

Causes of Mutation Article 3:

Human produced carcinogens: Benzene

Carcinogen: A substance capable of causing cancer in living tissue.

Volatile: Easily evaporated at normal temperatures

Petroleum products: Materials derived from crude oil (**petroleum**) as it is processed in oil refineries.

Leachate: Water that has moved through a solid and absorbed parts of it

Myeloid leukaemia, acute non-lymphocytic leukaemia, lymphocytic leukaemia, non-Hodgkin's

lymphoma, multiple myeloma, aplastic anaemia: Different types of cancers and diseases

Immunotoxicity: Negative effects on the immune system when it's been exposed to chemical substances.

B-cells and T-cells: Cells used in the body's immune system

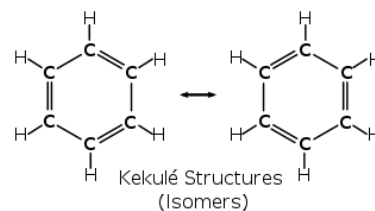
Proliferation: Rapid increase in numbers



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Exposure to Benzene: A Major Public Health Concern

Source: World Health Organization; <http://www.who.int/ipcs/features/benzene.pdf>
(selected sections, some sections are cut short, as indicated by [])

Human exposure to benzene has been associated with a range of acute and long-term adverse health effects and diseases, including cancer and aplastic anaemia. Exposure can occur occupationally and domestically as a result of the ubiquitous use of benzene-containing petroleum products, including motor fuels and solvents. Active and passive exposure to tobacco smoke is also a significant source of exposure. Benzene is highly volatile, and exposure occurs mostly through inhalation. 1–3 Public health actions are needed to reduce the exposure of both workers and the general population to benzene.

Sources of exposure to benzene

Benzene is highly volatile, and most exposure is through inhalation. Benzene is degraded rapidly in the upper atmosphere. Because of its solubility in water, a minor amount may be removed by rain to contaminate surface waters and soil. However, it is not persistent in surface water or soil, either volatilizing back to air or being degraded by bacteria.

Industrial processes

As benzene occurs naturally in crude petroleum at levels up to 4 g/l, human activities using petroleum lead to exposure. These activities include processing of petroleum products, coking of coal, production of toluene, xylene and other aromatic compounds, and use in industrial and consumer products, as a chemical intermediate and as a component of petrol (gasoline) and heating oils. The presence of benzene in petrol and as a widely used industrial solvent can result in significant occupational exposure and widespread emissions to the environment. Automobile exhaust accounts for the largest source of benzene in the general environment. Off-gassing from building materials and structural fires lead to increased atmospheric benzene levels. Industrial discharge, landfill leachate and disposal of benzene-containing waste are also sources of exposure.²

Indoor residential air

Benzene has been detected at high levels in indoor air. Although some of this exposure might be from building materials (paints, adhesives, etc.), most is from cigarette smoke in both homes and public spaces.² []

Inside vehicles

Benzene has been measured in air inside vehicles at levels higher than those in residential air, but substantially lower than those at petrol filling stations.⁴

Food and water

Waterborne and foodborne benzene contributes only a small percentage of the total daily intake in non-smoking adults.²

Health effects

Acute effects

- Acute occupational exposure to benzene may cause narcosis: headache, dizziness, drowsiness, confusion, tremors and loss of consciousness.² Use of alcohol enhances the toxic effect.⁷
- Benzene is a moderate eye irritant and a skin irritant.²

Effects following chronic exposure

- Benzene is a well-established cause of cancer in humans.^{1,3} The International Agency for Research on Cancer has classified benzene as carcinogenic to humans (Group 1).^{1,3} Benzene causes acute myeloid leukaemia (acute non-lymphocytic leukaemia), and there is limited evidence that benzene may also cause acute and chronic lymphocytic leukaemia, non-Hodgkin's lymphoma and multiple myeloma. Individuals who have experienced benzene poisoning requiring treatment show a substantially increased risk of mortality from leukaemia.³
- Chronic exposure to benzene can reduce the production of both red and white blood cells from bone marrow in humans, resulting in aplastic anaemia.²
- Both B-cell proliferation and T-cell proliferation are reduced by benzene. Decreased host resistance to infection has been reported in several laboratory animals exposed to benzene. However, other measures of immunotoxicity have not been studied.²
- Chromosomal aberrations in human peripheral lymphocytes are associated with occupational exposure to benzene. Chromosomal aberrations, micronuclei, sister chromatid exchange and sperm head abnormalities have been seen in laboratory species treated in vivo. Chromosomal aberrations and mutations were seen in human cells in vitro and in laboratory animal cells in some in vitro studies.^{1,2} []

Risk mitigation recommendations

Eliminate use

- Promote the use of alternative solvents in industrial processes, glues and paints.
- Develop and implement policies and legislation to remove benzene from consumer products.

Reduce exposure

- Reduce exposure at petrol filling stations as far as possible by following best practices in location, design and extraction.
- Minimize emissions from vehicle exhausts by improved design and regular monitoring of engine settings.
- Separate dwelling spaces from areas where vehicles and benzene-containing products are kept. In particular, isolate children from indoor exposure to vehicle emissions.
- Avoid domestic use of benzene-containing products.
- Discourage indoor use of unflued oil and gasoline heating.
- Prohibit smoking inside buildings.

Education

- Raise public awareness regarding sources of exposure to benzene and risk mitigation measures.
- Conduct educational activities to discourage the use of benzene or petrol for cleaning and degreasing in industry and domestically.

References

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