates</td>
<td>EC50 - Daphnia magna (Water flea) - 382 mg/l - 24 h</td>
</tr>
</tbody>
</table>

Persistence and degradability

Biodegradability
Method: OECD Test Guideline 301
Remarks: According to the results of tests of biodegradability this product is not readily biodegradable.

Bioaccumulative potential
No bioaccumulation is to be expected (log Pow <= 4).

Mobility in soil
no data available
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
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 2056   Class: 3   Packing group: II
Proper shipping name: Tetrahydrofuran
Reportable Quantity (RQ): 1000 lbs
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG
UN number: 2056   Class: 3   Packing group: II   EMS-No: F-E, S-D
Proper shipping name: TETRAHYDROFURAN
Marine pollutant: No

IATA
UN number: 2056   Class: 3   Packing group: II
Proper shipping name: Tetrahydrofuran

15. REGULATORY INFORMATION

OSHA Hazards
Flammable liquid, Target Organ Effect, Irritant, Carcinogen

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
SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

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

Massachusetts Right To Know Components

<table>
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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
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION
Further information
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