

ASPHALT PLANTS CONTAMINANTS OF CONCERN:

An overview of 7 toxic substances released from asphalt processing facilities and their known effects on human health

Asphalt plants are sources of air pollution that may emit significant levels of both particulate matter and gaseous volatile organic compounds (VOCs). These pollutants are considered to be dangerous to human health. Some VOCs are also suspected carcinogens or cancer-causing agents (*Fact Sheet: Information Regarding Asphalt Concrete Plants*, number 5, November 1996, Ohio EPA, Division of Air Pollution Control Small Business Assistance Program).

No two asphalts are chemically alike. The chemical makeup of asphalt depends on the chemical content of the original crude petroleum from which it is made. Other manufacturing methods which alter the chemical makeup of asphalt include asphalt cement additives, higher operating temperatures, and the use of recycled asphalt paving cause increases in toxic emissions (Letter to Dr. Ernest Fuller, Division of Air Quality, Raleigh Regional Office, from Louis Zeller, BREDL, re: Tar Heel Paving DRAFT permit #08977R00, March 12, 2001).

The following are examples of seven pollutants typically found at various levels in emissions from asphalt plants - hydrogen sulfide, benzene, chromium, formaldehyde, polycyclic aromatic hydrocarbons (PAHS), cadmium and arsenic – and the known effects of these substances on human health:

Hydrogen sulfide (H₂S). Hydrogen sulfide is a poisonous, colorless gas that is associated with the characteristic smell of rotten eggs. Exposure tends to be a problem in communities located near certain types of industrial sites that release hydrogen sulfide. People who live near an industrial facility that emits hydrogen sulfide may be exposed to higher levels of hydrogen sulfide. Exposure to hydrogen sulfide occurs from breathing contaminated air or drinking contaminated water. Hydrogen sulfide remains in the air for about 18 hrs. after which it changes into sulfur dioxide and sulfuric acid. Hydrogen sulfide may also be released as a liquid waste from an industrial facility. It is not known whether children are more sensitive to hydrogen sulfide than adults nor is it known if hydrogen sulfide causes birth defects (*ToxFAQs for Hydrogen Sulfide*, Agency for Toxic Substances and Disease Registry, July 2006, CAS #7783-06-04.)

Exposures to high concentrations of hydrogen sulfide may result in respiratory distress, pulmonary edema, nervous system depression, neurobehavioral effects, tissue hypoxia, cardiovascular effects, unconsciousness and death. Exposure to lower concentrations of hydrogen sulfide can result in less severe neurological and respiratory effects such as incoordination, loss of smell, nasal symptoms, sore throat, cough, and dyspnea. Some evidence suggests that people with asthma may be overly sensitive to hydrogen sulfide, and impaired function has been observed in people with asthma who were exposed to low levels of hydrogen sulfide.

One community exposure study found an increased prevalence of eye irritations in residents exposed to low levels of hydrogen sulfide. Numerous case reports suggest that high exposures to respiratory arrest and pulmonary edema can occur after a brief exposure to hydrogen sulfide. Although most people recover after exposure to hydrogen sulfide many individuals report permanent or persistent neurological effects including headache, poor concentration ability and attention span, impaired short memory and motor function (*Toxicological Profile for Hydrogen Sulfide*, US Department of Health and Human Services, Agency for Toxic Substances and Disease Registry, 2006).

Benzene. Benzene, also known as benzol, is a colorless liquid with a sweet odor. Benzene is a known carcinogen or cancer-causing agent. Benzene enters the body through the lungs, gastrointestinal tract, and across the skin. Brief exposure (5-10 minutes) to very high levels of benzene in air can result in death. Lower levels of exposure can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Continuous exposure to benzene can lead to anemia and excessive bleeding, and may be harmful to the immune system by increasing the chance for infection and perhaps lowering the body's defense against cancer.

Exposure to benzene has been associated with development of a particular type of leukemia called acute myeloid leukemia (AML). The Department of Health and Human Services, the International Agency for Cancer Research and the EPA has determined that benzene causes cancer.

Exposure to benzene may be harmful to human reproductive organs. Benzene can pass from the mother's blood to a fetus, but it is not known what effects exposure to benzene might have on the developing fetus in pregnant women or on fertility in men. However, studies with pregnant animals show that breathing benzene has harmful effects on the developing fetus. These effects include low birth weight, delayed bone formation, and bone marrow damage.

Children can be affected by benzene exposure in the same ways as adults, and is not known if children are more susceptible to benzene poisoning than adults (*Public Health Statement for Benzene, Draft for Public Comment*, Agency for Toxic Substances and Disease Registry, September 2005, CAS#: 71-43-2).

Chromium. Chromium is a naturally occurring element found in rocks, animals, plants, soil, and in volcanic dust and gases. Chromium cannot be tasted and has no odor. Chromium is present in the environment in several different forms. The most common forms are chromium(0), chromium(III), and chromium(VI), also known as hexavalent chromium.

Chromium(VI) and chromium(0) are usually produced by industrial processes. Breathing high levels of chromium(VI) can cause irritation to the nose, such as runny nose, nosebleeds, and ulcers and holes in the nasal septum. Chromium(VI) at high levels can damage the nose and can cause cancer. Ingesting large amounts of chromium(VI) can cause stomach upsets and ulcers, convulsions, kidney and liver damage, and even death. Skin contact with certain chromium(VI) compounds can cause skin ulcers. Some people are extremely sensitive to chromium(VI) or chromium(III). Allergic reactions consisting of severe redness and swelling of the skin have been noted (*ToxFAQs for Chromium*, Agency for Toxic Substances and Disease Registry, February 2001, CAS#: 7440-47-3).

Formaldehyde. Formaldehyde is a nearly colorless gas with a pungent, irritating odor even at very low concentrations (below 1 ppm). Formaldehyde is a potent sensitizer and a probable human carcinogen or cancer-causing agent. Formaldehyde is an eye, skin, and respiratory tract irritant; inhalation of vapors can produce narrowing of the bronchi and accumulation of fluid in the lungs.

Children may be more susceptible than adults to the respiratory effects of formaldehyde. Even fairly low concentrations of formaldehyde can produce rapid onset of nose and throat irritation, causing cough, chest pain, shortness of breath, and wheezing. Higher exposures can cause significant inflammation of the lower respiratory tract, resulting in swelling of the throat, inflammation of the windpipe and bronchi, narrowing of the bronchi, inflammation of the lungs, and accumulation of fluid in the lungs (*Medical Management Guidelines for Formaldehyde*, Agency for Toxic Substances and Disease Registry, CAS#: 50-00-0, updated 11/02/06).

Polycyclic aromatic hydrocarbons (PAHS). Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances and found in coal tar, crude oil, creosote, and roofing tar. The Department of Health and Human Services has determined that some PAHs may reasonably be expected to cause cancer. Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer.

Certain PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer) or had them applied to their skin (skin cancer). PAHs are found in air attached to dust particles, and can enter water through discharges can enter water from industrial and wastewater treatment plants where they can move through soil to contaminate groundwater. The PAH contents of plants and animals may be much higher than PAH contents of soil or water in which they live (*ToxFAQs for Polycyclic Aromatic Hydrocarbons (PAHs)*, Agency for Toxic Substances and Disease Registry, September 1996).

Cadmium. Cadmium is an element that occurs naturally in the earth's crust. Pure cadmium is a soft, silver-white metal that attaches to small particles in the air. People who live near hazardous waste sites or factories that release cadmium into the air have the potential for exposure to cadmium in air.

Breathing air with very high levels of cadmium can severely damage the lungs and may cause death. Breathing air with lower levels of cadmium over long periods of time (for years) may result kidney disease, lung damage and fragile bones. Data on human exposure to cadmium is limited, but studies show that rats that breathed in cadmium developed lung cancer, liver damage and changes in the immune system. Female rats and mice that breathed high levels of cadmium had fewer litters, babies with more birth defects than usual, reduced body weight, babies born with behavioral problems and learning disabilities.

As a conservative approach, and based on the limited human data and the studies in rats, the United States Department of Health and Human Services (DHHS) has determined that cadmium and cadmium compounds may reasonably be anticipated to be carcinogens. The International Agency for Research on Cancer (IARC) has determined that cadmium is carcinogenic to humans. The EPA has determined that cadmium is a probable human carcinogen by inhalation (*Public Health Statement for Cadmium*, Agency for Toxic Substances and Disease Registry, July, 1999, CAS # 1306-19-0).

Arsenic. Arsenic occurs naturally in soil and minerals and it therefore may enter the air, water, and land from wind-blown dust and may get into water from runoff and leaching. Arsenic released from power plants and other combustion processes is usually attached to very small dust particles. These dust particles settle to the ground or are washed out of the air by rain. Arsenic attached to dust may stay in the air for many days and travel long distances. Ultimately, most arsenic ends up in the soil or sediment. Children may also be exposed to arsenic by eating dirt, skin contact with soil or water that contains arsenic, or through inhalation. If you breathe air that contains arsenic dust, particles of arsenic-contaminated dust may settle onto the lining of the lungs.

Inorganic arsenic is usually found in the environment combined with other elements such as oxygen, chlorine, and sulfur. Arsenic combined with carbon and hydrogen is referred to as organic arsenic. Long-term oral exposure to inorganic arsenic can result in a pattern of skin changes called "corns" or "warts" on the palms, soles, and torso that may develop into skin cancer. Swallowing arsenic has also been reported to increase the risk of cancer in the liver, bladder, kidneys, prostate, and lungs. The Department of Health and Human Services (DHHS) has determined that inorganic arsenic is known to cause cancer. The International Agency for Research on Cancer (IARC) has determined that inorganic arsenic is carcinogenic to humans. The EPA also has classified inorganic arsenic as a known human carcinogen.

Breathing high levels of inorganic arsenic will result in a sore throat, irritated lungs and the potential to develop lung cancer. This has been seen mostly in workers exposed to arsenic at smelters, mines, and chemical factories, but also in residents living near smelters and chemical factories. People who live near waste sites with arsenic may have an increased risk of lung cancer as well. High doses of an organic arsenic compound may result in nerve injury, stomach irritation or other effects.

All health effects observed in adults are of potential concern in children. Children may be more susceptible to health effects from inorganic arsenic than adults, and there is evidence that suggests that long-term exposure to arsenic in children may result in lower IQ scores (*Public Health Statement for Arsenic, Draft for Public Comment*, Agency for Toxic Substances and Disease Registry, September 2005, CAS#: 7440-38-2).