Subject: Benzene Awareness

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Ah, the sweet smell of benzene; do not let it fool you! The improper handling and lack of safety precautions when working with or around benzene can lead to a regrettable experience; therefore, employees need to be aware of the risk of benzene exposure. We will look at what benzene is, where it can be found, its harmful effects, and protection against benzene exposure.

WHAT IS BENZENE?

Benzene (a.k.a. benzol or phenyl hydride) is an organic chemical compound and a known carcinogen with the molecular formula C₆H₆. Benzene is a colorless and highly flammable liquid with a sweet smell and a relatively high melting point. Because it is a known carcinogen, its use as an additive in gasoline is now limited. However, it is an important industrial solvent and precursor in the production of drugs, plastics, synthetic rubber, and dyes. Benzene is a natural constituent of crude oil and may be synthesized from other compounds present in petroleum. It is important to note that 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 (Arihant 2009).

WHERE IS BENZENE FOUND

Individuals employed in industries that make or use benzene may be exposed to the highest levels of benzene. These industries include benzene production (petrochemicals, petroleum refining, and coke and coal chemical manufacturing), rubber tire manufacturing, and storage or transport of benzene and petroleum products containing benzene. Other workers who may be exposed to benzene because of their occupations include steel workers, printers, rubber workers, shoe makers, laboratory technicians, firefighters, and gas station employees (OSHA 2009).

HARMFUL EFFECTS

Benzene exposure is most dangerous when it occurs over a long period of time or when its concentration is very high. Contact with low to moderate levels of benzene for a short time can cause headaches, vomiting, disorientation, shakiness, elevated heart rate, and loss of consciousness. Very high levels of exposure can be fatal. People who work with benzene or who are exposed to it over a long period of time...
are at the highest risk for developing benzene-related illnesses, which range from anemia to cancer (Benzenefyi 2009).

Benzene causes problems in the blood. People who breathe benzene for long periods may experience harmful effects in the tissues that form blood cells, especially the bone marrow. These effects can disrupt normal blood production and cause a decrease in important blood components. A decrease in red blood cells can lead to anemia. Reduction in other components in the blood can cause excessive bleeding. Blood production may return to normal after exposure to benzene stops. Excessive exposure to benzene can be harmful to the immune system, increasing the chance for infection and perhaps lowering the body's defense against cancer (ATSDR 2009).

The Department of Health and Human Services (DHHS) has determined that benzene is a known human carcinogen. Long-term exposure to relatively high levels of benzene in the air can cause cancer of the blood-forming organs; better known as leukemia.

Exposure to benzene may also be harmful to reproductive organs. In one study, a number of women workers who breathed high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries. However, exact exposure levels were unknown, and the studies of these women did not prove that benzene caused these effects (Eco-USA).

**EXPOSURE PROTECTION**

Employees are capable of working in an atmosphere that contains benzene (or other chemical hazards) without risking their health. OSHA enforces two permissible exposure limits (PEL) for benzene allowing staff to work without the use of a respirator: time-weighted-average (TWA) of 1 part per million (ppm) over 8-hours per day, 40-hour week; and a short-term exposure limit (STEL) of 5 ppm limiting exposure of 15-minutes. There is also a PEL referred to as “immediately dangerous to life and health (IDLH)” which has a limit of 500 ppm (NIOSH). IDLH atmospheres require the use of a self-contained breathing apparatus (SCBA) or supplied-air with escape pack.

To emphasize the Hazard Control Hierarchy, project team members are to first implement engineering controls, such as ventilation or containment, to eliminate or reduce benzene levels to the lowest level possible. Second, administrative controls can be used to limit employee exposures. An example of administrative controls is to reformulate the TWA PEL. Benzene’s TWA is 1 ppm for 8-hours for a total of 8 ppm for the day (1 ppm x 8 hours = 8 ppm). Employees can enter higher benzene levels (e.g. 4 ppm) for a shorter duration (2 hours; 8 ppm/2 hours = 4 ppm) as long as they do not exceed other PELs (4 ppm is less than the STEL of 5 ppm). Third, employees are to wear personal protective equipment (PPE). PPE is the last result, because if it fails the employee is still exposed to the hazard and, therefore, is at risk. Finally, a combination of the three controls can be used to reduce the risk as much as possible (OSHA 1910.1000).

Remember, though, the best defense is a good offense: if the team can delay the task in order to work under safer conditions, then do so. In addition, the necessary types of controls are site-specific and must
be included in the site-specific health and safety plan. Such risk assessments must be determined on a project and site basis.

Solutions containing benzene must be used in a well-ventilated work area and must also be correctly labeled. Samples believed to contain benzene are to be stored at room temperature away from heat and incompatible materials. For employees who are working with benzene, eyewash stations and/or safety showers are to be within the immediate work area. Gloves, goggles, and Tyvek must be worn as well. Additional PPE may be required depending on the procedure. If air-purifying respirators are necessary, Trihydro requires employees to replace the air-purifying element at the expiration of its service life or at the beginning of each shift in which such elements are used, whichever comes first.

Employees cannot take benzene for granted because of its everyday use or presence. Complacency is a characteristic that cannot be allowed to exist when dealing with hazardous materials like benzene. Following material handling procedures is one of the best ways to protect you from benzene exposure. Circumventing procedures puts you and your co-workers at risk. As with other hazardous materials, familiarize yourself with benzene, and read and understand the Materials Safety Data Sheet (MSDS) prior to exposure. It’s important that employees go home in the same condition they came to work: healthy. Following procedures and staying informed will help you do just that.

References


Eco-USA. Benzene. Available at http://www.eco-usa.net/toxics/chemicals/benzene.shtml