Material Safety Data Sheet

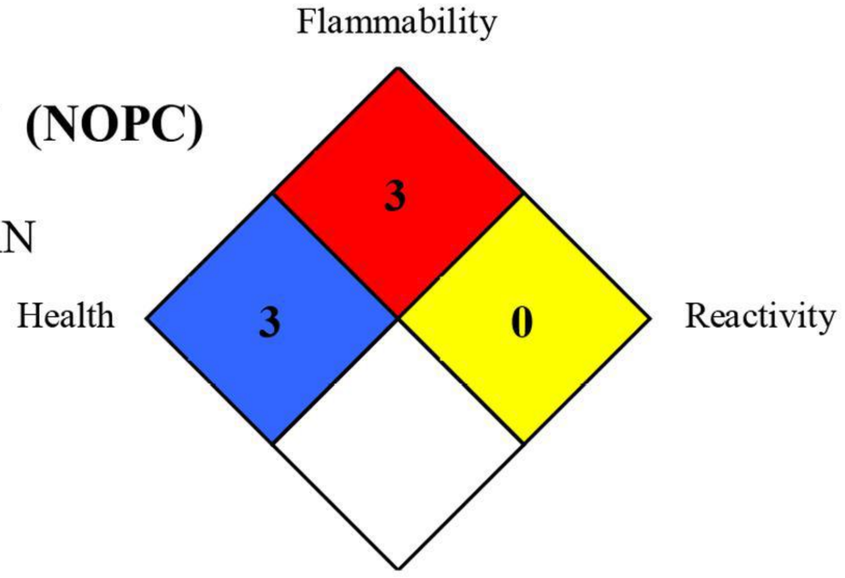
Section I – Product and Company Identification

Product Name: **BENZENE**

Synonyms:

BENZOL; CYCLOHEXATRIENE; BENZOLE; PHENE; PYROBENZOL; PYROBENZOLE; CARBON OIL; COAL TAR NAPHTHA; PHENYL HYDRIDE ; BENZOLENE; BICARBURET OF HYDROGEN; COAL NAPHTHA; MOTOR BENZOL; ANNULENE; MINERAL NAPHTHA; (6)ANNULENE; NITRATION BENZENE; RCRA U019; UN 1114; STCC 4908110; C6H6; OHS02610; RTECS CY1400000

Chemical Family: Hydrocarbons Aromatic
Formula: C6H6



Manufacturer: BORZUYEH PETROCHEMICAL COMPANY (NOPC)

PARS ENERGY ECONOMICAL SPECIAL ZONE – BUSHEHR – IRAN

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Section II – Composition / Information on Ingredients

Component Information:

Name	CAS #	% Wt
Benzene	71-43-2	>99

Section III – Hazard Identification

Appearance: Colorless to Yellow liquid. Flash Point: -11 deg C.
Odor: distinct odor

Danger!

Extremely flammable liquid and vapor. Vapor may cause flash fire. Harmful if swallowed, inhaled, or absorbed through the skin. Causes eye, skin, and respiratory tract irritation. Contains benzene. Benzene can cause cancer. Aspiration hazard if swallowed. Can enter lungs and cause damage. May cause blood abnormalities. May cause central nervous system effects.

Target Organs: Blood, central nervous system, respiratory system, eyes, bone marrow, immune system, skin.

Potential Health Effects:

Eye Contact
Causes eye irritation.

Skin Contact
Causes skin irritation, blisters. Harmful if absorbed through the skin. Prolonged and/or repeated contact may cause defeating of the skin and dermatitis.

Ingestion
May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma and possible death due to respiratory failure. May cause effects similar to those for inhalation exposure. Aspiration of material into the lungs may cause chemical pneumonitis, which may be fatal.

Inhalation
Causes respiratory tract irritation. May cause drowsiness, unconsciousness, and central nervous system depression. Exposure may lead to irreversible bone marrow injury. Exposure may lead to aplastic anemia. Potential symptoms of overexposure by inhalation are dizziness, headache, vomiting, visual disturbances, staggering gait, hilarity, fatigue, and other symptoms of CNS depression.

Chronic
May cause bone marrow abnormalities with damage to blood forming tissues. May cause anemia and other blood cell abnormalities. Chronic exposure to benzene has been associated with an increased incidence of leukemia and multiple myeloma (tumor composed of cells of the type normally found in the bone marrow). Immunodepressive effects have been reported. This substance has caused adverse reproductive and fetal effects in laboratory animals.

Section IV – First Aid Measures

Eyes Contact
In case of contact, immediately flush eyes with plenty of water for a t least 15 minutes. Get medical aid.

Skin Contact
In case of contact, flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical aid if irritation develops and persists. Wash clothing before reuse.

Ingestion
Potential for aspiration if swallowed. Get medical aid immediately. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If vomiting occurs naturally, have victim lean forward.

Inhalation
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician
Treat symptomatically and supportively.

Section V – Fire Fighting Measures

General Information
As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Use water spray to keep fire-exposed containers cool. Extremely flammable liquid and vapor. Vapor may cause flash fire. Approach fire from upwind to avoid hazardous vapors and toxic decomposition products. Vapors are heavier than air and may travel to a source of ignition and flash back. Vapors can spread along the ground and collect in low or confined areas. This liquid floats on water and may travel to a source of ignition and spread fire. May accumulate static electricity.

Extinguishing Media
Use water spray, dry chemical, carbon dioxide, or appropriate foam.

Flash Point	**:** -11 deg C (12.20 deg F)
Auto ignition Temperature	**:** 498 deg C (928.40 deg F)
Lower Explosion Limits	**:** 1.2 %
Upper Explosion Limits	**:** 7.8 %
Flammability class (osha)	**:** ib

Section VI – Accidental Release Measures

AIR RELEASE :
Reduce vapors with water spray. Stay upwind and keep out of low areas.

SOIL RELEASE :
Dig holding area such as lagoon, pond or pit for containment. Dike for later disposal. Absorb with sand or other non-combustible material.

WATER RELEASE :
Cover with absorbent sheets, spill-control pads or pillows. Apply detergents, soaps, alcohols or another surface active agent. Collect with absorbent into suitable container. Absorb with activated carbon. Remove trapped material with suction hoses. Collect spilled material using mechanical equipment. Subject to California Safe Drinking Water and Toxic Enforcement
Act of 1986 (Proposition 65). Keep out of water supplies and sewers.

OCCUPATIONAL RELEASE:
Avoid heat, flames, sparks and other sources of ignition. Stop leak if possible without personal risk. Reduce vapors with water spray. Small spills: Absorb with sand or other noncombustible material. Collect spilled material in appropriate container for disposal. Large spills : Dike for later disposal. Remove sources of ignition. Keep unnecessary people away, isolate hazard area and deny entry. Notify Local Emergency Planning committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800) 424-8802 (USA) or (202) 426-2675 (USA).

Section VII – Handling and Storage

Store and handle in accordance with all current regulations and standards. Subject to storage regulation : U.S. OSHA 29 CFR 1910.106. Grounding and bonding required. Protect from physical damage. Store outside or in a detached building. Store with flammable liquids. Keep separated from incompatible substances.
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Section VIII – Exposure Controls/ Personal Protection

Exposure Limits:
1 ppm OSHA TWA

5 ppm OSHA STEL 15 minute(s)

0.5 ppm OSHA action level

0.5 ppm (1.6 mg/m3) ACGIH TWA

2.5 ppm (8 mg/m3) ACGIH STEL

0.1 ppm (0.32 mg/m3) NIOSH recommended TWA 8 hour(s)

1 ppm (3.2 mg/m3) NIOSH recommended ceiling 15 minute(s)

3.2 mg/m3 (1 ml/m3) AGS MAK 4 times/shift

5 ppm (16 mg/m3) UK OES TWA

MEASUREMENT METHOD : charcoal tube; Carbon disulfide; Gas chromatography with flame ionization detection; NIOSH III # 1500, Hydrocarbons; ALSO NIOSH III # 3700.

VENTILATION : Provide local exhaust or process enclosure ventilation system. Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Ensure compliance with applicable exposure limits.

EYE PROTECTION : Wear splash resistant safety goggles. Provide an emergency eye wash fountain and quick drench shower in the immediate work area

CLOTHING : Wear appropriate chemical resistant clothing.

GLOVES : Wear appropriate chemical resistant gloves. OSHA REGULATED

SUBSTANCES: U.S. OSHA 29 CFR 1910.1028.

RESPIRATOR : The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.

10 ppm
Any air-purifying respirator with a full facepiece and an organic vapor canister.

50 ppm
Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s).
Any air-purifying respirator with a full facepiece and a canister providing protection against this substance.

100 ppm
Any powered air-purifying respirator with a full facepiece and organic vapor cartridge(s).

1000 ppm
Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode.

For Unknown Concentrations or Immediately Dangerous to Life or Health

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressuredemand or other positive-pressure mode.

Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.

Escape-

Any air-purifying respirator with a full facepiece and an organic vapor canister.

Any self-contained breathing apparatus with a full face piece.

Section IX – Physical and Chemical Properties

PHYSICAL STATE	:	liquid
COLOR	:	colorless to yellow
ODOR	:	distinct odor
MOLECULAR WEIGHT	:	78.11
MOLECULAR FORMULA	:	C6H6
BOILING POINT	:	176 F (80 C)
FREEZING POINT	:	43 F (6 C)
VAPOR PRESSURE	:	75 mmHg @ 20 C
VAPOR DENSITY (air=1)	:	2.8
SPECIFIC GRAVITY (water=1)	:	0.8765 @ 20 C
WATER SOLUBILITY	:	0.18% @ 25 C

PH : Not available
VOLATILITY : 100%
ODOR THRESHOLD : 4.68 ppm
EVAPORATION RATE : 5.1 (butyl acetate=1)
VISCOSITY : 0.6468 Cp @ 20 C
SOLVENT SOLUBILITY : Soluble:
acetone, alcohol, carbon disulfide, ether, carbon tetrachloride, chloroform, acetic, acid, oils, organic solvents.

Section X – Stability and Reactivity

REACTIVITY: Stable at normal temperatures and pressure.

CONDITIONS TO AVOID : Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat. Keep out of water supplies and sewers.

INCOMPATIBILITIES : acids, bases, halogens, oxidizing materials, metal salts

ACIDS (STRONG) : Incompatible

ALLYL CHLORIDE WITH DICHLOROETHYL ALUMINUM OR ETHYLALUMINUM SESQUICHLORIDE:

Possible explosion.
ARSENIC PENTAFLUORIDE + POTASSIUM METHOXIDE : Explosive interaction.

BASES (STRONG) : Incompatible
BROMINE + IRON : Incompatible
BROMINE PENTAFLUORIDE : Fire and explosion hazard.
BROMINE TRIFLORIDE : Possible explosion or ignition.
CHLORINE : Explosion in the presence of light.
CHLORINE TRIFLUORIDE : Violent reaction with possible explosion.
CHROMIC ANHYDRIDE (POWDERED) : Ignition.
DIBORANE : Spontaneously explosive reaction in air.
DIOXYGEN DIFLUORIDE : Ignition, even at reduced temperatures.
DIOXYGNEYL TETRAFLUOROBORATE : Ignition reaction.
INTERHALOGEN COMPOUNDS : Ignition or explosion.
IODINE HEPTAFLUORIDE : Ignition on contact.
IODINE PENTAFLUORIDE : Violent interaction above 50 C.
NITRIC ACID : Violent or explosive unless properly agitated and cooled.
NITRYL PERCHLORATE : Explosive interaction.
OXIDIZERS (STRONG) : Fire and explosion hazard.
OXYGEN (LIQUID): Explosive mixture.
OZONE : Formation of explosive gelatinous ozonide.
PERCHLORATES (METAL) : Formation of explosive complex.
PERCHLORYL FLUORIDE + ALUMINUM CHLORIDE : Formation of shock sensitive compound.
PERMANGANATES + SULFURIC ACID : Possible explosion.
PERMANGANIC ACID : Explosion hazard.
PEROXODISULFURIC ACID : Explosion hazard.
PEROXOMOUOSULFURIC ACID : Explosive interaction.
POTASSIUM PEROXIDE : Ignition.
SILVER PERCHLORATE : Formation of explosive complex.
SODIUM PEROXIDE + WATER : Ignition.
URANIUM HEXAFLUORIDE : Violent reaction.
HAZARDOUS DECOMPOSITION:
Thermal decomposition products : oxides of carbon
POLYMERIZATION : Will not polymerize.

Section XI – Toxicological Information

IRRITATION DATA :
15 mg/24 hour(s) open skin-rabbit mild; 20 mg/24 hour(s) skin-rabbit moderate; 88 mg eyesrabbit moderate; 2 mg/24 hour(s) eyes-rabbit severe

TOXICITY DATA:
2 pph/5 minute(s) inhalation-human LCLO; 50 mg/kg oral-man LDLO; 150 ppm/1 year(s) intermittent inhalation-man TCLO; 100 ppm inhalation-human TCLO; 65mg/m3/5 year(s) inhalation-human LCLO; 194 mg/kg unreported-man LDLO; 930 mg/kg oral-rat LD50; 10000 ppm/7 hour(s) inhalation-rat LC50; 1100 ug/kg intraperitoneal-rat LD50; 4700 mg/kg oral-mouse LD50; 9980 ppm inhalation-mouse LC50; 48 mg/kg skin-mouse LD50; 340 mg/kg intraperitoneal-mouse LD50; 2 gm/kg oral-dog LDLO' 146000 g/m3 inhalation-dog LCLO; 170000 mg/m3 inhalation-cat LCLO' 45000 ppm/30 minute(s) inhalation-rabbit LCLO; >9400 ul/kg skin-rabbit LD50; 88 mg/kg intravenous-rabbit LDLO; >9400 ul/kg skinguinea pig LD50; 527 mg/kg intraperitoneal-guinea pig LDLO; 1400 mg/kg subcutaneousfrog LDLO; 5700 mg/kg oral-mammal LD50; 20000 ppm/5 minute(s) inhalation-mammal LCLO; 1500 mg/kg intraperitoneal-mammal LDLO; 6600 mg/kg/27 (weeks) intermittent oral-rat TDLO; 23 mg/m3/4 hour(s)-8 day(s) intermittent inhalation-rat TCLO; 300 ppm/6 hour(s)-13 week(s) intermittent inhalation-rat TCLO; 17 gm/kg/17 week(s) intermittent oralrat TDLO; 1000 ppm/7 hour(s)-28 week(s) intermittent inhalation-rat TCLO; 500 ppm/6 hour(s)-3 week(s) intermittent inhalation-rat TCLO; 18 mg/kg/21 day(s) intermittent subcutaneous-rat TDLO; 2197 mg/kg/5 day(s) intermittent subcutaneous-rat TDLO; 13536 mg/kg/12 week(s) intermittent subcutaneous-rat TDLO; 4250 mg/kg/17 week(s) intermittent oral-mouse TDLO; 300 ppm/6 hour(s)-13 week(s) intermittent inhalation-mouse TCLO; 25 ppm/6 hour(s)-5 day(s)
intermittent inhalation-mouse TCLO; 10 ppm/6 hour(s)-10 week(s)
intermittent inhalation-mouse TCLO; 211 ppm/6 hour(s)-7 day(s) intermittent oral-mouse TCLO; 48 ppm/6 hour(s)-14 day(s) intermittent inhalation-mouse TCLO; 2197 mg/kg/5 day(s) intermittent subcutaneous-mouse TDLO; 100 ppm/6 hour(s)-72 week(s) intermittent inhalation-mouse TCLO; 500 mg/m3/3 hour(s)-13 week(s) intermittent inhalation-rabbit TCLO; 100 ppm/6 hour(s)-3 week(s) intermittent inhalation-pig TCLO
CARCINOGEN STATUS : OSHA : Carcinogen; NTP : Known Human Carcinogen; IARC : Human sufficient Evidence, Animal Sufficient Evidence, Group 1; ACGIH : A1 confirmed Human Carcinogen; EC : Category 1; TRGS 905 : K 1 Numerous case reports and series have suggested a relationship between exposure to benzene and the occurrence of various types of leukaemia. Several case-control studies have also shown increased odds ratios for exposure to benzene, but mixed exposure patterns and poorly defined exposures render their interpretation difficult. Three independent cohort studies have demonstrated an increased incidence of acute nonlymphocytic leukaemia in workers exposed to benzene.

LOCAL EFFECTS:
Irritant: inhalation, skin, eye

ACUTE TOXICITY LEVEL:
Highly Toxic: dermal absorption
Moderately Toxic: ingestion
Slightly Toxic: inhalation

TARGET ORGANS : immune system (blood), central nervous system

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE : blood system disorders,
immune system disorders or allergies

TUMORIGENTIC DATA:
200 mg/m3 inhalation-man TCLO/78 week(s) intermittent; 10 ppm inhalation-human TCLO/8 hour(s)-10 year(s) intermittent; 52 gm/kg oral-rat TDLO/52 week(s) intermittent; 1200 ppm inhalation-rat TCLO/6 hour(s)-10 week(s) intermittent; 18250 mg/kg oral-mouse TDLO/2 year(s) continuous; 300 ppm inhalation-mouse TCLO/6 hour(s)-16 week(s) intermittent; 1200 gm/kg skin-mouse TDLO/49 week(s) intermittent; 1200 mg/kg intraperitoneal-mouse TDLO/8 week(s) intermittent; 600 mg/kg subcutaneous-mouse TDLO/17 week(s) intermittent; 670 mg/kg parenterl-

mouse TDLO/19 week(s) intermittent; 150 ppm inhalation-human TC/15 minute(s)-8 year(s) intermittent; 52 gm/kg oral-rat TD/1 year(s) intermittent; 10 gm/kg oral-rat TD/52 week(s)intermittent; 600 mg/m3 inhalation-man TC/4 year(s) intermittent; 150 ppm inhalation-man TC/11 year(s) intermittent; 1200 ppm inhalation-mouse TC/6 hour(s)-10 week(s) intermittent; 2400 mg/kg oral-mouse TD/8 week(s) intermittent; 8 ppb inhalation-human TC/4 week(s) intermittent; 10 mg/m3 inhalation-human TC/11 year(s) intermittent; 300 ppm inhalation-mouse TC/6 hour(s)-16 week(s) intermittent

MUTAGENIC DATA

Mutation in microorganisms-Salmonella typhimurium 10 ppm (-S9) : specific locus test Drosophila melanogaster oral 11250 umol/L; sex chromosone loss and non disjunctiondrosophila melanogaster oral 7500 ppm; sex chromosone loss and non disjunction – Drosophila melanogaster multiple 27000 ppm; mutation in microorganisms – Saccharomyes cerevisae 549 mg/L (+S9); mutation in microorganisms – saccharomyes cerevisae 275 mg/L (-S9) gene conversion and miotic recombination – Saccharomyes cerevisae 275 mg/L; sex chromosone loss and non disjunction – Aspergillus nidulans 35000 ppm; other mutation test systems – grasshopper inhalation 14 pph 16 hour(s); other mutation test systems – nonmammulian species intraperitoneal 75 gm/kg; DNA inhibition – human leulocyte 2200 umol/L; DNA inhibition – human HeLa cell 2200 umol/L; other mutation test systems – human lymphocyte 5 umol/L; cytogenetic analysis – human inhalation 125 ppm 1 year(s); cytogenetic analysis – human leukocte 1 mmol/L 72 hour(s); cytogenetic analysis – human lymphocyte 1 mg/L; cytogenetic analysis – human unreported 10 ppm 4 week(s); sister chromatid exchange – human lymphocyte 200 umol/L; mutation in mammalian somatic cells – human lymphocyte 1 gm/L; micronucleus test – rat inhalation 1 ppm 6 hour(s); unscheduled DNA synthesis – rat liver 1 mmol/L; DNA inhibition – rat inhalation 400 ppm; other mutation test systems – rat liver 1 mmol/L; other mutation test systems – rat bone marrow 1 mmol/L; other mutation test systems – rat subcutaneous 1 gm/L; other mutation test system – rat subcutaneous 2200 mg/kg; cytogenetic analysis – rat inhalation 300 mg/m3 16 week(s) – intermittent; cytogenetic analysis – rat inhalation 300 mg/m3 16 week(s) – intermittent; cytogenetic analysis – rat subcutaneous 2400 mg/kg 12 day(s)-intermittent; cytogenetic analysis – rat oral 39060 ug/kg; sister chromatid exchange-rat inhalation 3 ppm 6 hour(s); sister chromatid exchange-rat leukocyte 1 mmol/L; micronucleus test – mouse embryo 12500 nmol/L; micronucleus test – mouse subcutaneous 440 mg/kg; micornucleus test – mouse oral 40 mg/kg – micronucleus test mouse intraperitoneal 264 mg/kg 24 hour(s); micronucleus test– mouse inhalation 10 ppm 6 hour(s); mutation in micoroorganisms – mouse lymphocyte 62500 ug/L (+S9); mutation in microorganisms – mouse embryo 2500 mg/L (+S9); morphological transformation-mouse embryo 1 gm/L; morphological transformation – mouse fibroblast 150 gm/L; DNA damage – mouse lymphocyte 3840 umol/L; DNA adduct – mouse intraperitoneal 2640 mg/kg 3 day(s) – continuous; other mutation test systems-mouse oral 2 gm/kg; other mutation test systems – mouse other cell types 5 mmol/L; DNA inhibition – mouse oral 20 gm/kg; other mutation test systems-mouse lymphocyte 10 mmol/L; DNA inhibition – mouse intraperitoneal 880 mg/kg; DNA inhibition – mouse inhalation 3000 ppm 4 hour(s)-continuous; DNA inhibition-mouse bone marrow 3 mmol/L; sister chromatid exchange – mouse inhaltion 10 ppm 6 hour(s); sister chromatid exchange – mouse intraperitoneal 5 gm/kg; cytogenetic analysis – mouse oral 20 mg/kg; cytogenetic analysis – mouse intraperitoneal 264 mg/kg 3 day(s)-continuous; cytogenetic analysis – mouse inhalation 3000 ppm; dominant lethal test – mouse oral 1 mg/kg; dominant lethal test – mouse intraperitoneal 5 mg/kg; mutation in mammalian somatic cells – mouse lymphocyte 12500 ug/L; mutation in mammalian somatic cells – mouse inhalation 40 ppb 6 week(s)-continuous; morphological transformation – hamster embryo 100 ug/L; DNA damage – hamster ovary 17 mmol/L; cytogenetic analysis – hamster lung 550 mg/L; cytogenetic analysis – hamster ovary 600 mg/L; sister chromatid exchange – hamster ovary 750 mg/L; sex chromosone loss and non disjunction – hamster liver 62500 ug/L; sex chromosone loss and non disjunction – hamster embryo 30 umol/L; mutation in mammalian somatic cells – hamster embryo 10 umol/L; DNA damage – rabbit subcutaneous 2344 mg/kg; DNA inhibition – rabbit subcutaneous 2 gm/kg; other mutation test systems – rabbit bone marrow 1 mmol/L; other mutation test systems – cat bone marrow 1 mmol/L; cytogenetic analysis – rabbit subcutaneous 8400 mg/kg.

REPRODUCTIVE EFFECTS DATA:

670 mg/m3 inhalation-rat TCLO/24 hour(s) 15 day(s) pre pregnancy/1-22 day(s) pregnant female continuous; 56600 ug/m3 inhalation-rat TCLO/24 hour(s) 1-22 day(s) pregnant female continuous; 50 ppm inhalation-rat TCLO/24hour(s) 7-14 day(s) pregnant female continuous; 150 ppm inhalation-rat TCLO/24 hour(s) 7-14 day(s) pregnant female continuous; 9 gm/kg oral-mouse TDLO 6-15 day(s) pregnant female continuous; 12 gm/kg oral-mouse TDLO 6-15 day(s) pregnant female continuous; 6500 mg/kg oral-mouse TDLO 8-12 day(s) pregnant female continuous; 500 ppm inhalation-mouse TCLO/7 hour(s) 6-15 day(s) pregnant female continuous; 500 mg/m3 inhalation-mouse TCLO/12 hour(s) 6-15 day(s) pregnant female continuous; 5 ppm inhalation-mouse TCLO 6-15 day(s) pregnant female continuous; 20 ppm inhalation-mouse TCLO/6 hour(s) 6-15 day(s) pregnant female continuous; 5 mg/kg intraperitoneal-mouse TDLO 1 day(s) male; 219 mg/kg intraperitoneal-mouse TDLO 14 day(s) pregnant female

continuous; 1100 mg/kg subcutaneous-mouse TDLO 12 day(s) pregnant female continuous; 7030 mg/kg subcutaneous-mouse TDLO 12-13 day(s) pregnant female continuous; 13200 ug/kg intravenous-mouse TDLO 13-16 day(s) pregnant female continuous; 4 gm/kg parenteral-mouse TDLO 12 day(s) pregnant female continuous; 1 gm/m3 inhalation-rabbit TCLO/24 hour(s) 7-20 day(s) pregnant female continuous; 1 gm/m3 inhalation-rabbit TCLO/24 hour(s) 7-20 day(s) pregnant female continuous

ADDITIONAL DATA : May cross the placenta. Alcohol may enhance the toxic effects. Interactions with drugs may occur.

Use of stimulants such as epinephrine may cause cardiac arrhythmias.

HEALTH EFFECTS :

INHALATION:

ACUTE EXPOSURE:

Concentrations of 3000 ppm may cause respiratory tract irritation; more severe exposures may result in pulmonary edema. Systemic effects are mainly on the central nervous system and depend on exposure time and concentration. No effects were noted at 25 ppm for 8 hours; signs of intoxication began at 50-150 ppm, within 5 hours; at 500-1500 ppm, within 1 hour; were severe at 7500 ppm, within 30-60 minutes; and 20000 ppm was fatal within 5-10 minutes. Effects may include nausea, vomiting, headache, dizziness, drowsiness, weakness, sometimes preceded by a brief period of exhilaration or euphoria, irritability, malaise, confusion, ataxia, staggering, weak, rapid pulse, chest pain and tightness with breathlessness, pallor, cyanosis of the lips and fingertips, and tinnitus. In sever exposures there may be blurred vision, shallow, rapid breathing, delirium, cardiac arrhythmias, unconsciousness, deep anesthesia, paralysis, and coma characterized by motor restlessness, tremors and hyperreflexia, sometimes preceded by convulsions. Recovery Depends on the severity of exposure. Polyneuritis may occur and there may be persistent nausea, anorexia, muscular weakness, headache, drowsiness, insomnia, and agitation. Nervous irritability, breathlessness, and unsteady gait may persist for 2-3 weeks; a peculiar skin color and cardiac distress may persist for 4 weeks. Liver and kidney effects may occur, but are usually mild, temporary impairments. Chromosomal damage has been found after exposure to toxic levels. Although generally hematotoxicity is not a significant concern in acute exposure, delayed hematological effects, including anemia and thrombocytopenia, have been reported, as have petechial hemorrhages, spontaneous internal bleeding and secondary infections. In fatal exposures, death may be due to asphyxia, central nervous system depression, cardiac or respiratory failure and circulatory collapse, or occasionally, sudden ventricular fibrillation. It may occur within a few minutes to several hours, or cardiac arrythmia may occur at anytime within 24 hours. Also, death from central nervous system, respiratory or hemorrhagic complications may occur up to 5 days after exposure. Pathologic findings have included respiratory inflammation with edema and hemorrhage of the lungs, renal congestion, cerebral edema, and extensive petechial hemorrhages in the brain, pleurae, pericardium, urinary tract, mucous membranes, and skin.

CHRONIC EXPOSURE:

Longterm exposure cause symptoms referable to the central nervous, hematopoietic and immune systems. Early effects are vague and varied and may include headache, light-headedness, dizziness, nausea, anorexia, abdominal discomfort, and fatigue.Sore, dry throat, weakness, lethargy, malaise, drowsiness, nervousness, and irritability have also been reported. Later there may be dyspnea, pallor, slightly increased temperature, decreased blood pressure, rapid pulse, palpitations, and visual disturbances. Dizziness when cold water is placed in the ear and hearing impairment have been reported, as have diffuse cerebral atrophy associated with ataxia, tremors and emotional lability. Workers exposed to benzene in combination with other solvents have exhibited polyneuritis. Several case reports, one of them an acute exposure, suggest the possibility that systemic exposure may be associated with retrobulbar or optic neuritis. Occasionally hemorrhages in retina and conjunctive occur and rarely neuroretinal edema and papilledema have accompanied the retinal hemorrhages. Hematological effects vary widely and may appear after a few weeks or many years of exposure or even many years after exposure has ceased. The degree of exposure below which no blood effects will occur cannot be established with certainty. In the early stages, there may be blood clotting defects due to morphological, functional and quantitative platelet alteration with resultant bleeding from the nose and gums, easy bruising and petechiae; leukopenia with predominant lymphocytopenia or neutropenia; and anemia which may be normochromic or macrocytic and hypochromic. Extramedullary hematopoiesis, splenomegaly, circulating immature marrow cells, and an initial increase in leukocytes, erythrocytes and platelets have also been reported. The bone marrow may be hyper-hypo or normoplastic and does not always correlate with the peripheral blood picture. Also, the symptoms do not always parallel the laboratory findings. If treated at this stage, the effects appear reversible, although recovery may be protracted and there may be relapses. Decreased erythrocyte survival, hemolysis, capillary fragility, internal hemorrhages, iron metabolism disturbances, and hyperbilirubinemia have also been reported. Exposure to high levels for longer periods may result in aplasia and fatty degeneration of the bone marrow with pancytopenia. The most serious cases of aplastic anemia may be fatal due to hemorrhage and infection; death may occur within 3 months of

diagnosis. Enormous variability in individual response, mcluding non-dose dependent aplasia, and the finding of eosinophilia suggests that, in some cases, the blood dyscrasia may partially be an allergic reaction. Numerous case reports and series have suggested a relationship between exposure to benzene and the occurrence of various types of leukaemia. Several case-control studies have also shown increased odds ratios for exposure to benzene, but mixed exposure patterns and poorly defined exposures render their interpretation difficult. Three independent cohort studies have demonstrated an increased incidence of acute nonlymphocytic leukemia in workers exposed to benzene. Several studies have also suggested a link between occupational exposure and multiple myeloma and lymphoma, both Hodgkin's and nonhodgkin's, Although aplastic anemia is probably the more likely consequence of longterm exposure, it is not uncommon for an individual surviving this, to go through a preleukemic phase into frank leukaemia. Conversely, leukemia without precedent aplastic anemia can occur. In one study the range of time from the start of the exposure to the diagnosis of leukemia was 3-24 years. It has been suggested that the chromosomal aberrations which can arise in peripheral blood and bone marrow cells and persist for a long time after exposure ceases, may be associated with the increased incidence of leukaemia. The immunosuppressive effect has also been suggested as being associated with the leukemogenesis. Adverse effects on the immunological system have been shown to make rabbits more susceptible to tuberculosis and pneumonia and may explain why the terminal event in some cases of benzene intoxication may be overwhelming infection. Exposed mice exhibited a tendency toward induction of neoplasms, mainly carcinomas, at various sites. Menstrual disturbances have been reported more frequently in exposed women. Testicular damage has been reported in rats, rabbits and guinea pigs. Some animal studies have demonstrated embryo/fetotoxicity, sometimes at levels as low as 10 ppm and the potential for teratogenic effects such as decreased body weight and skeletal variants, have also been shown. Other studies have not produced any abnormalities or embryolethality.

SKIN CONTACT:
ACUTE EXPOSURE:
Direct contact may cause irritation. Effects may include erythema, a burning sensation, and with prolonged contact, blistering and edema. Under normal conditions, significant signs of systemic toxicity are unlikely from skin contact alone due to the slow rate of absorption; it may however, contribute to the toxicity from inhalation. Application to guinea pigs resulted in increased dermal permeability.

CHRONIC EXPOSURE:
Repeated or prolonged contact defats the skin and may result in dermatitis with erythema, scaling, dryness, vesiculation, and fissuring, possibly accompanied by paresthesias of the fingers which may persist several weeks after the dermatitis subsides. Peripheral neuritis has also been reported. Secondary infections may occur. Tests on guinea pigs indicate sensitization is possible, Although animal studies have failed to establish a relationship between skin contact and a carcinogenic effect, most of the studies were inadequate; some papillomas and hematopoietic effects have been reported.

EYE CONTACT:
ACUTE EXPOSURE:
May cause irritation. Vapor concentrations of 3000 ppm are very irritating, even on brief exposure. Droplets cause a moderate burning sensation but only a slight, transient corneal epithelial injury with rapid recovery.
CHRONIC EXPOSURE:
BENZENE: Repeated or prolonged exposure my cause conjunctivitis. 50% of rats exposed to 50 ppm for more than 600 hours developed cataracts.

INGESTION :
ACUTE EXPOSURE :
May cause local irritation and burning sensation in the mouth, throat and stomach, and hemorrhagic inflammatory lesions of the mucous membranes in contact with the liquid. Signs and symptoms of systemic intoxication may include nausea, vomiting, headache, dizziness, weakness, staggering, chest pain and tightness, followed by flushing, and a fear of impending death. There may be visual disturbances, tremors, convulsions, ventricular irregularities, and paralysis. Excitement, euphoria or delirium may precede weariness, fatigue, sleepiness and followed by stupor and unconsciousness, coma and death form respiratory failure. Those who survive the central nervous system effects may develop bronchitis, pneumonia, pulmonary edema, and intrapulmonary hemorrhage. Aspiration may cause immediate pulmonary edema and hemorrhage. The usual lethal does in humans is 10-15 milliliters, but smaller amounts have been reported to cause death. A single exposure may produce longterm effects with pancytopenia persisting up to a year.

CHRONIC EXPOSURE :

Daily admonistration to humans of 2-5 grams in olive oil caused headache, vertigo, bladder irritability, impotence, gastric disturbances, and eidence of renal congestion. In female rats treated with 132 single daily doses over 187 days, no effects were observed at 1 mg/kg; slight leukopenia at 10 mg/kg; and both leukopenia and anemia at 50 and 100 mg/kg. Oral administration to rats and mice at various does levels induced neoplasms at multiple sites in males and females. In a one year gavage study, rats given 50 or 250 mg/kg, 4-5 days/week for 52 weeks did not exhibit acute or sub acute toxic effects, but a does correlated increase of leukemias and mammary carcinomas was observed; some other tumor types were also reported. Reproductive effects have been reported in animals.

Section XII – Ecological Information

ECOTOXICITY DATA :
FISH TOXICITY : 9200 ug/L 96 hour(s) LC50 (Mortality) Rainbow trout, Donaldson trout (Oncorhynchus mykiss)
INVERTEBRATE TOXICITY : 10000 ug/L 48 hour(s) EC50 (Immobilization) water flea (Daphnia magna)
ALGAL TOXICITY : 41000 ug/L 8 hour(s) EC50 (Growth) Green algae (Selenastrum capricornutum)
OTHER TOXICITY : 25 ug/L 24 day(s) (Residue) Wood frog (Rana sylvatica)
FATE AND TRANSPORT :
BIOCONCENTRATION : 4360 ug/L 24 day(s) BCF (Residue) Northern anchovy (Engraulis mordax) 97 ug/L

Section XIII – Disposal Considerations

Subject to disposal regulations : U.S. EPA 40 CFR 262. Hazardous Waste Number(s) : u019. Hazardous Waste Number(s) : D018. Dispose of in accordance with U.S. EPA 40 CFR 262 for concentrations at or above the Regulatory level.

Regulatory level-0.5 mg/l. Dispose in occur dance with all applicable regulations.
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Section XIV – Transportation Information

U.S. DOT 49 CFR 172.101 SHIPPING NAME-UN NUMBER: Benzene-UN1114
U.S. DOT 49 CFR 172.101 HAZARD CLASS OR VISION: 3
U.S. DOT 49 CFR 172.101 PACKING GROUP: II
U.S. DOT 49 CFR 172.101 AND SUBPART E LABELING REQUIREMENTS: Flammable liquid
U.S. DOT 49 CFR 172.101 PACKING AUTHORIZATIONS: EXCEPTIONS: 49 CFR 173.150
NON-BULK PACKAGING: 49 CFR 173.202
BULK PACKAGING: 49 CFR 173.242
U.S. DOT 49 CFR 172.101 QUANTITY LIMITATIONS: PASSENGER AIRCRAFT OR RAILCAR: 5 L
CARGO AIRCRAFT ONLY: 60 L
LAND TRANSPORT ADR/RID:SUBSTANCE NAME: Benzene
UN NUMBER: UN1114
ADR/RID CLASS: 3
ITEM NUMBER; 3 (b)
WARNING SIGN/LABEL: 3
HAZARD ID NUMBER: 33
AIR TRANSPORT IATA/ICAO:
CORRECT TECHNICAL NAME: Benzene
UN/ID NUMBER: UN1114
IATA/ICAO CLASS: 3
PACKAGING GROUP: II
LABEL: Flammable liquid
MARITIME TRANSPORT IMDG:
CORRECT TECHNICAL NAME: Benzene
UN/ID NUMBER: UN1114
IMDG CLASS: 3.2
PACKAGING GROUP: II

MFAG Table No.: 312
MARINE POLLUTANT: N

Section XV – Regulatory Information

U.S. REGULATIONS:
TSCA INVENTORY STATUS: Y
TSCA 12(b) EXPORT NOTIFICATION: Not Listed.
CERCLA SECTION 103 (40CFR302.4): Y
Benzene: 10 LBS RQ
SARA SECTION 302 (40CFR355.30): N
SARA SECTION 304 (40CFR355.40): N
SARA SECTION 313 (40CFR372.65): Y
SARA HAZARD CATEGORIES, SARA SECTION 311/312 (40CFR370.21):
ACUTE: Y
CHRONIC: Y
FIRE: Y
REACTIVE: N
SUDDEN RELEASE: N
OSHA PROCESS SAFETY (29CFR1910.119): N
STATE REGULATIONS:
California Proposition 65: Y
Known to the state of California to cause the following:
Cancer (Feb 27, 1987)
Developmental toxicity (Dec 26, 1997)
Male reproductive toxicity (Des 26, 1997)
EUROPEAN REGULATIONS:
EC NUMBER (EINECS): 200-753-7
EC RISK AND SAFETY PHRASES:
R 11 Highly flammable.
R 45 May cause cancer.
R 48/23/24/25
Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed. S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). S 53 Avoid exposure – obtain special introductions before use.
GERMAN REGULATIONS:
WATER HAZARD CLASS (WGK): 3 (Official German Classification)

Section XVI – Other Information

MSDS SUMMARY OF CHANGES
SECTION 6 ACCIDENTAL RELEASE MEASURES

Adress:

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