

Material Safety Data Sheet

1. CHEMICAL PRODUCT IDENTIFICATION

Effective Date: 01/18/03
 Revision: Ten
 Last Revision: 02/21/03
 Emergency Ph: 800-424-9300
 (CHEMTREC)

PRODUCT: Triethylene Glycol

Chemical Name: Triethylene Glycol
 Chemical Family: Glycol
 Synonyms: T.E.G.; Triglycol; Ethylene Glycol Dihydroxydiethyl Ether
 Chemical Formula: $C_6H_{14}O_4$

2. COMPOSITION/INFORMATION ON INGREDIENTS

| <u>Ingredients</u> | <u>CAS No.</u> | <u>Wt%</u> |
|--------------------|----------------|------------|
| Triethylene Glycol | 112-27-6 | 98, min |
| Diethylene Glycol | 111-46-6 | 2, max |

Exposure Guidelines: OSHA STANDARDS - None established

NIOSH RECOMMENDATIONS – Reduce the exposure to the lowest feasible concentration and preventing contact with skin.

ACGIH THRESHOLD LIMIT VALUES – None Established

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Liquid may be irritating to eyes and skin. Ingestion of larger amounts of triethylene glycol is mildly harmful. At greatly elevated temperatures vapors may produce CNS damage. Can react with oxidizers.

Not for use in the manufacture of food or pharmaceuticals where ingestion could occur.

NFPA Ratings -
 Health 1
 Fire 1
 Reactivity 0

Key:
 0 – Minimal
 1 – Slight
 2 – Moderate
 3 – Serious
 4 – Severe

POTENTIAL HEALTH EFFECTS:

| | |
|---------------------|--|
| Target Organs: | Respiratory system, liver, kidneys, central nervous system, gastrointestinal tract. |
| Routes of Exposure: | Inhalation, skin contact and absorption, eye contact, ingestion. |
| Eyes: | Splash contamination causes acute smarting which may be followed by transitory disturbance of corneal epithelium with gradually diminishing sensation and signs of irritation. No persistent injury is to be expected. |
| Skin: | Essentially non-irritating. Prolonged contact may cause skin softening. Slightly toxic to animals by absorption. |
| Ingestion: | Moderately toxic by ingestion. |
| Inhalation: | If inhaled, symptoms include general anesthetic effect, headache, coughing, nausea or vomiting. |
| Signs/Symptoms: | <p>Acute exposure to glycols can cause CNS depression, liver or kidney injury and death from anesthetic effects. Overexposure can cause malaise, dizziness, fatigue and headache.</p> <p>(30 minutes to 12 hours post ingestion): CNS and metabolic abnormalities occur within minutes to hours following ingestion and include ethanol-like inebriation, ataxia, slurred speech, convulsions, coma, cerebral edema, anion gap metabolic acidosis associated with tachypnea, and Kussmaul's respiration. Calcium oxalluria, hematuria, and proteinuria are common, however severe poisoning can occur in the absence of crystalluria. Calcium oxalate crystals can assume many forms including octahedral (envelope-like), prismatic (spindles, hippurate-like), or dumbbell shaped.</p> <p>(12 to 36 hours post-ingestion): Rapidly progressive tachypnea, cyanosis, pulmonary edema, and cardiomegaly. Death is common in this phase.</p> <p>(2 to 3 day post-ingestion): Signs of renal insufficiency may occur as soon as 36 to 48 hours post ingestion. Renal insufficiency may vary from proteinuria, hematuria and crystalluria with a mild increase in BUN to prolonged anuria with death to azotemia.</p> |
| Chronic Effects: | Damage to liver, kidneys, lungs, blood, and central nervous system. |

4. FIRST AID MEASURES

Ensure physician has access to this MSDS

Eyes: Immediately flush eyes with large amounts of water for 15 minutes, lifting lower and upper lids. Get medical attention as soon as possible. Contact lenses should never be worn when working with this chemical.

Skin: Flush area of skin contact immediately with large amounts of water for at least 15 minutes while removing contaminated clothing. If irritation persists after flushing, get medical attention promptly. Wash clothing before re-use.

Inhalation: If inhaled, immediately remove victim to fresh air and **call emergency medical care**. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

Ingestion: If swallowed give two glasses of water and immediately **call physician**. Induce vomiting of conscious patient by pressing finger down throat. Small amounts entering mouth should be rinsed out for 5 minutes.

5. FIRE FIGHTING MEASURES

Flashpoint (CC) 177°C (350°F)

Auto Ignition Temp: 375°C (707°F)

LEL: 0.9% by volume

UEL: 9.0% by volume

Sensitive to Mechanical Impact: No

Static: No

Extinguishing Media: Alcohol foam, water, foam, carbon dioxide, dry chemical

Special Procedures: Firefighters should wear proper protective equipment and self-contained breathing apparatus with full face-piece operated in positive pressure mode.

Explosion Hazards: For mist in air, moderate explosion hazard when exposed to flames.

Small Fires: Dry chemical, carbon dioxide, halon.

Large Fires: Water spray, fog or standard foam is recommended. Cool containers that are exposed to flames with water from the side until well after fire is out. If the fire involves a tank car or truck, isolate the area for 1 mile in all directions. Stay away from ends of tanks.

6. ACCIDENTAL RELEASE MEASURES

Large Spill: Wear self-contained breathing apparatus and full protective clothing. Stop leak if you can do so without risk. Ventilate area. Dike area if feasible. Take up with vermiculite, dry sand or earth.

Small Spills: Use full protective clothing including high efficiency particulate respirator. Take up with vermiculite, dry sand or earth.

7. HANDLING AND STORAGE

Keep containers tightly closed. Store in a cool, dry, well-ventilated location, away from strong oxidizers and potential fire hazards and incompatible chemicals.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Respiratory Protection: Respiratory protection is required if airborne concentration exceeds TLV. At any detectable concentration, any self-contained breathing apparatus with a full face piece and operated in a pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.

Escape: Any air-purifying full face piece respirator (gas mask) with a chin-style or front or back-mounted organic vapor canister or any appropriate escape-type self-contained breathing apparatus.

Skin Protection: Protective gloves recommended when prolonged skin contact cannot be avoided. Safety shower should be available.

Eye Protection: Safety goggles and face shield. Emergency eyewash should be available. Contact lenses should not be worn when working with this chemical.

Engineering Controls: Use general or local exhaust ventilation to meet TLV requirements.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Colorless, viscous liquid

Odor: Mild odor

Physical State: Liquid

Boiling Point: 25°C (545°F) @ 760 mm Hg

Freezing Point: -7.3°C (18.8°F)

Vapor Pressure: 1.0 mm @ 20°C (68°F)

Vapor Density (air=1): 5.17

Solubility: Complete

% Volatiles: none @ 20°C (68°F)

Specific Gravity (H₂O=1): 1.12 @ 15.5°C (60.4°F)

10. STABILITY AND REACTIVITY

Stability: Stable under normal conditions of use.

Incompatibility: Strong oxidizing agents, strong acids and polymerization catalysts.

Hazardous Decomposition Products: Acrid smoke and irritating fumes. Carbon monoxide and carbon dioxide may evolve.

Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Irritation Data: skin-rabbit 500mg/24H MOD

Mutagenic Data: No data found

Toxicity Data:

| | |
|------------------------|-------------------|
| oral-mouse | LD50: 90160 mg/kg |
| oral-human | LDLo: 5000 mg/kg |
| oral-rat | LD50: 17 g/kg |
| intravenous-rat | LDLo: 11700 ug/kg |
| oral-mouse | LDLo: 8400 mg/kg |
| intravenous-mouse | LD50: 6500 mg/kg |
| oral-rabbit | LD50: 8400 mg/kg |
| intravenous-rabbit | LD50: 1900 ug/kg |
| oral-guinea pig | LD50: 7900 mg/kg |
| intravenous-guinea pig | LD50: 10600 ug/kg |
| intraperitoneal-mouse | LD50: 8141 mg/kg |
| subcutaneous-mouse | LD50: 8750 mg/kg |

Classification of carcinogenicity: None

12. ECOLOGICAL CONSIDERATIONS

EXOTOXICITY VALUES

LC50 *Lepomis macrochirus* > 10,000 ppm/96 hr
LC50 *Menidia beryllina* > 10,000 ppm/96 hr
LC50 *Pimephales promelas* (fathead minnow) 59.9 g/l/96 hr
LC50 *Pimephales promelas* (fathead minnow) 70.2 g/l/96 hr
LC50 *Pimephales promelas* (fathead minnow) 77.4 g/l/96h

Terrestrial Fate: Glycols and ethers are generally resistant to hydrolysis (2). They do hydrolysis in moist terrestrial environments, or direct photolysis on sunlit soil surfaces. An estimated Henry's Law constant of 3.16×10^{-11} atm m³/mole at 25°C (1) indicates that volatilization of triethylene glycol from moist soil should not be an important fate process (2). An estimated Koc of 2 (2) indicates triethylene glycol

should be highly mobile in soil (3). A series of aerobic river die-away tests (4), which utilized several differing sources of freshwater, suggest that rapid biodegradation is likely to be the most important removal mechanism of triethylene glycol from aerobic soil. [(1) Hine J, Mookerjee PK; J Org Chem 40: 292-8 (1975) (2) Lyman WJ et al; Handbook of Chemical Property Estimation Methods NY: McGraw-Hill pp. 4-9, 5-4, 6-3, 15-16 (1982) (3) Swann RL et al; Res Rev 85: 16-28 (1983) (4) Evans WH, David EJ; Water Res 8: 97-100 (1974) (5) Silverstein RM, Bassler GC; spectrometric Id Org Compd NY: J Wiley & Sons Inc p. 148-69 (1963)]

Aquatic Fate:

Triethylene glycol should not undergo hydrolysis or direct photolysis in aquatic environments. The complete miscibility of triethylene glycol in water (1) suggest that volatilization, adsorption and bioconcentration are not important fate processes. This is supported by an estimated Henry's law constant of 3.16×10^{-11} atm m³/mole at 25°C (1) indicates that volatilization of triethylene glycol from natural water column to organic matter contained in sediments and suspended solids; and an estimated bioconcentration factor (log BCF) of -1.73 (3) indicates triethylene glycol should not bioconcentrate among aquatic organisms. A series of aerobic river die-away tests, which utilized several differing sources of freshwater, suggest that rapid aerobic biodegradation is likely to be the most important removal mechanism of triethylene glycol for aquatic systems. [(1) Riddick JA et al; Organic Solvents NY: John Wiley & Sons Inc (1984) (2) Hine J, Mookerjee PK; J Org Chem 40: 292-8 (1975) (3) Lyman WJ et al; Handbook of Chemical Property Estimation Methods NY: McGraw-Hill pp. 4-9, 5-4, 6-3, 15-16 (1982) (4) Evans WH, David EJ; Water Res 8: 97-100 (1974) (5) Silverstein RM, Bassler GC; spectrometric Id Org Compd NY: J Wiley & Sons Inc p. 148-69 (1963)]

Atmospheric Fate:

Triethylene glycol should not undergo direct photolysis in the atmosphere. Based on a vapor pressure of 1.32×10^{-3} mm Hg at 25°C (1), triethylene glycol is expected to exist almost entirely in the vapor phase in ambient air (2) where vapor phase reactions with photochemically produced hydroxyl radical may be important. The rate constant for triethylene glycol has been estimated to be 3.38×10^{-11} cm³/molecule-sec at 25°C, which corresponds to an atmospheric half-life of about 11.5 hrs at an atmospheric concentration of 5×10^5 hydroxyl radicals per cm³ (3). The complete miscibility of triethylene glycol in water (4) indicates that physical removal from air by precipitation and dissolution in clouds may occur; however, its short atmospheric residence time suggest that wet deposition is of limited importance. [(1) Daubert TE, Danner RP; Data Compilation, Tables of Properties of Pure Compds, Design Inst for Phys Prop Data, NY, NY (1989) (2) Eisenreich SJ et

al; Environ Sci Technol 15: 30-8 (1981) (3) Atkinson R; Intern J Chem Kin 19: 799-828 (1987) (4) Riddick JA et al; Organic Solvent sn Y: Jon Wiley & Sons Inc (1984) (5) Silverstein RM, Bassler GC; spectrometric Id org Cmpd NY: J. Wilesey & Sons Inc p. 148-69 (1963)]

Biodegradation:

Soil sample data pertaining to the biodegradation of triethylene glycol in soil were not located in the available literature. However, a series of aerobic river die-away tests, which utilized several differing sources of freshwater, have demonstrated that triethylene glycol should biodegrade rapidly in the environment (1). At 20°C, the breakdown of 10 mg/L triethylene glycol was complete within 7-11 days (1). [(1) Evans WH, David EJ; Water Res 8: 97-100 (1974)]

Abiotic Degradation:

Triethylene glycol should not undergo hydrolysis or direct photolysis in the environment. The rate constant for vapor-phase reaction of triethylene glycol with photochemically produced hydroxyl radical in air has been estimated to be 3.38×10^{-11} cm³/molecules-sec at 25°C, which corresponds to an atmospheric half-life of about 11.5 hrs at an atmospheric concentration of $5 \times 10^{+5}$ hydroxyl radicals per cm³ (3). [(1) Silverstein RM, Bassler GC; Spectrometric Id Org Cmpd NY: J Wiley & Sons Inc p. 148-69 (1963) (2) Lyman WJ et al; Handbook of Chemical Property Estim Meth NY: McGraw-Hill p. 7-4 (1982) (3) Atkinson R; Intern J Chem Kin 19: 799-828, (1987)]

Bioconcentration:

Because triethylene glycol is miscible in water (1), bioconcentration in aquatic systems is not expected to be an important fate process. Based upon an estimated log Kow of -1.98 (2), a bioconcentration factor (log BCF) of -1.73 for triethylene glycol has been calculated using a recommended regression-derived equation (3). This BCF value also indicates triethylene glycol should not bioconcentrate in aquatic organisms. [(1) Riddick JA et al; Organic Solvents NY: John Wiley & Sons Inc (1984) (2) Hansch C, Leo AJ; Medchem Project Issue No 26. Claremont CA: Pomona College (1985) (3) Lyman WJ et al; Handbook of Chemical Property Estimation Methods NY: McGraw-Hill p. 5-4 (3) (1982)]

Soil Adsorption/Mobility:

Because triethylene glycol is miscible in water (1), soil adsorption is not expected to be an important fate process. Based on an estimated log Kow of -1.98 (2), a Koc of 2 for triethylene glycol has been calculated using a recommended regression-derived equation (3). This Koc value indicates triethylene glycol will be highly mobile in soil (4), and it would not partition from the water column to organic matter contained in sediments and suspended solids. [(1) Riddick JA et al; Organic Solvents NY: John Wiley & Sons Inc (1984) (2) Hansch C, Leo AJ; Medchem Project Issue No 26. Claremont CA: Pomona College (1985) (3) Lyman WJ et al; Handbook of Chemical

Property Estimation Methods NY: McGraw-Hill p. 4-9 (1982)
Swann RL et al; Res Rev 85: 16-28 (1983)]

Volatilization:

Because triethylene glycol is miscible in water (1), and based upon an estimated Henry's Law constant of 3.16×10^{-11} atm-cm³/mole at 25°C, which has been calculated using a bond contribution method (2), the volatilization of triethylene glycol from natural bodies of water and moist soils is not expected to be an important fate process (3). [(1) Riddick JA et al; Organic Solvents NY: John Wiley & Sons Inc (1984) (2) Hine J, Mookerjee PK; J Org Chem 40: 292-8 (1975) (3) Lyman WJ et al; Handbook of Chemical Property Estimation Methods NY: McGraw-Hill pp. 15-15 to 15-29 (1982)]

13. DISPOSAL CONSIDERATIONS

DO NOT discharge to sewer. Wear appropriate personal protection. Take up with sand, vermiculite, or similar inert material. Dispose in accordance with federal, state and local regulations.

14. TRANSPORT INFORMATION

| | |
|-----------------------|--------------------|
| Proper Shipping Name: | Triethylene glycol |
| ID No: | Not regulated |
| Hazard Class: | Not regulated |
| Packaging Group: | Not regulated |
| Label: | Not regulated |

15. REGULATORY INFORMATION

United States-

TSCA – Inventory: Listed

Water Standards: No data available

Atmospheric Standards: Standards of performance for newly constructed, modified and reconstructed SOCM (Synthetic Organic Chemical Manufacturing Industry) process units using triethylene glycol are regulated under 40 CFR 60.489.

CERCLA: Not reportable

SARA Title III: Section 311-312 – Categories: Acute; chronic

Section 312 – Inventory Reporting: Triethylene glycol is subject to Tier I and/or Tier II annual inventory reporting.

Section 313 – Emission Reporting: Triethylene glycol is not subject to Form R reporting requirements.

Section 302 – Extremely Hazardous Substances: Triethylene glycol is not listed.

Other Regulations:

| | |
|--|---|
| <u>California</u> | |
| Exposure Limits/Ceilings: | none established |
| Director's List of Hazardous Substances: | not listed |
| <u>Florida</u> | |
| Hazardous Substances: | not listed |
| <u>Massachusetts</u> | |
| Right to Know List: | not listed |
| <u>Minnesota</u> | |
| Hazardous Substances: | not listed |
| <u>New Jersey</u> | |
| Right-to-Know List: | not listed |
| <u>Pennsylvania</u> | |
| Right-to-Know List: | listed |
| <u>Michigan</u> | |
| Critical Materials List: | not listed |
| <u>Canada</u> | |
| WHMIS | 1% on Ingredient Disclosure List – item 1625 (1667) |
| <u>Risk Phrases:</u> | |
| R: | 22 |
| S: | 2 |