

Petroleum Products and Products of Incomplete Combustion

WHAT ARE PETROLEUM PRODUCTS?

Petroleum products are derived from crude oil, and their by-products contribute to air pollution and global warming.¹ They are used as fuel for automobiles, airplanes, snow machines, ATVs, cooking stoves, generators, furnaces, and more.

HOW ARE WE EXPOSED?

Breathing vapors and exhaust of petroleum products is a major source of exposure. Petroleum products contribute to air pollution, a serious public health problem which kills about 70,000 Americans each year.²

Exposure to vapors can occur when filling fuel tanks for vehicles, stoves, or houses. Soil contaminated with petroleum products or fuel spills may also release toxic vapors. If a house or building is located over an area where there has been an oil spill, vapors can enter the building through cracks in the walls and floors, as well as places where pipes enter the building.³

People are exposed to exhaust from petroleum products via traffic, ATVs, snow machines, storing vehicles in a garage that is attached to a house, using stoves in enclosed spaces, and living near petroleum refineries or power plants.⁴

Drinking water contaminated by petroleum products is another source of exposure.⁵ When gasoline seeps into soil, it can contaminate groundwater used for drinking.

Most chemicals in gasoline and other petroleum products are removed during water treatment, but people who drink untreated water or water from private wells can be exposed.

Other possible sources of exposure to petroleum products include:

- Accidental ingestion of petroleum products:⁶ children may inadvertently swallow petroleum-based fuels when, for example, they are stored in a familiar container such as a soda bottle;
- Touching petroleum products, soil or water contaminated by petroleum products;
- Swimming in bodies of water contaminated by petroleum products;
- Using fuel oils to wash paint or grease from skin or equipment;
- Fixing gasoline or diesel engines;
- Cleaning up fuel spills without proper protective equipment;⁷
- Working in the oil and gas industry;
- Having served in the Persian Gulf War: many veterans have reported exposures to diesel fuel and oil fires;⁸
- Some people also inhale gasoline or diesel fumes in order to become intoxicated. This is known as "huffing" or "sniffing" and is done more frequently by children and adolescents than adults.^{9,10} According to a 2004 study, gasoline was the most commonly abused volatile substance in the United States.

SYMPTOMS & HEALTH OUTCOMES

The health effects of exposure to petroleum

products can vary based on the specific chemical and the level of exposure. Different petroleum products will result in an array of symptoms. Included here are the symptoms of exposure for a few of the most commonly used petroleum products.

Benzene

Benzene is a petrochemical, meaning it is a refined product of oil. It is present in the environment in water, soil and air. Some of the major sources of benzene are car exhaust, paint, and glues. Cigarette smoke also contains benzene from the burning of tobacco.¹¹ Exposure to benzene through food, water, and soil is not common, unless there is a local source of contamination. Approximately 95% of exposure to benzene is through inhalation.¹² Acute exposure can cause dizziness, rapid heart rate, tremors and unconsciousness.

Benzene is a known carcinogen. The most significant health risk to low level exposure to benzene is leukemia. However, research suggests that benzene can induce other diseases of the blood, such as anemia, and uncontrolled bleeding.¹³ Benzene may also cause reproductive effects such as irregular menstruation and birth defects. (*Please see the Benzene fact sheet for more details.*)

Gasoline

Gasoline is a complex mixture of volatile hydrocarbons derived by distillation from crude petroleum. More than 100 billion gallons of gasoline are consumed annually in the US. Gasoline combustion is an important contributor to ambient air pollution and global warming.¹⁴

- Severe ingestion can result in central nervous system toxicity, visceral involvement, and inflammation of the lungs which can lead to respiratory arrest.^{15,16}
- Less serious nervous system effects include dizziness and headaches, while more serious effects include coma and the inability to breathe.¹⁷

- Long-term occupational exposure to gasoline vapors is associated with kidney and nasal cancer.^{18,19} It can also result in damage to the nervous system.²⁰
- Chronic exposure to combustion products of gasoline is associated with an increased risk for cancer.^{21,22}

Diesel Exhaust

Diesel exhaust is produced by motor boats, heavy equipment, generators, trucks, buses, and trains.²³ These engines spew emissions that severely compromise air quality.

Inhaling diesel exhaust particles (DEPs) can induce inflammation of the respiratory tract,^{24,25} and increase the incidence of wheezing, bronchitis, and asthma hospitalization.²⁶

- Allergic and inflammatory response to DEPs may facilitate development of allergies to other irritants. Symptoms of existing asthma or allergic rhinitis (inflammation of the mucus membranes of the nose) may worsen with DEP exposure.
- Exposure to diesel exhaust also may cause throat irritation, headache, dizziness, nausea, tiredness, and coughing.²⁷
- DEP exposure can also lead to a decreased immune response to bacterial infection.²⁸
- Chronic inhalation of DEPs is associated with an increased incidence of heart and lung diseases.^{29,30}
- There is an increased incidence of lung cancer in those who have chronic or occupational exposure to diesel exhaust.^{31,32}
- Chronic exposure to diesel exhaust is also associated with premature death.

Kerosene

Kerosene is used as a fuel in cooking stoves and heaters. Exposure to kerosene fuel and exhaust is associated with several adverse health effects.

- Accidental ingestion of small amounts of kerosene may cause coughing, fever, vomiting, tachypnoea (rapid breathing),

constipation, restlessness, drowsiness, abdominal pain, and diarrhea.³³ Ingesting large amounts of kerosene may cause convulsions, coma, or even death.³⁴

- Skin contact with kerosene for short periods may cause itchy, red, sore, or peeling skin.^{35,36}
- Using kerosene to clean used gasoline engine oil off skin may facilitate the passage of carcinogens from the oil to the lungs.³⁷
- Cooking on gas stoves indoors is associated with an increase in asthma³⁸ and acute respiratory infections in children.³⁹

Polycyclic Aromatic Hydrocarbons

Polycyclic Aromatic Hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete combustion of oil, gas, coal, garbage, wood, tobacco, or charcoal broiled meat.⁴⁰ They are also found in asphalt, roofing tar, moth balls, creosote wood preservatives, incense, pesticides, explosives, plastics, skin creams for psoriasis, and anti-dandruff shampoos that contain coal tar.⁴¹

Engine lubricating oils are known to accumulate carcinogenic PAHs while the engine is running.⁴²

Health risks associated with exposure to PAHs include:

- Clogged arteries and heart disease: a high occupational exposure to PAHs is related to a high risk of mortality from heart disease.⁴³
- Carcinogenicity: PAH exposure from coal emissions increases the risk damage to DNA and lung cancer.⁴⁴ There is a strong link between childhood cancer and prenatal or early postnatal exposure to PAHs.^{45,46}
- PAHs are linked to breast cancer, laryngeal cancer, and leukemia.^{47,48,49}
- PAHs are toxic to the kidney and are associated with kidney cancer.⁵⁰

- Benzo[a]pyrene is a PAH and a reproductive toxicant.⁵¹ It is associated with decreased fetal growth^{52,53} and developmental delays.⁵⁴

Carbon Monoxide

Carbon monoxide, or CO, is an odorless, colorless gas which is found in combustion fumes from vehicles, stoves, wood, coal, lanterns, and heating systems.^{55,56} Inhaling CO can lead to sudden illness and death.

Common early signs and symptoms of carbon monoxide poisoning include headache, dizziness, fatigue, lethargy, weakness, drowsiness, nausea, vomiting,⁵⁷ chest pain, shortness of breath, anxiousness, impaired judgment, and increased blood pressure, heart rate, and respiratory rate.⁵⁸

Late signs of carbon monoxide poisoning are cherry-red skin, hypotension, poor capillary refill, unconsciousness, seizures, coma, and cardiac arrest.⁵⁹

Exposure to low levels of carbon monoxide over a long period of time can also lead to adverse health outcomes:

- Low birth weight is associated with chronic exposure to CO.^{60,61} Increased exposure to CO during the first trimester of pregnancy is associated with decreased birth weight.⁶² A recent study provided evidence that exposure to CO decreases fetal growth during all trimesters of pregnancy.⁶³
- Cardiovascular and hematological effects: CO has been shown to increase the formation of blood clots.⁶⁴ There is also evidence that links CO with an increased risk for a heart attacks, arrhythmias, and an increased risk of readmission to the hospital for heart problems after the first heart attack.^{65,66,67}
- Respiratory effects: Increased exposure to carbon monoxide is related to increased emergency room admissions for respiratory distress.⁶⁸ Exposure to carbon

monoxide from air pollution is associated with acute asthma exacerbations in children and adults.^{69,70}

FOLLOW UP ACTION

- Acute exposure to petroleum products or carbon monoxide is a medical emergency. If you think your patient may have been exposed to petroleum products or carbon monoxide, refer patient to a physician immediately.
- The Agency for Toxic Substances and

Disease Registry provides a more detailed explanation of the medical management of patients exposed to gasoline. Keeping yourself from being exposed to petroleum products while providing patient care is also important. This guide can be found at: www.atsdr.cdc.gov/MHMI/mmg72.html

- Chronic exposure can be addressed by treating the symptoms and informing patients about ways to limit future exposure to petroleum products and carbon monoxide (see "*Reducing Your*

REDUCING YOUR EXPOSURE

You can prevent or minimize exposure to petroleum products in the following ways:

- Ventilation is one of the most effective ways to improve indoor air quality.^{71,71} When possible, open doors, windows, and vents to reduce the level of indoor air pollutants. Cook in well-ventilated areas and clean the chimney so that carbon monoxide, benzene, PAHs, and other chemicals in smoke can escape.
- If possible, use gasoline containers specifically designed to store gasoline, which do not allow gasoline vapors to seep through the plastic, do not contain secondary vent holes, and contain spill-proof spouts. Avoid storing gasoline in plastic containers designed for other purposes, such as milk jugs or soda bottles.
- Dispense gasoline in well-ventilated areas, preferably outdoors. Avoid using around children.
- Store petroleum products out of the reach of children in childproof containers. Also, make sure that they are not stored in food or water containers that could be mistaken for something edible.
- Store and use petroleum products as far away from your drinking water as possible.
- Keep petroleum products tightly capped and store them in places where people do not spend much time, such as in a garage or shed. The ideal storage place is cool, dry, and well-ventilated.
- If you have a fuel storage tank, inspect it for leaks and corrosion.
- When trying to remove oil from hands, use non-toxic, water-based solvents instead of kerosene and benzene whenever possible.⁷²
- Wear gloves or use a barrier cream designed to protect skin from petroleum products when you are repairing vehicles.⁷³
- Wear protective clothing and equipment so that your skin is not exposed to gasoline. If your skin is exposed to gasoline, wash it thoroughly. Wash your hands carefully before eating, smoking, drinking, or using the toilet if you have been handling petroleum products. Wash clothing that has been contaminated with gasoline separate from other clothing.
- Install a carbon monoxide detector in your home and office.
- In houses that were built on fuel contaminated ground, seal the cracks in floors, foundation, and areas around pipes to decrease fuel vapors entering the house from outside.
- Do not let children pump gas into your vehicle. If they are small and stand at the same level as the gas pump, they will inhale more gasoline vapors.
- Avoid idling ATVs, snow machines, and other vehicles near homes and other places where people spend time.

Exposure" section below).

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