# BENZENE AWARENESS TRAINING

**Substance: Benzene**

**CAS Registry Number: 1076-43-3**

**Synonyms:** Benzol, benzole, coal naphtha, cyclohexatriene, phene, phenyl hydride, pyrobenzol. (Benzin, petroleum benzin and Benzine do not contain Benzene).

**Physical and Chemical Characteristics:** Benzene is a clear, colorless liquid with a distinctive sweet odor. Its boiling point is 176 degrees F and its flash point is 12 degrees F. The flammable limits in air are 1.3% for the low end and 7.5% for the high end.

Benzene is a flammable liquid. Its vapors can form explosive mixtures. All ignition sources must be controlled when Benzene is used, handled, or stored. Where liquid or vapor may be released, such areas shall be considered as hazardous locations. Benzene vapors are heavier than air; thus the vapors may travel along the ground and be ignited by open flames or sparks at locations remote from the site at which Benzene is handled.

Benzene is classified as a 1 B flammable liquid for the purpose of conforming to the requirements of 29 CFR 1910.106. A concentration exceeding 3,250 ppm is considered a potential fire explosion hazard. Locations where Benzene may be present in quantities sufficient to produce explosive or ignitable mixtures are considered Class I Group D for the purposes of conforming to the requirements of 29 CFR 1910.309.

**Health Effects:** Benzene is primarily an inhalation hazard. Systemic absorption may cause depression of the hematopoietic system, pancytopenia, aplastic anemia, and leukemia. Inhalation of high concentrations can affect central nervous system function. Aspiration of small amounts of liquid Benzene immediately causes pulmonary edema and hemorrhage of pulmonary tissue. There is some absorption through the skin. Absorption may be more rapid in the case of abraded skin, and Benzene may be more readily absorbed if it is present in a mixture or as a contaminant in solvents that are readily absorbed. The defatting action of Benzene may produce primary irritation due to repeated or prolonged contact with the skin. A high concentration is irritating to the eyes and the mucous membranes of the nose, and respiratory tract.

Direct skin contact with Benzene may cause erythema. Repeated or prolonged contact may result in drying, scaling dermatitis, or development of secondary skin infections. In addition, there is Benzene absorption through the skin. Local effects of Benzene vapor or liquid on the eye are slight. Only at very high concentrations is there any smarting sensation in the eye. Inhalation of high concentrations of Benzene may have an initial stimulatory effect on the central nervous system characterized by exhilaration, nervous excitation, and/or giddiness, followed by a period of depression, drowsiness, or fatigue. A sensation of tightness in the chest accompanied by breathlessness may occur and ultimately the victim may lose consciousness. Tremors, convulsions and death may follow from respiratory paralysis or circulatory collapse in a few minutes to several hours following severe exposures.

The detrimental effect on the blood-forming system of prolonged exposure to small quantities of Benzene vapor is of extreme importance. The hematopoietic system is the chief target for Benzene's toxic effects that are manifested by alterations in the levels of formed elements in the peripheral blood. These effects have occurred at concentrations of Benzene that may not cause irritation of mucous membranes, or any unpleasant sensory effects. Early signs and symptoms of Benzene morbidity are varied, often not readily noticed and non-specific. Subjective complaints of headache, dizziness, and loss of appetite may precede or follow clinical signs. Rapid pulse and low blood pressure, in addition to a physical appearance of anemia, may accompany a subjective complaint of shortness of breath and excessive tiredness. Bleeding from the nose, gums, or mucous membranes, and the development of purpuric spots (small bruises) may occur as the condition progresses. Clinical evidence of leukopenia, anemia, and thrombocytopenia, singly or in combination, has been frequently reported among the first signs.

Bone marrow may appear normal, aplastic, or hyperplastic, and may not, in all situations, correlate with peripheral blood forming tissues. Because of variations in the susceptibility to Benzene morbidity, there is no "typical" blood picture. The onset of effects of prolonged Benzene exposure may be delayed for many months or years after the actual exposure has ceased and identification or correlation with Benzene exposure must be sought out in the occupational history.

**Regulatory Limits:** The permissible exposure limits for Benzene are as follows

1. Airborne: The maximum time-weighted average (TWA) exposure limit is 1 part of Benzene vapor per million parts of air (1 ppm) for an 8-hour workday and the maximum short-term exposure limit (STEL) is 5 ppm for any 15-minute period.

2. Dermal: Eye contact shall be prevented and skin contact with liquid Benzene shall be limited.

## Working Safely with Benzene

1. Order only the amount needed for your work. Excessive chemicals produce increased risk to the work place.
2. Store Benzene in a vented flammable storage cabinet.
3. Before you are about to use Benzene, don personal protective equipment, laboratory coat, and proper resistant gloves and safety glasses.
4. Remove container from storage and bring to operating fume hood. Place container on tray in hood. Keep bottle at least six inches from front of hood.
5. Bring hood sash down to 12” opening.
6. Open bottle and remove quantity needed either with an automatic pipetor or by pouring into a measure cylinder.
7. Dilute by adding stock to the dilutent, avoid spilling.
8. If you detect a Benzene odor, work further in the hood and reduce the sash opening. If odor persists, stop work and call EH&S, extension 4150 at AECOM or extension 221at YU.
9. After you remove the needed amount, return stock solution to the flammable storage cabinet.

10. Dispose of waste Benzene into a labeled sealed bottle. The label must read:
    WASTE CHEMICAL: Benzene
    Date First Collected: _____
    When bottle is full, call EH&S, extension 4150 at AECOM or extension 221 at YU for a chemical waste pick up.
11. For a small spill <50 ml, using the appropriate protective equipment, absorb the spill material with absorbent pad. Place in plastic bag. WASH area with soap and water.
    For a large spill >50 ml, advise everyone in area to leave. Call EH&S, extension 4150 at AECOM or extension 221 at YU.
12. For body contamination, see Emergency Procedures below.

**Personal Protective Equipment:** The follow protective equipment is required when working with Benzene:

1. Respiratory Protection: Respirators are required for those operations in which engineering controls or work practice controls are not feasible to reduce exposure to the permissible level. However, where employers can document that Benzene is present in the workplace less than 30 days a year, respirators may be used in lieu of engineering controls. If respirators are worn, they must have joint Mine Safety and Health Administration and the National Institute for Occupational Safety and Health (NIOSH) seal of approval, and cartridge or canisters must be replaced before the end of their service life, or the end of the shift, whichever occurs first. If you experience difficulty breathing while wearing a respirator, you may request a positive pressure respirator from your employer. You must be medically screened, fit tested and thoroughly trained to use the assigned respirator, and your employer will provide the training.

2. Protective Clothing: You must wear appropriate protective clothing (such as boots, gloves, sleeves, aprons, etc.) over any parts of your body that could be exposed to liquid Benzene. In a laboratory setting a laboratory coat and gloves are a must when handling Benzene.

3. Eye and Face Protection: You must wear splash-proof safety goggles if it is possible that Benzene may get into your eyes. In addition, you must wear a face shield if your face could be splashed with Benzene liquid.

**Exposure Monitoring:** Determinations of employee exposure shall be made from breathing zone air samples that are representative of each employee's average exposure to airborne Benzene. Representative 8-hour TWA employee exposures shall be determined on the basis of one sample or samples representing the full shift exposure for each job classification in each work area. Employees are monitored initially and periodically thereafter depending on whether the exposure exceeds the TWA.

**Medical Surveillance:** The employer shall make available a medical surveillance program for employees who are or may be exposed to Benzene at or above the action level of 0.5 ppm calculated as an hour time-weighted average for 30 or more days per year.

The employer shall provide for an initial physical exam of the employee by a physician that will consist of a detailed occupational history that includes:

1. Past work exposure to Benzene or any other hematological toxins,
2. A family history of blood dyscrasias including hematological neoplasms;
3. A history of blood dyscrasias including genetic hemoglobin abnormalities, bleeding abnormalities, abnormal function of formed blood elements;
4. A history of renal or liver dysfunction;
5. A history of medicinal drugs routinely taken;
6. A history of previous exposure to ionizing radiation and
7. Exposure to marrow toxins outside of the current work situation.

**Regulated Areas:** Employers shall establish regulated areas wherever the airborne concentration of Benzene exceeds or can reasonably be expected to exceed the permissible exposure limits, either the 8-hour time weighted average exposure of 1 ppm or the short-term exposure limit of 5 ppm for 15 minutes. Access to regulated areas shall be posted and limited to authorized persons.

**Communication to Employees:** The employer shall post signs at entrances to regulated areas. The sign shall bear the following legend:

Danger
Benzene
Cancer Hazard
Flammable – No Smoking
Authorized Personnel Only
Respirator Required

Employer shall ensure that labels or other appropriate forms of warning are provided for containers of Benzene within the workplace. The Employer shall obtain material safety data sheets (MSDS) for Benzene.

The employer shall provide the employee with information and training at the time of their initial assignment to a work area where Benzene is present and annually after that.

**Record keeping:** The employer shall establish and maintain records regarding employee's exposure, monitoring and sampling, exposure levels, and respiratory devices to be worn. The employer must keep records for at least 30 years.

**Applicability:** This procedure applies to all occupational exposure to Benzene.

**Emergency Procedures:** In a medical emergency call 911, then 4111

**Inhalation:** If inhaled, move to fresh air. If not breathing give artificial respiration. If breathing difficultly, give oxygen.

**Skin Contact:** In case of skin contact, flush with copious amounts of water for at least 15 minutes. Remove contaminated clothing and shoes. Call a physician.

**Eye Contact:** If in contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating eyelids with fingers. Call a physician.

**Ingestion:** If swallowed, wash out mouth with water provided person is conscious. Call a physician immediately.