



PUBLIC HEALTH STATEMENT

TOTAL PETROLEUM HYDROCARBONS

Division of Toxicology

September 1999

This Public Health Statement is the summary chapter from the Toxicological Profile for Total Petroleum Hydrocarbons (TPH). It is one in a series of Public Health Statements about hazardous substances and their health effects. A shorter version, the ToxFAQs™, is also available. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present. For more information, call the ATSDR Information Center at 1-888-422-8737.

This public health statement tells you about total petroleum hydrocarbons (TPH) and the effects of exposure.

The Environmental Protection Agency (EPA) identifies the most serious hazardous waste sites in the nation. These sites make up the National Priorities List (NPL) and are the sites targeted for long-term federal cleanup activities. TPH, itself, has been reported at 34 of the 1,519 current or former NPL sites. Many NPL sites are contaminated with components of TPH, though no estimate has been made of the number of these sites. This information is important because exposure to these components may harm you and because these sites may be sources of exposure.

When a substance is released from a large area, such as an industrial plant, or from a container, such as a drum or bottle, it enters the environment. This release does not always lead to exposure. You are exposed to a substance only when you come in contact with it. You may be exposed by breathing, eating, or drinking the substance or by skin contact.

If you are exposed to TPH, many factors determine whether you'll be harmed. These factors include the dose (how much), the duration (how long), and how you come in contact with it. You must also consider the other chemicals you're exposed to and your age, sex, diet, family traits, lifestyle, and state of health.

1.1 WHAT ARE TOTAL PETROLEUM HYDROCARBONS (TPH)?

Total Petroleum Hydrocarbons (TPH) is a term used to describe a broad family of several hundred chemical compounds that originally come from crude oil. In this sense, TPH is really a mixture of chemicals. They are called hydrocarbons because almost all of them are made entirely from hydrogen and carbon. Crude oils can vary in how much of each chemical they contain, and so can the petroleum products that are made from crude oils. Most products that contain TPH will burn. Some are clear or light-colored liquids that evaporate easily, and others are thick, dark liquids or semi-solids that do not evaporate. Many of these products have characteristic gasoline, kerosene, or oily odors. Because modern society uses so many petroleum-based products (for example, gasoline, kerosene, fuel oil, mineral oil, and asphalt), contamination of the environment by them is potentially widespread. Contamination caused by petroleum products will contain a variety of these hydrocarbons. Because there are so many, it is not usually practical to measure each one individually. However, it is useful to measure the total amount of all hydrocarbons found together in a particular sample of soil, water, or air.

The amount of TPH found in a sample is useful as a general indicator of petroleum contamination at that

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site. However, this TPH measurement or number tells us little about how the particular petroleum hydrocarbons in the sample may affect people, animals, and plants. By dividing TPH into groups of petroleum hydrocarbons that act alike in the soil or water, scientists can better know what happens to them. These groups are called petroleum hydrocarbon fractions. Each fraction contains many individual compounds.

1.2 WHAT HAPPENS TO TPH WHEN IT ENTERS THE ENVIRONMENT?

TPH is released to the environment through accidents, as releases from industries, or as byproducts from commercial or private uses. When TPH is released directly to water through spills or leaks, certain TPH fractions will float in water and form thin surface films. Other heavier fractions will accumulate in the sediment at the bottom of the water, which may affect bottom-feeding fish and organisms. Some organisms found in the water (primarily bacteria and fungi) may break down some of the TPH fractions. TPH released to the soil may move through the soil to the groundwater. Individual compounds may then separate from the original mixture, depending on the chemical properties of the compound. Some of these compounds will evaporate into the air and others will dissolve into the groundwater and move away from the release area. Other compounds will attach to particles in the soil and may stay in the soil for a long period of time, while others will be broken down by organisms found in the soil.

1.3 HOW MIGHT I BE EXPOSED TO TPH?

Everyone is exposed to TPH from many sources, including gasoline fumes at the pump, spilled

crankcase oil on pavement, chemicals used at home or work, or certain pesticides that contain TPH components as solvents. A small amount of lighter TPH components are found in the general air you breathe. Many occupations involve extracting and refining crude oil, manufacturing petroleum and other hydrocarbon products, or using these products. If you work with petroleum products, you may be exposed to higher levels of TPH through skin contact or by breathing contaminated air. If TPH has leaked from underground storage tanks and entered the groundwater, you may drink water from a well contaminated with TPH. You may breathe in some of the TPH compounds evaporating from a spill or leak if you are in the area where an accidental release has occurred. Children may be exposed by playing in soil contaminated with TPH.

1.4 HOW CAN TPH ENTER AND LEAVE MY BODY?

TPH can enter and leave your body when you breathe it in air; swallow it in water, food, or soil; or touch it. Most components of TPH will enter your bloodstream rapidly when you breathe them as a vapor or mist or when you swallow them. Some TPH compounds are widely distributed by the blood throughout your body and quickly break down into less harmful chemicals. Others may break down into more harmful chemicals. Other TPH compounds are slowly distributed by the blood to other parts of the body and do not readily break down. When you touch TPH compounds, they are absorbed more slowly and to a lesser extent than when you breathe or swallow them. Most TPH compounds leave your body through urine or when you exhale air containing the compounds.

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1.5 HOW CAN TPH AFFECT MY BODY?

Health effects from exposure to TPH depend on many factors. These include the types of chemical compounds in the TPH, how long the exposure lasts, and the amount of the chemicals contacted. Very little is known about the toxicity of many TPH compounds. Until more information is available, information about health effects of TPH must be based on specific compounds or petroleum products that have been studied.

The compounds in different TPH fractions affect the body in different ways. Some of the TPH compounds, particularly the smaller compounds such as benzene, toluene, and xylene (which are present in gasoline), can affect the human central nervous system. If exposures are high enough, death can occur. Breathing toluene at concentrations greater than 100 parts per million (100 ppm) for more than several hours can cause fatigue, headache, nausea, and drowsiness. When exposure is stopped, the symptoms will go away. However, if someone is exposed for a long time, permanent damage to the central nervous system can occur. One TPH compound (n-hexane) can affect the central nervous system in a different way, causing a nerve disorder called "peripheral neuropathy" characterized by numbness in the feet and legs and, in severe cases, paralysis. This has occurred in workers exposed to 500–2,500 ppm of n-hexane in the air. Swallowing some petroleum products such as gasoline and kerosene causes irritation of the throat and stomach, central nervous system depression, difficulty breathing, and pneumonia from breathing liquid into the lungs. The compounds in some TPH fractions can also affect the blood, immune system, liver, spleen, kidneys, developing fetus, and lungs. Certain TPH

compounds can be irritating to the skin and eyes. Other TPH compounds, such as some mineral oils, are not very toxic and are used in foods.

To protect the public from the harmful effects of toxic chemicals and to find ways to treat people who have been harmed, scientists use many tests.

One way to see if a chemical will hurt people is to learn how the chemical is absorbed, used, and released by the body; for some chemicals, animal testing may be necessary. Animal testing may also be used to identify health effects such as cancer or birth defects. Without laboratory animals, scientists would lose a basic method to get information needed to make wise decisions to protect public health. Scientists have the responsibility to treat research animals with care and compassion. Laws today protect the welfare of research animals, and scientists must comply with strict animal care guidelines. Animal studies have shown effects on the lungs, central nervous system, liver, kidney, developing fetus, and reproductive system from exposure to TPH compounds, generally after breathing or swallowing the compounds.

One TPH compound (benzene) has been shown to cause cancer (leukemia) in people. The International Agency for Research on Cancer (IARC) has determined that benzene is carcinogenic to humans (Group 1 classification). Some other TPH compounds or petroleum products, such as benzo(a)pyrene and gasoline, are considered to be probably and possibly carcinogenic to humans (IARC Groups 2A and 2B, respectively) based on cancer studies in people and animals. Most of the other TPH compounds and products are considered not classifiable (Group 3) by IARC.

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1.6 IS THERE A MEDICAL TEST TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO TPH?

There is no medical test that shows if you have been exposed to TPH. However, there are methods to determine if you have been exposed to some TPH compounds, fractions, or petroleum products. For example, a breakdown product of n-hexane can be measured in the urine. Benzene can be measured in exhaled air and a metabolite of benzene, phenol, can be measured in urine to show exposure to gasoline or to the TPH fraction containing benzene.

Exposure to kerosene or gasoline can be determined by its smell on the breath or clothing. Methods also exist to determine if you have been exposed to other TPH compounds. For example, ethylbenzene can be measured in the blood, urine, breath, and some body tissues of exposed people. However, many of these tests may not be available in your doctor's office.

If you have TPH compounds in your body, they could be from exposure to many different products, and tests cannot determine exactly what you were exposed to. Tests are useful if you suspect that you were exposed to a particular product or waste that contains TPH. For information on tests for exposure to specific TPH compounds, see the ATSDR toxicological profiles for benzene, toluene, total TPHs, polycyclic aromatic hydrocarbons, and hexane.

1.7 WHAT RECOMMENDATIONS HAS THE FEDERAL GOVERNMENT MADE TO PROTECT HUMAN HEALTH?

The federal government develops regulations and guidelines to protect public health. Regulations can

be enforced by law. Federal agencies that develop regulations for toxic substances include the EPA, the NRC (Nuclear Regulatory Commission), the Occupational Safety and Health Administration (OSHA), and the Food and Drug Administration (FDA). Recommendations provide valuable guidelines to protect public health but cannot be enforced by law. Federal organizations that develop recommendations for toxic substances include the Agency for Toxic Substances and Disease Registry (ATSDR), Centers for Disease Control and Prevention (CDC), and the National Institute for Occupational Safety and Health (NIOSH).

Regulations and recommendations can be expressed in not-to-exceed levels in air, water, soil, or food that are usually based on levels that affect animals. Then they are adjusted to help protect people. Sometimes these not-to-exceed levels differ among federal organizations because of different exposure times (an 8-hour workday or a 24-hour day), the use of different animal studies, or other factors.

Recommendations and regulations are also periodically updated as more information becomes available. For the most current information, check with the federal agency or organization that provides it.

Although there are no federal regulations or guidelines for TPH in general, the government has developed regulations and guidelines for some of the TPH fractions and compounds. These are designed to protect the public from the possible harmful health effects of these chemicals. To protect workers, the Occupational Safety and Health Administration (OSHA) has set a legal limit of 500 parts of petroleum distillates per million parts of air (500 ppm) in the workplace.

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EPA regulates certain TPH fractions, products, or wastes containing TPH, as well as some individual TPH compounds. For example, there are regulations for TPH as oil; these regulations address oil pollution prevention and spill response, stormwater discharge, and underground injection control. EPA lists certain wastes containing TPH as hazardous. EPA also requires that the National Response Center be notified following a discharge or spill into the environment of 10 pounds or more of hazardous wastes containing benzene, a component in some TPH mixtures.

Nearly all states have cleanup standards for TPH or components of TPH (common cleanup standards are for gasoline, diesel fuel, and waste oil). Analytical methods are specified, many of which are considered to be TPH methods.

1.8 WHERE CAN I GET MORE INFORMATION?

If you have any more questions or concerns, please contact your community or state health or environmental quality department or:

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road NE, Mailstop F-32
Atlanta, GA 30333

Information line and technical assistance:

Phone: 888-422-8737
FAX: (770)-488-4178

ATSDR can also tell you the location of occupational and environmental health clinics.

These clinics specialize in recognizing, evaluating, and treating illnesses resulting from exposure to hazardous substances.

To order toxicological profiles, contact:

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Phone: 800-553-6847 or 703-605-6000

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for total petroleum hydrocarbons (TPH). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

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