1. PUBLIC HEALTH STATEMENT

This Statement was prepared to give you information about fuel oils and to emphasize the human health effects that may result from exposure to them. The Environmental Protection Agency (EPA) has identified 1,397 sites on its National Priorities List (NPL). Fuel oils have been found in 2% (26 out of the 1,397) of the NPL sites. However, we do not know how many of the 1,397 NPL sites have been evaluated for fuel oils. As EPA evaluates more sites, the number of sites at which fuel oils are found may change. This information is important for you to know because fuel oils may cause harmful health effects and because these sites are potential or actual sources of human exposure to fuel oils.

When a chemical 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 as a chemical emission. This emission, which is also called a release, does not always lead to exposure. You can be exposed to a chemical only when you come into contact with the chemical. You may be exposed to it in the environment by breathing, eating, or drinking substances containing the chemical or from skin contact with it.

If you are exposed to hazardous chemicals such as fuel oils, several factors will determine whether harmful health effects will occur and what the type and severity of those health effects will be. These factors include the dose (how much), the duration (how long), the route or pathway by which you are exposed (breathing, eating, drinking, or skin contact), the other chemicals to which you are exposed, and your individual characteristics such as age, sex, nutritional status, family traits, lifestyle, and state of health.

1.1 WHAT ARE FUEL OILS?

Fuel oils are petroleum products that are used in many types of engines, lamps, heaters, furnaces, stoves, and as solvents. Fuel oils come from crude petroleum and are refined to

meet specifications for each use. Fuel oils are mixtures of aliphatic (open chain and cyclic compounds that are similar to open chain compounds) and aromatic (benzene and compounds similar to benzene) petroleum hydrocarbons. In addition, they may contain small amounts of nitrogen, sulfur, and other elements as additives. The exact chemical composition (i.e., precise percentage of each constituent) of each of the fuel oils discussed in this profile may vary somewhat, depending on the source and other factors. Fuel oils are distinguished from each other primarily by their boiling point ranges, chemical additives, and uses. In this profile, six fuel oils are discussed. The fuel oils of interest and common synonyms follow:

- fuel oil no. 1 (the most widely used fuel oil)
    - kerosene
    - straight-run kerosene
    - kerosene
    - range oil
    - Deobase (the trade name of a clear, white, deodorized kerosene)
    - coal oil
    - JP-5 (jet fuel)
- fuel oil no. 1-D
    - diesel fuel
    - diesel fuel oil no. 1
- fuel oil no. 2
    - home heating oil
    - gas oil
    - no. 2 burner oil
- fuel oil no. 2-D
    - diesel fuel oil no. 2
    - diesel fuel no. 2
    - diesel oil no. 2
    - no. 2 diesel

- fuel oil no. 4
    - diesel fuel oil no. 4
    - heavy residual fuel oil
    - marine diesel fuel
    - residual fuel oil no. 4
- fuel oil UNSP (which is not referred to by any synonyms)

In this profile, a fuel oil is referred to by the name used in the cited study. That is, if one study identifies a fuel oil as fuel oil no. 1, and another study identifies the same fuel oil as kerosene, the names “fuel oil no. 1” and “kerosene” will be used, respectively. All fuel oils are liquids at room temperature, although they can evaporate. The rates at which the various fuel oils will evaporate is dependent on the temperature and the composition of the individual fuel oil. Most fuel oils are yellowish to light brown in color. They generally have a kerosene-like odor, are flammable, and burn at temperatures between 177°C and 329°C.

In this profile, fuel oils are discussed together because of the similarities in their chemical and physical properties. More information on the chemical and physical properties of fuel oils is provided in Chapter 3. More information on the production and use of fuel oils is found in Chapter 4.

1.2 WHAT HAPPENS TO FUEL OILS WHEN THEY ENTER THE ENVIRONMENT?

Fuel oils are composed of a large number of different chemicals, and each fuel oil is a slightly different mixture of these chemicals. Some of these chemicals evaporate into the air when fuel oils are spilled onto soils or surface waters (e.g., streams, rivers, lakes, or oceans) or are stored in open containers. Other chemicals in the fuel oils dissolve in water following spills to surface waters or leaks from underground storage tanks. Some of the chemical constituents of fuel oils may slowly move down through the soil to the groundwater. Another group of chemicals in fuel oils can attach to particles in the soil or water and, in water, may sink down into the sediment. The chemicals that evaporate may break down in air by

reacting with sunlight, *e.g.*, photooxidation, or other chemicals in the air. The chemicals that dissolve in water may also be broken down by organisms (primarily bacteria and fungi) in the soil or water. However, this may take up to a year to occur, if ever, depending on the environmental conditions. Chemicals that attach to soil or other matter (e.g., marsh sediment) may remain in the environment for more than a decade. Benzene, toluene, and xylenes (single-ring aromatic compounds), as well as polycyclic aromatic compounds, are the fuel oil components about which we have the greatest amount of information. You can find this information in the ATSDR toxicological profiles for these specific chemicals. See Chapter 5 for more information on what happens to fuel oils when they enter the environment.

1.3 HOW MIGHT I BE EXPOSED TO FUEL OILS?

The most likely way for you to be exposed to fuel oils in the home is if you use a kerosene heater. If you handle fuel oils or use a fuel oil to clean equipment at your job, or if fuel oils are stored at your workplace, you may also be exposed to them through contact with the skin or in the air. Some workers may be exposed to fuel oils through their skin if they come into contact with them without adequate protection, such as gloves, boots, coveralls, or other protective clothing. There are no data on background levels of fuel oils that may be found in the environment or workplace.

You may also be exposed to fuel oils if you swim in waters where fuel oils have been spilled. If fuel oils have leaked from underground storage tanks and entered underground water, you may drink contaminated water from a well containing fuel oils. The vapor (the gas phase) of fuel oils can also move through the soil and enter basements of homes or buildings near areas where leaks have occurred. Children may also be exposed by playing in soil contaminated with fuel oils. A major pathway of exposure is washing one’s hands with fuel oils to remove paint, grease, etc. For more information on how you might be exposed to fuel oils, see Chapter 5.

1.4 HOW CAN FUEL OILS ENTER AND LEAVE MY BODY?

Fuel oils can enter and leave your body when you breathe them in the air, when you drink water or eat food containing them, and when your skin comes into contact with them. This can occur in the workplace or if you live near an area where fuel oils have been dumped or spilled. We do not know how much of a fuel oil might be taken up by your body if you inhale fuel oil vapor, drink contaminated water, or come in contact with fuel oils. We have no information on what happens to fuel oils once they enter your body. Kerosene has been found in small amounts in the brain, lung, liver, spleen, and kidney of exposed animals. We do not know if fuel oils are broken down and leave the body in the urine or the feces. For more information on how fuel oils can enter and leave your body, see Chapter 2.

1.5 HOW CAN FUEL OILS AFFECT MY HEALTH?

We know very little of the human health effects caused by fuel oils. Daily use of a kerosene stove for cooking should not cause any breathing problems for most people. People who use kerosene stoves to cook do not have more colds than people who have other types of stoves. Breathing moderate amounts of deodorized kerosene (fuel oil no. 1) has been shown to slightly affect the ability to smell and to cause a taste sensation. Numerous case-studies have reported accidental poisoning in children as the result of drinking kerosene. These accidents are probably much more frequent in areas where kerosene is commonly used for cooking and heating. Drinking kerosene may cause vomiting, diarrhea, swelling of the stomach, stomach cramps, coughing, drowsiness, restlessness, irritability, and unconsciousness; also, it may be difficult to breathe, and breathing may be painful. Coughing, pneumonia, and difficult or painful breathing after drinking kerosene suggest that kerosene has entered the lungs. In addition, drinking large amounts of kerosene can put you into a coma, cause convulsions, and may even cause death. When kerosene gets on your skin for short periods, it can make your skin itchy, red, and sore; sometimes blisters may occur and your skin may peel.

Breathing fuel oil no. 1 vapor for periods as short as 1 hour may make you feel nauseous, increase your blood pressure, be irritating to your eyes, or make your eyes bloodshot. Breathing kerosene or JP-5 vapors can also affect your nervous system. Some of the effects that have been noted in case studies include headache, light-headedness, anorexia (loss of appetite), poor coordination, and difficulty concentrating. Breathing diesel fuel vapors for a long time may damage your kidneys, increase your blood pressure, or lower your blood's ability to clot. Constant skin contact (for example, washing) with diesel fuel may also damage your kidneys.

It appears that repeated contact with fuel oils can cause skin cancer in mice and may cause liver cancer in mice. However, there is some conflicting information. Further, the fuel oils were tested only on mice. We do not know if fuel oils can cause cancer in humans. The International Agency for Research on Cancer (IARC) has determined that residual (heavy) fuel oils and marine diesel fuel are possibly carcinogenic to humans (Group 2B classification). In addition, IARC considers that there is not enough information (Group 3 classification) available to determine if distillate (light) fuel oils or distillate (light) diesel fuels cause cancer. They have also determined that occupational exposures to fuel oils during petroleum refining are probably carcinogenic to humans (Group 2A classification). We do not know if fuel oils can cause birth defects or if they affect reproduction. See Chapter 2 for more information on the health effects of fuel oils.

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

There is no medical test that shows if you have been exposed to fuel oils. There are methods to determine if your blood contains some fuel oil components such as benzene, toluene, and xylenes; however, the concentrations of these compounds in distilled fuels are so low that if they were detected in your blood, it might not indicate specific or exclusive exposure to fuel oils. For information on tests for measuring exposure to some individual components of fuel oils, see the ATSDR toxicological profiles on benzene, toluene, total xylenes, and polycyclic

aromatic hydrocarbons. See Chapters 2 and 6 for information on symptoms that suggest exposure to fuel oils.

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

The government has developed regulations and guidelines for fuel oils and some of the chemicals in them. These are designed to protect the public from the possible harmful health effects of these chemicals. The Department of Transportation also regulates the transportation of fuel oils, because they are classified as hazardous materials that are considered to pose a risk to health, safety, or property when transported.

The Occupational Safety and Health Administration (OSHA) and the Air Force Office of Safety and Health (AFOSH) regulate levels of petroleum products in the private sector and Air Force workplaces, respectively. The maximum allowable amount of petroleum products in the workroom air during an &hour workday, 40-hour workweek, is 400 parts of petroleum distillates (naphtha) per million parts of air, or more simply stated, 400 ppm.

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, E-29
Atlanta, Georgia 30333

This agency can also provide you with information on the location of the nearest occupational and environmental health clinic. These clinics specialize in the recognition, evaluation, and treatment of illnesses resulting from exposure to hazardous substances.