

newsletter

Benzene

The industrial chemical benzene has long been considered a health hazard. Enhanced scientific and medical knowledge about its precise mechanism of action, however, has inspired the legal community to take a new look at this long-familiar claims category. Special emphasis is placed on persons with current or past exposure to benzene in the workplace.

Benzene: properties, occurrence

Benzene (CAS No.: 71-43-2), an aromatic hydrocarbon, is a colourless, volatile, flammable and highly combustible liquid with a sweet smell that forms an explosive mixture at certain concentrations of air volume. Coal tar and crude oil are the most significant natural occurrence. Benzene is commercially extracted by steam cracking or catalytic reforming of naphtha, in which long-chain molecules are split at high temperatures with catalytic converters and benzene is extracted from the end products. Another production process is thermal dealkylation. Benzene is found in petrol (approx. 1%), and in significant amounts in cigarette smoke, particularly indoors. Benzene is not persistent and quickly breaks down in the atmosphere.

Industrial use

Benzene is one of the key technological aromatics (BTEX aromatics - benzene, toluene, ethylbenzene, xylene). The worldwide production capacity in 2006 was about 48 million tonnes, accounting for \$16 billion in turnover. The leading producers are in the US and Western Europe (20% each), followed by Japan (12%). Benzene is used for the synthesis of various chemical compounds and is widely used as a solvent and basic chemical, as well as an intermediate in chemicals and pharmaceuticals.

Over 85% of industrially manufactured benzene is used as feed for the synthesis of three important industrial chemicals: ethylbenzene (for styrene), cumene (for phenol, acetone) and cyclohexane (for synthetic fibres, nylon). Benzene is also used to produce nitrobenzene (aniline production), surfactants (alkyl benzene sulfonates), halogenated benzenes (pharmaceuticals, pesticides, dyes, perfumes) and maleic acid (resins, lubricants, fats).

Benzene in consumer products

Benzene was formerly used as a solvent in various adhesives, cleansers and rubber. Due to its toxic and carcinogenic properties, it has virtually disappeared from consumer products (except for petrol). Numerous bans and exposure limits have also been imposed to regulate its use. However, benzene is sometimes found in the aforementioned products – used either inadvertently or for cost reasons, often illegally.

**Toxicity;
acute,
chronic
exposure**

There are extensive studies on the toxicity of benzene and a great deal of published research about its health risks.
(e.g. Toxicological Profile for Benzene; US Department of Health and Human Services, Public Health Service Agency for Toxic Substances and Disease Registry, 2007 and references therein).

Benzene is acute toxic. The absorption of larger amounts can lead, as concentration and exposure times increase, to severe damage that is only partly reversible (light-headedness, unconsciousness) or even death. Chronic, and particularly occupational, exposure to smaller amounts of benzene is far more critical. Apart from general symptoms such as fatigue, memory loss and concentration disorders, long-term inhalation can damage the bone marrow (anaemia), because it builds up in the brain and fatty tissue and is only slowly excreted by the kidneys. Benzene is also genotoxic, toxic to reproduction and neurotoxic. The International Agency for Research on Cancer, IARC, categorises benzene as a Class I carcinogen, i.e. there is sufficient evidence of its harmful effects.

**AML
(acute
myeloid
leukaemia)**

Observational studies of workers with years of exposure to benzene vapours have shown that certain cancers occur in these groups more frequently - in particular, acute myeloid leukaemia (AML), a malignant disorder of the hematopoietic system that is otherwise rare. Chronic exposure to benzene is now a known risk factor for AML. Typically, AML develops after a latency period of 5 to 15 years, i.e. after exposure has ended. If left untreated, the disease is fatal. The 5-year survival rate for AML patients who have undergone extensive, strenuous chemotherapy is about 30%.

**Causal
relationship**

In general, it is always time-consuming, difficult and therefore very expensive to establish a causal relationship between exposure to a toxic substance and a particular illness. This is especially true if the exposure of the affected persons was only minimal and dates back a number of years, or if they were simultaneously exposed to multiple toxic substances. Among those illnesses linked to benzene, it is most possible to substantiate a link to AML.

Exposure

In the absence of tobacco use or long-term passive tobacco exposure, the majority of the population in Western industrialised nations is only exposed to small amounts of benzene. As such, benzene-related illnesses are rare. Exposure and thus endangerment of persons in areas with greater concentrations of benzene is higher. This category includes areas near chemical production facilities, landfills and waste management facilities or areas with high amounts of vehicle emissions (busy streets). Research to date indicates that the potential health risk of oral benzene absorption from food and beverages is minimal. Benzene can unintentionally occur, however, in carbonated drinks with contaminated CO₂.

**Workplace
exposure**

Because people who work with benzene have the highest exposure rates, a number of limits have been set for the workplace. The maximum concentration set by OSHA (Occupational Safety and Health Administration) in the US, for instance, is 1 ppm (8h/day, 40 h/week); this is in the same magnitude as

3.25/m³ pursuant to EU Directive 97/42/EC. However, there is no definition of "safe" exposure limits. In many countries, benzene-related conditions are recognised as an occupational disease (e.g. Germany; occupational illness no. 1303: illness caused by benzene, its homologues or styrene).

Number of workers, affected industries

In Europe and North America, legal regulations coupled with stricter industrial safety measures have significantly reduced the risks. It can be expected, therefore, that over the long term, benzene-related illnesses will decline. One must bear in mind, however, that there is still no absolute limit. The current limits are controversial and could change in the future. And, ultimately, some illnesses have not yet been detected due to their long latency period.

Due to the widespread industrial use of benzene, the number of exposed workers is difficult to estimate. Published findings vary greatly, some of which are outdated. In any case, the number of potentially exposed persons is assumed to be high. Examples from the US:

- National Occupational Exposure Survey (NOES), 1981-1983: 272,000 workers (<http://www.cdc.gov/noes/noes4/09070sco.html>)
- OSHA (1987): An estimated 238,000 workers in the most heavily exposed branches of industry (petrochemicals, refineries, coal/coke processing plants, tyre manufacturers, warehouses, trucking, transport)

US claims

Claims related to benzene are not new, and related lawsuits have been going on for many decades. In light of recent findings combined with improved scientific and medical knowledge, such as with regard to the link between AML and benzene, American law firms have been paying closer attention to these types of claims, as evidenced by benzene-related entries on many websites of American law firms. Some plaintiffs affected by benzene have been awarded damages in the millions.

Information for the underwriter

The biggest exposure in connection with benzene is chronic workplace inhalation and the related frequent occurrence of acknowledged occupational illnesses, in particular AML. The US is particularly affected due to the nature of its legal system. This is of special relevance for branches of industry with high exposure. In terms of technical evaluation, however, benzene exposure should be regarded separately. Due to its long-tail character, exposure dating back a number of years can be highly significant.

It is also advisable to continue to follow the developments. Ultimately, it remains to be seen whether further causal relationships will be revealed between exposure and illness.

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