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BUILDING EVIDENCE FOR HEALTH

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POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)

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What are polycyclic aromatic hydrocarbons (PAHs)?
Polycyclic aromatic hydrocarbons (PAHs) are a class of chemicals that occur naturally in fossil fuels and are produced by the burning of fossil fuels and other organic matter like wood, garbage, tobacco, and meat. They are released into the environment from both natural (e.g. forest fires, volcanic activity) and anthropogenic (e.g. cooking, heating) sources. More than one hundred PAHs exist in the environment and often occur as complex mixtures.[1] Larger PAHs are persistent in the environment due to their chemically stable structure and are often found in the soil and sediment. PAHs are widely distributed in the atmosphere, and in 1915, were one of the first atmospheric pollutants designated as a suspected carcinogen.

How are we exposed to PAHs?
The major route of exposure to PAHs for most people is from breathing ambient outdoor and indoor air.[2] Indoor sources of PAHs include cigarette smoke, wood-burning fireplaces, and gas appliances. High temperature cooking and processing of foods, such as smoking, grilling and charring, are also major sources of PAH generation.[3,4] In urban and suburban areas of industrialized countries, outdoor sources of PAHs, like vehicle exhaust, have been found to be the main contributor to indoor PAH concentrations.[5] Other outdoor sources include agricultural production, residential waste burning, combustion of fossil fuels, leakage from the petroleum industry, manufacturing of carbon black coal, tar pitch and asphalt, heating and power generation, and emissions from internal combustion engines.[6,7] In addition to polluting the air, PAHs from these outdoor sources can be transported in the atmosphere over long distances before being deposited onto soils, vegetation or waters, contaminating food and water sources.[8,9] Occupational exposure to PAHs may occur from workers (such as mechanics, street vendors, or motor vehicle drivers) breathing exhaust fumes and those involved in mining, metal working, or oil refining.[9,10]

Several studies have documented high levels of PAHs in household dust[11-13] and indoor air.[14] Because PAHs can accumulate in carpets over years and decades, house-dust PAH concentrations may be long-term predictors of indoor PAH exposures.[15] Levels of PAHs in house dust may be particularly important for exposure of children, given their increase time spent close to the floor and frequent hand-mouth behaviors. One study estimated that inadvertent dust ingestion could be responsible for more than 50% of non-dietary total PAH exposure in young children.[16]

How do PAHs impact health?
The major health concern regarding PAHs is cancer. The US EPA has classified several PAH compounds as known and probable human carcinogens based on epidemiological and animal studies.[17,18] As far back as 1775, the British surgeon Sir Percival Pott hypothesized that scrotal cancer in chimney sweeps originates from occupational exposure to coal soot.19 Since then, occupational exposure to high levels of PAHs has been shown to increase the risk of developing many cancers including lung,[20,21] skin,[22] bladder,[23] and larynx cancers.[24]

Non-occupational PAH exposures via such sources as in-home,[25,26] residential proximity to traffic,[27,28] and household dust[29] have been linked to increased risk of other cancers including childhood leukemia, and non-Hodgkin lymphoma.[30] Risk of lung cancer among lifelong never smokers, (who account for ~10–15% of all lung cancer diagnoses in the USA,[31] has been correlated with urinary levels of PAH metabolites in a recent biomarker study.[32]

Other non-cancer outcomes associated with PAHs include immune system disturbance, endocrine disruption, and general toxicity. PAHs associated with ambient particulate matter have been linked to the development of cardiopulmonary and cardiovascular disease,[33,34] and to the exacerbation of asthma and allergic diseases and symptoms.[35-38] Hormonal and immune disruption from PAH has been linked with pregnancy complications, abnormalities of fetal development (e.g. low birthweight),[39] and impaired mental development in exposed children.[40-42] Acute exposure effects include skin and eye irritation, nausea, vomiting, diarrhea and confusion.[43]

What can I do?

- Stop smoking tobacco products. If you must smoke, do it outdoors, and away from others - especially children.
- Avoid smoke from wood and garbage fires.
- Avoid exposure to automobile exhaust and areas of high traffic congestion.
- Prepare foods by cooking slowly over low heat, rather than by charring or grilling.
- Decrease consumption of smoked and charbroiled foods.
- Wash your hands before eating.
- Remove shoes before entering the home to avoid bringing in contaminated soil and dust.
- Decrease use of personal care products that contain tar
- Avoid the use of mothballs; try cedar shavings or aromatic herbs instead.
- Wear protective clothing to avoid skin contact with soot or contaminate soil.
- Wear an appropriate respirator when working with products containing PAHs.

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