1. PRODUCT AND COMPANY INFORMATION

CHEMICAL NAME; CLASS:  TOLUENE

Packaged in Cylinders Pressurized with Nitrogen or Helium

SYNONYMS:  Antisal 1a; Methyl-Benzene, Methacide; Phenyl-Methane, Methylbenzol; Toluol; Tolu-Sol; NCI-C07272

CHEMICAL FAMILY NAME:  Aromatic Hydrocarbon/Alkylbenzene

FORMULA:  $C_7H_8$

PRODUCT USE:  Manufacture of chemicals, explosives and dyes; solvent for inks, paints, lacquers, resins, cleaners, glues and adhesives; component of automotive and aviation fuels.

MANUFACTURED/SUPPLIED FOR:

ADDRESS:  2700 Post Oak Drive
            Houston, TX  77056-8229

EMERGENCY PHONE:  CHEMTREC: 1-800-424-9300

BUSINESS PHONE:

General MSDS Information 1-713/896-2896
Fax on Demand:  1-800/231-1366
2. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Toluene is a colorless, flammable, toxic liquid, with gasoline-like odor. Inhalation of vapors of Toluene can affect the central nervous system. Symptoms of central nervous system over-exposure can include headache, drowsiness, dizziness, fatigue, nausea and weakness. Skin and eye contact can be irritating. This liquid is very flammable; vapors are heavier than air and may travel long distances to source of ignition and flashback. If involved in a fire Toluene will decompose to produce toxic gases (i.e. carbon monoxide, carbon dioxide, reactive hydrocarbons and aldehydes). Toluene is not reactive under normal circumstances. Persons responding to releases of this product must have adequate fire protection for the specific emergency situation.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant routes of occupational over-exposure for Toluene are by inhalation, and contact with skin or eyes.

INHALATION: Exposures to high concentrations of vapors of Toluene can cause central nervous system effects. Symptoms of central nervous system effects are related to exposure concentrations. The following effects associated with various levels of Toluene vapors are as follows:

<table>
<thead>
<tr>
<th>CONCENTRATION</th>
<th>SYMPTOM OF EXPOSURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>~50 ppm</td>
<td>Slight drowsiness and headache.</td>
</tr>
<tr>
<td>50-100 ppm</td>
<td>Irritation of the nose, throat and respiratory tract.</td>
</tr>
<tr>
<td>Above 100 ppm</td>
<td>Fatigue and dizziness.</td>
</tr>
<tr>
<td>Over 200 ppm</td>
<td>Symptoms similar to drunken-ness, giddiness, numbness, and mild nausea.</td>
</tr>
<tr>
<td>Over 500 ppm</td>
<td>Mental confusion and in-coordination, loss of appetite, a bad taste.</td>
</tr>
<tr>
<td>10,000 ppm (est)</td>
<td>At this concentration Toluene causes visual disturbances and further depression of the central nervous system which can result in unconsciousness and death.</td>
</tr>
</tbody>
</table>

In an industrial setting, the most serious over-exposures have occurred when vapors of Toluene have accumulated in small, confined spaces or other poorly-ventilated areas. Liver and kidney damage as well as disturbances to the heart have been reported from over-exposure to vapors of Toluene, in cases of sniffing abuse of glues. Sniffing of glues containing Toluene can lead to the three syndromes described as follows:
- Severe muscle weakness leading to limb paralysis, associated with hypokalemia (deficiency of potassium in the blood) due to renal tubular acidosis. Cardiac arrhythmias often accompany the hypokalemia.
- Gastrointestinal complaints, including abdominal pain, nausea, vomiting, and hematemesis (vomiting of blood).
- Neuropsychiatric complaints including:
  a) lethargy, hallucinations, coma, or
  b) headache, dizziness, syncope (loss of consciousness due to sudden lack of blood supply to brain), or
  c) paresthesias (morbid sensations) and peripheral neuropathy (tingling in the extremities), or
  d) cerebellar ataxia (incoordination of voluntary muscular movements) and other cerebellar signs.

The symptoms described above may potentially occur after long-term inhalation over-exposures to Toluene in occupational settings.

CONTACT WITH SKIN or EYES: Initial contact with the skin can cause mild irritation. Prolonged contact can result in a burning sensation and reddening of the skin. Toluene is a defatting agent, removing oils from the skin and causing red cracked and dry skin. Prolonged or repeated contact with the skin will cause dermatitis. Very short exposure (3-5 minutes) to the eyes of vapors of Toluene at a concentration of 300 ppm causes slight irritation. Longer exposures (6-7 hours) to levels above 100 ppm will cause irritation. Contact of the liquid the eyes will be irritating, but will not cause permanent damage.

SKIN ABSORPTION: Toluene can somewhat absorbed through the skin, which may result in irritation at the site of absorption. Symptoms similar to those described for "Inhalation" may also occur, especially in cases of severe over-exposure.

INGESTION: Toluene is readily absorbed by the tissues of the digestive system, producing symptoms of central nervous system depression similar to those described in "Inhalation". If ingested, Toluene presents a potential aspiration hazard. The aspiration of Toluene into the lungs can result in severe lung irritation, leading to damage to the lungs; death may result.

INJECTION: Injection is not anticipated to be a significant route of over-exposure for this product. If Toluene is "injected" (as may occur through punctures by contaminated, sharp objects), symptoms described in "Inhalation" can occur.

OTHER HEALTH EFFECTS: Acute Toluene poisoning can lead to anemia and leukopenia (deficiency of blood corpuscle which protects against disease), which, upon biopsy, has shown bone marrow hypoplasia (failure of new bone marrow to mature). Exposure to other solvents (such as benzene and ethanol) slows the rate of clearance from the body, enhancing the toxicity of Toluene. For further information, see Section 11, Toxicological Information. In rare cases, repeated over-exposure to very high concentrations of Toluene has lead to enlargement of the liver.
2. HAZARD IDENTIFICATION (Continued)

ACUTE: Acute inhalation over-exposure to Toluene will initially act as a narcotic, possibly leading to coma in extreme cases. Following exposure to high concentrations, victims may be unconscious, and if exposure continues, death can follow from respiratory failure. Contact with the skin can cause irritation and dermatitis. Contact with the eyes is irritating, causing burning and watering of the eyes. Ingestion of Toluene will cause gastric distress and possible severe depression of the central nervous system. Aspiration of Toluene into the lungs, following ingestion can result in severe damage to the lungs; death may result.

CHRONIC: In rare cases, chronic poisoning has lead to anemia and other problems with the blood and bone marrow.

TARGET ORGANS: Respiratory system, central nervous systems, heart, kidneys, bone marrow, skin, eyes, reproductive system, and liver.

3. COMPOSITION and INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>CHEMICAL NAME</th>
<th>CAS #</th>
<th>mole %</th>
<th>EXPOSURE LIMITS IN AIR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACGIH</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TLV ppm</td>
</tr>
<tr>
<td>Toluene</td>
<td>108-88-3</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This material is classified as hazardous under OSHA regulations in the United States and the WHMIS in Canada.

NE = Not Established  C = Ceiling Limit  A4 = Not Classifiable as a Human Carcinogen.  See Section 16 for Definitions of Terms Used.

NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-2004 format.

4 FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO TOLUENE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. If necessary, a Self-Contained Breathing Apparatus should be worn.

INHALATION: If vapors, mists, or sprays of Toluene are inhaled, remove victim to fresh air. Remove victim(s) to fresh air as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary. Remove or cover gross contamination to avoid exposure to rescuers.

SKIN EXPOSURE: If Toluene contaminates the skin, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek medical attention if any adverse reaction occurs.

EYE EXPOSURE: If Toluene or its vapors enter the eyes, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Victim must seek immediate medical attention.

INGESTION: If Toluene is swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. If professional advice is not available, do not induce vomiting. Victim should drink milk, egg whites, or large quantities of water. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or who cannot swallow.

Victims of chemical exposure must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Physicians should refer to "Recommendations to Physicians" in Section 11 (Toxicological Information). Take copy of label and MSDS to health professional with victim.
5. FIRE-FIGHTING MEASURES

FLASH POINT, (Closed Cup): 4.4°C (40°F)
AUTOIGNITION TEMPERATURE: 480°C (896°F)
FLAMMABLE LIMITS (in air by volume, %):

<table>
<thead>
<tr>
<th></th>
<th>Lower (LEL)</th>
<th>Upper (UEL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.2%</td>
<td>7.1%</td>
</tr>
</tbody>
</table>

FIRE extinguishing MATERIALS:
Water Spray: YES (for cooling only)
Foam: YES
Halon: YES
Carbon Dioxide: YES
Dry Chemical: YES
Other: Any "B" Class.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Toluene is a Class IB flammable liquid and presents a serious fire hazard to firefighters. When involved in a fire, this material may decompose and produce toxic gases (i.e., carbon monoxide, carbon dioxide, reactive hydrocarbons and aldehydes). The vapors of Toluene are heavier than air and may spread long distances; distant ignition and flash-back are possible. Toluene can float on water; therefore, water contaminated with this product can spread the flammable liquid and can spread fire. Containers of Toluene, when involved in fire, may rupture or burst in the heat of the fire.

Explosion Sensitivity to Static Discharge: Toluene can accumulate static charge by flow or agitation; vapors can be ignited by static discharge.

SPECIAL FIRE-FIGHTING PROCEDURES: Eliminate sources of ignition. In the event of fire, cool containers of this product with water to prevent failure. Use a water spray or fog to reduce or direct vapors. Water may not be effective in actually extinguishing a fire involving Toluene, due to its low flash point. Stop the leak or discharge, if possible. For small releases, if it is not possible to stop the leak, and it does not endanger personnel, let the fire burn itself out. Incipient fire responders should wear eye protection. Structural fire fighters must wear Self-Contained Breathing Apparatus and full protective equipment. Large fires should be fought from a distance with an unmanned hose holder or monitor nozzles. If this product is involved in a fire, fire run-off water should be contained to prevent possible environmental damage. If necessary, decontaminate fire-response equipment with soap and water solution.

6. ACCIDENTAL RELEASE MEASURES

LEAK RESPONSE: Evacuate immediate area. Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a leak, clear the affected area, protect people, and respond with trained personnel.

Minimum Personal Protective Equipment should be Level B: triple-gloves (rubber gloves and nitrile gloves, over latex gloves), chemically resistant suit and boots, hard-hat, and Self-Contained Breathing Apparatus. Monitor the surrounding area for combustible vapor levels. Combustible vapor levels must be below 10% of the LEL for Toluene (LEL = 1.2%) before personnel are permitted to enter the area. If necessary, ventilate area. Monitoring should be done for the levels of Toluene and oxygen. Colorimetric tubes are available to detect the presence of Toluene. Levels of Toluene should be below levels listed in Section 2 (Composition and Information on Ingredients) and the atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus.

Eliminate all sources of ignition before clean-up operations begin. Use non-sparking tools. Absorb spilled liquid with activated carbon, polyponds or other suitable absorbent materials. Prevent material from entering sewer or confined spaces. Decontaminate the area thoroughly. Place all spill residue in an appropriate container and seal. If necessary, decontaminate spill-response equipment with soap and water solution. Dispose of in accordance with Federal, State, and local hazardous waste disposal regulations (see Section 13, Disposal Considerations).

THIS IS A TOXIC, FLAMMABLE LIQUID: Protection of all personnel and the area must be maintained. All responders must be adequately protected from exposure.

7. HANDLING AND STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: Avoid all contact with this material. All employees who handle this material should be trained to handle it safely. Avoid breathing the sprays or mists generated by Toluene. Wash hands after handling chemicals. Do not eat or drink while handling chemicals. All work practices should minimize the release of Toluene. Eyewash stations and safety showers should be in areas of use of Toluene. Eyewash stations and/or safety showers should be near areas where Toluene is used.
STORAGE AND HANDLING PRACTICES: Cylinders should be stored upright and be firmly secured to prevent falling or being knocked-over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting.

7. HANDLING AND STORAGE (Continued)

STORAGE AND HANDLING PRACTICES (continued): Cylinders of this product must be properly labeled. When handling the liquid, care must be taken to avoid splashing during dispensing from the container. Never transfer liquids by pressurizing the original container with air or gas. Do not dispense in storage area unless the dispensing area is segregated by fire-resistant construction. Never return contaminated Toluene to original container.

Cylinders should be stored in dry, well-ventilated areas away from sources of heat, ignition and direct sunlight. Keep storage area clear of materials which can burn. Do not allow area where cylinders are stored to exceed 52°C (125°F). Store containers away from heavily trafficked areas and emergency exits. Store away from process and production areas, away from elevators, building and room exits or main aisles leading to exits. Protect cylinders against physical damage. Consideration should be taken to install leak detection and alarm equipment for storage areas.

Cylinders should be separated from oxygen cylinders, or other oxidizers, by a minimum distance of 20 ft., or by a barrier of non-combustible material at least 5 ft. high, having a fire-resistance rating of at least 0.5 hours. Isolate from other incompatible chemicals, such as strong oxidizers, metals, and metal oxides (refer to Section 10, Stability and Reactivity, for more information).

Storage areas must meet national electrical codes for Class 1 Hazardous Areas. Post "No Smoking or Open Flames" signs in storage or use areas. Consider installation of leak detection and alarm for storage and use areas. Have appropriate extinguishing equipment in the storage area (i.e. sprinkler system, portable fire extinguishers). Use only compatible materials for cylinders, process lines, and other Toluene-handling equipment. Lines should be purged with dry nitrogen both before and after maintenance activity. Use a check valve or other protective device in the discharge line to prevent hazardous backflow.

Never tamper with pressure relief valves and cylinders. Use non-sparking ventilation systems, approved explosion-proof equipment, and appropriate electrical systems. Electrical equipment used in gas-handling operations, or located in storage areas, should be non-sparking or explosion proof.

Use a check valve in the discharge line to prevent hazardous backflow. Never tamper with pressure relief devices in valves and cylinders.

Periodic inspections of process equipment by knowledgeable persons should be made to ensure that the equipment is used appropriately and the system is kept in suitable operating condition. Keep the smallest amount necessary on-site at any one time. Full and empty cylinders should be segregated. Use a first-in, first-out inventory systems to prevent full containers from being stored for long periods of time.

SPECIAL PRECAUTIONS FOR HANDLING CYLINDERS: Cylinders of Toluene can present significant safety hazards. The following rules are applicable to work situations in which cylinders are being used.

Before Use: Move cylinders with a suitable hand-truck. Do not drag, slide or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap (where provided) in-place until cylinder is ready for use.

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Do not use oils or grease on cylinder-handling fittings or equipment. Immediately contact the supplier if there are any difficulties associated with operating cylinder valve. Never insert an object (e.g. wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing a leak to occur. Use an adjustable strap wrench to remove over-tight or rusted caps. Never strike an arc, on a compressed gas cylinder or make a cylinder part of an electric circuit.

After Use: Close main cylinder valve. Valves should be closed tightly. Replace valve protection cap. Mark empty cylinders "EMPTY".

NOTE: Use only DOT or ASME code containers designed for flammable storage. Close valve after each use and when empty.

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA: Use the proper CGA connections, DO NOT USE ADAPTERS:

- threaded: CGA - 510
- pin-indexed yoke: Not applicable.
- ultra high integrity: Not applicable.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Purge gas handling equipment with inert gas (i.e. nitrogen) before attempting repairs. Always use product in areas where adequate ventilation is provided.
8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation. Use a mechanical fan or vent area to outside. Where appropriate, use a non-sparking, grounded ventilation system separate from other exhaust ventilation systems. Ensure eyewash/safety shower stations are available near areas where this product is used.

RESPIRATORY PROTECTION: Maintain exposure levels of Toluene below the levels listed in Section 2 (Composition and Information on Ingredients) and oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection if Toluene levels exceed exposure limits and if oxygen level is below 19.5% or during emergency response to a release of this product. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent State standards. The following NIOSH respiratory protection recommendations are for Toluene.

<table>
<thead>
<tr>
<th>CONCENTRATION</th>
<th>RESPIRATORY EQUIPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 500 ppm</td>
<td>Chemical cartridge respirator with organic vapor cartridges; or gas mask with organic vapor canister, or powered, air-purifying respirator with organic vapor cartridges, or Supplied Air Respirator (SAR), or full-facepiece SCBA.</td>
</tr>
</tbody>
</table>

Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Positive-pressure, full facepiece SCBA or positive pressure, full-facepiece Supplied Air Respirator (SAR) with an auxiliary positive pressure SCBA.

Escape Gas mask with organic vapor cartridge or escape-type SCBA should be used.

The IDLH concentration for Toluene is 500 ppm.

EYE PROTECTION: Splash goggles or safety glasses. Face-shields should be worn if contact with the liquid is anticipated.

HAND PROTECTION: Wear leather gloves for handling of cylinders of this product. Wear chemically resistant gloves appropriate for Toluene for industrial use. Gloves should have a resistance to breakthrough greater than 8 hours, such as Teflon™ or Viton™. Butyl rubber, natural rubber, neoprene, nitrile rubber, or polyethylene are not recommended. Use triple gloves for spill response (see Section 6, Accidental Release Measures).

BODY PROTECTION: Use body protection appropriate for task. Transfer of large quantities under pressure may require protective equipment appropriate to protect employees from splashes of liquefied product. Safety shoes are recommended when handling cylinders.

9. PHYSICAL and CHEMICAL PROPERTIES

VAPOR DENSITY (air = 1) = 3.1

BOILING POINT: 110.6°C (231.1°F)

FREEZING/MELTING POINT: -95°C (-139°F)

SPECIFIC GRAVITY @ 20°C (68°F) (water = 1): 0.86

SOLUBILITY IN WATER @ 25°C (77°F): 54-58 mg/100 mL

EVAPORATION RATE (nBuAc = 1): 2.24

ODOR THRESHOLD: 0.1-70 ppm.

VAPOR PRESSURE @ 20°C (68°F) 22 mm Hg: 2.93 kPa

COEFFICIENT WATER/OIL DISTRIBUTION: Log P (oct) = 2.11-2.80

APPEARANCE AND COLOR: Colorless, flammable liquid with a strong, gasoline-like odor.

HOW TO DETECT THIS SUBSTANCE (warning properties): The odor of Toluene is not a good warning property as a variation of odor threshold values. The smell of Toluene may not be noticed after short exposure.

10. STABILITY and REACTIVITY

STABILITY: Normally stable.

DECOMPOSITION PRODUCTS: If Toluene is involved in a fire, it may decompose yielding toxic fumes of carbon monoxide, carbon dioxide, reactive hydrocarbons and aldehydes.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Toluene is incompatible with strong oxidizers, which increase the risk of fire and explosion. Toluene reacts violently to nitric acid and sulfur dichloride. When combined with sulfuric acid, an exothermic reaction will occur. Toluene will react vigorously with uranium hexafluoride. When mixed with silver perchlorate Toluene forms explosive complexes and with tetrinitromethane Toluene forms a sensitive, highly explosive mixture.
10. STABILITY AND REACTIVITY (Continued)

CONDITIONS TO AVOID: Avoid contact with incompatible materials, sparks, flame static discharge and other sources of ignition. Avoid exposing cylinders to extremely high temperatures, which could cause the cylinders to rupture or burst.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following information is available for Toluene.

<table>
<thead>
<tr>
<th>Effect</th>
<th>Species/Exposure</th>
<th>Route/Time</th>
<th>Concentration/API</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye effects-Human</td>
<td>300 ppm</td>
<td>Inhalation-Mouse</td>
<td>400 ppm/7 hours</td>
<td>Teratogenic effects</td>
</tr>
<tr>
<td>Eye effects-Rabbit, adult</td>
<td>435 mg Mild irritation</td>
<td>Oral-Mouse TDLo</td>
<td>9 g/kg (female 6–15 days post)</td>
<td>Teratogenic effects</td>
</tr>
<tr>
<td>Skin</td>
<td>500 Moderate</td>
<td>Oral-Human LDLo</td>
<td>50 mg/kg</td>
<td></td>
</tr>
<tr>
<td>Eye effects-Rabbit, adult</td>
<td>870 μg Mild irritation</td>
<td>Inhalation-Human TLo</td>
<td>200 ppm: BRN,</td>
<td></td>
</tr>
<tr>
<td>Eye effects-Rabbit, adult</td>
<td>2 mg/24 hours</td>
<td>Central nervous system</td>
<td>Blood effects</td>
<td></td>
</tr>
<tr>
<td>Eye effects-Rabbit, adult</td>
<td>100 mg/30S</td>
<td>Inhalation-Man TLo</td>
<td>100 ppm: Central</td>
<td></td>
</tr>
<tr>
<td>oms-grasshopper-Inhalation</td>
<td>562 mg/L</td>
<td>Oral-Rat LD50</td>
<td>5000 mg/kg</td>
<td></td>
</tr>
<tr>
<td>Cytogenetic Analysis-Rat-Subcutaneous</td>
<td>12 g/kg/12 days-Intermittent</td>
<td>Inhalation-Rat LCLo</td>
<td>4000 ppm/4 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intraperitoneal-Rat</td>
<td>1332 mg/kg</td>
<td></td>
</tr>
</tbody>
</table>

SURVEYED CARCINOGEN: Toluene is listed as follows:
- ACGIH-A4 (Not Classifiable as a Human Carcinogen)
- EPA-D (Not Classifiable as to Human Carcinogenicity)
- IARC-3 (Not Classifiable as to Human Carcinogenicity)

Toluene is not found on the following lists: NTP, OSHA, CAL/OSHA; therefore is not considered to be, nor suspected to be a cancer-causing agent by these agencies.

IRRITANCY OF PRODUCT: Toluene is irritating to the skin, eyes, and other contaminated tissue.

SENSITIZATION OF PRODUCT: Toluene is not known to cause respiratory system or skin sensitization in humans. Cardiac sensitization to stimulants (i.e. epinephrine, ephedrine) is a possible result of severe or chronic over-exposure.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Toluene on the human reproductive system.

Mutagenicity: Toluene was not mutagenic in most of the numerous in vivo and in vitro tests. There is some evidence that it can cause chromosome damage in vivo when administered to mice by injection, although conflicting results have been obtained.

Embryotoxicity: Toluene is not reported to cause embryotoxic effects in humans. However, there is some evidence of embryotoxic effects in animals during clinical studies. Refer to “Teratogenicity” for additional information.

Teratogenicity: Toluene is not reported to cause embryotoxic effects in humans. Many studies have been conducted on rats, mice, and rabbits (primarily through inhalation exposure). Toluene did not cause birth defects, but exposures of pregnant rats to concentrations greater than 500 ppm resulted in fetotoxicity effects (i.e., reduced birth weights, delay in bone formation).

Reproductive Toxicity: Data on reproductive effects are available from clinical studies involving test animals exposed to relatively high doses of Toluene.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing respiratory conditions, central nervous, liver, kidney, and cardio-vascular conditions may be aggravated by severe or chronic over-exposure to this product. Skin disorders may also be aggravated by exposures to Toluene.

RECOMMENDATIONS TO PHYSICIANS: The following guidelines are derived from “Clinical Toxicology of Commercial Chemical Products” (5th edition, 1984)

- Check for signs of impending pulmonary edema.
- Because of the aspiration hazard, avoid emetic drugs, whenever practical.
11. TOXICOLOGICAL INFORMATION (Continued)

- For ingestion over-exposures in which Toluene contains another toxic component and induction of emesis is advisable: If the patient is not drowsy, comatose, or in respiratory difficulty, induce vomiting. If necessary, as an alternative treatment, remove Toluene from the stomach via gastric lavage. One or two ounces of mineral oil may be instilled and left in the stomach at the completion of lavage.
- Avoid epinephrine because of its possible adverse effect on the sensitized myocardium. Avoid all digestible fats, oils and alcohol, which may promote the absorption of Toluene in the intestinal system.
- If eyes or skin are affected, wash thoroughly and apply a bland analgetic ointment.
- Because of the possibility of ventricular fibrillation, monitor the ECG continuously and be prepared to administer external cardiac massage.
- In chronic solvent abusers, correct dehydration, acidosis, hypokalemia and hypophosphatemia. Usually toxic signs and symptoms (except those due to neuropathies and to cerebellar lesions) disappear within a few days after fluid and electrolyte abnormalities are corrected.

BIOLOGICAL EXPOSURE INDICES (BEIs): The following Biological Exposure Indices (BEIs) are currently applicable for Toluene.

<table>
<thead>
<tr>
<th>CHEMICAL DETERMINANT</th>
<th>SAMPLING TIME</th>
<th>BEI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toluene in venous blood</td>
<td>End of shift</td>
<td>1 mg/L</td>
</tr>
<tr>
<td>Toluene in end-exhaled air</td>
<td>End of shift</td>
<td>Refer to current TLV list.</td>
</tr>
</tbody>
</table>

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: Toluene will be degraded over time into other organic compounds. The following environmental data are available for Toluene.

K<sub>OC</sub> = 2.73. Water Solubility = 534 mg/L. Biological Half-Life = 0.083 days. Bioconcentration Factors = 13.2 (eels, Anguilla japonica); 1.67 (Manila clam (Tapes semidecussata); 4.2 (mussel, Mytilus edulis); 380 (algae, Chlorella fusca); 90 (golden ide fish). Toluene is rapidly volatilized from water and undergoes moderate biodegradation. The half-life in water is on the order of days to weeks.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Toluene may be harmful or fatal to contaminated plant and animal-life (especially if large quantities of this product are released). Refer to Section 11 (Toxicology Information).

EFFECT OF CHEMICAL ON AQUATIC LIFE: Toluene can be harmful or fatal to contaminated aquatic plant and animal life. Toluene floats on water, and can potentially form slicks which are capable of creating oxygen-deprived waterways which can contaminate coastal and shore life. The following aquatic toxicity data are available for Toluene.

EC<sub>50</sub> (Pimephales promelas, fathead minnow - embryos/larvae/minnows) = 55-72 mg/L/25-36 mg/L/26-31 mg/L - 96 hours. Effect - loss of equilibrium. LC<sub>50</sub> (Pimephales promelas, fathead minnow) = 36.2 mg/L/96 hours LC<sub>50</sub> (Bluegill) = 17 mg/L/24 hours; 13 mg/L/96 hours; 21-23 °C LC<sub>50</sub> (Palaemonetes pugio, grass shrimp) = 9.5 ppm/96 hours LC<sub>50</sub> (Cancer magister, crab larvae) = 28 ppm/96 hours LC<sub>50</sub> (Crangon francisorum, shrimp) = 4.3 ppm. 96 hours TLM (Pimephales promelas, fathead minnow) = 56-34 mg/L; 24-96 hours TLM (Lebistes reticulats, guppy) = 63-59 mg/L; 24-96 hours LC<sub>50</sub> (Channel Catfish) = 7.3 mg/L; 96 hours LC<sub>50</sub> (Cyprinodon vaiegatus, sheephead minnow) = 277-485 mg/L/96 hours LC<sub>50</sub> (Aedes aegypti) 22 mg/L LC<sub>50</sub> (Alandra granaria, grain weevil) = 210 mg/L.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with any residual product to Air Liquide. Do not dispose of locally.
14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Toluene
HAZARD CLASS NUMBER and DESCRIPTION: 3 (Flammable Liquid)
UN IDENTIFICATION NUMBER: UN 1294
PACKING GROUP: PG II
DOT LABEL(S) REQUIRED: Flammable Liquid
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 130

MARINE POLLUTANT: Toluene is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles present serious safety hazards and should be discouraged.

NOTE: Shipment of compressed gas cylinders which have not been filled with the owners consent is a violation of Federal law (49 CFR, Part 173.301 (b).

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the following information for the preparation of Canadian Shipments.

PROPER SHIPPING NAME: Toluene
HAZARD CLASS NUMBER and DESCRIPTION: 3 (Flammable Liquid), 9.2 (Substance Hazardous to the Environment)
UN IDENTIFICATION NUMBER: UN 1294
PACKING GROUP: PG II
SPECIAL PROVISION: 109
REGULATED LIMIT: 50 kg

15. REGULATORY INFORMATION

SARA REPORTING REQUIREMENTS: Toluene is subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>SARA 302</th>
<th>SARA 304</th>
<th>SARA 313</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toluene</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

This product is subject to the reporting requirements of Sections 311 and 312 of Title III of the Superfund Amendments and Reauthorization Act (40 CFR 370.21).

SARA THRESHOLD PLANNING QUANTITY: Not applicable.

TSCA INVENTORY STATUS: Toluene is listed on the TSCA Inventory.

CERCLA REPORTABLE QUANTITIES (RQ): 1000 lbs.

CALIFORNIA PROPOSITION 65: Toluene is listed on the California Proposition 65 Lists. WARNING: Toluene is known to the State of California to cause birth defects or other reproductive harm.

STATE REGULATORY INFORMATION: Toluene is covered under the following specific State regulations:

Alaska - Designated Toxic and Hazardous Substances: Toluene.
California - Permissible Exposure Limits for Chemical Contaminants: Toluene.
Florida - Substance List: Toluene.
Illinois - Toxic Substance List: Toluene.
Kansas - Section 302/313 List: Toluene.
Massachusetts - Substance List: Toluene.


Missouri - Employer Information/Toxic Substance List: Toluene.
New Jersey - Right to Know Hazardous Substance List: Toluene.
Pennsylvania - Hazardous Substance List: Toluene.
Rhode Island - Hazardous Substance List: Toluene.
Texas - Hazardous Substance List: Toluene.
West Virginia - Hazardous Substance List: Toluene.
Wisconsin - Toxic and Hazardous: Toluene.
15. REGULATORY INFORMATION (Continued)

OTHER U.S. FEDERAL REGULATIONS:
• Toluene is subject to the requirements of CFR 29 1910.1000. Toluene is listed on Table Z.2.
• Toluene is a toxic pollutant under Section 307(a)(1) of the Clean Water Act and is subject to effluent limitations.
• Toluene is not subject to the reporting requirements of Section 112(r) of the Clean Air Act.
• Toluene is not listed in Appendix A as a highly hazardous chemical, per 29 CFR 1910.119: Process Safety Management of Highly Hazardous Chemicals. Under this regulation, however, any process that involves a flammable liquid on-site, in one location, in quantities of 10,000 lbs (4,553 kg) or greater is covered under this regulation unless it is used as a fuel.
• Toluene does not contain any Class I or Class II ozone depleting chemicals (40 CFR part 82).

OTHER U.S. FEDERAL REGULATIONS (continued):
• Toluene is not listed under as a Regulated Substance, per 40 CFR, Part 68, of the Risk Management for Chemical Releases as a toxic substance.

OTHER CANADIAN REGULATIONS: Toluene is categorized as a Controlled Product, Hazard Classes B2, D2A and D2B, as per the Controlled Product Regulations.

16. OTHER INFORMATION

MIXTURES: When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.

Further information can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 4221 Walney Road 5th floor, Chantilly, VA 20151-2923. Telephone: (703) 788-2700.

P-1 “Safe Handling of Compressed Gases in Containers”
AV-1 “Safe Handling and Storage of Compressed Gases”