This Public Health Statement is the summary chapter from the Toxicological Profile for DDT, DDE, and DDD. 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, you may call the ATSDR Information Center at 1-888-422-8737.

This Statement was prepared to give you information about DDT, DDE, and DDD and to emphasize the human health effects that may result from exposure to them. The Environmental Protection Agency (EPA) has identified 1,350 hazardous waste sites as the most serious in the nation. These sites comprise the "National Priorities List" (NPL): those sites which are targeted for long-term federal cleanup activities. DDT, DDE, and DDD have been found in at least 316 of the sites on the NPL. However, the number of NPL sites evaluated for DDT, DDE, and DDD is not known. As EPA evaluates more sites, the number of sites at which DDT, DDE, and DDD are found may increase. This information is important because exposure to DDT, DDE, and DDD may cause harmful health effects and because these sites are potential or actual sources of human exposure to DDT, DDE, and DDD.

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 can be exposed to a substance only when you come in contact with it. You can be exposed by breathing, eating, drinking, or through skin contact with substances containing DDT, DDE, and DDD.

If you are exposed to a substance such as DDT, DDE, and DDD, many 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, gender, nutritional status, family traits, life-style, and state of health.

1.1 What are DDT, DDE, and DDD?

DDT (1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane) was a widely used chemical to control insects on agricultural crops and insects that carry diseases like malaria and typhus. Technical grade DDT is a mixture of three forms, p,p'-DDT (85%), o,p'-DDT (15%), and o,o'-DDT (trace amounts). All of these are white, crystalline, tasteless, and almost odorless solids. Technical grade DDT is made from chloral hydrate, chloro-benzene, and sulfuric acid. Also, DDE (1,1-dichloro-2,2-bis(p-chlorophenyl) ethylene) and DDD (1,1-dichloro-2,2-bis(p-chlorophenyl) ethane) sometimes contaminate technical grade DDT. DDD was also used to kill pests; one form of DDD (o,p'-DDD) has been used medically to treat cancer of the adrenal gland.

DDT does not occur naturally in the environment. DDT is no longer used as a pesticide in the United States except in cases of public health emergency. It is, however, still used in several other areas of the world. The use of DDD to kill pests has also been banned.

1.2 What happens to DDT, DDE, and DDD when they enter the environment?

DDT entered the environment after it was produced to use as an insecticide. DDT is present at many waste sites, including NPL sites; releases from these sites might contaminate the environment. Most DDT in the environment is a result of past use; DDD was also used as a pesticide to a limited extent in the past. DDT still enters the environment because of its current use in other areas of the world. DDE is only found in the environment as a result of contamination or breakdown of DDT.

Large amounts of DDT were directly applied to soil. Some DDT may have entered the soil when it was stored or disposed of in waste sites. DDT has entered surface water either by direct spraying of the water during insecticide use or indirectly when rain-washed soil containing DDT entered surface waters. In the past, DDT entered the air directly when used as an insecticide. Small amounts may still be released to air when DDT is manufactured and used as an insecticide in other countries.

Once in the environment, DDT in soil lasts for a very long time. Some studies show that half the DDT in soil breaks down within 2 years, but other studies show that it takes more than 15 years. Some DDT may evaporate from soil and enter the air, and some may be broken down by the sun or by microorganisms.

DDT in soil usually breaks down to form DDE or DDD. DDT in surface water may also evaporate into the air, and the sun or microorganisms break down some DDT in water.

DDT in air lasts for only a short time. Half the DDT in air is gone within 2 days. DDT attaches tightly to soil and does not move down through the soil quickly to underground water supplies. DDT may attach to small particles and be carried by the wind. In surface water, DDT may also
bind to soil particles mixed in water and settle to the bottom of the body of water. DDT in soil can be absorbed by some growing plants and by the animals or people who eat those crops.

DDT in water can be absorbed by small aquatic organisms and then concentrate in the fish which eat these organisms. The levels of DDT in animals or fish can be higher than in the environment because fat cells store DDT and because DDT takes a long time to break down.

1.3 How might I be exposed to DDT, DDE, and DDD?

People are exposed to DDT, DDE, and DDD mainly by eating foods containing small amounts of these compounds. Even though DDT has not been used in this country since 1972, soil has small amounts of DDT and DDE and, under certain conditions, contaminated soil transfers DDT to crops. Imported foods may have been directly exposed to DDT. The amount of DDT in crops has decreased and is expected to continue to go down. In the United States, people in 1981 ate an average of 0.001 part of DDT and DDE per million parts of food (ppm) with root and leafy vegetables having the highest amount. Meat, fish, and poultry also contain very low levels of these compounds. Infants may be exposed by drinking breast milk.

DDT or its breakdown products are still present in some air, water, and soil samples. However, levels in most air and water samples are low and exposure by these pathways is of little concern. Air samples in the United States have shown levels of DDT ranging from 0.0000007 to 0.1 ppm, depending on the location and year of sampling. Most reported samples were collected in the mid-1970s, and present levels are probably much lower.

DDT and DDE have been reported in surface waters at levels of 1 part DDT per trillion parts (ppt) of water, while DDD generally is not found in surface water. DDT was found in 45% of the surface water samples tested. National soil testing programs in the early 1970s reported levels in soil ranging from 0.2 to 6 ppm (0.2–6 mg/kg soil). People who work or live around NPL sites would most likely be exposed by accidentally taking in soil through the mouth or by breathing in DDT on dust or soil particles.

1.4 How can DDT, DDE, and DDD enter and leave my body?

DDT, DDE, or DDD enter the body mainly when a person eats contaminated food. The actual amounts of DDT, DDE, and DDD absorbed from foods depends on both the concentration of chemical in the food and the amount of food eaten. Small amounts of DDT, DDE, and DDD may also be breathed in and absorbed into the body. Because DDT, DDE, and DDD attached to particles are usually too large to pass through the lungs into the body after breathing air containing them, these particles are more likely to be carried upward in the mucus of the air passages and swallowed. DDT, DDE and DDD do not enter the body through the skin very easily.

Once inside the body, DDT can break down to form DDE or DDD. DDE and DDD in turn, break down to other metabolites that leave the body in urine. These compounds are stored most readily in fatty tissue. Stored amounts leave the body very slowly. Levels in fatty tissues may either remain relatively the same over time or even increase with continued exposure. However,
amounts of DDT in the body decrease with less exposure. DDT metabolites leave the body mostly in urine, but may also leave by breast milk.

1.5 How can DDT, DDE, and DDD affect my health?

Eating food with large amounts of DDT over a short time mostly affects the nervous system. People who accidentally swallowed large amounts of DDT became excitable and had tremors and seizures. These effects on the nervous system went away once exposure stopped. Tests in laboratory animals confirm the effect of DDT on the nervous system.

No effects have been reported in people given small daily doses of DDT by capsule exposed for 18 months. People exposed for a long time to small amounts, such as people who made DDT, had some reversible changes in the levels of liver enzymes. However, there was no sign that DDT caused permanent harmful effects.

Animal studies show that long-term exposure to DDT may affect the liver. Tests in animals also suggest that short-term exposure to DDT in food may have a harmful effect on reproduction.

Studies in animals have shown that oral exposure to DDT can cause liver cancer. Studies of DDT-exposed workers did not show increases in deaths or cancers. However, these studies had problems or flaws so possible increases in cancer may not have been detected. The Department of Health and Human Services has determined that DDT may reasonably be anticipated to be a human carcinogen. The International Agency for Research on Cancer (IARC) has determined that DDT, DDE, and DDD are possibly carcinogenic in humans. EPA has determined that DDT, DDE, and DDD are probable human carcinogens.

1.6 Is there a medical test to determine whether I have been exposed to DDT, DDE, and DDD?

DDT, DDE, and DDD can be measured in fat, blood, urine, semen, and breast milk. Samples of blood and urine are easy to get, and levels in these samples may help show the amount of exposure. These tests are not readily available at your doctor's office, but your doctor can tell you where they can be done. Tests may show low, moderate, or excessive exposure to these compounds. However, such tests cannot show the exact amount of DDT, DDE, or DDD to which a person was exposed, or predict the chance of health effects in the person.

1.7 What recommendations has the federal government made to protect human health?

In 1972, EPA banned all uses of DDT, except in cases of public health emergencies, because amounts were building up in the environment and possibly hurting wildlife. Also, some cancer tests in laboratory animals showed positive results. Although DDT is no longer used in the United States, federal regulations still control the amounts of DDT allowed in food and water.

The Occupational Safety and Health Administration (OSHA) states that workers may not be exposed to amounts of DDT greater than 0.07 ppm (1 mg/m³) in air for an 8-hour work day, 40-hour work week. EPA estimates that drinking 2 liters of water containing 0.59 nanograms of
DDT per liter of water (1 nanogram is one billionth of a gram) and eating 6.5 grams (g) of fish and shellfish per day (from waters containing 0.59 nanograms DDT/L) would be associated with an increased risk of one extra cancer case for every one million people exposed. Fish and shellfish tend to concentrate DDT from the surrounding water in their tissues. The Food and Drug Administration (FDA) sets standards for almost all foods.

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 E-29
Atlanta, GA 30333

* Information line and technical assistance

Phone: 888-422-8737
FAX: (404)498-0057

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