## Benzene Exposure

1. **Purpose**

The purpose of this program is to inform personnel of the dangers of benzene exposure, benzene permissible exposure limits, regulated areas, exposure monitoring, medical surveillance, personal protection, and basic emergency preparedness procedures. The plan should be reviewed and revised to reflect the most recent exposure monitoring data.

1. **Responsibility**

* Senior management will provide the resources, guidance, equipment, and enforcement necessary to protect personnel from exposure to benzene and ensure compliance with this policy.
* All personnel will comply with all elements of this program to prevent benzene exposure.
* Environmental, Health and Safety (EHS) Department will assist supervisors, managers, and other employees to implement and maintain the elements of this policy.

1. **Exposure Limits**

OSHA Permissible Exposure Limit (PEL), Subpart Z Tables Z-1-A

* 8-hour Time-Weighted Average **1 ppm**
* 12-hour Time-Weighted Average **0.67 ppm**
* Short-Term Exposure Limit (STEL) **5 ppm**
* Action Level **0.5 ppm**

1. **Regulated Areas**

Regulated areas shall be established wherever the airborne concentration of benzene exceeds or can reasonably be expected to exceed the PEL or STEL. Access to regulated areas shall be limited to authorized persons.

1. **Physical and Chemical Characteristics of Benzene**

* Benzene can be found in locations such as petroleum refining sites, tank gauging, field maintenance, paint storage area, burning coal, refineries, printing facilities, in the production of plastic, detergents, pesticides, rubbers, dyes, resins, lubricants, and areas where paint is being used and in the fuel storage area.
* Benzene is clear, colorless liquid at room temperature, with a distinctive sweet, harsh odor. Benzene is highly flammable and toxic. Its vapors can form explosive mixtures. Benzene dissolves only slightly in water and will float on the top of water.
* Benzene vapors are heavier than air – 2.7 times as dense; 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 used, handled or stored.
* Benzene has a flash point of 12 degrees, an autoignition temperature of 1,076 degrees and a lower explosion limit (LEL) of 1.3% and an upper flammable limit (UFL) of 7.5%.
* A concentration exceeding 3,250 ppm is considered a potential fire explosion hazard.

1. **Health Effects of Benzene**

Exposure to benzene, even at low concentrations, can lead to inflammation of the nasal airways and throat.

High level exposures can severely damage the lungs causing fluid accumulation and bleeding, which is often fatal.

Benzene exposure can lead to excessive bleeding and negatively affect the immune system, increasing the chance for infection. Females that have breathed high levels of benzene for many months, experienced irregular menstrual periods and decrease in the size of their ovaries.

Short term effects of overexposure may include irritation of eyes, nose and skin, breathlessness, irritability, euphoria, headache, dizziness, or nausea.

Long term effects may result in blood disorders such as leukemia and anemia.

1. **Exposure Monitoring**

Each workplace with the potential for benzene exposure shall be monitored. Employees shall be notified of the monitoring results within 15 working days. The following measures shall be used to monitor employee benzene exposure:

* Initial monitoring of workplaces and work operations
* Periodic monitoring and monitoring frequency
  + at or above the action level but below the TWA - annually.
  + above the TWA - every six months.
  + monitoring for STEL - repeated as necessary.
* Additional monitoring
  + when a change in the production, process, control equipment, personnel or work practices which may result in new or additional exposure to benzene.
  + after the cleanup of a spill or repair of the leak, rupture or other breakdown.

1. **Medical Surveillance**

A medical surveillance program shall be made available for employees who are or may be exposed to benzene at or above the action level 30 or more days per year; for employees who are or may be exposed to benzene at or above the PELs 10 or more days per year. If an employee refuses to take a medical examination, the employee will sign a release affirming that he or she had been offered the benefits and refused to participate.

* Initial Examination

Medical examinations shall include the following elements:

* + Detailed occupational history
  + Complete physical examination
  + Laboratory tests - A complete blood count
  + Additional tests as necessary
* Periodic Examinations – Annually

For persons required to use respirators for at least 30 days a year, a pulmonary function test shall be performed every three (3) years.

* Emergency Examinations

If an employee is exposed to benzene in an emergency situation, the employer shall have the employee provide a urine sample at the end of the employee’s shift and have a urinary phenol test performed on the sample within 72 hours.

* Periodic examinations if directed by physicians :
  + Termination Exam – Employees shall be provided with a medical exam upon termination of employment or termination of exposure.
  + Physician’s Written Opinions - employer shall obtain and provide employee with written copy of physician’s opinion within 15 days of examination.

1. **Methods of Compliance**

Engineering controls, work practices controls, shall be used to minimize employee exposure to or below the PELs. When exposures are above the PEL, a written program will be established and implemented to reduce employee exposure to, below the PEL, or to the lowest levels achievable by means of engineering and work practice controls when possible. The written program will include a schedule for development and implementation of the engineering and work practice controls. The plan will be reviewed and revised according to the most recent exposure monitoring data.

Wherever feasible engineering and work practice controls are not sufficient to reduce employee exposure to or below the PELs, it shall be documented why such types of controls are not feasible to reduce employee exposures and PPE, including respiratory protection, will be provided to employees.

The following are minimal work practices for protection from benzene exposure:

* Use only the amount needed for your work. Excessive chemicals produce increased risk to the work place.
* Store benzene in a vented flammable storage cabinet.
* Wear proper PPE: Respiratory, eye and face, boots, gloves and apron protection to prevent eye contact and limit dermal exposure.
* Use only approved containers.
* Cleanup spills as quickly as possible.
* All ignition sources must be controlled and kept a safety distance away when benzene is used, handled or stored.
* No smoking in work areas.
* Fire extinguishers must be readily available in work areas.

1. **Respiratory Protection for Benzene**

The following guidelines shall be used for respiratory protection. When air-purifying respirators are used, the employees will replace the air-purifying element (cartridge) at the expiration of service life, or at the beginning of each shift in which they will be used, whichever comes first.

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| **Employee Exposure** | **Respiratory Protection Needed** |
| < or = 10ppm | Half-mask air purifying Respirator (APR) with Organic Vapor Cartridges |
| < or = 50ppm | Full-mask air purifying Respirator (APR) with Organic Vapor Cartridges or Full-facepiece gas mask with chin-style canisters |
| < or = 100ppm | Full-facepiece powered air-purifying respirator with organic vapor canister |
| < or = 1,000ppm | Supplied-air respirator with full facepiece in positive-pressure mode. |
| > 1,000ppm or unknown concentrations | Self-contained breathing apparatus with full facepiece in positive-pressure mode or Full-facepiece positive-pressure supplied-air respirator with auxiliary self-contained air supply. |

1. **Protective Clothing and Equipment**

The selection of PPE will be based upon the working conditions, amount and duration of exposure, and other environmental factors. Selection of PPE for protection from benzene will be conducted by the Environmental, Safety and Health Department or on-site safety professional. Protective clothing and equipment shall be provided at no cost to the employee.

Employees are required to use protective clothing, protective gloves, eye protection, and the appropriate respiratory protection to prevent eye contact and limit dermal exposure to benzene.

1. **Basic Emergency Procedures**

* All personnel will be informed of the site specific emergency plan.
* Inhalation: If inhaled, move to fresh air. If not breathing give artificial respiration. If breathing difficulty, 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.
* Eye Contact: if in contact with eyes, flush with large amounts of water for at least 15 minutes. Assure adequate flushing by separating eyelids with fingers.
* Ingestion**:** If swallowed, wash mouth out with water.

1. **Communication of Benzene Hazards**

Signs, labels, and verbal (briefings, training) shall be used to communicate benzene hazards to employees. As part of the benzene communication strategy, safety data sheets (SDS) for benzene are available to employees. Benzene awareness training is provided annually to employees. The written plan shall be made available to the Assistant Secretary, the Director, affected employees and designated employee representatives.

* Signs will be posted at entrances to regulated areas. The sign shall bear the legend:

**DANGER BENZENE CANCER HAZARD FLAMMABLE – NO SMOKING AUTHORIZED PERSONNEL ONLY RESPIRATOR REQUIRED**

* Labels for containers will have the following wording, as a minimum:

**DANGER CONTAINS BENZENE CANCER HAZARD FLAMMABLE**

1. **Recordkeeping**

In compliance with the OSHA benzene standard, records shall be maintained for employee exposure, medical surveillance, monitoring and sampling results, exposure levels and respiratory devices to be worn. Exposure records are kept for 30 years after employee termination or after the completion of the job or project.

Exposure and medical monitoring records are made available to the affected employees or their representatives and OSHA upon their request. Any transfer of the records will require written approval of the Environmental, Safety and Health Department.