1 Identification of substance:

Product details:

Product name: 1-Chloroethyl chloroformate

Stock number: L14197

Manufacturer/Supplier:
Alfa Aesar, A Johnson Matthey Company
Johnson Matthey Catalog Company, Inc.
30 Bond Street
Ward Hill, MA 01835-8099
Emergency Phone: (978) 521-6300
CHEMTREC: (800) 424-9300
Web Site: www.alfa.com

Information Department: Health, Safety and Environmental Department

Emergency information:
During normal hours the Health, Safety and Environmental Department. After normal hours call
Chemtrec at (800) 424-9300.

2 Composition/Data on components:

Chemical characterization:

Description: (CAS#)
1-Chloroethyl chloroformate (CAS# 50893-53-3): 100%

Identification number(s):
EINECS Number: 256-834-2

3 Hazards identification

Hazard description:

T Toxic

Information pertaining to particular dangers for man and environment
R 10 Flammable.
R 22 Harmful if swallowed.
R 23 Toxic by inhalation.
R 34 Causes burns.

Classification system

HMIS ratings (scale 0-4)
(Hazardous Materials Identification System)

<table>
<thead>
<tr>
<th>HEALTH</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Health (acute effects) = 3</td>
</tr>
<tr>
<td></td>
<td>Flammability = 2</td>
</tr>
<tr>
<td></td>
<td>Reactivity = 1</td>
</tr>
</tbody>
</table>

GHS label elements

Danger

3.1/3 - Toxic if swallowed.
3.1/2 - Fatal if inhaled.

Danger

3.2/1B - Causes severe skin burns and eye damage.

Warning

2.6/3 - Flammable liquid and vapour.

Prevention:
Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
Keep container tightly closed.
Ground/bond container and receiving equipment.
Use explosion-proof electrical/ventilating/lighting/ equipment.
Use only non-sparking tools.
Take precautionary measures against static discharge.
Do not breathe dust/fume/gas/mist/vapours/spray.
Material Safety Data Sheet
acc. to OSHA and ANSI

Printing date 05/15/2009 Reviewed on 05/13/2009

Product name: 1-Chloroethyl chloroformate

Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.
Use only outdoors or in a well-ventilated area.
Wear protective gloves/protective clothing/eye protection/face protection.
Wear respiratory protection.

Response:
IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
IF INHALED: Remove 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.
Immediately call a POISON CENTER or doctor/physician.
Specific treatment is urgent (see label).
Specific treatment (see label).
Rinse mouth.
Wash contaminated clothing before reuse.
In case of fire: Use for extinction: CO2, powder or water spray.

Storage:
Store in a well-ventilated place. Keep container tightly closed.
Store in a well-ventilated place. Keep cool.
Store locked up.

Disposal:
Dispose of contents/container in accordance with local/regional/national/international regulations.

4 First aid measures

General information
Immediately remove any clothing soiled by the product.
Remove breathing apparatus only after contaminated clothing has been completely removed.
In case of irregular breathing or respiratory arrest provide artificial respiration.

After inhalation
Supply fresh air. If required, provide artificial respiration. Keep patient warm.
Seek immediate medical advice.

After skin contact
Immediately wash with water and soap and rinse thoroughly.
Seek immediate medical advice.

After eye contact
Rinse opened eye for several minutes under running water. Then consult a doctor.

After swallowing
Do not induce vomiting; immediately call for medical help.
Seek immediate medical advice.

5 Fire fighting measures

Suitable extinguishing agents CO2, sand, extinguishing powder. Do not use water.
For safety reasons unsuitable extinguishing agents Water
Special hazards caused by the material, its products of combustion or resulting gases:
In case of fire, the following can be released:
Carbon monoxide and carbon dioxide
Hydrogen chloride (HCl)

Protective equipment:
Wear self-contained respirator.
Wear fully protective impervious suit.

6 Accidental release measures

Person-related safety precautions:
Wear protective equipment. Keep unprotected persons away.
Ensure adequate ventilation

Measures for environmental protection:
Do not allow material to be released to the environment without proper governmental permits.

Measures for cleaning/collecting:
Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
Use neutralizing agent.
Dispose contaminated material as waste according to item 13.
Ensure adequate ventilation.

Additional information:
See Section 7 for information on safe handling.
7 Handling and storage

Handling
Information for safe handling:
Handle under dry protective gas.
Keep container tightly sealed.
Ensure good ventilation at the workplace.
Open and handle container with care.

Information about protection against explosions and fires:
Keep ignition sources away.
Protect against electrostatic charges.
Fumes can combine with air to form an explosive mixture.

Storage
Requirements to be met by storerooms and receptacles: Refrigerate
Information about storage in one common storage facility:
Store away from oxidizing agents.
Store away from strong bases.
Protect from heat.
Store away from water/moisture.

Further information about storage conditions:
Store under dry inert gas.
This product is moisture sensitive.
Keep container tightly sealed.
Protect from humidity and water.
Refrigerate

8 Exposure controls and personal protection

Additional information about design of technical systems:
Properly operating chemical fume hood designed for hazardous chemicals and having an average face velocity of at least 100 feet per minute.

Components with limit values that require monitoring at the workplace: Not required.

Additional information: No data

Personal protective equipment
General protective and hygienic measures
The usual precautionary measures for handling chemicals should be followed.
Keep away from foodstuffs, beverages and feed.
Remove all soiled and contaminated clothing immediately.
Wash hands before breaks and at the end of work.
Store protective clothing separately.
Avoid contact with the eyes and skin.

Breathing equipment: Use suitable respirator when high concentrations are present.

Protection of hands:
Impervious gloves
Check protective gloves prior to each use for their proper condition.

Material of gloves
The selection of suitable gloves not only depends on the material, but also on quality.
Quality will vary from manufacturer to manufacturer.

Eye protection:
Safety glasses
Tightly sealed goggles
Full face protection

Body protection: Protective work clothing.

9 Physical and chemical properties:

General Information

<table>
<thead>
<tr>
<th>Form:</th>
<th>Liquid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color:</td>
<td>Colorless</td>
</tr>
<tr>
<td>Odor:</td>
<td>Fungent</td>
</tr>
</tbody>
</table>

Change in condition

<table>
<thead>
<tr>
<th>Melting point/Melting range:</th>
<th>-65°C (-85°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiling point/Boiling range:</td>
<td>119-121°C (246-250°F)</td>
</tr>
<tr>
<td>Sublimation temperature / start:</td>
<td>Not determined</td>
</tr>
</tbody>
</table>
10 Stability and reactivity

Thermal decomposition / conditions to be avoided: Do not heat above 80°C.
Materials to be avoided:
- Oxidizing agents
- Bases
- Water/moisture
- Heat

Dangerous reactions: No dangerous reactions known

Dangerous products of decomposition:
- Carbon monoxide and carbon dioxide
- Hydrogen chloride (HCl)

11 Toxicological information

Acute toxicity:

LD50/LC50 values that are relevant for classification:

Oral LD50 470 mg/kg (rat)

Primary irritant effect:
- on the skin: Corrosive effect on skin and mucous membranes.
- on the eye:
  - Strong corrosive effect.
  - Lachrymatory effect.

Sensitization: No sensitizing effects known.

Subacute to chronic toxicity:

Corrosive materials are acutely destructive to the respiratory tract, eyes, skin and digestive tract. Eye contact may result in permanent damage and complete vision loss. Inhalation may result in respiratory effects such as inflammation, edema, and chemical pneumonitis. May cause coughing, wheezing, laryngitis, shortness of breath, headache, nausea and vomiting. Ingestion may cause damage to the mouth, throat and esophagus. May cause skin burns or irritation depending on the severity of the exposure.

Additional toxicological information:

To the best of our knowledge the acute and chronic toxicity of this substance is not fully known. Swallowing will lead to a strong corrosive effect on mouth and throat and to the danger of perforation of esophagus and stomach. No classification data on carcinogenic properties of this material is available from the EPA, IARC, NTP, OSHA or ACGIH.

12 Ecological information:

General notes:
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
Do not allow material to be released to the environment without proper governmental permits.

13 Disposal considerations

Product:
Recommendation Consult state, local or national regulations to ensure proper disposal.
Material Safety Data Sheet
acc. to OSHA and ANSI

Product name: 1-Chloroethyl chloroformate

Uncleaned packagings:
Recommendation: Disposal must be made according to official regulations.

14 Transport information

DOT regulations:

Hazard class: 6.1
Identification number: UN2742
Packing group: II
Proper shipping name (technical name): CHLOROFORMATES, TOXIC, CORROSIVE, FLAMMABLE, N.O.S. (1-Chloroethyl chloroformate)
Label 6.1+8+3

Land transport ADR/RID (cross-border)

ADR/RID class: 6.1 (TFC) Toxic substances
Danger code (Kemler): 638
UN-Number: 2742
Packaging group: II
Description of goods: 2742 CHLOROFORMATES, TOXIC, CORROSIVE, FLAMMABLE, N.O.S. (1-Chloroethyl chloroformate)

Maritime transport IMDG:

IMDG Class: 6.1
UN Number: 2742
Label 6.1+3+8
Packaging group: II
Proper shipping name: CHLOROFORMATES, TOXIC, CORROSIVE, FLAMMABLE, N.O.S. (1-Chloroethyl chloroformate)

Air transport ICAO-TI and IATA-DGR:

ICAO/IATA Class: 6.1
UN/ID Number: 2742
Label 6.1+3+8
Packaging group: II
Proper shipping name: CHLOROFORMATES, TOXIC, CORROSIVE, FLAMMABLE, N.O.S. (1-Chloroethyl chloroformate)

UN "Model Regulation":
UN2742, CHLOROFORMATES, TOXIC, CORROSIVE, FLAMMABLE, N.O.S., 6.1 (3+8), II

15 Regulations

Product related hazard informations:

Hazard symbols:
T Toxic

Risk phrases:
10 Flammable.
22 Harmful if swallowed.
23 Toxic by inhalation.
34 Causes burns.

Safety phrases:
26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
36/37/39 Wear suitable protective clothing, gloves and eye/face protection.
45 In case of accident or if you feel unwell, seek medical advice immediately.

National regulations
This product is not listed in the U.S. Environmental Protection Agency Toxic Substances Control Act Chemical Substance Inventory. Use of this product is restricted to research and development only.
Some or all of the components of this product are not listed on the Canadian Domestic Substances List (DSL) or the Canadian Non-Domestic Substances List (NDSL).

Information about limitation of use: For use only by technically qualified individuals.

16 Other information:
Employers should use this information only as a supplement to other information gathered by them, and should make independent judgement of suitability of this information to ensure proper use and protect the health and safety of employees. This information is furnished without warranty, and any use of the product not in conformance with this Material Safety Data Sheet, or in combination with any other product or process, is the responsibility of the user.

Department issuing MSDS: Health, Safety and Environmental Department.
Contact: Zachariah Holt

Abbreviations and acronyms:
ADR: Accord européen sur le transport des marchandises dangereuses par route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
RID: Règlement international concernant le transport des marchandises dangereuses par chemin de fer (Regulations Concerning the International Transport of Dangerous Goods by Rail)
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
IATA-DGR: Dangerous Goods Regulations by the "International Air Transport Association" (IATA)
ICAO: International Civil Aviation Organization
ICAO-TI: Technical Instructions by the "International Civil Aviation Organization" (ICAO)
GHS: Globally Harmonized System of Classification and Labelling of Chemicals
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
HMIS: Hazardous Materials Identification System (USA)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent