Public Health England

Polycyclic aromatic hydrocarbons (Benzo[a]pyrene)

General Information

Key Points

Identity

- The term polycyclic aromatic hydrocarbons (PAHs) refers to a group of several hundred chemically-related environmentally persistent organic compounds of various structures and varied toxicity
- Benzo[a]pyrene (BaP) is commonly used as an indicator species for PAH contamination and most of the available data refer to this compound

Fire

- May react violently with oxidising agents
- Emits toxic and irritating fumes on decomposition
- In the event of fire involving PAHs, use fine water spray and liquid tight chemical protective equipment

Health

- Toxic by inhalation, ingestion or skin absorption
- Carcinogen, mutagen and reproductive toxin
- Long-term inhalation can cause a decrease in lung function, chest pain and irritation
- Long-term skin contact can cause dermatitis and warts
- BaP is thought to probably cause lung and skin cancer in humans

Environment

- Environmentally hazardous substance
- Inform Environment Agency of substantial release incidents

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Background

Polycyclic aromatic hydrocarbons (PAHs) are a diverse class of organic compounds. There are several hundred PAHs, which usually occur as complex mixtures rather than as individual compounds. The most well known PAH is benzo[a]pyrene (BaP), on which this report focuses. PAH are flammable, colourless solids or crystals at room temperature with no perceptible odour.

PAHs may be formed during natural processes such as incomplete combustion of organic materials such as coal and wood, or during forest fires. PAHs are released during industrial activities such as aluminium, iron and steel production in plants and foundries, waste incineration, mining or oil refining. PAHs have also been detected at low levels in cigarette smoke and motor vehicle emissions. They are persistent organic pollutants and are slow to degrade in the environment.

PAHs have been found to be present in very small amounts in some foods including meat, fruit, vegetables and cereals. Various cooking processes such as charbroiling, frying or grilling, as well as barbequing or smoking also increases the amount of PAHs in food.

Overall, the major route of exposure to PAHs in the general population is from breathing ambient and indoor air, eating food containing PAHs, smoking cigarettes, or breathing smoke from open fireplaces. Occupational exposure may also occur in workers breathing in exhaust fumes, such as mechanics, street vendors, motor vehicle drivers, as well as those involved in mining, metal working or oil refining.

If exposed to PAHs, the harmful effects that may occur largely depend on the way people are exposed. Various studies on workers that breathed in or touched PAHs for a long time have suggested that PAHs may cause lung or skin cancer. The International Agency for Research on Cancer (IARC) stated that some PAHs are carcinogenic to humans. Occupational exposure may also cause breathing problems, chest pain and irritation and coughing.

There have been no studies that looked at whether PAHs affect the unborn child or fertility in humans, but animal studies have shown that some PAHs affect reproduction and the development of offspring. Children exposed to PAHs will have the same symptoms as adults.

Frequently Asked Questions

What are PAHs?
PAHs are a group of chemicals that are produced during the incomplete combustion of organic substances such as coal, oil, gas and wood.

How do PAHs get into the environment?
The main way PAHs can enter the environment is due to the incomplete combustion of organic materials such as coal and wood, from forest fires and from vehicle exhausts.

How will I be exposed to PAHs?
The major sources of PAHs to the general public include inhalation of tobacco smoke, wood smoke and ambient air, and consumption of PAHs in food such as cereals, bread or processed food, as well as fruit and vegetables grown in contaminated soil. Charbroiling and grilling food at high temperatures also increases the amount of PAHs in the food. Other sources of PAHs include vehicle exhausts, asphalt roads and waste incineration.

Occupational exposure may occur in workers inhaling engine exhaust, such as mechanics, street vendors and drivers, as well as those working in industries such as mining, oil refining and metal working.

If there are PAHs in the environment will I have any adverse health effects?
The presence of PAHs in the environment does not always lead to exposure as you must come into contact with the chemical. You may be exposed by breathing, eating, or drinking the substance or by skin contact. Following exposure to any hazardous chemical, the adverse health effects you may encounter depend on several factors, including the amount to which you are exposed (dose), the duration of exposure, the way you are exposed and if you were exposed to any other chemicals.

Some PAHs, including BaP caused tumours in animals when they breathed, ate or had skin contact for long periods. Studies in humans have shown that breathing or skin contact for long periods may cause lung or skin cancer.

Can PAHs cause cancer?
Several PAHs, including BaP, have been classified by the International Agency for Research on Cancer (IARC) as being carcinogenic in humans.

Do PAHs affect children or damage the unborn child?
Animals fed high concentrations of BaP during pregnancy had future fertility problems, as did the offspring, which also showed some birth defects in some breeds of mice. There are few studies in humans so it is unclear whether these effects also occur in people.

What should I do if I am exposed to PAHs?
It is very unlikely that the general population will be exposed to a level of PAHs high enough to cause adverse health effects.