Report

Urban Legend: Benzene Fumes from Car Dashboard

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1. Background
This article concerns the contents of the message repeated below which has been in circulation since around 2009. It was widely reported on the internet. The following are examples of places on the internet where the message (widely referred to as an urban legend) was reported:

http://urbanlegends.about.com/od/automobiles/a/benzene_in_car.htm
http://www.socon.ca/or_bust/?p=6672

1.1 The Urban Legend of Benzene Fumes in a closed Car
The e-mail message that was widely reported on during the course of 2009 and reported on the internet. It reads as follows:

“According to research, the dashboard of a car, sofa and air freshener emit Benzene, a cancer-causing toxin (carcinogen - take time to observe the smell of heated plastic in your car).

In addition to causing cancer, Benzene poisons your bones, causes anaemia and reduces white blood cells.

Prolonged exposure will cause Leukaemia, increasing the risk of cancer.

Can also cause miscarriage.

Acceptable Benzene level indoors is 50 mg per sq. ft. A car parked indoors with windows closed will contain 400-800 mg of Benzene.

If parked outdoors under the sun at a temperature above 60 degrees F, the Benzene level goes up to 2000-4000 mg, 40 times the acceptable level.

People who get into the car, keeping windows closed will inevitably inhale, in quick succession, excessive amounts of the toxin.

Benzene is a toxin that affects your kidney and liver. What's worse, it is extremely difficult for your body to expel this toxic stuff.

So friends, please open the windows and doors of your car and give time for the deadly interior air to clear out before you enter.

Thought:

"When someone shares something of value with you and you benefit from it, you have a moral obligation to share it with others."

2. Search For Information to Substantiate or Disprove the Benzene Fumes Message
A search was conducted on the internet to establish:

- whether the message in question appeared on the internet;
- whether there is any truth in the contents of the message;
- what benzene is;
- the uses of benzene;
**2.1 The Facts**
The message regarding the presence of benzene fumes in a car that was parked in the sun was widely reported on the internet. Evidence of the reporting of the message can be found at:

- [http://urbanlegends.about.com/od/automobiles/a/benzene_in_car.htm](http://urbanlegends.about.com/od/automobiles/a/benzene_in_car.htm)
- [http://www.socon.ca/or_bust/?p=6672](http://www.socon.ca/or_bust/?p=6672)

**2.2 The Presence of Benzene in the Material used to Manufacture Certain Car Dashboards**
The answer as to whether automobile dashboards, door panels, seats, and other interior components can emit benzene, as claimed in the e-mail message is “most likely true”. However, the air in our homes also generally contains levels of benzene higher than those in outdoor air. The benzene in indoor air comes from products that contain benzene such as glues, paints, furniture wax, and detergents. This means, in effect, that one can also breathe in benzene fumes in one’s own home.

In most cars dashboards and similar items are made from plastics, synthetic fabrics, and glues, some of which are manufactured using benzene. According to scientists, such items may "off-gas" trace amounts of benzene, especially under hot weather conditions. This then, creates the chances of benzene fumes building up inside a closed car which is parked in the sun.

As to car air fresheners, there is precious little information available about the ingredients, though one European study found that some household air fresheners emit measurable amounts of benzene. It is not inconceivable that some car air fresheners do, too.

The crucial question is *how much*. Might all of these potential emitters cumulatively give off enough benzene to harm your health? This questions will, for the time being, remain unanswered.

**3. Benzene**
Benzene is an organic chemical compound with the molecular formula C₆H₆. It is sometimes abbreviated Ph–H. Benzene is a colourless 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 petrol is now limited, but it is an important industrial solvent and precursor in the production of certain drugs, plastics, synthetic rubber, and dyes. Benzene is a natural constituent of crude oil, and may be synthesised from other compounds present in petroleum products.

Benzene is an aromatic hydrocarbon and the second \([n]-\)annulene ((6)-annulene), a cyclic hydrocarbon with a continuous \(\pi\) bond. It is also related to the functional group arene which is a generalised structure of benzene.

Many important chemicals are derived from benzene by replacing one or more of its hydrogen atoms with another functional group. Examples of simple benzene derivatives are phenol, toluene, and aniline, abbreviated PhOH, PhMe, and PhNH₂, respectively. Linking
benzene rings gives biphenyl, \( \text{C}_8\text{H}_{12} \). Further loss of hydrogen gives "fused" aromatic hydrocarbons, such as naphthalene and anthracene. The limit of the fusion process is the hydrogen-free material graphite.

In heterocycles, carbon atoms in the benzene ring are replaced with other elements. The most important derivatives are the rings containing nitrogen. Replacing one \( \text{CH} \) with \( \text{N} \) gives the compound pyridine, \( \text{C}_5\text{H}_5\text{N} \). Although benzene and pyridine are structurally related, benzene cannot be converted into pyridine.

Trace amounts of benzene may result whenever carbon-rich materials undergo incomplete combustion. It is produced in volcanoes and forest fires, and is also a component of cigarette smoke. Benzene is a principal component of combustion products produced by the burning of PVC (polyvinyl chloride).

4. Uses of Benzene

Today benzene is mainly used as an intermediate to make other chemicals. Its most widely-produced derivatives include styrene, which is used to make polymers and plastics, phenol for resins and adhesives (via cumene), and cyclohexane, which is used in the manufacture of nylon. Smaller amounts of benzene are used to make some types of rubbers, lubricants, dyes, detergents, certain drugs, explosives, napalm and some pesticides.

In both the United States of America and Europe, 50% of benzene is used in the production of ethylbenzene / styrene, 20% is used in the production of cumene, and about 15% of benzene is used in the production of cyclohexane (eventually to nylon).

In laboratory research, toluene is now often used as a substitute for benzene. The solvent properties of the two are similar but toluene is less toxic and has a wider liquid range.

Benzene has also been used as a basic research tool in a variety of experiments including analysis of a two-dimensional gas.

Major commodity chemicals and polymers derived from benzene:

As a petrol additive, benzene increases the octane rating and reduces knocking. Consequently, petrol often contained several percent benzene before the 1950s, when tetra-ethyl lead replaced it as the most widely-used antiknock additive. With the global phaseout of leaded petrol, benzene has made a comeback as a petrol additive in some countries.
5. Possible Sources of Benzene Exposure
If a person has worked in ANY of the following industries, he/she was most probably exposed to benzene:

- Detergent production
- Pesticides production
- Petrol production
- Solvent production
- Paint and varnish production
- Adhesives production
- Rubber processing
- Petroleum processing
- Waste management
- Laboratory technician
- Auto mechanic
- Degreasing operations
- Hauling and tank cleaning operations.

6. The Effects of Benzene on the Human Body
Benzene exposure has serious health effects. Outdoor air may contain low levels of benzene from tobacco smoke, wood smoke, automobile service stations, the transfer of petrol, exhaust from motor vehicles, and industrial emissions (ToxFAQs for Benzene, Agency for Toxic Substances and Disease Registry, Department of Health and Human Services, United States of America). Vapors from products that contain benzene, such as glues, paints, furniture wax, and detergents, can also be a source of exposure, although many of these have been modified or reformulated since the late 1970s to eliminate or reduce the benzene content. Air around hazardous waste sites or petrol stations may also contain higher levels of benzene.

The short term breathing of high levels of benzene can result in death, while low levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, and death.

The major effects of benzene are manifested via chronic (long-term) exposure through the blood. Benzene damages the bone marrow and can cause a decrease in red blood cells, leading to anaemia. It can also cause excessive bleeding and depress the immune system, increasing the chance of infection. Benzene causes leukemia and is associated with other blood cancers and pre-cancers of the blood.

Human exposure to benzene is a global health problem. Benzene targets liver, kidney, lung, heart and the brain and can cause DNA strand breaks, chromosomal damage, etc. Benzene causes cancer in both animals and humans.

1. Benzene was first reported to induce cancer in humans in the 1920s. The chemical industry claims it wasn't until 1979 that the cancer-inducing properties were determined "conclusively" in humans, despite many references to this fact in the medical literature. Industry exploited this "discrepancy" and tried to discredit animal studies which showed benzene caused cancer, saying that they weren't relevant to humans. Benzene has been shown to cause cancer in both sexes of multiple species of laboratory animals exposed via various routes (Huff, J. 2007. Benzene-induced cancers: abridged history and occupational health impact. Int J Occup Environ Health 13 (2): 213–21. Rana, S.V. & Verma, Y. 2005. Biochemical toxicity of benzene. J Environ Biol 26 (2): 157–68).
Some women who breathed high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries. It is not known whether benzene exposure affects the developing foetus in pregnant women or fertility in men.

Animal studies have shown low birth weight offspring, delayed bone formation, and bone marrow damage when pregnant animals breathed benzene.

Benzene has been connected to a rare form of kidney cancer in two separate studies, one involving tank truck drivers, and the other involving seamen on tanker vessels, both carrying benzene-laden chemicals.

Benzene works by causing cells not to work correctly. For example, it can cause bone marrow not to produce enough red blood cells, which can lead to anaemia. Also, it can damage the immune system by changing blood levels of antibodies and causing the loss of white blood cells.

The seriousness of poisoning caused by benzene depends on the amount, route, and length of time of exposure, as well as the age and pre-existing medical condition of the exposed person.

6.1 Immediate signs and symptoms of exposure to benzene:
People who breathe in high levels of benzene may develop the following signs and symptoms within minutes to several hours:
- Drowsiness
- Dizziness
- Rapid or irregular heartbeat
- Headaches
- Tremors
- Confusion
- Unconsciousness
- Death (at very high levels).

Eating foods or drinking beverages containing high levels of benzene can cause the following symptoms within minutes to several hours:
- Vomiting
- Irritation of the stomach
- Dizziness
- Sleepiness
- Convulsions
- Rapid or irregular heartbeat
- Death (at very high levels).

The US Department of Health and Human Services (DHHS) classifies benzene as a human carcinogen. Long-term exposure to excessive levels of benzene in the air causes leukaemia, a potentially fatal cancer of the blood-forming organs, in susceptible individuals. In particular, acute myeloid leukemia or acute non-lymphocytic leukaemia (AML & ANLL) is not disputed to be caused by benzene.

The United States Environmental Protection Agency has set the maximum permissible level of benzene in drinking water at 0.005 milligrams per liter (0.005 mg/L). The EPA requires that spills or accidental releases into the environment of 10 pounds (4.5 kg) or more of benzene be reported to the EPA.

The US Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit of 1 part of benzene per million parts of air (1 ppm) in the workplace during an
8-hour workday, 40-hour workweek. The short term exposure limit for airborne benzene is 5 ppm for 15 minutes.

Workers in various industries that make or use benzene may be at risk for being exposed to high levels of this carcinogenic chemical. Industries that involve the use of benzene include the rubber industry, oil refineries, chemical plants, shoe manufacturers, and petroleum-related industries.

Water and soil contamination are important pathways of concern for transmission of benzene contact. In the US alone there are approximately 100,000 different sites which have benzene soil or groundwater contamination. There is no information of similar possible pollution in South Africa.

In 2005, the water supply to the city of Harbin in China with a population of almost nine million people, was cut off because of a major benzene exposure. Benzene leaked into the Songhua River, which supplies drinking water to the city, after an explosion at a China National Petroleum Corporation (CNPC) factory in the city of Jilin on 13 November.

2. In March 2006, the official *Food Standards Agency* in Britain conducted a survey of 150 brands of soft drinks. It found that four contained benzene levels above World Health Organization limits. The affected batches were removed from sale (FDA. 2006. Too Much Benzene In Some Drinks", *CBS News*).

7. **What the Experts Say**

Based on animal and human evidence like the examples above, expert agencies have evaluated the carcinogenicity of benzene.

The National Toxicology Program (NTP) evaluates exposures that may be carcinogenic. Exposures that are thought to be carcinogenic are included in the Reports on Carcinogens, published every 2 years. Each exposure is assigned to one of two categories: "known to be human carcinogens," and "reasonably anticipated to be human carcinogens." The first category includes substances for which human studies (epidemiology studies and/or experimental studies) provide "sufficient evidence" of carcinogenicity in humans. The second category includes substances for which there is limited evidence of carcinogenicity in humans and/or sufficient evidence of carcinogenicity in experimental animals. Using this scheme, the National Toxicology Program classifies benzene a "known carcinogen."

The International Agency for Research on Cancer (IARC) also evaluates exposures that may be carcinogenic. IARC classifies exposures into 1 of 4 categories: Group 1 exposures are those "known to be carcinogenic to humans," usually based on "sufficient" human evidence, but sometimes based on "sufficient" evidence in experimental animals and "strong" human evidence. Group 2 exposures are divided into 2 categories. Group 2A ("probably carcinogenic to humans") has stronger evidence, and Group 2B ("possibly carcinogenic to humans") has weaker evidence. Group 3 exposures are not considered classifiable, because available evidence is limited or inadequate. Finally, Group 4 exposures are "probably not carcinogenic to humans," based on evidence suggesting lack of carcinogenicity in humans and in experimental animals. IARC rated benzene as "known to be carcinogenic to humans" (Group 1).

The Environmental Protection Agency (EPA), through its Integrated Risk Information System, uses a classification scheme very similar to that of IARC. It classifies exposures into 1 of 5 categories: (A) Known human carcinogen, (B) Probable human carcinogen, (C) Possible human carcinogen, (D) Not classifiable as to human carcinogenicity, and (E)
Evidence of non-carcinogenicity for humans. EPA classifies benzene as "a known carcinogen" (Group A).
(http://www.cancer.org/Cancer/CancerCauses/OtherCarcinogens/IntheWorkplace/benzene?sitearea=PED)

8. Comments
In a search of the literature I could not find any recorded cases where anyone had litigated against the manufacturer of any vehicle because of the emission of benzene fumes from the dashboard or any other structures within the vehicle. Litigation cases of so-called “benzene lawyers” in the United States of America was also checked in an effort to determine whether any cases had been dealt with – but to no avail. No reports of successful or failed court cases because of benzene fumes emanating from dashboards or any other (plastic) structures within vehicles could be found.

It is my personal opinion, however, that until specific scientific evidence to the contrary is presented, it would be prudent to take note of statements to the effect that some fumes may build up in a vehicle that was parked in the sun with closed windows. We must, however, not forget about our own safety and open doors and windows of a parked car and be hijacked or something similar!