

ETHYL CHLOROFORMATE

ECF

CAUTIONARY RESPONSE INFORMATION

Common Synonyms Chloroformic acid, ethyl ester Ethyl chloroformate		Liquid Colorless to light yellow Irritating odor Reacts slowly with water. Irritating vapor is produced.
<p>KEEP PEOPLE AWAY. AVOID CONTACT WITH LIQUID AND VAPOR. Avoid inhalation. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Shut off ignition sources. Call fire department. Evacuate area in case of large discharge. Stay upwind. Use water spray to "knock down" vapor. Notify local health and pollution control agencies. Protect water intakes.</p>		
Fire	FLAMMABLE. POISONOUS GASES MAY BE PRODUCED IN FIRE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves). Extinguish with dry chemicals or carbon dioxide. Cool exposed containers with water.	
Exposure	CALL FOR MEDICAL AID. VAPOR POISONOUS IF INHALED OR IF SKIN IS EXPOSED. Irritating to eyes, nose and throat. Move victim to fresh air. If in eyes, hold eyelids open and flush with plenty of water. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. LIQUID POISONOUS IF SWALLOWED OR IF SKIN IS EXPOSED. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.	
Water Pollution	Effect of low concentrations on aquatic life is unknown. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.	

1. CORRECTIVE RESPONSE ACTIONS

Dilute and disperse
 Stop discharge
 Collection Systems: Pump
 Chemical and Physical Treatment:
 Neutralize
 Do not burn

2. CHEMICAL DESIGNATIONS

2.1 CG Compatibility Group: Not listed.
 2.2 Formula: C₂H₃ClO₂
 2.3 IMO/UN Designation: 3.2/1182
 2.4 DOT ID No.: 1182
 2.5 CAS Registry No.: 541-41-3
 2.6 NAERG Guide No.: 155
 2.7 Standard Industrial Trade Classification: 51374

3. HEALTH HAZARDS

- 3.1 **Personal Protective Equipment:** Air-line mask, self-contained breathing apparatus, or organic and acid canister mask; full protective clothing.
- 3.2 **Symptoms Following Exposure:** Inhalation causes mucous membrane irritation, coughing, and sneezing. Vapor causes severe lachrymation; liquid causes acid-type burns of eyes and skin, like those of hydrochloric acid. Ingestion causes severe burns of mouth and stomach.
- 3.3 **Treatment of Exposure:** INHALATION: remove to fresh air; use artificial respiration if breathing has stopped; call a doctor; keep victim quiet and administer oxygen if needed. EYES: flush with water for at least 15 min.; see a doctor. SKIN: wash liberally with water for at least 15 min., then apply dilute solution of sodium bicarbonate or commercially prepared neutralizer. INGESTION: do NOT induce vomiting; give large amount of water; get medical attention.
- 3.4 TLV-TWA: Not listed.
 3.5 TLV-STEL: Not listed.
 3.6 TLV-Ceiling: Not listed.
 3.7 **Toxicity by Ingestion:** Grade 4; oral LD₅₀ <50 mg/kg (rat)
 3.8 **Toxicity by Inhalation:** Currently not available.
 3.9 **Chronic Toxicity:** Currently not available
 3.10 **Vapor (Gas) Irritant Characteristics:** Vapors are moderately irritating such that personnel will not usually tolerate moderate or high concentrations.
 3.11 **Liquid or Solid Characteristics:** Causes smarting of the skin and first-degree burns on short exposure and may cause second-degree burns on long exposure.
 3.12 **Odor Threshold:** Currently not available
 3.13 IDLH Value: Not listed.
 3.14 OSHA PEL-TWA: Not listed.
 3.15 OSHA PEL-STEL: Not listed.
 3.16 OSHA PEL-Ceiling: Not listed.
 3.17 EPA AEGL: Not listed

4. FIRE HAZARDS

- 4.1 **Flash Point:** 82°F O.C. 61°F C.C.
 4.2 **Flammable Limits in Air:** Currently not available
 4.3 **Fire Extinguishing Agents:** Water, dry chemical, carbon dioxide
 4.4 **Fire Extinguishing Agents Not to Be Used:** Not pertinent
 4.5 **Special Hazards of Combustion Products:** Toxic chlorine and phosgene gases may be formed in fires.
 4.6 **Behavior in Fire:** Not pertinent
 4.7 **Auto Ignition Temperature:** 932°F
 4.8 **Electrical Hazards:** Currently not available
 4.9 **Burning Rate:** 2.6 mm/min.
 4.10 **Adiabatic Flame Temperature:** Currently not available
 4.11 **Stoichiometric Air to Fuel Ratio:** 14.3 (calc.)
 4.12 **Flame Temperature:** Currently not available
 4.13 **Combustion Molar Ratio (Reactant to Product):** 6.0 (calc.)
 4.14 **Minimum Oxygen Concentration for Combustion (MOCC):** Not listed

5. CHEMICAL REACTIVITY

- 5.1 **Reactivity with Water:** Slow reaction with water, evolving hydrogen chloride (hydrochloric acid)
 5.2 **Reactivity with Common Materials:** Slow evolution of hydrogen chloride from surface moisture reaction can cause slow corrosion.
 5.3 **Stability During Transport:** Stable
 5.4 **Neutralizing Agents for Acids and Caustics:** Flush with water, rinse with sodium bicarbonate or lime solution.
 5.5 **Polymerization:** Not pertinent
 5.6 **Inhibitor of Polymerization:** Not pertinent

6. WATER POLLUTION

- 6.1 **Aquatic Toxicity:** Currently not available
 6.2 **Waterfowl Toxicity:** Currently not available
 6.3 **Biological Oxygen Demand (BOD):** Currently not available
 6.4 **Food Chain Concentration Potential:** None
 6.5 **GESAMP Hazard Profile:**
 Bioaccumulation: 0
 Damage to living resources: 3
 Human Oral hazard: 2
 Human Contact hazard: II
 Reduction of amenities: XXX

7. SHIPPING INFORMATION

- 7.1 **Grades of Purity:** Technical: 94+%
 7.2 **Storage Temperature:** Ambient
 7.3 **Inert Atmosphere:** No requirement
 7.4 **Venting:** Pressure-vacuum
 7.5 **IMO Pollution Category:** Currently not available
 7.6 **Ship Type:** Currently not available
 7.7 **Barge Hull Type:** Currently not available

8. HAZARD CLASSIFICATIONS

- 8.1 49 CFR Category: Poison
 8.2 49 CFR Class: 6.1
 8.3 49 CFR Package Group: I
 8.4 Marine Pollutant: No
 8.5 NFPA Hazard Classification:
- | Category | Classification |
|---------------------------|----------------|
| Health Hazard (Blue)..... | - |
| Flammability (Red)..... | 3 |
| Instability (Yellow)..... | 1 |
- 8.6 EPA Reportable Quantity: Not listed.
 8.7 EPA Pollution Category: Not listed.
 8.8 RCRA Waste Number: Not listed
 8.9 EPA FWPCA List: Not listed

9. PHYSICAL & CHEMICAL PROPERTIES

- 9.1 **Physical State at 15° C and 1 atm:** Liquid
 9.2 **Molecular Weight:** 108.5
 9.3 **Boiling Point at 1 atm:** 201°F = 94°C = 367°K
 9.4 **Freezing Point:** -114°F = -81°C = 192°K
 9.5 **Critical Temperature:** Not pertinent
 9.6 **Critical Pressure:** Not pertinent
 9.7 **Specific Gravity:** 1.135 at 20°C (liquid)
 9.8 **Liquid Surface Tension:** 27.5 dynes/cm = 0.0275 N/m at 15°C
 9.9 **Liquid Water Interfacial Tension:** Not pertinent
 9.10 **Vapor (Gas) Specific Gravity:** 3.7
 9.11 **Ratio of Specific Heats of Vapor (Gas):** 1.1044
 9.12 **Latent Heat of Vaporization:** (est.) 140 Btu/lb = 79 cal/g = 3.3 X 10⁵ J/kg
 9.13 **Heat of Combustion:** (est.) -6,900 Btu/lb = -3,800 cal/g = -160 X 10⁵ J/kg
 9.14 **Heat of Decomposition:** Not pertinent
 9.15 **Heat of Solution:** Currently not available
 9.16 **Heat of Polymerization:** Not pertinent
 9.17 **Heat of Fusion:** Currently not available
 9.18 **Limiting Value:** Currently not available
 9.19 **Reid Vapor Pressure:** Currently not available

NOTES

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9.20 SATURATED LIQUID DENSITY		9.21 LIQUID HEAT CAPACITY		9.22 LIQUID THERMAL CONDUCTIVITY		9.23 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F	Temperature (degrees F)	British thermal unit inch per hour-square foot-F	Temperature (degrees F)	Centipoise
35	72.790	42	0.406	42	1.048	42	4.641
40	72.500	44	0.407	44	1.048	44	4.504
45	72.209	46	0.408	46	1.048	46	4.372
50	71.910	48	0.409	48	1.048	48	4.245
55	71.620	50	0.410	50	1.048	50	4.123
60	71.320	52	0.411	52	1.048	52	4.005
65	71.030	54	0.412	54	1.048	54	3.892
70	70.730	56	0.413	56	1.048	56	3.782
75	70.440	58	0.414	58	1.048	58	3.677
80	70.139	60	0.416	60	1.048	60	3.575
85	69.849	62	0.417	62	1.048	62	3.476
90	69.549	64	0.418	64	1.048	64	3.381
95	69.259	66	0.419	66	1.048	66	3.290
100	68.959	68	0.420	68	1.048	68	3.201
		70	0.421	70	1.048	70	3.116
		72	0.422	72	1.048	72	3.033
		74	0.423	74	1.048	74	2.954
		76	0.424	76	1.048	76	2.877

9.24 SOLUBILITY IN WATER		9.25 SATURATED VAPOR PRESSURE		9.26 SATURATED VAPOR DENSITY		9.27 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
	R	60	0.055	60	0.00107	0	0.179
	E	70	0.090	70	0.00172	20	0.183
	A	80	0.145	80	0.00271	40	0.188
	C	90	0.229	90	0.00421	60	0.192
	T	100	0.356	100	0.00644	80	0.196
	S	110	0.546	110	0.00969	100	0.201
		120	0.825	120	0.01438	120	0.205
		130	1.228	130	0.02105	140	0.209
		140	1.804	140	0.03042	160	0.213
		150	2.618	150	0.04341	180	0.217
		160	3.753	160	0.06122	200	0.221
		170	5.319	170	0.08538	220	0.226
		180	7.457	180	0.11780	240	0.230
		190	10.350	190	0.16100	260	0.234
		200	14.210	200	0.21770	280	0.238
		210	19.340	210	0.29190	300	0.242
						320	0.246
						340	0.250
						360	0.253
						380	0.257
						400	0.261
						420	0.265
						440	0.269