SILVER FERN CHEMICAL

Material Safety Data Sheet
TOLUENE COMMERCIAL GRADE

SECTION 1: IDENTIFICATION

Product Name: TOLUENE COMMERCIAL GRADE

CAS Number: 108-88-3

Synonyms: Methyl benzene, Toluol, Toluene Commercial Grade

Company
Silver Fern Chemical, Inc.
2226 Queen Anne Avenue North
Suite #C
Seattle WA 98109, USA

Business Contact
Customer Service: 206-282-3376
info@silverfernchemical.com

24 Hour Emergency Contact
Infotrac 800-535-5053
Outside USA & Canada 352-323-3500

SECTION 2: HAZARD IDENTIFICATION

Emergency Overview
This material is HAZARDOUS by OSHA Hazard Communication definition.

Signal Word
DANGER.

Hazards

HMIS (U.S.A.):
Health Hazard: 2
Fire Hazard: 3
Reactivity: 0
Personal Protection: h

National Fire Protection Association (U.S.A.):
Health: 2
Flammability: 3
Reactivity: 0
Specific hazard:__
Physical State
Liquid.

Color
Colorless.

Odor Threshold
AIHA reports the odor threshold at 1.6 ppm for toluene. Patty's reports the odor threshold at 2.5 to 8.0 ppm, for toluene.

Potential Health Effects

Routes of Exposure
Eye. Inhalation. Skin.

Signs and Symptoms of Acute Exposure
See component summary.

Toluene 108-88-3
Toluene is of slight acute toxicity, although inhalation exposure may cause dizziness and CNS depression, while ingestion may be fatal if aspiration into the lung occurs. Toluene may increase the sensitivity of the heart leading to potentially fatal cardiac sensitization. It is moderately irritating to skin and eye.

Benzene 71-43-2
Slight acute toxicity. Inhalation exposure to high concentrations may cause dizziness and CNS depression. Ingestion of relatively small amounts may be fatal if aspiration into the lungs takes place.

Ethyl Benzene 100-41-4
Inhalation hazard. Ingestion hazard. Skin and eye irritant.

Skin
May cause moderate skin irritation. Not expected to be a sensitizer.

Inhalation
Signs of eye, throat, and respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death) and possible cardiac sensitization may occur after exposure to high vapor concentrations.

Eye
Moderate eye irritant. Effects of eye irritation are reversible.

Ingestion
Ingestion may cause discomfort and irritation of the gastrointestinal tract and CNS depression (fatigue, dizziness, collapse, coma and death). Aspiration into the lung may cause fatal chemical pneumonitis. May lead to potentially fatal cardiac sensitization.

Chronic Health Effects
See component summary.
**Toluene 108-88-3**
Repeated exposure to high concentrations has been shown to cause neurological changes and hearing loss in animals, and in humans in abuse situations. May cause developmental toxicity.

**Benzene 71-43-2**
Benzene is considered to be a cancer-causing agent. Repeated exposure is linked to bone marrow toxicity, reduced red and white blood cell counts and decreased immunological function irrespective of the route of contact.

**Ethyl Benzene 100-41-4**
May effect hearing. Repeated or prolonged exposure may damage liver and kidneys. Possible cancer hazard. Repeated contact with skin may cause cracking and/or fissuring.

### SECTION 3: COMPOSITION / INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Component Name</th>
<th>CAS #</th>
<th>EU Inventory</th>
<th>Concentration Wt.%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toluene</td>
<td>108-88-3</td>
<td>203-625-9</td>
<td>95.0 &lt;= 99.0</td>
</tr>
<tr>
<td>Benzene</td>
<td>71-43-2</td>
<td>200-753-7</td>
<td>2.0 &lt;= 5.0</td>
</tr>
<tr>
<td>p-Xylene</td>
<td>106-42-3</td>
<td>203-396-5</td>
<td>0.5 &lt;= 1.0</td>
</tr>
<tr>
<td>Ethyl Benzene</td>
<td>100-41-4</td>
<td>202-849-4</td>
<td>0.5 &lt;= 1.0</td>
</tr>
</tbody>
</table>

Compositions given are typical values, not specifications.

### SECTION 4: FIRST AID MEASURES

**General**
Take proper precautions to ensure your own health and safety before attempting rescue and providing first aid. For specific information refer to the Emergency Overview in Section 2 of this MSDS.

**Skin**
Immediately remove excess chemical and contaminated clothing; thoroughly wash contaminated skin with mild soap and water. If irritation persists after washing, seek medical attention. Thoroughly clean contaminated clothing before reuse; discard contaminated leather goods (gloves, shoes, belts, wallets, etc.).

**Inhalation**
Move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. When breathing is difficult, properly trained personnel may assist the affected person by administering oxygen. Keep the affected person warm and at rest. Get medical attention immediately.

**Eye**
Thoroughly flush the eyes with large amounts of clean low-pressure water for at least 15 minutes, occasionally lifting the upper and lower eyelids. If irritation persists, seek medical attention.
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Ingestion
DO NOT induce vomiting. Give large quantities of water. Obtain emergency medical attention.

SECTION 5: FIRE FIGHTING MEASURES

Flammable Properties

Classification
OSHA/NFPA Class IB Flammable Liquid.

Flash Point
4.4 °C (39.92 °F) closed cup

Auto-Ignition Temperature
498 °C (928.4 °F)

Lower Flammable Limit
1.3 vol%

Upper Flammable Limit
8 vol%

Extinguishing Media

Suitable:
SMALL FIRE: Use dry chemicals, CO2, or foam LARGE FIRE: Use water spray, water fog or foam. DO NOT use straight streams

Protection of Firefighters

Protective Equipment/Clothing:
Wear an approved positive pressure self-contained breathing apparatus and firefighter turnout gear.

Fire Fighting Guidance:
Vapors may travel long distances along the ground before reaching a source of ignition and flashing back. Fight from a maximum distance or use unmanned hose holders or monitor nozzles. Containers can build up pressure if exposed to heat; cool with flooding quantities of water until well after the fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of vessel. Always stay away from the ends of tanks.

Hazardous Combustion Products:
Carbon oxides (CO, CO2)

SECTION 6: ACCIDENTAL RELEASE MEASURES

Release Response
Eliminate all sources of ignition. Stop leak if you can do it without risk. Release can cause fire or explosion. Blanket with alcohol-resistant foam. Prevent spreading of vapors through sewers, ventilation systems and confined areas. Prevent entry into waterways, sewers, basements or confined areas. All equipment used when handling this product must be grounded. Do not touch or walk through spilled material. Water spray may reduce vapor; but may not prevent ignition in closed spaces. Use clean non-sparking tools to collect absorbed material. Dike large spills and place materials in salvage containers.

SECTION 7: HANDLING AND STORAGE
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Handling
Do not handle near heat, sparks, or flame. Avoid contact with incompatible agents. Use only with adequate ventilation/personal protection. Avoid contact with eyes, skin and clothing. Do not enter storage area unless adequately ventilated. Metal containers involved in the transfer of this material should be grounded and bonded.

Storage
Keep container tightly closed and properly labeled. Do not store near strong oxidizers. Keep away from all ignition sources; segregate from incompatible materials. Keep containers tightly closed in a dry, cool, well-ventilated place, plainly labeled, and out of closed vehicles. Ground all containers, transfer vessels, and equipment containing this material. Containers should be able to withstand pressures expected from warming or cooling during storage. Flammable materials should be stored in separate safety storage cabinet or room.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits.

Personal Protection
Inhalation
A respiratory protection program that meets OSHA's 29 CFR 1910.134 or ANSI Z88.2 requirements must be followed whenever workplace conditions warrant respirator use.

Skin
Use chemical resistant gloves appropriate to conditions of use. When skin contact is possible, protective clothing including gloves, apron, sleeves, boots, head and face protection should be worn.

Eye
Use splash goggles when eye contact due to splashing or spraying liquid is possible. Safety glasses are the minimum requirements.

Additional Remarks
Selection of appropriate personal protective equipment should be based on an evaluation of the performance characteristics of the protective equipment relative to the task(s) to be performed, conditions present, duration of use, and the hazards and/or potential hazards that may be encountered during use. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Use good personal hygiene practices. Wash hands before eating, drinking, smoking, or using toilet facilities. Promptly remove soiled clothing/wash thoroughly before reuse. Shower after work using plenty of soap and water.

Occupational Exposure Limits:

<table>
<thead>
<tr>
<th>Component Name</th>
<th>Source</th>
<th>Type</th>
<th>Value</th>
<th>Notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toluene</td>
<td>US (ACGIH)</td>
<td>TWA</td>
<td>20 ppm</td>
<td>None.</td>
</tr>
<tr>
<td></td>
<td>US (OSHA)</td>
<td>CEILING</td>
<td>300 ppm</td>
<td>None.</td>
</tr>
<tr>
<td></td>
<td>US (OSHA)</td>
<td>TWA</td>
<td>200 ppm</td>
<td>None.</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Substance</th>
<th>US (ACGIH) STEL</th>
<th>US (ACGIH) TWA</th>
<th>US (OSHA) CEILING</th>
<th>US (OSHA) STEL</th>
<th>US (OSHA) TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>2.5 ppm</td>
<td>0.5 ppm</td>
<td>25 ppm</td>
<td>5 ppm</td>
<td>1 ppm</td>
</tr>
<tr>
<td>p-Xylene</td>
<td>150 ppm</td>
<td>100 ppm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethyl Benzene</td>
<td>125 ppm</td>
<td>100 ppm</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Liquid. Colorless.
Odor: Sweet aromatic.
Odor Threshold: AIHA reports the odor threshold at 1.6 ppm for toluene. Patty’s reports the odor threshold at 2.5 to 8.0 ppm, for toluene.
PH: Not applicable.
Boiling Point/Boiling Range: 111 °C (231.8 °F)
Freezing Point/Melting Point: -95 °C (-139 °F)
Flash Point: 4.4 °C (39.92 °F) closed cup
Auto-ignition: 498 °C (928.4 °F)
Flammability: OSHA/NFPA Class IB Flammable Liquid.
Lower Flammable Limit: 1.3 vol%
Upper Flammable Limit: 8 vol%
Explosive Properties: No Data Available.
Oxidizing Properties: No Data Available.
Vapor Pressure: 22 mm Hg @ 20 °C (68 °F)
Evaporation Rate: 2.24 (butyl acetate = 1)
Relative Density: 0.866 @ 20 °C (68 °F) (Water = 1)
Relative Vapor Density: 3.1 (Air = 1.0)
Viscosity: 0.560 mPa.s @ 25 °C (77 °F)
Solubility (Water): Slightly soluble in water.
Partition Coefficient (Kow): Log Pow = 2.69
Additional Physical and Chemical Properties: No additional information available.
SECTION 10: STABILITY AND REACTIVITY

Chemical Stability
The product is stable.

Conditions to Avoid
Avoid contact with strong oxidizers, excessive heat, sparks or open flame.

Substances to Avoid
Does not react with water or common materials.

Decomposition Products
Excessive heating and/or incomplete combustion may produce carbon monoxide, carbon dioxide and other harmful substances.

Hazardous Polymerization
Will not occur.

Reactions with Air and Water
Does not react with air, water or other common materials.

SECTION 11: TOXICOLOGICAL INFORMATION

PRODUCT INFORMATION
Product Summary
See component summary.

COMPONENT INFORMATION

Toluene 108-88-3

Acute Toxicity - Lethal Doses
LC50 (vapor) Rat 7500 PPM 4 HOURS
Rat 5,580 MG/KG BWT
Rabbit > 5000 MG/KG BWT

Acute Toxicity - Effects
Inhalation
Vapors or aerosol may cause irritation of the eyes, nose and throat as well as CNS depression (fatigue, dizziness, loss of concentration, with collapse, coma and death possible in cases of severe overexposure).

Ingestion
Ingestion may cause discomfort and irritation of the gastrointestinal tract and CNS depression (fatigue, dizziness, collapse, coma and death). Aspiration into the lung may cause fatal chemical pneumonitis. May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Skin Contact
Repeated contact with skin may cause cracking and/or fissuring.

Irritation
Skin
Moderate skin irritant.

Eye
Moderate eye irritant.

Sensitization
Not expected to cause sensitization by skin contact.

Target Organ Effects

Repeated Dose Toxicity
No evidence of systemic toxicity was reported in rats exposed to 1.15 mg/l (300 ppm) toluene vapor for two years, while higher exposures were associated with inflammation and degeneration of nasal epithelial tissue. Rats exposed repeatedly to very high concentrations of toluene exhibited neurological changes and permanent hearing loss. Clinical case reports indicate the occurrence of serious and persistent changes (including tremor, ataxia, memory impairment and possible hearing loss) in humans following deliberate over-exposure to toluene in abuse situations. The relevance of these findings to low level occupational exposure to toluene is not known.

Reproductive Effects
Studies in animals demonstrate no histopathological lesions in testes or ovaries of rats and mice exposed to 9.4 mg/l (2500 ppm) toluene vapor for 14-15 weeks, and no loss of fertility in male rats after exposure to 7.5 mg/l (2000 ppm) for a similar period of time. Epididymal weights and sperm counts were decreased in one study, but the absence of any adverse effect on reproduction makes the functional relevance of these observations unclear. No reliable human data are available.

Developmental Effects
Studies in pregnant rats demonstrate that toluene is not a teratogen, however mild fetotoxicity (lower body weight, delayed ossification, delayed physical development) may occur in the absence of maternal toxicity at exposures in the range 1.9-2.8 mg/l (500-750 ppm). Other studies describe adverse effects on learning and cognitive functions in rat pups exposed to 4.5-6.7 mg/l (1200-1800 ppm) in utero, although it is unclear if end-points evaluated in these tests are directly relevant to humans.

Genetic Toxicity
In vitro and in vivo mutagenicity tests were negative.

Carcinogenicity
Inhalation studies in rats and mice demonstrate that toluene is not a carcinogen. It has been used extensively as a solvent in rodent skin painting studies with occasional slight, increases in tumor incidence reported: an epigenetic mechanism (based on irritation rather than genotoxicity) may underpin these findings. Toluene is considered a Group 3 substance by IARC, not classifiable as to its carcinogenicity to humans.

Benzene 71-43-2

Acute Toxicity - Lethal Doses
| LC50 (vapor) | Rat | 13,700 PPM | 4 HOURS |
| LD50 (Oral) | Rat | 3400 - 5960 MG/KG BWT |
| LD50 (Skin) | Rabbit | > 8260 MG/KG BWT |
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Acute Toxicity - Effects
Inhalation
Signs of eye, throat, and respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death) and possible cardiac sensitization may occur after exposure to high vapor concentrations.

Ingestion
Ingestion may cause discomfort and irritation of the gastrointestinal tract and CNS depression (fatigue, dizziness, collapse, coma and death). Aspiration into the lung may cause fatal chemical pneumonitis.

Skin Contact
No systemic toxicity is expected from acute dermal exposure.

Irritation
Skin
Skin irritant.
Eye
Severe eye irritant.

Sensitization
Not expected to cause sensitization by skin contact.

Target Organ Effects
Damages bone marrow. Eye. Skin.

Repeated Dose Toxicity
The hematopoietic system is the primary target for benzene, irrespective of the route of exposure. Broadly similar effects are seen in rodents and humans, including bone marrow toxicity and reduced red- and white blood cell counts. Immunological functions are also depressed in mice following repeated exposure to low levels by inhalation or ingestion. Effects in other organ systems include alterations in behavior and brain biochemistry along with lesions of the ovary and testis, however the relevance of these findings to humans is unclear.

Reproductive Effects
Results from animal studies are inconsistent, with adverse effects on the ovary and testis reported in mice following repeated inhalation exposure but no effects on the gonads or on fertility observed in rats exposed under similar conditions. No reliable human data are available, hence the relevance of these findings to human reproductive health is not known.

Developmental Effects
Results from animal studies clearly demonstrate that benzene is not a teratogen, however mild fetotoxicity (including lowered body weight, delayed ossification and sub-clinical hematological changes) have been observed in rodents exposed during pregnancy, generally in association with maternal toxicity. No reliable human data are available, hence the relevance of these findings to human reproductive health is not known.

Genetic Toxicity
Benzene is genotoxic in vivo, and induces chromosomal aberrations and micronuclei in rats and mice following oral or inhalation exposure. Comparable changes would be anticipated in humans. The incidence of micronuclei in fetal rat liver is increased following administration of large doses by intraperitoneal injection to pregnant mice, while high-level oral exposure induced chromosomal aberrations in germ cells from male mice. The relevance to humans of these latter findings is not known.
Carcinogenicity
Benzene is a multi-site animal carcinogen, producing tumors in hematopoietic- and epithelial tissues after long term inhalation or oral exposure. Epidemiology studies confirm it is a human carcinogen, causing primarily acute nonlymphocytic leukemia.

\[ p\text{-Xylene 106-42-3} \]

**Acute Toxicity - Lethal Doses**

| LC50 (vapor) | Rat | 4740 PPM | 4 HOURS |
| LC50 (Inh) | Mouse | 3907 | 6 HOURS |
| LD50 (Oral) | Rat | 4,029 MG/KG |
| LD50 (Skin) | Rabbit | 4,350 MG/KG |

**Acute Toxicity - Effects**

**Inhalation**
Signs of eye, throat, and respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death) and possible cardiac sensitization may occur after exposure to high vapor concentrations. Exposure to high vapor concentrations may cause effects on hearing.

**Ingestion**
May be harmful if swallowed. Ingestion may cause effects on liver, spleen and kidneys. High doses may cause CNS depression (fatigue, dizziness and possibly loss of concentration, with collapse, coma and death in cases of severe overexposure). Possible cardiac sensitization. Aspiration into the lungs may cause fatal chemical pneumonitis.

**Skin Contact**
Skin absorption hazard. Considered to be of low toxicity by the dermal route of exposure. However, dermal exposure to high concentrations may cause discomfort and irritation of the gastrointestinal tract; effects on lungs, liver and kidneys; and CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe over-exposure). Repeated contact with skin may cause cracking and/or fissuring.

**Irritation**

**Skin**
May be irritating to the skin. Repeated contact with skin may cause cracking and/or fissuring.

**Eye**
May cause eye irritation.

**Sensitization**
Not expected to cause sensitization by skin contact.

**Target Organ Effects**

**Repeated Dose Toxicity**
May be toxic following repeated exposure to high doses. No standard repeated inhalation exposure study was available. However, in limited scope studies, repeated inhalation exposure of rats to p-xylene caused ototoxicity at \(>=900\) ppm (3.91 mg/L) but not at 450 ppm (1.95 mg/L). Repeated inhalation exposures of laboratory animals to other xylene isomers and/or mixed xylene caused reduced body weight/weight gain at \(>=1000\) ppm (4.35 mg/L), liver and CNS (behavioral) effects at \(>=100\) ppm (0.43 mg/L), and, in rats, ototoxicity at \(>=250\) ppm (1.09 mg/L). No treatment-related effects were
seen in rats after oral exposure to p-xylene at 800 mg/kg bwt/day for 13 weeks. Short-term (10-14 days) repeated oral exposure of rats to p-xylene produced increases in liver weights and decreases in body weights and relative thymus weights at 2000 mg/kg bwt/day, and ototoxicity at 899 mg/kg bwt/day (the only concentration tested for ototoxicity). No ototoxicity was observed in guinea pigs exposed to p-xylene at this dose level. Oral exposure of rats to mixed xylenes at 500 mg/kg bwt/day for 103 weeks produced only slightly decreased body weight. Repeated oral exposure of mice to mixed xylenes produced a reduction in body weight in females at 2000 mg/kg bwt/day for 13 weeks, but no treatment-related effects were seen after exposure to 1000 mg/kg bwt/day for 103 weeks. The observed liver effects may be

Repeated Dose Toxicity
adaptive rather than adverse effects.

Reproductive Effects
This substance is not expected to be a reproductive toxicant. No damage to reproductive organs was noted in rats exposed by oral gavage to p-xylene at 800 mg/kg bwt/day for 13 weeks. Results for mixed xylenes in a one-generation reproductive toxicity study (rats, inhalation at 500 ppm/2.17 mg/L) and two dominant lethal studies (rats, i.p.; mice, s.c: 864 mg/kg bwt), and from evaluation of reproductive organs in repeated dose studies (male rats, inhalation, 1000 ppm [4.35 mg/L]; rats [1000 mg/kg bwt/day] and mice [2000 mg/kg bwt/day], oral) indicate that mixed xylenes do not affect reproductive performance or induce structural damage to reproductive organs of laboratory animals at high inhalation or oral doses. However, xylenes have been shown to produce damage to reproductive organs in rats repeatedly exposed to extremely high, anesthetic doses.

Developmental Effects
May be toxic to the developing embryo and fetus. Inhalation exposure of pregnant rats to p-xylene was reported to produce decreases in fetal weight and increases in post implantation loss at >=700 ppm 3.0 mg/L), and increases in skeletal variations, but not malformations, at 2000 ppm (8.7 mg/L) in the presence of maternal toxicity (decreased body weight gain and feed consumption, and increased relative liver weight). No effect on neurobehavior was noted in offspring of rat dams exposed to 800 and 1600 ppm (3.5 or 7.0 mg/L) prenatally. After oral gavage exposure, increased resorptions and cleft palate formation were reported in fetuses of mice exposed to p-xylene at >=1935 mg/kg bwt/day, in the presence of maternal toxicity (unspecified). As mice under stress have been shown to be predisposed to produce offspring with cleft palate, the significance of this finding is uncertain.

Genetic Toxicity
Not expected to be genotoxic. p-Xylene produced negative results in assays for gene mutation in bacteria and induction of micronuclei in mouse bone marrow after intraperitoneal injection. Two positive responses have been reported for mixed xylenes, but the overall weight of evidence from a variety of in vitro and in vivo genotoxicity studies with xylenes indicates that they are not genotoxic.

Carcinogenicity
Available data for mixed xylenes indicate that the para-Xylene product is not likely to be carcinogenic to humans. Cancer data for mixed xylenes are used as surrogate data for this product. Oral exposure to mixed xylenes for 2 years did not produce tumors in rats or mice at doses up to 500 or 1000 mg/kg bwt/day, respectively. IARC concluded that xylenes are not classifiable as to their carcinogenicity to humans (Group 3).

Ethyl Benzene 100-41-4

Acute Toxicity - Lethal Doses
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LC50 (vapor) Rat 4000 PPM
LD50 (Oral) Rat 3500 - 4700 MG/KG BWT
LD50 (Skin) Rabbit > 15,000 MG/KG BWT

Acute Toxicity - Effects

Inhalation
Vapors may cause irritation of the eyes, nose and throat as well as CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe over-exposure) May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Ingestion
Ingestion may cause discomfort and irritation of the gastrointestinal tract. High doses may cause CNS depression (fatigue, dizziness and possibly loss of concentration, with collapse, coma and death in cases of severe over-exposure). May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization. Aspiration into the lungs may cause fatal chemical pneumonitis.

Skin Contact
Repeated contact with skin may cause cracking and/or fissuring. While skin absorption is a potential route of exposure, no adverse health effects are anticipated following accidental or incidental contact.

Irritation
Skin
This product is expected to be an skin irritant.

Eye
Moderate to severe eye irritant.

Sensitization
Not expected to cause sensitization by skin contact.

Target Organ Effects

Repeated Dose Toxicity
No adverse effects were present in rats or mice exposed to 1000 ppm (4.3 mg/l) ethylbenzene vapor for up to 13 weeks. Longer-term exposure resulted in an increased incidence of chronic progressive nephropathy (CPN) in kidneys from rats inhaling 750 ppm (3.3 mg/l) for up to two years. Since CPN is a spontaneous age-related condition specific to rodents, these findings are of doubtful relevance to humans. Mice exposed chronically under similar conditions responded with changes in the lung, liver and thyroid. Additional effects in rats observed with repeated oral exposure of >= 250 mg bwt/day ethyl benzene for 90 days include changes in hematology (indicative of a mild regenerative anemia) and clinical chemistry parameters (indicative of hepatic microsomal enzyme induction), decreases in prothrombin time, mild alimentary effects and liver pathology. A standard neurotoxicity protocol study conducted in young adult rats did not find neurotoxic effects following repeated daily oral exposure to doses up to 500 mg/kg bwt/day.

Specialist investigations provide evidence of hearing loss in rats following repeated exposure (13 weeks) to concentrations of 200 ppm (0.85 mg/l) and above. Ethyl benzene at up to 500 ppm vapor concentration did not adversely affect the functional ability of the humoral component of the immune system of rats as measured by splenic IgM antibody forming cell response to the T-dependent antigen, sheep erythrocytes.

Reproductive Effects
No parental, neonatal, or reproductive toxicity was observed following inhalation exposure of rats to up to 500 ppm or 500 ppm/342 mg/kg bwt/day ethylbenzene. Histopathological examination of reproductive tissue from rats, mice and rabbits has generally revealed no adverse changes following sub-chronic- or chronic inhalation exposure to high vapor...
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concentrations. An increased incidence of testicular tumors in F344 male rats exposed to 750 ppm (3.3 mg/l) ethylbenzene vapor for 2 years is considered of doubtful relevance to reproductive toxicity.

Developmental Effects
Decreased fetal body weight and an increased occurrence of skeletal and other variations were reported in the presence of concurrent maternal toxicity (CNS effects, decreased body weight, liver enlargement) when female rats were exposed to ethylbenzene concentrations of 1000 ppm (4.3 mg/l) or above throughout pregnancy. No adverse effects to neurodevelopment were observed in rats exposed to 500 ppm/342 mg/kg bwt/day ethylbenzene.

Genetic Toxicity
No increase in micronuclei or hepatic UDS was observed in mice after treatment with ethylbenzene in vivo. It was not genotoxic in microbial systems, nor did it induce chromosomal aberrations or sister chromatid exchanges in mammalian cells in vitro. Variable results were obtained for mutation at the TK+/- locus in L5178Y cells, although the most reliable study that utilized the current standard study protocol and doses that were not significantly cytotoxic gave a negative mutagenic response. The overall weight of evidence indicates that ethylbenzene is not genotoxic.

Carcinogenicity
The carcinogenic potential of ethylbenzene after inhalation exposure has been investigated in two recent regulatory guideline studies performed by NTP. Male rats exposed to 750 ppm (3.3 mg/l) over 2 years showed an increased incidence of testicular interstitial cell adenoma, a common tumor present also in a large majority of the untreated males included in the study. High level exposure was also linked with an increased incidence of kidney tumors in both sexes; the appearance of these lesions was strongly associated with the development of Chronic Progressive Nephropathy, a spontaneous age-related disease of rats with no equivalent counterpart in humans. Male mice exposed to 750 ppm ethylbenzene for 2 years responded with an increased incidence of lung tumors, while the incidence of liver tumors was increased in females. Mechanistic studies suggest that these lesions in the mouse developed secondary to enhanced cell proliferation in these tissues, while the weight of evidence from mutagenicity testing also indicates that a nongenotoxic mechanism was involved. Listed by IARC as possibly carcinogenic in humans (Group 2B).

SECTION 12: ECOLOGICAL INFORMATION

PRODUCT INFORMATION

Ecotoxicity

Environmental Fate and Pathway
Other Adverse Effects
See component summary.

COMPONENT INFORMATION

Toluene 108-88-3

Ecotoxicity
Acute toxicity to fish
LC50 / 96 HOUR Oncorhynchus mykiss 55 mg/l
LC50 / 96 HOUR Carassius auratus 22.8 mg/l
LC50 / 96 HOUR Pimephales promelas 31.7 mg/l

Acute toxicity to aquatic invertebrates
EC50 / 48 HOUR Daphnia magna. 11.5 - 14.9 mg/l

Toxicity to aquatic plants
Summary: No Data Available.

Toxicity to microorganisms
Summary: No Data Available.

Chronic toxicity to fish
NOEC / 40 DAY Oncorhynchus sp. 1.4 mg/l
Summary: Actual exposure time: 27 - 40 day.

Chronic toxicity to aquatic invertebrates
NOEC / 21 DAY Daphnia magna. 1.0 mg/l
NOEC / 7 DAY Ceriodaphnia dubia 0.74 mg/l

Environmental Fate and Pathway

Mobility
Transport between environmental compartments: The atmosphere is the main environmental compartment for the release of toluene. In water, volatilization will result in substantial losses to the atmosphere with a half-life of 1-2 days. A calculated Koc value of 37-160 indicates no significant potential for geoaccumulation.

Persistence and Degradability
Biodegradation: Readily biodegradable in aerobic conditions.
Bioaccumulation: Log Kow (Fish) <3 This material is not expected to bioaccumulate.

Other Adverse Effects
See component summary.

Benzene 71-43-2

Ecotoxicity

Acute toxicity to fish
LC50 / 96 HOUR Oncorhynchus mykiss 5.3 - 21.6 mg/l
LC50 / 96 HOUR Pimephales promelas 14.0 - 15.6 mg/l
LC50 / 96 HOUR Poecilia reticulata 28.6 mg/l

Acute toxicity to aquatic invertebrates
EC50 / 48 HOUR Daphnia magna. 10 mg/l
Material Safety Data Sheet

TOLUENE COMMERCIAL GRADE

EC50 / 48 HOUR Ceriodaphnia dubia 17.2 mg/l

Toxicity to aquatic plants
EC50 / 72 HOUR Selenastrum capricornutum 28 - 100 mg/l

Toxicity to microorganisms
Summary: No Data Available.

Chronic toxicity to fish
ELS NOEC / 32 DAY Pimephales promelas 1.6 mg/l

Chronic toxicity to aquatic invertebrates
EC50 / 7 DAY Ceriodaphnia dubia 11.6 mg/l

Environmental Fate and Pathway

Mobility
Transport between environmental compartments: When released to water, volatilization will result in substantial losses to the atmosphere with a calculated half-life in the troposphere of approximately 13.4 days. A calculated Koc value of 134.1 l/kg does not indicate a significant potential for geoaccumulation.

Persistence and Degradability
Biodegradation: Readily biodegradable in aerobic conditions.
Bioaccumulation: BCF in fish ~ 10. This material is not expected to bioaccumulate.

*p-Xylene 106-42-3*

Ecotoxicity

Acute toxicity to fish
LC50 / 96 HOURS Oncorhynchus mykiss 2.6 mg/l

Acute toxicity to aquatic invertebrates
EC50 / 48 HOURS Daphnia magna. 3.6 mg/l

Toxicity to aquatic plants
EC50 / 72 HOURS Selenastrum capricornutum 4.4 mg/l

Toxicity to microorganisms
NOEC / 3 HOURS Activated sludge 157 mg/l

Chronic toxicity to fish
NOEC / 56 d Oncorhynchus mykiss 1.3 mg/l

Chronic toxicity to aquatic invertebrates
NOEC / 21 d Daphnia magna. 1.57 mg/l
Material Safety Data Sheet

TOLUENE COMMERCIAL GRADE

Environmental Fate and Pathway

Mobility
Transport between environmental compartments: Some volatilization from water or soil is expected, with p-xylene initially partitioned mainly to soil and water

Persistence and Degradability
Biodegradation: This material is expected to be readily biodegradable. Expected to be hydrolytically stable, but rapidly degraded following atmospheric release.
Bioaccumulation: Significant bioaccumulation is not expected. Fish BCF (Anguilla japonica) 23.6 after 10 days; BCF (Carassius auratus) 14.8.

Ethyl Benzene 100-41-4

Ecotoxicity
Acute toxicity to fish
LC50 / 96 HOUR Oncorhynchus mykiss 4.2 mg/l
LC50 / 96 HOUR Menidia menidia 5.1 mg/l
LC50 / 96 HOUR Poecilia reticulata 9.6 mg/l

Acute toxicity to aquatic invertebrates
EC50 / 48 HOUR Daphnia magna. 1.8 - 2.9 mg/l
EC50 / 48 HOUR Artemia salina 9.2 mg/l

Toxicity to aquatic plants
EC50 / 72 HOUR Selenastrum capricornutum 4.6 mg/l
EC50 / 96 HOUR Selenastrum capricornutum 3.6 mg/l
EC50 / 96 HOUR Skeletonema costatum 7.7 mg/l

Toxicity to microorganisms
IC50 / 48 HOUR Sewage sludge 130 mg/l

Chronic toxicity to fish
Summary: No Data Available.

Chronic toxicity to aquatic invertebrates
IC50 / 7 DAY Ceriodaphnia dubia 3.3 mg/l
Summary: (reproduction)
NOEL / 7 DAY Ceriodaphnia dubia 1.0 mg/l
Summary: (reproduction)
Summary: May exhibit chronic toxicity in specific invertebrates.

Environmental Fate and Pathway

Mobility
Transport between environmental compartments: The atmosphere is the main environmental compartment for releases of ethylbenzene (half-life approx. 1 day). In water, volatilization to air and biodegradation will result in substantial losses, with an estimated half-life of approx. 0.1 - 13 days.

Persistence and Degradability
Biodegradation: Readily biodegradable in aerobic conditions.
Bioaccumulation: This material is not expected to bioaccumulate.

SECTION 13: DISPOSAL CONSIDERATIONS

Contaminated product/soil/water may be U.S. Resource Conservation and Recovery Act (RCRA)/U.S. Occupational Safety and Health Administration (OSHA) hazardous waste due to potentially low flash point. Comply with federal, state, or local regulations for disposal. Use registered transporters.

SECTION 14: TRANSPORT INFORMATION

Special Requirements
If you reformulate or further process this material, you should consider re-evaluation of the regulatory status of the components listed in the composition section of this sheet, based on final composition of your product.

Proper Shipping Name: Toluene
RQ: TOLUENE
ID No.: UN1294
Hazard Class: 3
PG: II

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

SECTION 15: REGULATORY INFORMATION

Regulatory Status:

<table>
<thead>
<tr>
<th>Country</th>
<th>Inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>AICS</td>
</tr>
<tr>
<td>Canada</td>
<td>DSL</td>
</tr>
<tr>
<td>China</td>
<td>IECS</td>
</tr>
<tr>
<td>European Union</td>
<td>EINECS</td>
</tr>
<tr>
<td>Japan</td>
<td>ENCS</td>
</tr>
<tr>
<td>Korea</td>
<td>ECL</td>
</tr>
<tr>
<td>Philippines</td>
<td>PICCS</td>
</tr>
<tr>
<td>United States</td>
<td>TSCA</td>
</tr>
</tbody>
</table>

If identified components of this product are listed under the TSCA 12(b) Export Notification rule, they will be listed below.

SARA 302/304
Material Safety Data Sheet

TOLUENE COMMERCIAL GRADE

This material contains a component(s) with known CAS numbers classified as hazardous substances subject to the reporting of CERCLA (40 CFR 302) and/or to the release reporting requirements of SARA (Section 302) based on reportable quantities (RQs).

<table>
<thead>
<tr>
<th>Component</th>
<th>RQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toluene / CAS# 108-88-3</td>
<td>1,000 lbs</td>
</tr>
<tr>
<td>Benzene / CAS# 71-43-2</td>
<td>10 lbs</td>
</tr>
<tr>
<td>p-Xylene / CAS# 106-42-3</td>
<td>100 lbs</td>
</tr>
<tr>
<td>Ethylbenzene / CAS# 100-41-4</td>
<td>1,000 lbs</td>
</tr>
</tbody>
</table>

SARA 311/312
Based upon available information, this material is classified as the following health and/or physical hazards according to Section 311 & 312:
Immediate (Acute) Health Hazard.
Delayed (Chronic) Health Hazard.
Fire Hazard.

SARA 313
This material contains the following chemicals with known CAS numbers subject to the reporting requirements of SARA Title III, Section 313 and 40 CFR 372:

<table>
<thead>
<tr>
<th>Component</th>
<th>Reporting Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toluene / CAS# 108-88-3</td>
<td>1.0%</td>
</tr>
<tr>
<td>p-Xylene / CAS# 106-42-3</td>
<td>1.0%</td>
</tr>
<tr>
<td>Benzene / CAS# 71-43-2</td>
<td>0.1%</td>
</tr>
<tr>
<td>Ethylbenzene / CAS# 100-41-4</td>
<td>0.1%</td>
</tr>
</tbody>
</table>

State Reporting
This product contains the following ingredients for which the state of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute:
- Toluene; developmental toxin
- Benzene, Carcinogenic Hazard, Male Reproductive Toxin and Developmental Toxin
- Ethylbenzene, Carcinogen
- p-Xylene / CAS# 106-42-3

Hazardous Substances listed by the State of Pennsylvania must be identified when present in materials at levels greater than the state specified criterion. The criterion is >= 1%. Components with CAS numbers in this material at a level which could require reporting under the statute are:
- Benzene / CAS# 71-43-2

Environmentally Hazardous Substances listed by the State of Pennsylvania must be identified when present in materials at levels greater than the state specified criterion. The criterion is >= 1%. Components with CAS numbers in this material at a level which could require reporting under the statute are:
- Benzene / CAS# 71-43-2
- Ethylbenzene / CAS# 100-41-4
- Toluene / CAS# 108-88-3

Massachusetts Substances List (MSL) - Extraordinarily Hazardous Substances must be identified when present in materials at levels greater than state specified criterion. The criterion is >=0.0001%. Components with CAS numbers present in this material, at levels specified in Section 3 - Composition, do not require reporting under the statute.
- Benzene / CAS# 71-43-2
SILVER FERN CHEMICAL

Material Safety Data Sheet

TOLUENE COMMERCIAL GRADE

Ethylbenzene / CAS# 100-41-4.

Massachusetts Substances List (MSL) - Hazardous substances on the MSL must be identified when present in materials at levels greater than state specified criterion. The criterion is: >= 1%. Components with CAS numbers present in this material at a level which could require reporting under the statute are:
  p-Xylene / CAS# 106-42-3

  Benzene / CAS# 71-43-2
  Ethylbenzene / CAS# 100-41-4.
  p-Xylene / CAS# 106-42-3

SECTION 16: OTHER INFORMATION

Latest Revision(s)
Revised Section(s): 2 11 12 Date of Revision: January 2008

DISCLAIMER OF RESPONSIBILITY

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