1. PUBLIC HEALTH STATEMENT

This public health statement tells you about atrazine 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. Atrazine has been found in at least 20 of the 1,636 current or former NPL sites. However, the total number of NPL sites evaluated for this substance is not known. As more sites are evaluated, the sites at which atrazine is found may increase. This information is important because exposure to this substance 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 atrazine, 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/them. 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 IS ATRAZINE?

Atrazine is the common name for an herbicide that is widely used to kill weeds. It is used mostly on farms. Pure atrazine—an odorless, white powder—is not very volatile, reactive, or flammable. It will dissolve in water. Atrazine is made in the laboratory and does not occur naturally.

Atrazine is used on crops such as sugarcane, corn, pineapples, sorghum, and macadamia nuts, and on evergreen tree farms and for evergreen forest regrowth. It has also been used to keep

weeds from growing on both highway and railroad rights-of-way. Atrazine can be sprayed on croplands before crops start growing and after they have emerged from the soil. Some of the trade names of atrazine are Aatrex®, Aatram®, Atratol®, and Gesaprim®. The scientific name for atrazine is 6-chloro-N-ethyl-N'-(1-methylethyl)-triazine-2,4-diamine. Atrazine is a Restricted Use Pesticide (RUP), which means that only certified herbicide users may purchase or use atrazine. Certification for the use of atrazine is obtained through the appropriate state office where the herbicide user is licensed.

Certified herbicide workers (see Section 1.7) may spread atrazine on crops or croplands as a powder, liquid, or in a granular form. Atrazine is usually used in the spring and summer months. For it to be active, atrazine needs to dissolve in water and enter the plants through their roots. It then acts in the shoots and leaves of the weed to stop photosynthesis. Atrazine is taken up by all plants, but in plants not affected by atrazine, it is broken down before it can have an effect on photosynthesis. The application of atrazine to crops as an herbicide accounts for almost all of the atrazine that enters the environment, but some may be released from manufacture, formulation, transport, and disposal.

More complete information about the sources, properties, and uses of atrazine can be found in Chapters 4 and 5 of this profile.

1.2 WHAT HAPPENS TO ATRAZINE WHEN IT ENTERS THE ENVIRONMENT?

Atrazine is applied to agricultural fields or to crops to kill weeds. It is also used near highways and railroads for the same purposes. Some atrazine may enter the air after it is applied to the soil. Some atrazine may also be washed from the soil by rainfall and enter surrounding areas, including streams, lakes, or other waterways. Some atrazine may migrate from the upper soil surface to deeper soil layers and enter the groundwater.

After atrazine is applied to soils, it will remain there for several days to several months; in rare situations, it may remain in soils for a few years. However, in most cases, atrazine will be broken down in the soil over a period of one growing season. In addition to being removed from

soil, atrazine is also taken up by the plants that grow there, and this uptake is the first step in killing weeds.

Any atrazine that is washed from the soil into streams and other bodies of water will stay there for a long time, because breakdown of the chemical is slow in rivers and lakes. It will also persist for a long time in groundwater. This is one reason why atrazine is commonly found in the water collected from drinking water wells in some agricultural regions.

If atrazine enters the air, it can be broken down by reactions with other reactive chemicals in the air. However, sometimes atrazine is on particles such as dust. When this happens, breakdown is not expected to occur. Atrazine is removed from air mainly by rainfall. When atrazine is on dust particles, the wind can blow it long distances from the nearest application area. For example, atrazine has been found in rainwater more than 180 miles (300 kilometers) from the nearest application area.

Atrazine does not tend to accumulate in living organisms such as algae, bacteria, clams, or fish, and, therefore, does not tend to build up in the food chain.

More complete information about the environmental fate of atrazine can be found in Chapter 6 of this profile.

1.3 HOW MIGHT I BE EXPOSED TO ATRAZINE?

Most people are not exposed to atrazine on a regular basis. People living near areas where atrazine was applied to crops may be exposed through contaminated drinking water. Atrazine has been found at about 20 Superfund sites in the United States. People living near those sites may be exposed to higher levels of atrazine. If you are a factory worker who works with atrazine, you may be exposed to higher amounts of atrazine. The government has estimated that approximately 1,000 people may be exposed to atrazine in this way.

Atrazine, one of the most widely used herbicides in the United States, is intentionally applied to crops, especially corn, sugarcane, pineapples, and sorghum. Therefore, people who live near areas where these crops are grown, especially farm workers and herbicide applicators who apply atrazine, may be exposed to atrazine because it is used in agriculture. You may be exposed to atrazine if you are nearby when crops are treated with atrazine, if you are involved in the application of atrazine to crops, or if you are near other places where it is applied. Most of the time, atrazine is not found in high concentrations in the air, but may be found in higher concentrations in the air near disposal facilities or near areas where it is being applied to crops. You may also be exposed to atrazine by digging in dirt that has atrazine in it. Your children may be exposed to atrazine by playing in dirt that contains atrazine. You and your children may also be exposed to atrazine if you drink water from wells that are contaminated with the herbicide. While it is used on many crops, it has not been found in many food samples, and then only at very low levels. Therefore, it is very unlikely that you would be exposed to atrazine by eating any foods.

More information regarding exposure to atrazine can be found in Chapter 6.

1.4 HOW CAN ATRAZINE ENTER AND LEAVE MY BODY?

Scientists do not know how much or how quickly atrazine will be absorbed into your body if you breathe it in. If you inhale atrazine-containing dust, some of the particles may deposit in your lungs. Larger atrazine particles may deposit before reaching the lungs and be coughed up and swallowed. If your skin comes in contact with atrazine-contaminated soil or water, a small amount of it may pass through your skin and into your bloodstream. If you swallow food, water, or soil containing atrazine, most of it will pass through the lining of your stomach and intestines and enter your bloodstream.

Once atrazine enters your bloodstream (is absorbed), it is distributed to many parts of your body. Animal studies indicate that atrazine is changed in your body into other substances called metabolites. Some atrazine and its metabolites may enter some of your organs or fat, but

atrazine does not build up or remain in the body. Most of the metabolites leave your body within 24–48 hours, primarily in your urine, with a lesser amount in your feces.

More information on how atrazine enters and leaves your body can be found in Chapter 3.

1.5 HOW CAN ATRAZINE AFFECT MY HEALTH?

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.

One of the primary ways that atrazine can affect your health is by altering the way that the reproductive system works. Studies of couples living on farms that use atrazine for weed control found an increase in the risk of pre-term delivery. These studies are difficult to interpret because most of the farmers were men who may have been exposed to several types of pesticides. Atrazine has been shown to cause changes in blood hormone levels in animals that affected the ability to reproduce. Some of the specific effects observed in animals are not likely to occur in occur in humans because of biological differences between humans and these types of animals. However, atrazine may affect the reproductive system in humans by a different mechanism. Atrazine also caused liver, kidney, and heart damage in animals; it is possible that atrazine could cause these effects in humans, although this has not been examined.

Not enough information is available to definitely state whether atrazine causes cancer in humans. Studies of human populations indicate that there may be a link between atrazine use and some

types of cancer, but the information was not specific enough to make a definitive connection between atrazine and cancer. An increased risk of developing mammary tumors was observed in one strain of female rats. Because of biological differences between rats and humans, it is not likely that humans would develop this type of cancer following atrazine exposure. Other studies in animals did not find atrazine-related increases in cancer. The International Agency for Research on Cancer (IARC) has determined that atraine is not classifiable as to its carcinogenicity to humans based on inadequate evidence in humans and sufficient evidence in experimental animals.

More information on how atrazine can affect your health can be found in Chapter 3.

1.6 HOW CAN ATRAZINE AFFECT CHILDREN?

This section discusses potential health effects from exposures during the period from conception to maturity at 18 years of age in humans.

Children are likely to be exposed to atrazine in the same way as adults, primarily through contact with dirt that contains atrazine or by drinking water from wells that are contaminated with the herbicide.

Little information is available regarding the effects of atrazine in children. Maternal exposure to atrazine in drinking water has been associated with low fetal weight and heart, urinary, and limb defects in humans. Atrazine has been shown to slow down the development of fetuses in animals, and exposure to high levels of atrazine during pregnancy caused reduced survival of fetuses. It is unclear whether or at what level of exposure this might occur in humans.

It is not known whether atrazine or its metabolites can be transferred from a pregnant mother to a developing fetus through the placenta or from a nursing mother to her offspring through breast milk.

1.7 HOW CAN FAMILIES REDUCE THE RISK OF EXPOSURE TO ATRAZINE?

If your doctor finds that you have been exposed to significant amounts of atrazine, ask whether your children might also be exposed. Your doctor might need to ask your state health department to investigate.

Only certain people can use atrazine because it is a Restricted Use Pesticide (RUP), so most people cannot purchase it freely or use it. Since most people cannot purchase it for private use, one way you can reduce your risk of exposure to atrazine is by avoiding areas where it is being used on crops or for control of weeds. You can also reduce your risk of exposure by avoiding digging or working in soils where it has been applied. If you live in an area where atrazine is used, you may wish to avoid being near the area when it is being applied. If children play in or near areas where it atrazine has been applied too soon after it has been applied, they can be exposed to the herbicide. You should encourage your children to not play in these areas.

Atrazine has been found in water collected from many drinking water wells in the Midwestern United States. Therefore, you may be able to reduce your risk of exposure to atrazine by ensuring that your water supply is free of atrazine, or contains no measurable levels of atrazine. Atrazine has also been found in streams, rivers, and lakes near fields where it has been applied. Higher amounts have been found in these waterways in the spring and summer months. Therefore, you may wish not to swim in, nor drink from, these bodies of water. Children may be exposed to atrazine if they play in fields where atrazine has been applied or in streams receiving runoff from those fields. They should be encouraged not to play in these fields or bodies of water. Low amounts of atrazine have also been found in carpet and house dust in homes in the Midwest. However, very few children living in these homes have had any atrazine in their bodies. To prevent possible exposure of yourself or your children to atrazine, you may wish to vacuum floors and dust surfaces on a frequent basis, especially during the spring and summer months.

If you are a worker who applies atrazine to crops or for weed control, you can reduce your exposure to atrazine by using it according to instructions and wearing proper clothing and protective gear. Be sure to follow all instructions and heed any warning statements.

1.8 IS THERE A MEDICAL TEST TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO ATRAZINE?

Specific and sensitive tests have been developed to detect atrazine in blood, fat, semen, and breast milk of exposed individuals. Because atrazine is removed from the body relatively quickly, these tests are only useful in detecting recent exposures (within 24–48 hours) and are not useful for detecting past exposures to atrazine. These tests currently cannot be used to estimate how much atrazine you have been exposed to or whether adverse health effects will occur. These tests are not usually performed in a doctor's office because special equipment is required and samples must be sent to a laboratory for testing.

More information on tests that detect atrazine and its metabolites can be found in Chapter 7.

1.9 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 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. Some regulations and recommendations for atrazine include the following:

Atrazine is currently under review for pesticide re-registration by EPA. Therefore, EPA may be contacted for more information about atrazine. OSHA has set a limit of 5 mg atrazine/m^3 of workroom air for an 8-hour workday. NIOSH recommends a standard for occupational exposure of 5 mg atrazine/m^3 of workroom air during a 10-hour shift to protect workers from a concern that atrazine may cause cancer. The EPA has set a maximum amount of atrazine allowable in drinking water of 3 μg/L. In addition, atrazine is designated as a Restricted Use Pesticide, which means that only certified pesticide applicators can use atrazine. For more information, please see Chapter 8.

1.10 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 contact ATSDR at the address and phone number below.

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.

Toxicological profiles are also available on-line at www.atsdr.cdc.gov and on CD-ROM. You may request a copy of the ATSDR ToxProfiles CD-ROM by calling the information and

technical assistance toll-free number at 1-888-42ATSDR (1-888-422-8737), by email at atsdric@cdc.gov, or by writing at:

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road NE
Mailstop E-29
Atlanta, GA 30333
Fax: 1-404-498-0093

For-profit organizations may request a copy of final profiles from the following:

National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, VA 22161
Phone: 1-800-553-6847 or 1-703-605-6000
Web site: http://www.ntis.gov/