The life science business of Merck KGaA, Darmstadt, Germany operates as MilliporeSigma in the US and Canada

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

1.1 Product identifiers

Product name : Formic acid
Product Number : 27001
Brand : SIGALD
Index-No. : 607-001-00-0
CAS-No. : 64-18-6

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 3), H226
- Acute toxicity, Oral (Category 4), H302
- Acute toxicity, Inhalation (Category 3), H331
- Skin corrosion (Category 1A), H314
- Serious eye damage (Category 1), H318

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

2.2 GHS Label elements, including precautionary statements
2.3 Hazards not otherwise classified (HNOC) or not covered by GHS
Corrosive to the respiratory tract.

SECTION 3: Composition/information on ingredients

3.1 Substances

Formula: \( \text{CH}_2\text{O}_2 \)

SIGALD - 27001
Molecular weight : 46.03 g/mol  
CAS-No. : 64-18-6  
EC-No. : 200-579-1  
Index-No. : 607-001-00-0

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formic acid</td>
<td>Flam. Liq. 3; Acute Tox. 4; Acute Tox. 3; Skin Corr. 1A; Eye Dam. 1; H226, H302, H331, H314, H318</td>
<td>&lt;= 100 %</td>
</tr>
<tr>
<td></td>
<td>Concentration limits:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; 78.5 %: Acute Tox. 3, H331; 75 - 78.5 %: Acute Tox. 4, H332; &gt; 75 %: , EUH071; &gt;= 90 %: Skin Corr. 1A, H314; 10 - &lt; 90 %: Skin Corr. 1B, H314; 2 - &lt; 10 %: Skin Irrit. 2, H315; 2 - &lt; 10 %: Eye Irrit. 2, H319;</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
First aiders need to protect themselves. Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Immediately call in physician. If breathing stops: immediately apply artificial respiration, if necessary also oxygen.

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

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

If swallowed
After swallowing: make victim drink water (two glasses at most), avoid vomiting (risk of perforation). Pulmonary failure possible after aspiration of vomit. Call a physician immediately. Do not attempt to neutralise.

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
Water Foam Carbon dioxide (CO2) 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.
Vapors are heavier than air and may spread along floors.
Forms explosive mixtures with air at elevated temperatures.
Development of hazardous combustion gases or vapours possible in the event of fire.

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. Keep locked up or in an area accessible only to qualified or authorized persons.

Vent periodically. Handle and open container with care. Hygroscopic.

**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>Formic acid</td>
<td>64-18-6</td>
<td>TWA</td>
<td>5 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>STEL</td>
<td>10 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA</td>
<td>5 ppm 9 mg/m3</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA</td>
<td>5 ppm 9 mg/m3</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
<tr>
<td></td>
<td></td>
<td>STEL</td>
<td>10 ppm 19 mg/m3</td>
<td>California permissible exposure limits for chemical contaminants (Title 8, Article 107)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PEL</td>
<td>5 ppm 9 mg/m3</td>
<td>California permissible exposure limits for chemical contaminants (Title 8, Article 107)</td>
</tr>
</tbody>
</table>

**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>Inhalation</td>
<td>Long-term local effects, Long-term systemic effects</td>
<td>9.5 mg/m3</td>
</tr>
<tr>
<td>Workers</td>
<td>Inhalation</td>
<td>Acute local effects, Acute systemic effects</td>
<td>19 mg/m3</td>
</tr>
<tr>
<td>Consumers</td>
<td>Inhalation</td>
<td>Acute local effects, Acute systemic effects</td>
<td>9.5 mg/m3</td>
</tr>
<tr>
<td>Consumers</td>
<td>Inhalation</td>
<td>Long-term local effects, Long-term systemic effects</td>
<td>3 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>1.5 mg/kg</td>
</tr>
<tr>
<td>Sea water</td>
<td>0.22 mg/l</td>
</tr>
<tr>
<td>Fresh water</td>
<td>2 mg/l</td>
</tr>
<tr>
<td>Sea sediment</td>
<td>1.34 mg/kg</td>
</tr>
<tr>
<td>Fresh water sediment</td>
<td>13.4 mg/kg</td>
</tr>
<tr>
<td>Sewage treatment plant</td>
<td>7.2 mg/l</td>
</tr>
<tr>
<td>Aquatic intermittent release</td>
<td>1 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). Tightly fitting safety goggles

**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).

**Full contact**
Material: Chloroprene
Minimum layer thickness: 0.65 mm
Break through time: 480 min
Material tested: KCL 720 Camapren®

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: Latex gloves
Minimum layer thickness: 0.6 mm
Break through time: 60 min
Material tested: Lapren® (KCL 706 / Aldrich Z677558, Size M)

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

**Respiratory protection**
Recommended Filter type: Filter E-(P3)
The entrepreneur 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.

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**SECTION 9: Physical and chemical properties**

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

a) **Appearance**
   Form: liquid
   Color: colorless

b) **Odor**
   Stinging

---

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c) Odor Threshold 0.02 ppm

d) pH 2.2 at 10 g/l at 20 °C (68 °F)

e) Melting point/freezing point Melting point/range: 8.2 - 8.4 °C (46.8 - 47.1 °F) - lit.

f) Initial boiling point and boiling range 100 - 101 °C 212 - 214 °F - lit.

g) Flash point 48 °C (118 °F) - closed cup

h) Evaporation rate No data available

i) Flammability (solid, gas) No data available

j) Upper/lower flammability or explosive limits Upper explosion limit: 38 % (V)
Lower explosion limit: 18 % (V)

k) Vapor pressure 171 hPa at 50 °C (122 °F) - OECD Test Guideline 104

l) Vapor density 1.59 - (Air = 1.0)

m) Density 1.22 g/cm³ at 25 °C (77 °F) - lit.

Relative density 1.2220 °C - OECD Test Guideline 109

n) Water solubility miscible in all proportions, (experimental)

o) Partition coefficient: n-octanol/water log Pow: -2.1 at 23 °C (73 °F) - OECD Test Guideline 107 - Bioaccumulation is not expected.

p) Autoignition temperature 528 °C (982 °F) at 1,008 hPa - Tested according to Directive 92/69/EEC.

q) Decomposition temperature 350 °C (662 °F) -

r) Viscosity 1.47 mm²/s at 20 °C (68 °F) - OECD Test Guideline 114 - 1.02 mm²/s at 40 °C (104 °F) - OECD Test Guideline 114 -

s) Explosive properties No data available

t) Oxidizing properties none

9.2 Other safety information

Surface tension 71.5 mN/m at 1g/l at 20 °C (68 °F) - OECD Test Guideline 115
Dissociation constant 3.7 at 20 °C (68 °F) - OECD Test Guideline 112
Relative vapor density 1.59 - (Air = 1.0)

SECTION 10: Stability and reactivity

10.1 Reactivity

Vapor/air-mixtures are explosive at intense warming.
10.2 **Chemical stability**  
The product is chemically stable under standard ambient conditions (room temperature).

10.3 **Possibility of hazardous reactions**  
Risk of ignition or formation of inflammable gases or vapours with:  
Aluminum  
Risk of explosion with:  
organic nitro compounds  
sodium hypochlorite  
hydrogen peroxide  
furfuryl alcohol  
Generates dangerous gases or fumes in contact with:  
alkalines  
Strong oxidizing agents  
sulfuric acid  
nonmetallic oxides  
metal catalysts  
Oxides of phosphorus  
Nitric acid  
nitrates  
Exothermic reaction with:  
alkaline earth hydroxides  
alkali hydroxides  
bases  
Amines

10.4 **Conditions to avoid**  
Heating.

10.5 **Incompatible materials**  
No data available

10.6 **Hazardous decomposition products**  
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 - 730 mg/kg  
(OECD Test Guideline 401)  
LC50 Inhalation - Rat - male and female - 4 h - 7.85 mg/l - vapor  
(OECD Test Guideline 403)  
Dermal: No data available

**Skin corrosion/irritation**  
Skin - Rabbit  
Result: Causes severe burns.  
(OECD Test Guideline 404)  
Remarks: Classified according to Regulation (EU) 1272/2008, Annex VI (Table 3.1/3.2)
**Serious eye damage/eye irritation**
Remarks: Causes serious eye damage.
Conjunctivitis
Lacrimal irritation due to vapours.

**Respiratory or skin sensitization**
Buehler Test - Guinea pig
Result: negative
(OECD Test Guideline 406)
Prolonged or repeated exposure may cause allergic reactions in certain sensitive individuals.

**Germ cell mutagenicity**
Test Type: Ames test
Test system: Salmonella typhimurium
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 471
Result: negative
Test Type: sister chromatid exchange assay
Test system: Chinese hamster lung cells
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 479
Result: negative
Test Type: sister chromatid exchange assay
Test system: Human lymphocytes
Metabolic activation: without metabolic activation
Method: OECD Test Guideline 479
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: gene mutation test
Species: Drosophila melanogaster

Application Route: Oral
Method: OECD Test Guideline 477
Result: negative

**Carcinogenicity**
IARC: No ingredient 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 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
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11.2 **Additional Information**

Repeated dose toxicity - Rat - male and female - Oral - 52 Weeks - NOAEL (No observed adverse effect level) - 400 mg/kg - LOAEL (Lowest observed adverse effect level) - 2,000 mg/kg

Remarks: (in analogy to similar products)

RTECS: LQ4900000
Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin., spasm, inflammation and edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema, burning sensation, Cough, wheezing, laryngitis, Shortness of breath, Headache, Nausea, Vomiting

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Kidney - Irregularities - Based on Human Evidence

Kidney - Irregularities - Based on Human Evidence

**SECTION 12: Ecological information**

12.1 **Toxicity**

Toxicity to fish

static test LC50 - Danio rerio (zebra fish) - 130 mg/l - 96 h

(OECD Test Guideline 203)

Remarks: The value is given in analogy to the following substances: ammonium formate

Toxicity to daphnia and other aquatic invertebrates

static test EC50 - Daphnia magna (Water flea) - 365 mg/l - 48 h

(OECD Test Guideline 202)

Remarks: The value is given in analogy to the following substances: ammonium formate

Toxicity to algae

static test ErC50 - Pseudokirchneriella subcapitata - 1,240 mg/l - 72 h

(OECD Test Guideline 201)

Remarks: The value is given in analogy to the following substances: ammonium formate
Toxicity to bacteria: static test NOEC - activated sludge - 72 mg/l - 13 d
Remarks: (ECHA)

Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity): semi-static test NOEC - Daphnia magna (Water flea) - >= 100 mg/l - 21 d
(OECD Test Guideline 211)

12.2 Persistence and degradability
Biodegradability: aerobic - Exposure time 14 d
Result: 100 % - Readily biodegradable.
(OECD Test Guideline 301C)

Biochemical Oxygen Demand (BOD): 86 mg/g
Remarks: (External MSDS)

Ratio BOD/ThBOD: 8.60 %

12.3 Bioaccumulative potential
Bioaccumulation is unlikely. Does not significantly accumulate in organisms.

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

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: 1779 Class: 8 (3) Packing group: II
SIGALD - 27001
Proper shipping name: Formic acid
Reportable Quantity (RQ): 5000 lbs
Poison Inhalation Hazard: No

**IMDG**
UN number: 1779  Class: 8 (3)  Packing group: II  EMS-No: F-E, S-C

**IATA**
UN number: 1779  Class: 8 (3)  Packing group: II

---

**SECTION 15: Regulatory information**

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

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

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formic acid</td>
<td>64-18-6</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>

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

**Massachusetts Right To Know Components**

<table>
<thead>
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<tbody>
<tr>
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<td>2007-07-01</td>
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</table>

**Pennsylvania Right To Know Components**

<table>
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<th>CAS-No.</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Formic acid</td>
<td>64-18-6</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>

---

**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 and is applicable to appropriate safety precautions for the product. 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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