1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product Identifiers

Product name: Tetrahydrofuran
Product Number: 34885
Brand: Sigma-Aldrich
Index No.: 603-025-99-9
CAS-No.: 109-99-9

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

Identified uses: Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company: Sigma-Aldrich
3600 Spruce Street
SAINT LOUIS MO 63103
USA
Telephone: +1 800-325-5832
Fax: +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable liquids (Category 2), H225
Eye irritation (Category 2A), H319
Carcinogenicity (Category 2), H351
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word: Danger

Hazard statement(s)
H225: Highly flammable liquid and vapour.
H319: Causes serious eye irritation.
H335: May cause respiratory irritation.
H351: Suspected of causing cancer.

Precautionary statement(s)
P201: Obtain special instructions before use.
P202: Do not handle until all safety precautions have been read and understood.
P203: Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P233: Keep container tightly closed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula: C4H8O
Molecular Weight: 72.11 g/mol
CAS-No.: 109-99-9
EC-No.: 203-726-8
Index No.: 603-025-99-9
Registration number: 01-2119444314-46-XXXX

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of 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
Flush thoroughly with plenty of water for at least 15 minutes and consult a physician.

Ground/bond container and receiving equipment.
Use explosion-proof electrical, ventilating, lighting equipment.
Use only non-sparking tools.
Take precautionary measures against static discharge.
Avoid breathing dust, fumes, gas, mist, vapours, spray.
Wash skin thoroughly after handling.
Use only outdoors or in a well-ventilated area.
Wear protective gloves, protective clothing, eye protection, face protection.

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.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
IF EXPOSED OR CONSIDERED: Get medical advice/attention.
IFSkin irritation: Get medical advice/attention.
In case of fire: Use dry powder, dry chemical or alcohol-resistant foam for extinction.
Store in a well-ventilated place. Keep container tightly closed.
Store in a well-ventilated place. Keep cool.
Store locked up.
Dispose of contents/container to an approved waste disposal plant.
If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most Important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11.

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES
5.1 Extinguishing media
Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for fire fighting if necessary.

5.4 Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES
6.1 Personal precautions, protective equipment and emergency procedures
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. For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not to product enter drains.

6.3 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).

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE
7.1 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. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
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. Dry residue is explosive. Store under inert gas. Test for peroxide formation periodically and before distillation.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS - PERSONAL PROTECTION
8.1 Control parameters
Component with workplace control parameters

<table>
<thead>
<tr>
<th>Component</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 outaneous absorption

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

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

<table>
<thead>
<tr>
<th>Value</th>
<th>USA, NIOSH Recommended Exposure Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWA</td>
<td>50 ppm</td>
</tr>
<tr>
<td>ST</td>
<td>250 ppm</td>
</tr>
</tbody>
</table>

Remarks
TWA | 220 ppm | USA, Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants |

The value in mg/m3 is approximate.

<table>
<thead>
<tr>
<th>STEL</th>
<th>735 mg/m3</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEL</td>
<td>735 mg/m3</td>
</tr>
</tbody>
</table>

Remarks
TWA | 220 ppm | USA, OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1006 |

Biological occupational exposure limits

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Parameters</th>
<th>Value</th>
<th>Biological species</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetrahydrofuran</td>
<td>109-99-9</td>
<td>Tetrahydrofur an</td>
<td>2 mg/l</td>
<td>Urine</td>
<td>ACGIH - Biological Exposure Indices (BEI)</td>
</tr>
</tbody>
</table>

Remarks
End of shift (As soon as possible after exposure cease)

Derived No Effect Level (DNEL)

<table>
<thead>
<tr>
<th>Application Area</th>
<th>Exposure routes</th>
<th>Health effect</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workers</td>
<td>Skin contact</td>
<td>Long-term systemic effects</td>
<td>25 mg/kg BW/d</td>
</tr>
<tr>
<td>Consumers</td>
<td>Skin contact</td>
<td>Long-term systemic effects</td>
<td>15 mg/kg BW/d</td>
</tr>
<tr>
<td>Workers</td>
<td>Inhalation</td>
<td>Long-term systemic effects</td>
<td>150 mg/m3</td>
</tr>
<tr>
<td>Consumers</td>
<td>Inhalation</td>
<td>Long-term systemic effects</td>
<td>60 mg/m3</td>
</tr>
<tr>
<td>Workers</td>
<td>Inhalation</td>
<td>Acute systemic effects</td>
<td>150 mg/m3</td>
</tr>
<tr>
<td>Consumers</td>
<td>Inhalation</td>
<td>Acute systemic effects</td>
<td>150 mg/m3</td>
</tr>
</tbody>
</table>

Predicted No Effect Concentration (PNEC)

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil</td>
<td>5.13 mg/kg</td>
</tr>
<tr>
<td>Marine water</td>
<td>0.45 mg/l</td>
</tr>
<tr>
<td>Fresh water</td>
<td>4.5 mg/l</td>
</tr>
<tr>
<td>Marine sediment</td>
<td>2.38 mg/kg</td>
</tr>
<tr>
<td>Fresh water sediment</td>
<td>0.3 mg/kg</td>
</tr>
<tr>
<td>Onsite sewage treatment plant</td>
<td>4.6 mg/l</td>
</tr>
</tbody>
</table>
8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of
workday.

Personal protective equipment

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

Skin protection
Hands 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: Nitrile rubber
Minimum layer thickness: 0.5 mm
Break through time: 12 min
Material tested: Camaleon (KCL 733 / Allrich ZE7798, Size M)
Data source: KCL GmbH, D-36124 Echterhalden, phone +49 (0)5659 67300, 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.

Body Protection
Complete suit protecting against chemicals. Flame retardant antiacid protective clothing. The type of
protective equipment must be selected according to the concentration and amount of the dangerous substance
at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full face respirator with multi-
purpose combination (US) or type AXB/EN (EN 4087) 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).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a) Appearance
Form: liquid, clear
Colour: colourless
b) Odour
No data available
c) Odour Threshold
No data available
d) pH
No data available
e) Melting point/Freezing
Point -108.0 °C (-162.4 °F)
f) Initial boiling point and
Boiling range 65.0 - 67.0 °C (149.0 - 152.6 °F)
g) Flash point
-17.0 °C (1.4 °F) - closed cup
h) Evaporation rate
No data available
i) Flammability (solid, gas)
No data available
j) Upper/Lower Upper explosion limit: 11.8 %(V)

lower explosion limit: 1.1 %(V)
k) Vapour pressure
152.0 HPa (114.0 mmHg) at 15.0 °C (59.0 °F)
109.7 HPa (82.0 mmHg) at 20.0 °C (68.0 °F)
210.3 HPa (160.0 mmHg) at 25.0 °C (77.0 °F)
373.3 HPa (280.0 mmHg) at 35.0 °C (100.4 °F)
l) Vapour density
No data available
m) Relative density
0.89 g/cm³
n) Water solubility
Soluble
o) Partition coefficient: n-octanol/water
Log Pow: ˂ 1
p) Auto-ignition
Temperature 391.0 °C (736.8 °F)
q) Decomposition
Temperature No data available
r) Viscosity
0.512 mm²/s at 25 °C (77 °F) - 0.403 mm²/s at 50 °C (122 °F)
s) Explosive properties
No data available
t) Oxidizing properties
No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.
Test for peroxide formation before distillation or evaporation. Test for peroxide formation or discard after 1 year.

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

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

10.5 Incompatible materials
Oxidizing agents, Oxygen

10.6 Hazardous decomposition products
Other decomposition products - no data available
In the event of fire, see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - rat - 2.050 - 2.850 mg/kg
LD50 Inhalation - rat - 4 h - 54 mg/l
LD50 Dermal - rat - > 2,000 mg/kg
No data available

Skin corrosion/irritation
Skin - rabbit
Result: Mild skin irritation
(Draize Test)
12. ECOLOGICAL INFORMATION

12.1 Toxicity

- Toxicity to fish: LC50 - Phoxinus phoxinus (fathead minnow) - 2,160 mg/l - 96 h
- Toxicity to daphnia and other aquatic invertebrates: EC50 - Daphnia magna (Water flea) - 382 mg/l - 24 h
- Toxicity to algae: Growth inhibition IC50 - Algae - 3,700 mg/l - 162 h

12.2 Persistence and degradability

Biodegradability: (OECD Test Guidelines 301)

Remarks: According to the results of tests of biodegradability this product is not readily biodegradable.

12.3 Bioaccumulative potential

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

12.4 Mobility In soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

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

DCT (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

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

Tetrahydrofuran CAS-No. 109-99-9 Revision Date 1993-04-24

Pennsylvania Right To Know Components

Tetrahydrofuran CAS-No. 109-99-9 Revision Date 1993-04-24

New Jersey Right To Know Components

Tetrahydrofuran CAS-No. 109-99-9 Revision Date 1993-04-24

Sigma-Aldrich - 54055

Del/usa 9650149142-000000 Purchase Order CC/149515/ARANDA
**Tetrahydrofuran**

**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

Full text of H-Statements referred to under sections 2 and 3.

- **Carc**: Carcinogenicity
- **Eye Irrit**: Eye Irritation
- **Flam Lq**: Flammable liquids
- **H225**: Highly flammable liquid and vapour.
- **H319**: Causes serious eye irritation.
- **H335**: May cause respiratory irritation.
- **H351**: Suspected of causing cancer.
- **STOT SE**: Specific target organ toxicity - single exposure

#### HMIS Rating
- Health hazard: 2
- Chronic Health Hazard: *
- Flammability: 3
- Physical Hazard: 0

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

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Further Information
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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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**Preparation Information**
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-921-8958
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