

Material Safety Data Sheet

Material Name: **Benzene**

MSDS ID: NOVA-0011

Section 1 - Product and Company Identification

Synonyms: Benzene, benzol**Chemical Name:** Benzene**Chemical Family:** Aromatic hydrocarbons**Material Use:** Petrochemical industry: Solvent, raw material for petrochemicals**Chemical Formula:** (C₆H₆)**NOVA Chemicals**

P.O. Box 2518, Station M

Calgary, Alberta, Canada T2P 5C6

Product Information: 1-412-490-4063**MSDS Information Email:**msdsemail@novachem.com**EMERGENCY Telephone Numbers:****North America (Canada and US):**

1-800-561-6682, 1-403-314-8767 (NOVA Chemicals) (24 hours)

1-800-424-9300 (CHEMTREC-USA) (24 hours)

1-613-996-6666 (Canutec-Canada) (24 hours)

Section 2 - Hazards Identification

HMIS Ratings: Health: 2* Fire: 3 Physical Hazard: 0 Personal Protection: chemical goggles, gloves, respirator, coveralls*Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe * = Chronic hazard***NFPA Ratings: Health: 2 Fire: 3 Reactivity: 0***Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe***Emergency Overview**

DANGER! TOXIC! EXTREMELY FLAMMABLE! CANCER HAZARD! Product is a clear liquid at room temperature with a sweet, solvent-like odour. Vapour is heavier than air and may spread long distances. Distant ignition and flashback are possible. Flammable liquid and vapour can accumulate static charge. Product will float on water and may travel to distant locations and/or spread fire. This product is considered harmful by inhalation, by skin contact, and if it is swallowed. This product is irritating to the eyes and skin. Excessive inhalation may result in heartbeat irregularities and adverse central nervous system effects including headache, sleepiness, dizziness, nausea, loss of coordination, tremors, and in extreme conditions, coma and death. Systemic absorption effects may include long-term damage to the blood-forming system, kidney and liver damage, and/or cancer (leukemia). Ingestion may also cause adverse central nervous system effects, blood disorders, kidney and/or liver damage. Small amounts, if aspirated into the lungs, may cause mild to severe pulmonary injury.

Potential Health Effects: Eye

Contact with liquid and high concentrations of this product's vapours are irritating to the eyes.

Potential Health Effects: Skin

Product may be rapidly absorbed through the skin. Prolonged and/or repeated skin contact may cause mild to severe irritation/dermatitis and chemical blistering. Prolonged contact may also cause skin sensitization and secondary skin infections.

Potential Health Effects: Ingestion

This product may be harmful if swallowed. Ingestion of this product may result in adverse central nervous system effects including headache, sleepiness, dizziness, nausea, loss of coordination, and in extreme conditions coma and/or death. Ingestion may also cause kidney and liver damage and blood disorders. Small amounts of this product, if aspirated into the lungs, may cause mild to severe pulmonary injury.

Potential Health Effects: Inhalation

This product may be harmful if inhaled. Excessive inhalation may result in heartbeat irregularities and adverse central nervous system effects including headache, sleepiness, dizziness, nausea, loss of coordination, and in extreme conditions, coma and death. Additional adverse inhalation effects may also include long-term damage to blood-forming system, kidney and liver damage, and/or cancer (leukemia). Small amounts of this product, if aspirated into the lungs, may cause mild to severe pulmonary injury.

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Section 3 - Composition/Information on Ingredients

CAS #	Component	Percent by Wt.
71-43-2	Benzene	99.87-99.99
Not Available	Other hydrocarbons	0.01-0.10
Not Available	Other hydrocarbons	0.10-0.13

Additional Information

* May include cyclohexane (CAS # 110-82-7), cyclohexene (CAS # 110-83-8) and/or toluene (CAS # 108-88-3) as impurities.

The actual components and weight % concentrations vary based on operating conditions.

This product is hazardous under 29 CFR 1910.1200 (Hazard Communication).

This material is a controlled product under Canadian WHMIS regulations.

This material is regulated as a hazardous material/dangerous goods for transportation.

See Section 8 for applicable exposure limits. See Section 11 for applicable toxicity data.

Section 4 - First Aid Measures

First Aid: Eyes

Remove contact lenses, if it can be done safely. Immediately flush eyes with water for at least 15 minutes, while holding eyelids open. Seek medical if symptoms develop or persist.

First Aid: Skin

Remove contaminated clothing and shoes. Wash immediately with soap and water. Seek medical attention if symptoms develop or persist. Completely decontaminate clothing, shoes and other protective equipment before reuse or discard.

First Aid: Inhalation

Move affected individual to non-contaminated air. Loosen tight clothing such as a collar, tie, belt or waistband to facilitate breathing. Seek immediate medical attention if the individual is not breathing, is unconscious or if any other symptoms persist. WARNING: Contact through mouth-to-mouth resuscitation may pose a secondary risk to the rescuer. Avoid mouth-to-mouth contact by using a mouth shield or guard to perform artificial respiration.

First Aid: Ingestion

DO NOT INDUCE VOMITING. Loosen tight clothing such as a collar, tie, belt or waistband. Seek immediate medical attention.

First Aid: Notes to Physician

For more detailed medical emergency support information call 1-800-561-6682 or 1-403-314-8767 (24 hours, NOVA Chemicals Emergency Response). Ensure thorough eye and skin decontamination. Treat unconsciousness, nausea, hypotension, seizures and cardiac arrhythmias in the conventional manner. Aspiration of this product during induced emesis can result in lung injury. If evacuation of stomach contents is considered necessary use the method least likely to cause aspiration, such as gastric lavage after protecting the airway. Observe hospitalized patients for delayed chemical pneumonia, acute tubular necrosis, encephalopathy and dysrhythmias. Monitor for urinary phenol within 72 hours of acute exposure.

Section 5 - Fire Fighting Measures

See Section 9: Physical Properties for flammability limits, flash point and auto-ignition information.

General Fire Hazards

Fire and container explosion hazards are serious when this product is exposed to heat or flame. Vapours are heavier than air and may travel along the ground to some distant source of ignition and flash back. Consider need for immediate emergency isolation and evacuation for at least 300 metres (984 feet). If tank is involved in a fire, ISOLATE for 800 metres (1/2 miles) in all directions.

Explosion Hazards

Vapours may form explosive mixture with air. Keep containers away from source of heat or fire. Containers may explode when involved in a fire. Evacuate personnel to a distance of at least 0.8 to 1.6 kilometres (1/2 mile) if a fire or rail car, tank car, or major vessel rupture is possible. This product may be a static accumulator which can form an ignitable vapour-air mixture in a storage tank.

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Hazardous Combustion Products

Upon combustion, this product emits carbon monoxide, carbon dioxide, and/or low molecular weight hydrocarbons.

Extinguishing Media

Dry chemical, foam, carbon dioxide, and water spray or fog. Use water to cool fire-exposed containers and to protect personnel. Water may be an ineffective extinguishing medium. Use of an inert foam extinguishing material may also assist in short term flammable vapour suppression. Monitor water run-off for flammability, and prevent entry into ditches, sewers, drains and, waterways, or other confined or underground spaces.

Fire Fighting Equipment/Instructions

Reference 2008 Emergency Response Guidebook, Guide No. 130. Position upwind. Keep unnecessary personnel away. Move containers from fire area if you can do so without risk. Fight fire from maximum distance or use unmanned holders or monitor nozzles. Immediately withdraw in case of fire and container venting or heat discoloration of a container. Fire fighters should wear full-face, self-contained breathing apparatus and thermal protective clothing. Avoid inhaling any smoke and combustion materials. Remove and clean or destroy any contaminated clothing. Cool containers with flooding quantities of water until well after the fire is out. Control runoff waters to prevent entry into ditches, sewers, drains, underground or confined spaces and waterways.

Section 6 - Accidental Release Measures

Evacuation Procedures

Isolate area. Keep unnecessary personnel away. Alert stand-by emergency and fire fighting personnel. Monitor surrounding area for buildup of flammable concentrations in air.

Small Spills

Eliminate ignition sources. Spill or leak area should be isolated immediately for 25 to 50 metres (82 to 164 feet) in all directions. Keep upwind and out of low areas. Stop discharge if safe to do so. Contain discharge by booming on water or diking on ground. Spills on water will volatilize rapidly, making containment or recovery difficult. Remove liquid material with non-sparking approved pumps, skimmers or vacuum equipment. Absorb/adsorb residual materials and clean up with non-sparking tools. Prevent entry into ditches, sewers, drains, underground or confined spaces, water intakes and waterways. Shovel material with non-sparking tools into appropriate container for disposal.

Large Spills

Consider downwind evacuation for 300 metres (984 feet). Eliminate ignition sources. Keep upwind and out of low areas. Stop discharge if safe to do so. Contain liquids by booming on water or by diking on land to prevent entry into ditches, sewers, drains or waterways. Spills on water will volatilize rapidly, making containment or recovery difficult. Recover any pooled liquid material with approved, non-sparking pumps, skimmers or vacuum equipment. An inert foam cover material may assist in short term vapour suppression. Absorb with DRY earth, sand or other non-combustible material and clean up with non-sparking tools. Soil remediation may be required.

Special Procedures

Contact local police/emergency services and appropriate emergency telephone numbers provided in Section 1. Ensure that statutory and regulatory reporting requirements in the applicable jurisdiction are met. Wear appropriate protective equipment and clothing during cleanup. Individuals without appropriate protective equipment should be excluded from area of spill until cleanup has been completed.

See Section 8 for recommended Personal Protective Equipment and see Section 13 for waste disposal considerations.

Section 7 - Handling and Storage

Handling Procedures

Keep locked up or secured. Handle in fully grounded, properly designed and approved equipment systems that are suitable for flammable liquids. Use with adequate ventilation. Do not ingest or inhale. Keep away from heat and ignition sources. No smoking or open flames permitted in storage, use, or handling areas. Dissipate static electricity during transfer by grounding and bonding containers and equipment. Bonding and grounding may be insufficient to eliminate the hazard from static-accumulating flammable liquids. For additional information on equipment bonding and grounding, refer to the American Petroleum Institute (API) Recommended Practice 2003, "Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents" or National Fire Protection Association (NFPA) 77, "Recommended Practice on Static Electricity". Avoid draining or venting to atmosphere if

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possible. Take special precautions when cold cutting or breaking into lines, or when cleaning and disposing of empty containers. Do not breathe product gas, fumes, vapour, or spray. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately. Avoid contact with skin and eyes. Keep away from incompatible materials such as oxidizing agents and acids. After handling, always wash hands thoroughly with soap and water.

Storage Procedures

Storage area should be clearly identified, well-illuminated, clear of obstruction and accessible only to trained and authorized personnel. Adequate security must be provided so that unauthorized personnel do not have access to material. Store in grounded, properly designed vessels and away from incompatible materials. Store and use away from heat, sparks, open flame, or any other ignition source. Store according to applicable regulations for flammable materials for storage tanks, containers, piping, buildings, rooms, cabinets, allowable quantities and minimum storage distances. Use non-sparking ventilation systems, approved explosion-proof equipment, and intrinsically safe electrical systems. Have appropriate extinguishing capability in storage area (e.g. portable fire extinguishers (dry chemical, foam or carbon dioxide)) and flammable gas detectors. Keep absorbents for leaks and spills readily available. Consider use of internal floating roof tanks or flame arrestors. Inspect vents during winter conditions for vapour ice buildup. Storage tanks should be above ground and diked to hold entire contents. A refrigerated room is generally recommended for warehouse storage of materials with a flash point lower than 37.8°C (100°F).

See Section 8: Exposure Controls/Personal Protection for appropriate Personal Protective Equipment. See Section 10 for information on Incompatibilities.

Section 8 - Exposure Controls / Personal Protection

Exposure Guidelines

A: General Product Information

Refer to published exposure limits - use effective control measures and PPE to maintain worker exposure to concentrations that are below these limits. Ensure that eyewash stations and safety showers are in close proximity to work locations.

B: Component Exposure Limits

ACGIH, OSHA, NIOSH, EPA, Alberta, and Ontario exposure limit lists have been checked for major components listed with CAS registry numbers. Other exposure limits may apply, check with proper authorities.

*Note: The Vacated OSHA Permissible Exposure Limits (PELs) are those provided in the 1989 update to OSHA's Air Contaminants Standard 29 CFR 1910.1000. These limits were vacated by the U.S. Court of Appeals, Eleventh Circuit but may be enforceable in some states.

Benzene (71-43-2)

ACGIH:	0.5 ppm TWA; 1.6 mg/m ³ TWA; 2.5 ppm STEL; 8 mg/m ³ STEL; BEI Skin - potential significant contribution to overall exposure by the cutaneous route
OSHA (Vacated)*:	0.5 ppm Action Level; 1 ppm TWA; 5 ppm STEL (Cancer hazard, Flammable - see 29 CFR 1910.1028)
OSHA Final:	0.5 ppm Action Level; 1 ppm TWA; 5 ppm STEL (Cancer hazard, Flammable - see 29 CFR 1910.1028); 1 ppm TWA; 10 ppm TWA (applies to industry segments exempt from the benzene standard at 29 CFR 1910.1028); 5 ppm STEL (see 29 CFR 1910.1028); 25 ppm Ceiling (applies to industry segments exempt from the 1 ppm TWA and 5 ppm STEL of the benzene standard)
NIOSH:	0.1 ppm TWA; 0.32 mg/m ³ TWA; 1 ppm STEL; 3.2 mg/m ³ STEL 500 ppm IDLH
Alberta:	0.5 ppm TWA; 1.6 mg/m ³ TWA; 2.5 ppm STEL; 8 mg/m ³ STEL Substance may be readily absorbed through intact skin
Ontario:	0.5 ppm TWA; 2.5 ppm STEL Skin - Danger of cutaneous absorption

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Cyclohexane (110-82-7)

ACGIH: 100 ppm TWA; 344 mg/m³ TWA
OSHA (Vacated)*: 300 ppm TWA; 1050 mg/m³ TWA
OSHA Final: 300 ppm TWA; 1050 mg/m³ TWA
NIOSH: 300 ppm TWA; 1050 mg/m³ TWA
1300 ppm IDLH (10% LEL)
Alberta: 100 ppm TWA; 344 mg/m³ TWA
Ontario: 100 ppm TWA

Cyclohexene (110-83-8)

ACGIH: 300 ppm TWA; 1010 mg/m³ TWA
OSHA (Vacated)*: 300 ppm TWA; 1015 mg/m³ TWA
OSHA Final: 300 ppm TWA; 1015 mg/m³ TWA
NIOSH: 300 ppm TWA; 1015 mg/m³ TWA
2000 ppm IDLH
Alberta: 300 ppm TWA; 1010 mg/m³ TWA
Ontario: 300 ppm TWA

Toluene (108-88-3)

ACGIH: 20 ppm TWA; 75 mg/m³ TWA; BEI
OSHA (Vacated)*: 100 ppm TWA; 375 mg/m³ TWA; 150 ppm STEL; 560 mg/m³ STEL
OSHA Final: 200 ppm TWA; 300 ppm Ceiling
NIOSH: 100 ppm TWA; 375 mg/m³ TWA; 150 ppm STEL; 560 mg/m³ STEL
500 ppm IDLH
Alberta: 50 ppm TWA; 188 mg/m³ TWA
Substance may be readily absorbed through intact skin
Ontario: 20 ppm TWA

ENGINEERING CONTROLS

Engineering methods to reduce hazardous exposure are preferred controls. Methods include mechanical ventilation (dilution and local exhaust) process or personal enclosure, remote and automated operation, control of process conditions, leak detection and repair systems, and other process modifications. Ensure all exhaust ventilation systems are discharged to outdoors, away from air intakes and ignition sources. Supply sufficient replacement air to make up for air removed by exhaust systems. Administrative (procedure) controls and use of personal protective equipment may also be required.

PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment: Eyes/Face

Wear safety glasses; chemical goggles are recommended to prevent eye irritation or injury from splashing or vapours.

Personal Protective Equipment: Skin/Hands/Feet

Use chemically resistant gloves when handling product. Wear chemical-resistant safety footwear with good traction to prevent slipping. Work clothing that sufficiently prevents skin contact should be worn, such as coveralls and/or long sleeves and pants. If splashing or contact with liquid material is possible, consider the need for an impervious overcoat. Fire resistant (i.e., Nomex) or natural fibre clothing (i.e., cotton or wool) is recommended. Synthetic clothing can generate static electricity and is not recommended where a flammable vapour release may occur. Static Dissipative (SD) rated footwear is recommended.

Personal Protective Equipment: Respiratory

If engineering controls and ventilation are not sufficient to control exposure to below the allowable limits then an appropriate NIOSH approved air-purifying respirator or self-contained breathing apparatus (SCBA) should be used. Supplied- air breathing apparatus must be used when oxygen concentrations are low or if airborne concentrations exceed the limits of the air-purifying respirators.

Personal Protective Equipment: General

Personal protective equipment (PPE) should not be considered a long-term solution to exposure control. Employer programs to properly select, fit, maintain, and train employees to use equipment must accompany PPE. Consult a competent industrial hygiene resource, the PPE manufacturer's recommendation, and/or applicable regulations to determine hazard potential and ensure adequate protection.

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Section 9 - Physical & Chemical Properties

Physical State and Appearance:	Liquid	Colour:	Colourless
Odour:	Sweet, solvent-like	Odour Threshold:	Range: 1.5 to 5 ppm
pH:	Not applicable	Vapour Pressure:	75 mm Hg at 20°C (68°F)
Vapour Density at 0°C (Air=1):	2.8	Boiling Point:	80°C (176°F)
Freezing Point:	5.5°C (41.9°F)	Solubility (H2O):	Slightly soluble (0.1 to 0.3%), rapidly volatilizes
Specific Gravity (Water=1):	0.88 at 15°C (59°F)	Evaporation Rate (n-Butyl Acetate=1):	Not available
Percent Volatile:	100%	Octanol/H2O Coeff.:	Kow = 2.13
Auto Ignition:	498°C (928°F)	Flash Point:	-11°C (12°F)
Flash Point Method:	Closed cup	Upper Flammable Limit (UFL):	7.8% (volume/volume)
Lower Flammable Limit (LFL):	1.2 % (volume/volume)	Flammability Classification:	Extremely Flammable

Section 10 - Stability & Reactivity Information

Chemical Stability

This product is stable under normal use conditions for shock, vibration, pressure, or temperature.

Chemical Stability: Conditions to Avoid

Keep away from heat, sparks, or open flame.

Incompatibility

Reactive with oxidizing agents, acids and halogens. May attack some forms of plastics, rubbers and coatings. Vapours may form explosive mixture with air.

Possibility of Hazardous Reactions or Hazardous Polymerization

Hazardous polymerization not likely to occur.

Corrosivity

Not corrosive to the common metals.

Hazardous Decomposition

Upon decomposition, this product emits carbon monoxide, carbon dioxide and/or low molecular weight hydrocarbons.

Section 11 - Toxicological Information

A: Acute Toxicity - General Product Information

Benzene may cause corneal injury to the eye. It is also a skin irritant that may be absorbed through the skin in harmful amounts. Inhalation of benzene can irritate the respiratory tract and may result in central nervous system (CNS) depression and possible death due to respiratory failure. Ingestion and subsequent aspiration into the lungs may cause chemical pneumonitis.

B: Component Analysis - LD50/LC50

Benzene (71-43-2)

Inhalation LC50 Rat: 13,050-14,380 ppm/4H; Oral LD50 Rat: 1800 mg/kg

Cyclohexane (110-82-7)

Inhalation LC50 Rat: 13.9 mg/L/4H; Oral LD50 Rat: >5000 mg/kg; Dermal LD50 Rabbit: >2000 mg/kg

Cyclohexene (110-83-8)

Oral LD50 Rat: 2400 µL/kg

Toluene (108-88-3)

Inhalation LC50 Rat: 12.5 mg/L/4H; Inhalation LC50 Rat: >26,700 ppm/1H; Oral LD50 Rat: 636 mg/kg; Dermal LD50 Rabbit: 8390 mg/kg; Dermal LD50 Rat: 12,124 mg/kg

C: Chronic Toxicity - General Product Information

Prolonged and/or repeated exposure can cause drying and scaling of the skin. Long-term exposure has been associated with certain types of leukemia in humans. IARC and OSHA consider benzene to be a human carcinogen. EPA has classified benzene as a Group A, known human carcinogen. Chronic exposure to benzene has been reported to cause bone marrow abnormalities and adverse blood effects including anaemia. Progressive deterioration of haematopoietic function expressed as a decrease in absolute lymphocyte count is the

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most sensitive indicator of benzene exposure. Benzene may cause fetotoxicity and teratogenicity. Chromosomal aberrations have been noted in animal tests.

D: Chronic Toxicity – Carcinogenic Effects

ACGIH, EPA, IARC, OSHA, and NTP carcinogen lists have been checked for selected similar materials or those components with CAS registry numbers.

Benzene (71-43-2)

- ACGIH: A1 - Confirmed Human Carcinogen
OSHA: 0.5 ppm Action Level; 1 ppm TWA; 5 ppm STEL (Cancer hazard, Flammable - see 29 CFR 1910.1028)
EPA: Classification: known human carcinogen for all routes of exposure
NTP: Known Human Carcinogen
IARC: Monograph 100F [in prep], Supplement 7 [1987], Monograph 29 [1982] (Group 1 (carcinogenic to humans))

Toluene (108-88-3)

- ACGIH: A4 - Not Classifiable as a Human Carcinogen
EPA: Classification: under the Guidelines for Carcinogen Risk Assessment (U.S. EPA, 2005), there is inadequate information to assess the carcinogenic potential of toluene.
IARC: Monograph 71 [1999], Monograph 47 [1989] (Group 3 (not classifiable))

E: Special Remarks on Chronic Effects

Benzene may pose a cancer hazard and may cause adverse birth and reproductive effects. Bone marrow abnormalities, leukemia, multiple myelomas, fetotoxicity, teratogenicity (ex. encephaly, angulated ribs and dilated brain ventricles) have been linked to benzene exposure.

Section 12 - Ecological Information

Ecotoxicity

A: General Product Information

Product is largely insoluble in water, and evaporates rapidly. Product has moderate absorption into soil and sediment. It is considered toxic to fish.

B: Component Analysis - Ecotoxicity - Aquatic Toxicity

Benzene (71-43-2)

Test and Species

96 Hr LC50 Pimephales promelas
96 Hr LC50 Oncorhynchus mykiss
96 Hr LC50 Lepomis macrochirus
96 Hr LC50 Poecilia reticulata
96 Hr LC50 Pimephales promelas
96 Hr LC50 Lepomis macrochirus
72 Hr EC50 Pseudokirchneriella subcapitata
48 Hr EC50 Daphnia magna
48 Hr EC50 Daphnia magna

Results and Conditions

10.7-14.7 mg/L [flow-through]
5.3 mg/L [flow-through]
22.49 mg/L [static]
28.6 mg/L [static]
22,330-41,160 µg/L [static]
70,000-142,000 µg/L [static]
29 mg/L
8.76 - 15.6 mg/L [Static]
10 mg/L

Cyclohexane (110-82-7)

Test and Species

24 Hr EC50 Daphnia magna
96 Hr LC50 Pimephales promelas
96 Hr LC50 Pimephales promelas
96 Hr LC50 Lepomis macrochirus
96 Hr LC50 Poecilia reticulata
72 Hr EC50 Desmodemus subspicatus
5 min EC50 Photobacterium phosphoreum
EC50 Photobacterium phosphoreum

Results and Conditions

>400 mg/L
3.96-5.18 mg/L [flow-through]
23.03-42.07 mg/L [static]
24.99-44.69 mg/L [static]
48.87-68.76 mg/L [static]
>500 mg/L
85.5 mg/L; 10 min
93 mg/L

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Toluene (108-88-3)

Test and Species

96 Hr LC50 Pimephales promelas
96 Hr LC50 Pimephales promelas
96 Hr LC50 Oncorhynchus mykiss
96 Hr LC50 Oncorhynchus mykiss
96 Hr LC50 Oncorhynchus mykiss
96 Hr LC50 Lepomis macrochirus
96 Hr LC50 Oryzias latipes
96 Hr LC50 Poecilia reticulata
96 Hr LC50 Poecilia reticulata
96 Hr EC50 Pseudokirchneriella subcapitata
72 Hr EC50 Pseudokirchneriella subcapitata
48 Hr EC50 Daphnia magna
48 Hr EC50 Daphnia magna

Results and Conditions

15.22-19.05 mg/L [flow-through] 1 day old
12.6 mg/L [static]
5.89-7.81 mg/L [flow-through]
14.1-17.16 mg/L [static]
5.8 mg/L [semi-static]
11.0-15.0 mg/L [static]
54 mg/L [static]
28.2 mg/L [semi-static]
50.87-70.34 mg/L [static]
>433 mg/L
12.5 mg/L [static]
5.46 - 9.83 mg/L [Static]
11.5 mg/L

Environmental Fate/Mobility

When released to soil or water, product will rapidly begin to volatilize. Evaporation rates, with moderate wind speed, for benzene range from <0.1 g/m²/s at 20°C (68°F) to > 3g/m²/s at 30°C (86°F).

Persistence/Degradability

Benzene in air will photo-degrade with a calculated half-life of 13.4 days. This is accelerated in polluted atmospheres containing nitrogen or sulphur oxides. By-products include phenol, nitrophenols, nitrobenzene, formic acid and peroxyacetyl nitrate. Benzene will biodegrade in soils and ground waters (half-life 16 to 28 days) under aerobic conditions. Limited degradation occurs under anaerobic conditions. Sewage treatment plants have been shown to remove 44 to 100%.

Bioaccumulation/Accumulation

Benzene has a reported Kow = 2.13. Metabolites may partially bioaccumulate in fatty fish tissues liver and brain.

Ecological Summary

The high volatility and water solubility of benzene suggests that readily available benzene will partition to the atmosphere from the surface of water and soil within seven days. Estimated volatilization half-life of benzene for soil was 7.2 to 38.4 days (Jury, WA et al., 1984). Benzene that does not evaporate will be highly to very highly mobile in the soil and may leach down into the ground water. Benzene may be subject to biodegradation based on reported biodegradation of 24% and 47% of the initial 20 ppm benzene in a base-rich, para-brownish soil within 1 to 10 weeks. Half-life of volatilization from a model river 1m deep was 2.7 hours at 20°C (68°F). In the atmosphere, benzene will exist predominantly in the vapour phase. It will react with oxygen photochemically to produce hydroxyl radicals with a half-life of 13.4 days. Products of photo-oxidation include phenol, nitrophenols, nitrobenzene, formic acid and peroxyacetyl nitrate. Based on the reported and estimated BCF, benzene is not expected to bioconcentrate in aquatic organisms.

Section 13 - Disposal Considerations

U.S./Canadian Waste Information

A: General Product Information

This product is known to be a hazardous waste according to US and Canadian regulations. The use, mixing or processing of this product may alter its properties or hazards. Contact federal, provincial/state and local authorities in order to generate or ship a waste material associated with this product to ensure materials are handled appropriately and meet all criteria for disposal of hazardous waste. DO NOT ATTEMPT TO DISPOSE OF BY UNCONTROLLED IGNITION. Since emptied containers retain product residue, follow safe handling/label warnings even after container is emptied.

See Section 7: Handling and Storage and Section 8: Exposure Controls/Personal Protection for additional handling information that may be applicable for safe handling and the protection of employees.

Waste generator is advised to carefully consider hazardous properties and control measures needed for other materials that may be found in the waste.

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B: Component Waste Numbers

Benzene (71-43-2)

RCRA: waste number U019 (Ignitable waste, Toxic waste); 0.5 mg/L regulatory level

Cyclohexane (110-82-7)

RCRA: waste number U056 (Ignitable waste)

Toluene (108-88-3)

RCRA: waste number U220

Section 14 - Transportation Information

US DOT Information

Shipping Name: Benzene

UN/NA #: UN1114 **Hazard Class:** 3 **Packing Group:** II

Required Label(s): FLAMMABLE LIQUID

Additional Info.: NOTE: The Reportable Quantity for benzene is 10 lbs. (4.54). The Reportable quantity for toluene is 1000 lbs. (454kg).

2008 Emergency Response Guidebook: Guide No. 130.

Canadian TDG Information

Shipping Name: Benzene

UN#: UN1114 **Hazard Class:** 3 **Packing Group:** II

Required Label(s): FLAMMABLE LIQUID

Additional Info.: 2008 Emergency Response Guidebook, Guide No. 130.

International Air Transport Association (IATA) and International Civil Aviation Organization (ICAO) Information

Shipping Name: Benzene

UN#: UN1114 **Hazard Class:** 3 **Packing Group:** II

Required Label(s): FLAMMABLE LIQUID

International Maritime Dangerous Goods (IMDG) Code

Shipping Name: Benzene

UN#: UN1114 **Hazard Class:** 3 **Packing Group:** II

Required Label(s): FLAMMABLE LIQUID

Additional Info.: EmS No.: F-E, S-D

Marine Pollutant: No

Section 15 - Regulatory Information

A: International Regulations

Component Analysis – International Inventory Status

Component	CAS #	US - TSCA	CANADA - DSL	EU - EINECS
Benzene	71-43-2	Yes	Yes	Yes
Cyclohexane	110-82-7	Yes	Yes	Yes
Cyclohexene	110-83-8	Yes	Yes	Yes
Toluene	108-88-3	Yes	Yes	Yes

B: USA Federal & State Regulations

Ongoing occupational hygiene, medical surveillance programs, site emission or spill reporting may be required by Federal or State regulations. Check for applicable regulations.

USA OSHA Hazard Communication Class

This product is considered hazardous under 29 CFR 1910.1200 (Hazard Communication). HCS Classes:

HCS CLASS: Flammable liquid IB having a flash point lower than 22.8°C (73°F) and having a boiling point at or above 37.8°C (100°F).

HCS CLASS: Toxic

HCS CLASS: HUMAN CARCINOGEN

HCS CLASS: Mutagen

HCS CLASS: Reproductive Hazard

HCS CLASS: Irritating substance

HCS CLASS: Target organ effects

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USA Right-to-Know - Federal

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4).

Benzene (71-43-2)

SARA 313: 0.1 % de minimis concentration

CERCLA: 10 lb final RQ

Cyclohexane (110-82-7)

SARA 313: 1.0 % de minimis concentration

CERCLA: 1000 lb final RQ; 454 kg final RQ

Toluene (108-88-3)

SARA 313: 1.0 % de minimis concentration

CERCLA: 1000 lb final RQ; 454 kg final RQ

USA Right-to-Know - State

The following components appear on one or more of the following state hazardous substances lists. Some components (including those present only in trace quantities, and therefore not listed in this document) may be included on the Right-To-Know lists of other U.S. states. The reader is therefore cautioned to contact his or her NOVA Chemicals' representative or NOVA Chemicals' Product Integrity group for further U.S. State Right-To-Know information.

Component	CAS #	NJ	PA
Benzene	71-43-2	Yes	Yes
Cyclohexane	110-82-7	Yes	Yes
Cyclohexene	110-83-8	Yes	Yes
Toluene	108-88-3	Yes	Yes

The following statement(s) are provided under the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65):

WARNING! This product contains a chemical known to the state of California to cause cancer.

WARNING! This product contains a chemical known to the state of California to cause reproductive/developmental effects.

C: Canadian Regulations - Federal and Provincial

WHMIS Ingredient Disclosure List (IDL)

The following components are identified under the Canadian Hazardous Products Act - Ingredient Disclosure List (IDL):

Component	CAS #	Minimum Concentration
Benzene	71-43-2	0.1 %
Cyclohexane	110-82-7	1 %
Cyclohexene	110-83-8	1 %
Toluene	108-88-3	1 %

WHMIS Classification

Workplace Hazardous Materials Information System (WHMIS): This product has been classified in accordance with the hazard criteria of the CPR (Controlled Products Regulations) and the MSDS contains all the information required by the CPR.

WHMIS CLASS B2: Flammable liquid with a flash point lower than 37.8°C (100°F).

WHMIS CLASS D2A: Carcinogen (Benzene), Mutagen (Benzene)

WHMIS CLASS D2B: Toxic

Other Regulations

Ongoing occupational hygiene, medical surveillance programs, site emission or spill reporting may be required by Federal or Provincial regulations. Check for applicable regulations.

Section 16 - Other Information

Label Information

DANGER! TOXIC! FLAMMABLE! CANCER HAZARD! Product is a clear liquid at room temperature with a sweet, solvent-like odour. Vapour is heavier than air and may spread long distances. Distant ignition and flashback are possible. Flammable liquid and vapour can accumulate static charge. Product will float on water and may travel to distant locations and/or spread fire. This product is considered harmful by inhalation, by skin contact, and if it swallowed. This product is irritating to the eyes and

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skin. Excessive inhalation may result in heartbeat irregularities and adverse central nervous system effects including headache, sleepiness, dizziness, nausea, loss of coordination, tremors, and in extreme conditions, coma and death. Systemic absorption effects may include long-term damage to the blood-forming system, kidney and liver damage, and/or cancer (leukemia). Ingestion may also cause adverse central nervous system effects, blood disorders, kidney and/or liver damage. Small amounts, if aspirated into the lungs, may cause mild to severe pulmonary injury.

FIRST AID:

SKIN: Remove contaminated clothing and shoes. Wash immediately with soap and water. Seek medical attention if symptoms develop or persist. Completely decontaminate clothing, shoes and other protective equipment before reuse or discard.

EYES: Remove contact lenses, if it can be done safely. Immediately flush eyes with water for at least 15 minutes, while holding eyelids open. Seek medical if symptoms develop or persist.

INHALATION: Move affected individual to non-contaminated air. Loosen tight clothing such as a collar, tie, belt or waistband to facilitate breathing. Seek immediate medical attention if the individual is not breathing, is unconscious or if any other symptoms persist. WARNING: Contact through mouth-to-mouth resuscitation may pose a secondary risk to the rescuer. Avoid mouth-to-mouth contact by using a mouth shield or guard to perform artificial respiration.

INGESTION: DO NOT INDUCE VOMITING. Loosen tight clothing such as a collar, tie, belt or waistband. Seek immediate medical attention.

IN CASE OF A LARGE SPILL: Consider downwind evacuation for 300 metres (984 feet). Eliminate ignition sources. Keep upwind and out of low areas. Stop discharge if safe to do so. Contain liquids by booming on water or by diking on land to prevent entry into ditches, sewers, drains or waterways. Spills on water will volatilize rapidly, making containment or recovery difficult. Recover any pooled liquid material with approved, non-sparking pumps, skimmers or vacuum equipment. An inert foam cover material may assist in short term vapour suppression. Absorb with DRY earth, sand or other non-combustible material and clean up with non-sparking tools. Soil remediation may be required.

References

Available on request.

Special Considerations

Bonding and grounding may be insufficient to eliminate the hazard from static-accumulating flammable liquids.

For additional information on equipment bonding and grounding, refer to the American Petroleum Institute (API)

Recommended Practice 2003, "Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents" or National Fire Protection Association (NFPA) 77, "Recommended Practice on Static Electricity".

Key/Legend

ACGIH = American Conference of Governmental Industrial Hygienists; ADR = Transport of Dangerous Goods by Road; ADR/RID = European Agreement of Dangerous Goods by Road/Rail; BOD = Biochemical Oxygen Demand; CAS = Chemical Abstracts Service; CEPA = Canadian Environmental Protection Act; CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act; CFR = Code of Federal Regulations; CPR = Controlled Products Regulations; DFG = Deutsche Forschungsgemeinschaft; DOT = Department of Transportation; DSL = Domestic Substances List; EC50 = Effective Concentration 50%; EEC = European Economic Community; EINECS = European Inventory of Existing Commercial Chemical Substances; ELINCS = European List of Notified Chemical Substances; EPA = Environmental Protection Agency; EU = European Union; FDA = Food and Drug Administration; GHS = Globally Harmonized System for the Classification and Labelling of Chemicals; HCS = Hazard Communication Standard; HMIS = Hazardous Materials Identification System; IARC = International Agency for Research on Cancer; IATA = International Air Transport Association; ICAO = International Civil Aviation Organization; IDL = Ingredient Disclosure List; IDLH = Immediately Dangerous to Life or Health; IMDG = International Maritime Dangerous Goods; IMO = International Maritime Organization; ISHL = Industrial Safety and Health Law; Kow = Octanol/water partition coefficient; LC50 = Lethal Concentration 50%; LD50 = Lethal Dose 50%; LEL = Lower Explosive Limit; LFL = Lower Flammable Limit; LLV = Level Limit Ceiling Limit (Sweden dust); MAK = Maximum Concentration Value in the Workplace; MITI = Ministry of International Trade and Industry; MSDS = Material Safety Data Sheet; NAB = Threshold Values (Indonesia); NCEC = National Chemical Emergency Centre; NDSL = Non-Domestic Substances List; NFPA = National Fire Protection Association; NIOSH = National Institute for Occupational Safety and Health; NJTSR = New Jersey Trade Secret Registry; NTP = National Toxicology Program; OEL = Occupational Exposure Limit; OSHA = Occupational Safety and Health Administration; PEL = Permissible Exposure Limit; PNOC = Particulates Not Otherwise Classified; PPE = Personal Protective Equipment; PRTR = Designated Chemical Substance Law (Japan); PSD = Short Term Exposure Limit (Indonesia); RCRA = Resource Conservation and Recovery Act; REACH = Registration, Evaluation, Authorisation and Restriction of Chemical Substances; REL = Recommended Exposure Limit; RID = Transport of Dangerous Goods by Rail; SARA = Superfund Amendments and Reauthorization Act; SCBA = Self Contained Breathing Apparatus; SDS = Safety Data Sheet; SEPA = State Environmental Protection Administration; STEL = Short Term Exposure Limit; TDG = Transportation of Dangerous Goods; TLV = Threshold Limit Value; TSCA = Toxic Substances Control Act; TWA = Time Weighted Average; UEL = Upper Explosive Limit; UFL = Upper Flammable Limit; VLA-ED = Valor límite Ambiental de Exposición Diaria (Environmental Exposure Daily Limit Value); VME = valeur limite d'exposition (Occupational Exposure Limits); WHMIS = Workplace Hazardous Materials Information Systems

MSDS Prepared by: NOVA Chemicals

MSDS Information Phone Number: 1-412-490-4063

Material Safety Data Sheet

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Other Information

Notice to Reader:

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This is the end of MSDS # NOVA-0011.