Polycyclic aromatic hydrocarbons (Benzo[a]pyrene)

General Information

Key Points

- the term polycyclic aromatic hydrocarbons (PAHs) refers to a group of several hundred chemicals
- PAHs typically exist as complex mixtures
- PAHs are formed from the incomplete combustion of material from living things
- they are released into the environment from both natural and man-made sources
- for the general public food is the major source of exposure, however levels in food are generally low
- tobacco smoke is the major source of exposure for smokers
- several PAHs, including BaP have been classified as causing cancer in humans
Public Health Questions

What are PAHs?
Polycyclic aromatic hydrocarbons (PAHs) are a large class of chemicals. There are several hundred PAHs, which usually occur as complex mixtures rather than as individual compounds. Different mixtures of PAHs may be formed depending on the process that forms them. The most well-known PAH is benzo[a]pyrene (BaP), the majority of the data on the health effects of PAHs comes from studies of this compound. PAHs are formed during the incomplete burning of organic materials such as coal, oil, tobacco and wood.

In the following document we will use the term “PAHs" to refer to complex mixtures of PAHs that may include BaP.

How do PAHs get into the environment?
PAHs may enter the environment from both human activities and natural processes that involve burning of organic material. Burning of coal, wood and other solid fuels can release PAHs into the environment. PAHs may also be present in vehicle emissions and cigarette smoke. Natural sources of PAHs include forest fires and volcanoes.

How might I be exposed to PAHs?
For the general public, food is the major source of exposure to PAHs. PAHs largely found in food which has been smoked or cooked using methods such as in charbroiling, grilling and frying. On reviewing a food survey the Food Standards Agency has determined that PAHs were typically found in low levels in food and that people do not need to change their eating habits. For further information on PAHs in food see: FSA - Polycyclic aromatic hydrocarbons in cereals, vegetables and smoked foods: https://www.food.gov.uk/science/research/surveillance/food-surveys/fsisbranch2012/polycyclic-hydrocarbons

Tobacco smoke is a major source of exposure to PAHs for smokers. In a smokers home the majority of PAHs in the air may be from cigarette smoke.

Indoor air sources of PAHs include cooking and heating with open fires. Exposure to PAHs from incense and candle burning can also occur, however exposure would be expected to be low and are therefore unlikely to pose a significant risk to health.

Exposure to low levels of PAHs may also occur through contaminated soil or drinking water.

People working with PAHs may be exposed through breathing them in or by skin contact.

If I am exposed to PAHs how might they affect my health?
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.

Any effects that may occur following exposure to PAHs largely depend on how exposure occurs. There are few reports on the health effects of single doses of PAHs, health effects are more likely following exposure over long periods of time.

Studies on workers inhaling PAHs for a number of years showed increased cases of lung damage, breathing problems, skin irritation, weakened immune systems and heart disease.

**Can PAHs cause cancer?**

Several PAHs, including BaP, have been classified by the International Agency for Research on Cancer (IARC) as causing cancer in humans. The ability of some to cause cancer is stronger than others.

In experimental animal studies some PAHs, including BaP caused tumours in animals when they breathed, ate or had skin contact for long periods. Many studies on workers that have been exposed to PAHs for a long time suggest that breathing in PAHs may cause lung cancer and skin contact with PAHs may cause skin cancer.

Exposure over short periods is unlikely to have the same level of cancer risk as exposure over many years.

**Do PAHs affect pregnancy or the unborn child?**

Studies of women who were exposed to very high levels of PAHs and specifically BaP throughout pregnancy showed effects on the growth of the unborn child and post-natal development of the child’s nervous system. Chronic exposure to high levels such as those seen in these studies would not be expected in the UK.

Some studies have also shown that PAHs and specifically BaP can affect the fertility of men and women when they were exposed to high levels.

**How might PAHs affect children?**

A small number of studies observing the development of children whose mothers were exposed to high levels of PAHs throughout pregnancy showed attention, intelligence and movement problems.

Chronic exposure to high levels such as those seen in these studies would not be expected in the UK.
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. However, if you have any health concerns regarding exposure to PAHs seek guidance from your GP or contact NHS 111.

Additional sources of information

HSE - Polycyclic Aromatic Hydrocarbons (PAH, Coal tars and pitches):

UKTIS Best Use of Medicines in Pregnancy (BUMPS): http://www.medicinesinpregnancy.org/