Material Safety Data Sheet

Section 1 - Product and Company Information

Product Name: Benzene, anhydrous, 99.8%
Product Number: 401765
Brand: Aldrich Chemical
Company: Sigma-Aldrich
Selling Address: 3550 Spruce Street
City, State, Zip: SAINT LOUIS, MO 63103 US
Technical Phone: 800-335-8872
Fax: 800-335-8842
Emergency Phone: 314-776-6656

Section 2 - Composition/Information on Ingredient

<table>
<thead>
<tr>
<th>Substance Name</th>
<th>CAS #</th>
<th>OSHA</th>
<th>SARA 313</th>
<th>EC no</th>
<th>Annex I Index Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>BENZENE</td>
<td>71-43-2</td>
<td>Yes</td>
<td>Yes</td>
<td>200-753-7</td>
<td>601-020-00-8</td>
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</table>

<table>
<thead>
<tr>
<th>Formula</th>
<th>Synonyms</th>
</tr>
</thead>
<tbody>
<tr>
<td>C6H6</td>
<td>0(Anilinobenzene, Benzene (Dutch), Benzene (Polish), Benzene (AGSH-OSHA), Benzol (Ols.), Benzin (Ols.)), Benzine (Ols.), Benzol (OSHA), Benzoel, Benzol, Benzol, Benzol (Italian), Bicarburet of hydrogen, Carbon oil, Coal naphtha, Cyclohexatetlen, Farenz (Czech), Mineral naphtha, NCI-5S0275, Phenol, Phenyl hydrate, Pyrobenzoal, Pyrobenzole, RCRA waste number UC19</td>
</tr>
</tbody>
</table>

Section 3 - Hazards Identification

Emergency Overview:
May cause cancer. May cause heritable genetic damage. Inhaling to respiratory system and skin. Risk of serious damage to eyes. Also toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed. Harmful: may cause lung damage if swallowed.

HMDI Rating
Health: 2 Flammability: 3 Reactivity: 0

NFPA Rating
Health: 2 Flammability: 0 Reactivity: 0

*additional chronic hazards present
For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures

Immediate Treatment - Work Site
In case of contact, immediately flush eyes or skin with copious amounts of water for at least 15 minutes while removing contaminated clothing and shoes.

Oral Exposure
If swallowed, wash out mouth with water provided person is conscious. Call a physician. Do not induce vomiting.

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

Dermal Exposure
In case of contact, immediately wash skin with soap and copious amounts of water.

Eye Exposure
Assure adequate flushing of the eyes by separating the eyelids with fingers.

Section 5 - Fire Fighting Measures

Flammable Hazards: Yes

Explosion Hazards
Vapor may travel considerable distance to source of ignition and flash back. Container explosion may occur under fire conditions.

Flash Point: 12 °F -11 °C

Explosion Limits: Lower: 1.3 % Upper: 8 %

Autoignition Temp: 562 °C

Flammability: Yes

Extinguishing Media
Suitable
For small (incipient) fires, use media such as "alcohol" foam, dry chemical, or carbon dioxide. For large fires, apply water from as far as possible. Use very large quantities (flooding) of water applied as a mist or spray. Solid streams of water may be ineffective. Cool all affected containers with flooding quantities of water.

Firefighting
Protective Equipment
Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.

Specific Hazard(s)
Flammable liquid. Vapor may travel considerable distance to source of ignition and flash back. Exerts toxic fumes under fire conditions.

Section 6 - Accidental Release Measures

Procedure to be Followed in Case of Leak or Spill
Evacuate area. Shut off all sources of ignition.

Procedure(s) of Personal Protection(s)
Wear self-contained breathing apparatus, rubber boots, and heavy rubber gloves.

Section 7 - Handling and Storage

Handling
User Exposure
Do not breathe vapor. Do not get in eyes, on skin, on clothing. Avoid prolonged or repeated exposure.

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**Section 8 - Exposure Controls / PPE**

**Engineering Controls**
Safety shower and eye bath. Use only in a chemical fume hood. Use nonsparking tools.

**Personal Protective Equipment**

**Respiratory**
Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Where risk assessment shows air-purifying respirators are appropriate, use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator.

**Other**
Wear appropriate government approved respirator, chemical-resistant gloves, safety goggles, other protective clothing.

**General Hygiene Measures**
Wash thoroughly after handling. Remove and wash contaminated clothing promptly.

**Exposure Limits**

<table>
<thead>
<tr>
<th>Country</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poland</td>
<td>NOS</td>
<td>1.6</td>
</tr>
<tr>
<td>Poland</td>
<td>NOSk</td>
<td>-</td>
</tr>
<tr>
<td>Poland</td>
<td>NOSP</td>
<td>-</td>
</tr>
</tbody>
</table>

**Exposure Limits, RTECS**

<table>
<thead>
<tr>
<th>Country</th>
<th>Source</th>
<th>Type</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>USA</td>
<td>ACGIH</td>
<td>TWISTEL</td>
<td>0.5 PPM/3.0 PPM</td>
</tr>
<tr>
<td>USA</td>
<td>MSHA Standard</td>
<td>Ceiling concentration</td>
<td>25 PPM (60 MG/MD) (SKIN)</td>
</tr>
<tr>
<td>New Zealand</td>
<td>OEL</td>
<td>TWACalling concentration</td>
<td>0.1 PPM/1 PPM/15M</td>
</tr>
</tbody>
</table>

**Section 9 - Physical/Chemical Properties**

<table>
<thead>
<tr>
<th>Appearance Property</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Molecular Weight</td>
<td>78.11 AMU</td>
</tr>
<tr>
<td>Property, Value</td>
<td>N Temperature or Pressure</td>
</tr>
<tr>
<td>pH</td>
<td>N/A</td>
</tr>
<tr>
<td>BP/BP Range</td>
<td>80 - 90.2 °C, 760 mmHg</td>
</tr>
<tr>
<td>MP/MP Range</td>
<td>5.5 °C</td>
</tr>
<tr>
<td>Freezing Point</td>
<td>N/A</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>74.6 mmHg</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>2.77 g/l</td>
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<tr>
<td>Saturated Vapor Conc.</td>
<td>N/A</td>
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<tr>
<td>SG/Density</td>
<td>0.879 g/cm³</td>
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<tr>
<td>Bulk Density</td>
<td>N/A</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>N/A</td>
</tr>
<tr>
<td>Volatile%</td>
<td>N/A</td>
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<tr>
<td>VOC Content</td>
<td>N/A</td>
</tr>
<tr>
<td>Water Content</td>
<td>N/A</td>
</tr>
<tr>
<td>Solvent Content</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Storage**
Suitable
Keep tightly closed. Keep away from heat, sparks, and open flames.

**Evaporation Rate**
N/A

**Viscosity**
N/A

**Partition Coefficient**
N/A

**Decomposition Temp.**
N/A

**Flash Point 'F**
12 °F

**Flash Point °C**
-11 °C

**Explosion Limits**
Lower: 1.3 %
Upper: 8 %

**Flammability**
N/A

**Autoignition Temp**
562 °C

**Refractive Index**
1.501

**Solubility**
N/A

**N/A = not available**

**Section 10 - Stability and Reactivity**

**Stability**
Stable

**Materials to Avoid**
Acids, Bases, Halogens, Strong oxidizing agents, Avoid contact with metal salts.

**Hazardous Decomposition Products**
Carbon monoxide, Carbon dioxide.

**Hazardous Polymerization**
Will not occur.

**Section 11 - Toxicological Information**

**Route of Exposure**

- **Skin Contact**: Causes skin irritation.
- **Eye Contact**: Causes eye irritation.
- **Inhalation**: May be harmful if inhaled. Material may be irritating to mucous membranes and upper respiratory tract.
- **Ingestion**: May be harmful if swallowed.

**Target Organ(s) or System(s)**
Blood, Bone marrow, Eyes. Female reproductive system.

**Signs and Symptoms of Exposure**
Exposure can cause: Nausea, dizziness, and headache. Nanotoxic effect. Inhalation of high concentrations of benzene may have an initial stimulatory effect on the central nervous system characterized by exhilaration, nervous excitement and/or giddiness, depression, drowsiness, or fatigue. The victim may experience tightness in the chest, breathlessness, and loss of consciousness. Tremors, convulsions, and death due to respiratory paralysis or circulatory collapse can occur in a few minutes to several hours following severe exposure. Aspiration of small amounts of liquid immediately causes pulmonary edema and hemorrhage of pulmonary tissue. Direct skin contact may cause erythema. Prolonged or repeated skin contact may result in drying, scaling dermatitis, or development of secondary skin infections. The chief target organ is the hematopoietic system. Bleeding from the nose, gums, or mucous membranes and the development of purpuric spots, pancytopenia, leukopenia, thrombocytopenia, aplastic anemia, and leukemia may occur as the condition progresses. The bone marrow may appear normal, aplastic or hyperplastic, and may not correlate with peripheral blood-forming tissues. The onset of effects of prolonged benzene exposure may be delayed for many months or years after the actual exposure has ceased. Blood effects.

**RTECS Number**: CY1400000

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Toxicity Data

**Oral** - Rat: 5,600 mg/kg (LD50)
**Oral** - Rat: 5,060 – 7,000 mg/kg (LD50)
**Oral** - Rat: 10,020 mg/kg (LD50)
**Oral** - Rat: 2,950 mg/kg (LD50)

**Inhalation** - rat: 44,700 mg/m³ (LC50)
**Inhalation** - Human: 2 PPh/m³ (LC50)
**Oral** - Man: 50 mg/kg (LD50)
**Inhalation** - Human: 65 mg/m³ (LC50)
**Remarks**: Blood/Other changes.

**Oral** - Rat: 9,900 mg/kg (LD50)
**Remarks**: Behavioral:Convulsion or effect on seizure threshold.

**Inhalation** - Rat: 10,000 ppm (LC50)

**Intrapерitoneal** - Rat: 1100 MG/KG (LD50)
**Oral** - Mouse: 4700 mg/kg (LD50)
**Inhalation** - Mouse: 9,980 ppm (LC50)
**Remarks**: Behavioral: General anesthetic.
Behavioral: Muscle weakness.
Lungs, Thorax, or Respiration:Dyspnea.

**Skin** - Mouse: 48 mg/kg (LD50)

**Intrapерitoneal** - Mouse: 340 MG/KG (LD50)
**Skin** - Rabbit: >9400 UL/KG (LD50)
**Skin** - Guinea pig: >9400 UL/KG (LD50)
**Oral** - Mammal: 5700 mg/kg (LD50)

**Irritation Data**

**Eyes** - Rabbit: Remarks: Moderate irritation effect.
**Skin** - Rabbit: Remarks: Moderate irritation effect.
**Skin** - Rabbit: 15 mg, 24H
**Remarks**: Open irritation test.
**Skin** - Rabbit: 20 mg, 24H
**Remarks**: Moderate irritation effect.
**Eye** - Rabbit: 86 mg
**Remarks**: Moderate irritation effect.
**Eye** - Rabbit: 2 mg, 24H
**Remarks**: Severe irritation effect.

**Chronic Exposure - Carcinogen**

**Result**: This is or contains a component that has been reported to be carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

**Human - Inhalation**: 200 MG/M³ 78W - 1

**Human - Inhalation**: 10 PPM 6H/16W - 1
**Result**: Tumorogenic: Carcinogenic by RTECS criteria. Blood: Leukemia

**Rat - Oral**: 52 MG/KG 52W - 1
**Result**: Tumorogenic: Carcinogenic by RTECS criteria. Endocrine: Tumors. Blood: Leukemia

**OSHA Carcinogen List**

**Rating**: Cancer hazard.

**IARC Carcinogen List**

**Rating**: Group 1

**NTP Carcinogen List**

**Rating**: Positive evidence.
**Species**: Mouse/rat
**Route**: Gavage

**ACGIH Carcinogen List**

**Rating**: A1
Chronic Exposure - Teratogen

Species | Route of Application | Exposure Time | Comments
--- | --- | --- | ---
Rat | 50 PPM/9H Inhalation | (7-14D PREG) | Result: Effects on Embryo or Fetus: Extra embryonic structures (e.g., placenta, umbilical cord). Effects on Embryo or Fetus: Fetal toxicity (except death, e.g., stunted fetus).

Mouse | 9 MG/KG Oral | (6-15D PREG) | Result: Effects on Embryo or Fetus: Fetal toxicity (except death, e.g., stunted fetus).

Mouse | 500 MMP/7H Inhalation | (6-15D PREG) | Result: Effects on Embryo or Fetus: Fetal toxicity (except death, e.g., stunted fetus).

Mouse | 500 MG/3/3/12H Inhalation | (6-15D PREG) | Result: Effects on Embryo or Fetus: Fetal toxicity (except death, e.g., stunted fetus).

Mouse | 5 PPM Inhalation | (6-15D PREG) | Specific Developmental Abnormalities: Blood and lymphatic system (including spleen and marrow).

Mouse | 20 PPM/9H Inhalation | (6-15D PREG) | Specific Developmental Abnormalities: Blood and lymphatic system (including spleen and marrow).

Mouse | 210 MG/KG Intraperitoneal | (14D PREG) | Result: Specific Developmental Abnormalities: Blood and lymphatic system (including spleen and marrow).

Mouse | 7000 MG/KG Subcutaneous | (12-13D PREG) | Result: Effects on Embryo or Fetus: Other effects to embryo.

Mouse | 1100 MG/KG Subcutaneous | (12-13D PREG) | Specific Developmental Abnormalities: Hematopoietic system.

Mouse | 13000 UG/KG Intravenous | (13-16D PREG) | Result: Effects on Embryo or Fetus: Cytological changes (including somatic cell genetic material).

Rabbit | 1 GM/50/24H Inhalation | (7-20D PREG) | Result: Effects on Embryo or Fetus: Fetal toxicity (except death, e.g., stunted fetus). Specific Developmental Abnormalities: Other developmental abnormalities.

Chronic Exposure - Mutagen

Species | Route of Application | Cell Type | Mutation test
--- | --- | --- | ---
Human | 2200 UMOL/L | leucocyte | DNA inhibition
Human | 2200 UMOL/L | DNA inhibition | Other mutation test systems
Human | 5 UMOL/L | Hen a cell | DNA inhibition
Human | 125 PPM Inhalation | 1Y | DNA inhibition
Human | 1 MMOL/L | lymphocyte | Other mutation test systems
Human | 14 MG/L | lymphocyte | DNA inhibition
Human | 10 PPM Unreported | 4W | DNA inhibition
Human | 200 MMOL/L | lymphocyte | Other mutation test systems
Human | 1 GM/L | lymphocyte | DNA inhibition
Rat | 1 PPM Inhalation | 6H | DNA inhibition
Rat | 1 MMOL/L | Unscheduled DNA synthesis | DNA inhibition
Rat | 14 MG/L | liver | DNA inhibition
Rat | 1 MMOL/L | Other mutation test systems | DNA inhibition
Rat | 1 MMOL/L | Bone marrow | Other mutation test systems
Rat | 10 PPM Inhalation | 6H | DNA inhibition
Rat | 1 MMOL/L | liver | Other mutation test systems
Rat | 1 GM/L | Subcutaneous | DNA inhibition
Rat | 2200 MS/KG | Subcutaneous | Other mutation test systems
Rat | 305 | Subcutaneous | DNA inhibition
Rat | 2400 MS/KG | Subcutaneous | DNA inhibition
Rat | 234 MG/KG | Intraperitoneal | DNA inhibition
Rat | 39000 UG/KG | Oral | DNA inhibition
Rat | 5 PPM Inhalation | 6H | DNA inhibition
Rat | 1 MMOL/L | Subcutaneous | DNA inhibition
Mouse | 12500 NMOL/L | Subcutaneous | DNA inhibition
Mouse | 144 MG/KG | Oral | DNA inhibition
Mouse | 264 MG/KG | Intraperitoneal | DNA inhibition
Mouse | 10 PPM Inhalation | 6H | DNA inhibition
Mouse | 62000 UG/L | Oral | DNA inhibition
Mouse | 2500 MG/L | Oral | DNA inhibition
Mouse | 1 GM/L | Embryo | DNA inhibition
Mouse | 150 GM/L | Embryo | DNA inhibition
Mouse | 38400 UMOL/L | Embryo | DNA inhibition
Mouse | 2640 MG/KG | Oral | DNA inhibition
Mouse | 2 GM/KG | Intraperitoneal | DNA inhibition
Mouse | 5 MMOL/L | Intraperitoneal | DNA inhibition
Mouse | 20 GM/KG | Intraperitoneal | DNA inhibition
Mouse | 10 MMOL/L | Intraperitoneal | DNA inhibition
Mouse | 1800 MG/KG | Intraperitoneal | DNA inhibition
Mouse | 3000 PPM | Intraperitoneal | DNA inhibition
Mouse | 3 MMOL/L | Intraperitoneal | DNA inhibition
Mouse | 10 PPM Inhalation | 6H | DNA inhibition
Mouse | 1 GM/KG | Intraperitoneal | DNA inhibition
Mouse | 20 MG/KG | Intraperitoneal | DNA inhibition
Mouse | 264 MG/KG | Intraperitoneal | DNA inhibition
Mouse | 3000 PPM | Intraperitoneal | DNA inhibition
Mouse | 1 MG/KG | Intraperitoneal | DNA inhibition
Mouse | 5 MG/KG | Intraperitoneal | DNA inhibition
Mouse | 12500 UG/L | Intraperitoneal | DNA inhibition
Mouse | 40 PPM/6W-C Inhalation | 5D | DNA inhibition
Mouse | 40 PPM/6W-C Intraperitoneal | 5D | DNA inhibition
Hamster | 100 UG/L | Embryo | DNA inhibition
Hamster | 17 MMOL/L | Embryo | DNA inhibition

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Section 12 - Ecological Information

Acute Ecotoxicity Tests

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Species</th>
<th>EC50, mg/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC50 Algae</td>
<td>Selenastrum capricornutum</td>
<td>25 mg/L</td>
</tr>
</tbody>
</table>

Section 15 - Regulatory Information

EU Directives Classification

- Symbol of Danger: F; T
- Indication of Danger: Highly Flammable. Toxic.
- Risk Statements: R: 45 46 53 65
  - May cause sensitization following repeated or extended exposure. May cause sensitization following prolonged or repeated exposure. May cause sensitization following prolonged or repeated exposure. May cause sensitization following prolonged or repeated exposure.
- Safety Statements: S: 53 65
  - Must be used in a well-ventilated area. Must be used in a well-ventilated area. Must be used in a well-ventilated area. Must be used in a well-ventilated area.
Risk Statements
May cause cancer. May cause heritable genetic damage. Irritating to respiratory system and skin. Risk of serious damage to eyes.
Also toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed.
Harmful: may cause lung damage if swallowed.
Safety Statements
Restricted to professional users: Attention: Avoid exposure - obtain special instructions before use. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
US Statements
United States Regulatory Information
SARA Listed: Yes
Deminimic: 0.1 %
Notes: This product is subject to SARA section 313 reporting requirements.
OSHA Remarks
OSHA-regulated carcinogen. See CFR title 29 part 1910.1208
TSCA Inventory Item: Yes
United States - State Regulatory Information
California Prop. 65
This product is or contains chemical(s) known to the state of California to cause cancer. This product is or contains chemical(s) known to the state of California to cause male reproductive toxicity.
Canada Regulatory Information
WHMIS Classification
This product has been classified in accordance with the hazard criteria of the CPR. and the MSDS contains all the information required by the CPR.
DSL: Yes
NDSL: No
Section 16 - Other Information
Disclaimer
For R&D use only. Not for drug, household or other uses.
Warranty
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