

Birth Defect Research for Children, inc.

Fact Sheets

Benzene and Birth Defects

What is it? Benzene is a clear, colorless liquid, highly flammable at room temperature. It is a natural component of crude and refined petroleum. Benzene vapor is heavier than air and has a pleasant odor detectable at concentrations greater than 4 parts per million (ppm).

What is it used for? Eighty-five percent of benzene's use is as an intermediate in the production of other chemicals, predominantly Styrofoam and other plastics, resins, and synthetic fibers. It is an important raw material for the manufacture of synthetic rubber, gums, lubricants, dyes, pharmaceuticals, and agricultural chemicals. Benzene is an excellent solvent and is used in paints, thinners, inks, adhesives, and in industrial cleaning and degreasing formulations. It is a major pollutant from internal combustion engines. The National Institute for Occupational Safety and Health (NIOSH) estimates that approximately 2 to 3 million US workers may be exposed to benzene. In addition, estimated 37 million people in the country were exposed in 1980 to benzene vapors at self-service gasoline stations at levels up to 6.6 ppm.

Because of its many uses, benzene is a widespread component of both indoor and outdoor air pollution. However in most cases, benzene levels inside residences or offices are higher than levels outside, especially in homes with attached garages and those occupied by smokers. Persons who smoke one pack of cigarettes inhale approximately 1 milligram of benzene, one-thirtieth of the daily permissible workplace level.

Adverse Human Health Effects: Benzene is absorbed rapidly by inhalation and ingestion, and slowly through contact with intact skin. Contact with benzene contaminated groundwater can lead to exposure by ingestion, plus

accelerated absorption through wet skin and inhalation as benzene volatilizes during washing and showering.

Acute exposure: Acute benzene toxicity is characterized by central nervous system depression. Symptoms may progress from light-headedness, headache, and euphoria, to respiratory depression, apnea (cessation of breathing), coma, and death. Benzene concentrations of about 20,000 ppm are fatal to humans within 5 to 10 minutes. "Benzol jag" is a term used to describe symptoms of confusion, euphoria, and unsteady gait associated with acute benzene exposure. Benzene is classified by the Environmental Protection Agency (EPA) as may cause irreversible effects, which can be life threatening.

Chronic exposure: Long-term benzene exposure affects the central nervous system (CNS), the production of blood cells and platelets, and possibly the immune system. Benzene is metabolized in the liver. The bone marrow is the main target organ of benzene toxicity associated with development of leukemia. Benzene is fat soluble and readily accumulates in the fatty part of the body, such as bone marrow. The release rate is slow. Early symptoms of chronic benzene exposure may be nonspecific, such as fatigue and anorexia (loss of appetite for food.) Conditions that first may lead to seeking medical help are typically fever due to infection or bleeding from the gums, skin, gastrointestinal tract, or elsewhere. By the time a physician is consulted, the bone marrow may have been significantly affected. Benzene induced depression of blood elements may reverse after exposure is terminated, if bone marrow damage has not become irreversible.

Reproductive effects: Teratogenic (developmental abnormalities in the fetus) effects of benzene have been observed in animals only at high exposure levels. Female animals were more susceptible to the effects of benzene than males. In humans there have been several reports of benzene exposure causing adverse reproductive effects. Exposure at acute and occupational levels has induced vaginal bleeding, complications of pregnancy, heavy menstrual bleeding, and various obstetrical disorders, including miscarriages, premature births, and stillbirths. Studies report that benzene crosses the human placenta, and cord blood concentrations are at least as high as maternal blood. Because of poorly documented, possibly mixed (with other contaminants) exposures, benzene is classified by the EPA as Class A-:

unconfirmed human reproductive hazard. However, one birth defects registry study investigating the effects of public drinking water contamination on births found some association between benzene exposure in drinking water and neural tube defects and major cardiac defects (Bove FJ et al, Am J Epidemiol 1995 May 1;141(9):850-862). Further investigations are needed in the reproductive area.

Carcinogenic potential: EPA classifies benzene as a Group A carcinogen with no minimum threshold for carcinogenic effects: sufficient evidence supports a causal association between exposure and cancer in humans and in experimental animals. The causal relationship between benzene exposure and leukemia has existed for over 50 years. Cohort studies of benzene-exposed workers in several industries have demonstrated significantly elevated risk of leukemia, primarily acute myelogenous leukemia. Erythroleukemia and acute myelomonocytic leukemia have also been found. Benzene induced leukemia has a usual latency period of 5 to 15 years, and may be associated with aplastic (underdevelopment of organ or tissue) anemia.

Genetic effects: Several studies have found that benzene and the break down products of its metabolism in the human body have been associated with elevated frequencies of chromosome aberrations in peripheral lymphocytes (white blood cells). One study advanced the theory that these aberrations may be an expression of benzene's carcinogenicity.

Resources

Birth Defect Research for Children, inc.
930 Woodcock Road, Suite 225
Orlando FL 32803
407-895-0802
<http://www.birthdefects.org>