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

1.1 Product identifiers

Product name : Tetrahydrofuran
Product Number : 401757
Brand : Sigma-Aldrich
Index-No. : 603-025-00-0
CAS-No. : 109-99-9

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

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES
Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 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
- Acute toxicity, Oral (Category 4), H302
- Eye irritation (Category 2A), H319
- Carcinogenicity (Category 2), H351
- Specific target organ toxicity - single exposure (Category 3), Respiratory system, Central nervous system, H335, H336

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 Statements**

H225  Highly flammable liquid and vapor.
H302  Harmful if swallowed.
H319  Causes serious eye irritation.
H335  May cause respiratory irritation.
H336  May cause drowsiness or dizziness.
H351  Suspected of causing cancer.

**Precautionary Statements**

P201  Obtain special instructions before use.
P202  Do not handle until all safety precautions have been read and understood.
P210  Keep away from heat/ sparks/ open flames/ hot surfaces. No smoking.
P233  Keep container tightly closed.
P240  Ground/bond container and receiving equipment.
P241  Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242  Use only non-sparking tools.
P243  Take precautionary measures against static discharge.
P261  Avoid breathing mist or vapors.
P264  Wash skin thoroughly after handling.
P270  Do not eat, drink or smoke when using this product.
P271  Use only outdoors or in a well-ventilated area.
P280  Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312 + P330  IF SWALLOWED: Call a POISON CENTER/ doctor if you feel unwell. Rinse mouth.
P303 + P361 + P353  IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340 + P312  IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/ doctor if you feel unwell.
P305 + P351 + P338  IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313  IF exposed or concerned: Get medical advice/ attention.
P337 + P313  If eye irritation persists: Get medical advice/ attention.
P370 + P378  In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
P403 + P233  Store in a well-ventilated place. Keep container tightly closed.
P403 + P235  Store in a well-ventilated place. Keep cool.
P405  Store locked up.
P501  Dispose of contents/ container to an approved waste disposal plant.

2.3 **Hazards not otherwise classified (HNOC) or not covered by GHS**

May form explosive peroxides.

May form explosive peroxides.
SECTION 3: Composition/information on ingredients

3.1 Substances
Synonyms: THF

Formula: C₄H₈O
Molecular weight: 72.11 g/mol
CAS-No.: 109-99-9
EC-No.: 5-53
Index-No.: 603-025-00-0

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetrahydrofuran</td>
<td>Flam. Liq. 2; Acute Tox. 4; Eye Irrit. 2A; Carc. 2; STOT SE 3; H225, H302, H319, H351, H335, H336</td>
<td>&lt;= 100 %</td>
</tr>
<tr>
<td>Concentration limits:</td>
<td>&gt;= 25 %: Eye Irrit. 2, H319; &gt; = 25 %: STOT SE 3, H335;</td>
<td></td>
</tr>
</tbody>
</table>

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

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Call in physician.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/shower. Consult a physician.

In case of eye contact
After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed
After swallowing: immediately make victim drink water (two glasses at most). 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
SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
- Carbon dioxide (CO2)
- Foam
- Dry powder

Unsuitable extinguishing media
- For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture

- Carbon oxides
- Combustible.
- Pay attention to flashback.
- Vapors are heavier than air and may spread along floors.
- Development of hazardous combustion gases or vapours possible in the event of fire.
- Forms explosive mixtures with air at ambient temperatures.

5.3 Advice for firefighters

- Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information

- Remove container from danger zone and cool with water. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel:
- Do not breathe vapors, aerosols. Avoid substance contact. Ensure adequate ventilation. Keep away from heat and sources of ignition.
- Evacuate the danger area, observe emergency procedures, consult an expert.
- For personal protection see section 8.

6.2 Environmental precautions

- Do not let product enter drains. Risk of explosion.

6.3 Methods and materials for containment and cleaning up

- Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up carefully with liquid-absorbent material (e.g. Chemizorb®). Dispose of properly. Clean up affected area.

6.4 Reference to other sections

- For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling
- Work under hood. Do not inhale substance/mixture. Avoid generation of vapours/aerosols.
Advice on protection against fire and explosion
Keep away from open flames, hot surfaces and sources of ignition. Take precautionary measures against static discharge.

Hygiene measures
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
Keep container tightly closed in a dry and well-ventilated place. Keep away from heat and sources of ignition.

Test for peroxide formation periodically and before distillation.

Storage class
Storage class (TRGS 510): 3: Flammable liquids

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

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients 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>
<tr>
<td>Remarks</td>
<td></td>
<td></td>
<td></td>
<td>Confirmed animal carcinogen with unknown relevance to humans Danger of cutaneous absorption</td>
</tr>
<tr>
<td>STEL</td>
<td></td>
<td>100 ppm</td>
<td></td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td>Remarks</td>
<td></td>
<td></td>
<td></td>
<td>Confirmed animal carcinogen with unknown relevance to humans Danger of cutaneous absorption</td>
</tr>
</tbody>
</table>
### Biological occupational exposure limits

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Parameters</th>
<th>Value</th>
<th>Biological specimen</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetrahydrofuran</td>
<td>109-99-9</td>
<td>Tetrahydrofuran</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 ceases)

### Derived No Effect Level (DNEL)

<table>
<thead>
<tr>
<th>Application Area</th>
<th>Routes of exposure</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>25mg/kg BW/d</td>
</tr>
<tr>
<td>Consumers</td>
<td>Skin contact</td>
<td>Long-term systemic effects</td>
<td>15mg/kg BW/d</td>
</tr>
<tr>
<td>Workers</td>
<td>Inhalation</td>
<td>Long-term local effects</td>
<td>150 mg/m3</td>
</tr>
<tr>
<td>Consumers</td>
<td>Inhalation</td>
<td>Long-term systemic effects</td>
<td>62 mg/m3</td>
</tr>
<tr>
<td>Consumers</td>
<td>Inhalation</td>
<td>Acute local 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>Compartment</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil</td>
<td>2.13 mg/kg</td>
</tr>
<tr>
<td>Sea water</td>
<td>0.432 mg/l</td>
</tr>
<tr>
<td>Fresh water</td>
<td>4.32 mg/l</td>
</tr>
<tr>
<td>Sea sediment</td>
<td>2.33 mg/kg</td>
</tr>
<tr>
<td>Fresh water sediment</td>
<td>23.3 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**

Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.
Personal protective equipment

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

**Skin protection**
This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).
Splash contact
Material: butyl-rubber
Minimum layer thickness: 0.7 mm
Break through time: 10 min
Material tested:Butoject® (KCL 898)

**Body Protection**
Flame retardant antistatic protective clothing.

**Respiratory protection**
Recommended Filter type: Filter A (acc. to DIN 3181) for vapours of organic compounds
The entrepeneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer.
These measures have to be properly documented.
required when vapours/aerosols are generated. Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

**Control of environmental exposure**
Do not let product enter drains. Risk of explosion.

---

**SECTION 9: Physical and chemical properties**

**9.1 Information on basic physical and chemical properties**

a) Appearance
Form: liquid

b) Odor
No data available

c) Odor Threshold
No data available

d) pH
c.a.7 - 8

e) Melting point/freezing point
Melting point: -108.44 °C (-163.19 °F) - (ECHA)

f) Initial boiling point and boiling range
65 °C 149 °F at 1,013.25 hPa - (ECHA)

g) Flash point
-21.2 °C (-6.2 °F) - closed cup - DIN 51755 Part 1

h) Evaporation rate
No data available

i) Flammability (solid, No data available
gas)

j) Upper/lower flammability or explosive limits
   - Upper explosion limit: 12.4 % (V) - (THF)
   - Lower explosion limit: 1.5 % (V)

k) Vapor pressure
   - 170 hPa at 20 °C (68 °F) - (THF)

l) Vapor density
   - No data available

m) Density
   - 0.89 g/cm³ at 20 °C (68 °F)
   - Relative density
     - No data available

n) Water solubility
   - miscible

o) Partition coefficient: n-octanol/water
   - log Pow: 0.45 at 25 °C (77 °F) - Bioaccumulation is not expected.

p) Autoignition temperature
   - 215 °C (419 °F) at 1,013 hPa - DIN 51794

q) Decomposition temperature
   - No data available

r) Viscosity
   - No data available

s) Explosive properties
   - No data available

t) Oxidizing properties
   - none

9.2 Other safety information
   - No data available

SECTION 10: Stability and reactivity

10.1 Reactivity
   - Formation of peroxides possible.
   - Vapors may form explosive mixture with air.

10.2 Chemical stability
   - Sensitivity to light
   - Sensitive to air.
   - The product is chemically stable under standard ambient conditions (room temperature).
   - 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
   - Vapors may form explosive mixture with air.

10.4 Conditions to avoid
   - Distillation (Risk of explosion).
   - Warming.
   - Moisture.
10.5 Incompatible materials
No data available

10.6 Hazardous decomposition products
Peroxides
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - male and female - 1,650 mg/kg
Remarks: (ECHA)
Symptoms: Irritation of mucous membranes
LC50 Inhalation - Rat - male and female - 6 h - > 14.7 mg/l - vapor

(US-EPA)
LD50 Dermal - Rat - male and female - > 2,000 mg/kg
(OECD Test Guideline 402)

Skin corrosion/irritation
Skin - Rabbit
Result: No skin irritation - 72 h
Remarks: Repeated or prolonged exposure may cause skin irritation and dermatitis, due to degreasing properties of the product.

Serious eye damage/eye irritation
Eyes - Rabbit
Result: Causes serious eye irritation.
Remarks: (IUCLID)

Remarks: Classified according to Regulation (EU) 1272/2008, Annex VI (Table 3.1/3.2)

Respiratory or skin sensitization

Germ cell mutagenicity
Test Type: Ames test
Test system: S. typhimurium
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 471
Result: negative
Test Type: In vitro mammalian cell gene mutation test
Test system: Chinese hamster ovary cells
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 476
Result: negative
Test Type: Chromosome aberration test in vitro
Test system: Chinese hamster ovary cells
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 473
Result: negative

Test Type: Micronucleus test
Species: Mouse
Cell type: Red blood cells (erythrocytes)
Application Route: inhalation (vapor)
Method: OECD Test Guideline 474
Result: negative

Carcinogenicity
Suspected of causing cancer.

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Tetrahydrofuran)
NTP: No ingredient 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 on OSHA’s list of regulated carcinogens.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
Inhalation - May cause respiratory irritation. - Central nervous system
Remarks: Classified according to Regulation (EU) 1272/2008, Annex VI (Table 3.1/3.2)
May cause drowsiness or dizziness.

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

11.2 Additional Information
Repeated dose toxicity - Rat - male and female - Oral - 4 Weeks

RTECS: LU5950000
Irritant effects, Cough, Shortness of breath, narcosis, somnolence
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.
In high doses:

somnolence
narcosis

Other dangerous properties can not be excluded.

This substance should be handled with particular care.

Stomach - Irregularities - Based on Human Evidence
SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish  
flow-through test LC50 - Pimephales promelas (fathead minnow) - 2,160 mg/l - 96 h  
(OECD Test Guideline 203)

Toxicity to daphnia and other aquatic invertebrates  
static test EC50 - Daphnia magna (Water flea) - 3,485 mg/l - 48 h  
(OECD Test Guideline 202)

Toxicity to fish (Chronic toxicity)  
flow-through test NOEC - Pimephales promelas (fathead minnow) - 216 mg/l - 33 d  
Remarks: (ECHA)

12.2 Persistence and degradability

Biodegradability  
aerobic Biochemical oxygen demand - Exposure time 28 d  
Result: 39 % - Not readily biodegradable.  
(OECD Test Guideline 301D)

12.3 Bioaccumulative potential

No data available

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 Endocrine disrupting properties

No data available

12.7 Other adverse effects

No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product  
Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.
SECTION 14: Transport information

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

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

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

SECTION 15: Regulatory information

SARA 302 Components
This material does not contain any components with a section 302 EHS TPQ.

SARA 313 Components
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 1993-02-16

Pennsylvania Right To Know Components
Tetrahydrofuran   CAS-No.   109-99-9   Revision Date 1993-02-16

California Prop. 65 Components
, which is/are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.Tetrahydrofuran

CAS-No.   Revision Date
109-99-9   2021-12-31

SECTION 16: Other information

Further information
The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture
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