1. PUBLIC HEALTH STATEMENT FOR JP-5, JP-8, and JET A FUELS

This Public Health Statement summarizes the Division of Toxicology and Human Health Science's findings on JP-5, JP-8, and Jet A fuels, tells you about them, the effects of exposure, and describes what you can do to limit that exposure.

The U.S. 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 sites targeted for long-term federal clean-up activities. U.S. EPA has found JP-5 and JP-8 in at least 23 of the 1,699 current or former NPL sites; however, it is unknown how many of the 1,699 current or former NPL sites have been evaluated for the presence of JP-5, JP-8, or Jet A fuels. As more sites are evaluated, the sites at which JP-5, JP-8, or Jet A fuels are found may increase. This information is important because these future sites may be sources of exposure, and exposure to JP-5, JP-8, and Jet A fuels may be harmful.

If you are exposed to JP-5, JP-8, or Jet A fuels, many factors determine whether you'll be harmed. These include how much you are exposed to (dose), how long you are exposed to it (duration), and how you are exposed (route of exposure). You must also consider the other chemicals you are exposed to and your age, sex, diet, family traits, lifestyle, and state of health.

WHAT ARE JP-5, JP-8, AND JET A FUELS?

JP-5 and JP-8 stand for jet propellant-5 and jet propellant-8. Propellants are substances that move other objects or give thrust. JP-5 and JP-8 are used as military aircraft fuels. They can also be used for fueling land vehicles and as a fuel source for heaters and lights. Jet A is the type of fuel used in civilian aircraft; however, the U.S. Air Force has recently started using Jet A (plus certain additives) for flying in the continental United States. JP-5, JP-8, and Jet A fuels are colorless liquids that are flammable and smell like kerosene. The fuels are made from chemical compounds called hydrocarbons, which are found naturally in the earth as crude oil. Hydrocarbons are compounds that contain only carbon and hydrogen. The crude oil is refined into a number of different types of fuel. Jet A, JP-5, and JP-8 fuels may also contain various additives such as antioxidants and additives to prevent icing in the fuel lines. More information on the chemical and physical properties of these fuels is found in Chapter 4. More information on the production and use of these fuels is found in Chapter 5.

WHAT HAPPENS TO JP-5, JP-8, AND JET A FUELS WHEN THEY ENTER THE ENVIRONMENT?

JP-5, JP-8, and Jet A fuels are made up of hundreds of hydrocarbon compounds; many of these hydrocarbons are also present in gasoline. These hydrocarbons can be grouped into several classes of chemicals which have similar chemical properties. The different chemical classes can behave differently when they enter the environment. For example, some of these can easily evaporate into the air during aircraft loading and unloading operations or as a result of their normal use as a jet fuel for civilian or military aircraft. Some may also evaporate when jet fuels are spilled accidentally onto soils or surface waters. Other chemical classes are more likely to dissolve in water following spills to surface waters or leaks from underground storage tanks. Some chemical classes found in jet fuels may slowly move down through the soil to the groundwater, while others may readily attach to particles in the soil or water. Once attached in water, these particles may sink down into the sediment.

The chemicals that evaporate may break down into other substances in air by reacting with sunlight or other chemicals in the air. The chemicals that dissolve in water may also be broken down into other substances by microorganisms found water and sediment. However, this may take many years to occur, depending on the environmental conditions. Some chemicals that attach to soil or other matter (for example, marsh sediment) may remain in the environment for more than a decade. Some of the chemicals in jet fuels may be detected in fish and aquatic organisms after an accidental release into a lake, river, or stream. These hydrocarbons are not expected to persist in aquatic organisms. For more information on what happens to JP-5, JP-8, and Jet A fuels when they enter the environment, see Chapter 6.

HOW MIGHT I BE EXPOSED TO JP-5, JP-8, AND JET A FUELS?

It is unlikely that you will be exposed to JP-5, JP-8, or Jet A fuels unless you work with jet fuels or live very close to where they are used or were spilled. Exposure to jet fuels can occur if you have skin contact with soil or water contaminated from a spill or leak. You may also be exposed to JP-5, JP-8, or Jet A fuels if you swim in waters where jet fuels have been spilled. If jet fuels have leaked from underground storage tanks and entered groundwater, you may be exposed from contaminated well water. You might breathe in some of the chemicals evaporating from a spill or leak site if you are in an area where an accident has occurred.

Workers involved in making or transporting jet fuels, aircraft or fuel tank maintenance, or in refueling aircraft that use JP-5, JP-8, or Jet A fuels may be exposed to some of the chemicals that have evaporated from the fuel. Workers in the vicinity of an aircraft during cold engine startup may also be exposed to airborne jet fuels. Some workers may be exposed to JP-5, JP-8, or Jet A fuels through their skin if they come into contact with them without adequate protection from gloves, boots, coveralls, or other protective clothing. For more information on how you might be exposed to JP-5, JP-8, or Jet A fuels, see Chapter 6.

HOW CAN JP-5, JP-8, AND JET A FUELS ENTER AND LEAVE MY BODY?

The chemicals in JP-5, JP-8, and Jet A fuels can enter your body through your lungs, digestive tract, or skin. We do not have information on how much of the chemicals in JP-5, JP-8, or Jet A fuels can enter your body, but we do know that large amounts of some of the chemicals in jet fuels can easily enter the body. Studies examining the absorption of jet fuels through the skin have shown that damage to the skin and the longer jet fuels stays on your skin will increase the amount chemicals that will enter your body. Once jet fuels enter your body, the chemicals in the fuel will be distributed throughout your body. A number of the chemicals in jet fuels were found in the blood, fat, brain, lungs, and liver following exposure to JP-8 in air. Some of the chemicals in JP-5, JP-8, or Jet A fuels will be broken down in the body to form other chemicals. The chemicals in JP-5, JP-8, or Jet A fuels will be eliminated from the body in the urine, feces, or breath.

HOW JP-5, JP-8, AND JET A FUELS CAN AFFECT YOUR HEALTH?

The health effects of JP-5, JP-8, and Jet A fuels depend on how much of these fuels you are exposed to and for how long. We know very little about the human health effects caused by JP-5, JP-8, or Jet A fuels. A few studies of military personnel have provided suggestive evidence that JP-8 can affect the nervous system. Some of the effects that have been observed in humans include changes in reaction time and other tests of neurological function. A number of effects have been reported in humans who accidentally ingested kerosene, a fuel oil similar in composition to JP-5, JP-8, and Jet A fuels, suffered harmful effects on the respiratory tract, gastrointestinal tract, and nervous system. The observed effects included cough and difficulty breathing, abdominal pain and vomiting, drowsiness, restlessness, and convulsions.

Studies in laboratory animals have examined the toxicity of JP-5, JP-8, and Jet A fuels following inhalation, ingestion, or dermal contact. In most cases, the levels tested in laboratory animals are higher than levels the public might encounter through contact or through water or soil. Health effects of JP-5,

JP-8, or Jet A fuels observed in these studies include damage to the liver, decreased immune response, impaired performance on neurological function tests, and impaired hearing. Dermatitis and damage to the skin have also been observed in laboratory animals following dermal contact.

There are no reliable studies of cancer in humans exposed to JP-5, JP-8, or Jet A fuels. A few studies that examined the possible association between exposure to various types of jet fuels or to kerosene and various types of cancer did not provide conclusive results. Because the studies involved exposure to several fuel types and there was no information on exposure concentrations, these studies were not considered adequate to assess the carcinogenicity of JP-5, JP-8, or Jet A fuels.

No inhalation or oral studies evaluated the carcinogenicity of JP-5, JP-8, or Jet A. No increases in tumor incidences were observed in rats administered kerosene by a feeding tube for 2 years. JP-5 applied to the skin for 2 years was not carcinogenic in mice. Increases in skin tumors were observed in mice dermally exposed to Jet A for 52–62 weeks; however, tumors were only observed at concentrations resulting in damage to the skin. Similarly, increased numbers of skin tumors were observed in mice that received applications of undiluted kerosene on the skin for 2 years, but this occurred only in the presence of skin damage.

The U.S. Department of Health and Human Services (DHHS) and the EPA have not classified JP-5, JP-8, or Jet A fuels as to their carcinogenicity. The International Agency for Research on Cancer (IARC) has classified JP-5, JP-8, and Jet A as Group 3 carcinogens (not classifiable as to their carcinogenicity to humans).

See Chapters 2 and 3 for more information on health effects of JP-5, JP-8, and Jet A fuels.

HOW CAN JP-5, JP-8, AND JET A FUELS AFFECT CHILDREN?

Exposure JP-5, JP-8, or Jet A fuels mainly occurs in occupational settings where children are unlikely to be exposed. No studies examining the health effects of JP-5, JP-8, or Jet A fuels in children were found. There are a number of reports of accidental kerosene ingestion in children in developing countries where kerosene is usually stored in containers and places easily accessible to children. Some of the more commonly reported effects include coughing, pneumonia, shortness of breath, vomiting, fever, unconsciousness, drowsiness, and irritability. These effects are similar to the effects seen in adults who ingest kerosene.

Studies in laboratory animals exposed to JP-8 during pregnancy did not find birth defects in the newborn animals. However, some effects on muscle coordination and immune function were found in the offspring.

HOW CAN FAMILIES REDUCE THE RISK OF EXPOSURE TO JP-5, JP-8, AND JET A FUELS?

If your doctor finds that you have been exposed to significant amounts of JP-5, JP-8, or Jet A fuels, ask whether your children or unborn baby might be at risk. Your doctor might need to ask your state health department to investigate. It is unlikely that you or your family will be exposed to JP-5, JP-8, or Jet A fuels. Jet fuels are not likely to be common contaminants in foods or drinking water. If you get JP-5, JP-8, or Jet A fuels on your work clothes, you should change your clothes before leaving your job and returning home.

ARE THERE MEDICAL TESTS TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO JP-5, JP-8, AND JET A FUELS?

Many of the individual chemicals found in JP-5, JP-8, and Jet A fuels and their breakdown products (metabolites) can be measured in blood and urine. Finding these chemicals does not mean that you were exposed to jet fuels because these chemicals may have come from a different source including exposure to gasoline fumes when pumping gas. The levels of these chemicals in your body cannot predict the kind of health effects that might occur or whether you will have any effects. JP-5, JP-8, and Jet A fuels and their metabolites leave the body fairly rapidly and tests to detect these chemicals need to be conducted within days of exposure.

For more information on the different substances formed by JP-5, JP-8, and Jet A fuels breakdown and on tests to detect these substances in the body, see Chapters 3 and 7.

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

The federal government develops regulations and recommendations to protect public health. Regulations can be enforced by law. Federal agencies that develop regulations for toxic substances include the Environmental Protection Agency (EPA), 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) and the National Institute for Occupational Safety and Health (NIOSH).

Regulations and recommendations can be expressed as "not-to-exceed" levels; that is, levels of a toxic substance in air, water, soil, or food that do not exceed a critical value usually based on levels that affect animals; levels are then adjusted to help protect humans. Sometimes these not-to-exceed levels differ among federal organizations. Different organizations use different exposure times (an 8-hour workday or a 24-hour day), different animal studies, or emphasize some factors over others, depending on their mission.

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

OSHA has not set a legal limit for jet fuels in workroom air. NIOSH has set a recommended limit of 100 mg/m^3 for kerosene in air averaged over a 10-hour work day. The EPA does not have recommended drinking water guidelines for jet fuels.

WHERE CAN I GET MORE INFORMATION?

If you have any questions or concerns, please contact your community or state health or environmental quality department, or contact ATSDR at the address and phone number below. ATSDR can also provide publically available information regarding medical specialists with expertise and experience recognizing, evaluating, treating, and managing patients exposed to hazardous substances.

- Call the toll-free information and technical assistance number at 1-800-CDCINFO (1-800-232-4636) or

- Write to:
  Agency for Toxic Substances and Disease Registry
  Division of Toxicology and Human Health Sciences
  1600 Clifton Road NE
  Mailstop F-57
  Atlanta, GA 30329-4027

Toxicological profiles and other information are available on ATSDR's web site: http://www.atsdr.cdc.gov.