PUBLIC HEALTH STATEMENT
ACETONE
CAS#: 67-64-1

Division of Toxicology **May 1994**

This Public Health Statement is the summary chapter from the Toxicological Profile for Acetone. 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 acetone and the effects of exposure. This information is important because this chemical may harm you. The Environmental Protection Agency (EPA) has identified 1,350 hazardous waste sites as the most serious in the nation. These sites make up the National Priorities List (NPL) and are targeted for long-term federal clean-up. Acetone has been found in at least 560 NPL sites. However, it's unknown how many NPL sites have been evaluated for this substance. As EPA tests more sites, the sites with acetone may increase. This is important because exposure to acetone may harm you and because these sites are or may be sources of exposure.

When a large industrial plant or a small container releases a substance, 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 by breathing, eating, touching, or drinking.

If you are exposed to acetone, many factors determine if you'll be harmed and how badly. These factors include the dose (how much), the duration (how long), and how you're exposed. You must also consider the other chemicals you're exposed to and your age, sex, nutritional status, family traits, lifestyle, and state of health.

1.1 WHAT IS ACETONE?

Acetone is a chemical that is found naturally in the environment and is also produced by industries. Low levels of acetone are normally present in the body from the breakdown of fat; the body can use it in normal processes that make sugar and fat. Acetone is a colorless liquid with a distinct smell and taste. People begin to smell acetone in air at 100 to 140 parts of acetone in a million parts of air (ppm), though some can smell it at much lower levels. Most people begin to detect the presence of acetone in water at 20 ppm. Acetone evaporates readily into the air and mixes well with water. Most acetone produced is used to make other chemicals that make plastics, fibers, and drugs. Acetone is also used to dissolve other substances.

1.2 WHAT HAPPENS TO ACETONE WHEN IT ENTERS THE ENVIRONMENT?

Acetone enters the air, water, and soil as a result of natural processes and human activities. Acetone occurs naturally in plants, trees, volcanic gases, and forest fires. People and animals breathe out acetone produced from the natural breakdown of body fat. Acetone is also released during its manufacture and use, in exhaust from automobiles, and from tobacco smoke, landfills, and certain kinds of burning waste materials. The levels of acetone in soil increase mainly because of acetone-containing wastes being buried in landfills. Acetone is present as a gas in air. Some acetone in air is lost when it reacts with sunlight and other chemicals. Rain and snow also

remove small amounts of acetone from the atmosphere and, in the process, deposit it on land and water. About half the acetone in a typical atmosphere at any time will be lost in 22 days. Microbes (minute life forms) in water remove some acetone from water. Some acetone in water will evaporate into air. About half the acetone in a stream will be removed from water in less than a day. Fish do not store acetone from water in their bodies. Microbes in soil remove part of the acetone in soil. Some is lost from soil by evaporation. Acetone molecules do not bind tightly to soil. Rainwater and melted snow dissolve acetone and carry it deeper into the soil to groundwater.

1.3 HOW MIGHT I BE EXPOSED TO ACETONE?

Your body makes small amounts of acetone. You can be exposed to a small amount of acetone by breathing air, drinking water, and eating food with acetone. You can also be exposed by contact with household chemicals with acetone. Several consumer products, including certain nail polish removers, particle board, some paint removers, many liquid or paste waxes or polishes, and certain detergents or cleansers, contain acetone. You can also be exposed to acetone if you are exposed to isopropyl alcohol, because isopropyl alcohol changes to acetone in the body. The level of acetone in air and water is generally low. The amount of acetone in the air of cities is generally higher than in remote and rural areas. The typical level of acetone in the air of cities in the United States is about 7 parts of acetone per billion parts of air (ppb). The level of acetone in air inside homes is usually slightly higher than in outside air (8 ppb versus 7 ppb). This is because of household chemical use inside homes. Acetone in drinking water is so low that its levels have not been measured in many samples. In a national survey, the acetone level in drinking water from Seattle, Washington, was 1 ppb. Acetone occurs naturally in many fruits and vegetables. The amount of acetone in food does not increase because of processing or packaging. The average amount of acetone an adult in the United States gets from food is not known.

People who work in certain industries that process and use acetone can be exposed to higher levels than the general populace. These industries include certain paint, plastic, artificial fiber, and shoe factories. Professional painters and commercial and household cleaners are also likely to breathe or touch higher acetone concentrations than the general population. As a member of the general public, you may be exposed to higher than normal levels of acetone if you smoke cigarettes, frequently use acetone nail polish removers, live near landfill sites that contain acetone, live near busy roadways (because automobile exhaust contains acetone), or live near other facilities that are known to release acetone, such as incinerators. The exposure from these sources will be mainly from breathing air that contains acetone or by direct skin contact with it. In addition, children can be exposed to acetone by eating dirt or by placing dirty hands in their mouths after exposing their skin to dirt from landfill sites.

1.4 HOW CAN ACETONE ENTER AND LEAVE MY BODY?

Your body normally contains some acetone because it's made during the breakdown of fat. Your body will make more acetone from body fat if you are on a low-fat diet. In addition to the acetone that your body makes from normal processes, acetone can enter your body if you breathe air that contains

acetone, drink water or eat food that contains acetone, or if you touch liquid acetone or soil that contains acetone.

The bloodstream absorbs acetone rapidly and completely from the lungs and stomach. The bloodstream can also absorb acetone from the skin, but less rapidly than from the lungs and stomach. Blood carries acetone to all body organs, but it does not stay there very long.

The liver breaks down acetone to chemicals that are not harmful. The body uses these chemical to make glucose (sugar) and fats that make energy for normal body functions. The breakdown of sugar for energy makes carbon dioxide that leaves your body in the air you breathe out. These are normal processes in the body.

Not all the acetone that enters your body from outside sources is broken down. The amount that is not broken down leaves your body mostly in the air that you breathe out. You also breathe out more carbon dioxide than normal if you are exposed to acetone from sources outside the body because more carbon dioxide is made from the extra acetone.

Only a small amount of acetone that is not broken down leaves the body in the urine. The acetone that is not used to make sugar leaves your body within a few days in the air you breathe out and in the urine. The amount of acetone that enters and leaves your body depends on how much you're exposed to and for how long. The higher the level of acetone and the longer that you are exposed will cause acetone to leave your body more slowly, but almost all the acetone will leave your body within 3 days after your exposure stops. If you exercise or work while exposed to acetone in air, more will enter your lungs because you breathe faster and more deeply during exercise.

1.5 HOW CAN ACETONE AFFECT MY HEALTH?

Low levels of acetone are normally present in the body from the breakdown of fat. The body uses acetone in normal processes that make sugar and fats that make energy for normal body functions. Many conditions can lead to higher-than-average amounts of acetone in the body. For example, babies, pregnant women, diabetics, and people who exercise, diet, have physical trauma, or drink alcohol can have higher amounts of acetone in their bodies. These higher amounts of acetone usually don't cause health problems. In addition, acetone can prevent convulsions.

Most of the information on how acetone affects human health comes from medical exams of workers on a single workday; from lab experiments in humans exposed to acetone in air for a few days; and from cases of people who swallowed acetone-based glue or fingernail polish remover.

Workers and people exposed to acetone in the lab complained that acetone irritated their noses, throats, lungs, and eyes. Some people feel this irritation at levels of 100 ppm acetone in the air, and more people feel the irritation as the level in air increases. The workers who complained of irritation were exposed to levels of 900 ppm or more. Workers exposed to acetone at 12,000 ppm or higher also complained of headache, lightheadedness, dizziness, unsteadiness, and confusion depending on how long they were

exposed (from 2 minutes to 4 hours). Two workers exposed for 4 hours became unconscious.

In addition, some people who had casts applied with acetone were exposed to acetone that evaporated into air during and after the casts were applied. These patients became nauseous, vomited blood, and became unconscious. These cases happened many years ago; modern hospitals have different methods that don't use acetone when casts are applied. Some people exposed to acetone in the air at about 250 ppm for several hours in the lab had headaches and lacked energy, and they also had some mild behavioral effects. These effects showed up in tests of how long it takes to react to a visual stimulus or the ability to hear different sounds. Some people exposed to 500 ppm in the air for several hours in the lab had effects on the blood, but other studies showed no effects on the blood at even higher exposure levels.

Some women exposed to 1,000 ppm for about 8 hours in a lab said that their periods came earlier than expected. Workers are not usually exposed to levels higher than 750 ppm anymore because of current government regulations. The regulation says workroom air should contain no more than an average of 750 ppm. Most people can smell acetone in the air at 100 to 140 ppm; that means you will probably smell acetone before you feel effects like headache and confusion. Levels of acetone in air in rural areas and in cities (less than 8 ppb) are generally lower than this.

People who swallowed acetone or substances that contained acetone became unconscious, but they recovered in the hospital. The amount of acetone that these people swallowed was not always known, but one man swallowed about 2,250 milligrams of pure acetone per kilogram of body weight (2,250 mg/kg). In addition to becoming unconscious, he had tissue damage in his mouth and he later developed a limp, which eventually cleared up, and symptoms similar to diabetes (excessive thirst, frequent urination). The amount of acetone in water or food would never be high enough to cause these effects, but people, especially children, could accidentally swallow enough acetone in nail polish remover or some household cleaners to cause such effects.

In a lab experiment, people who had liquid acetone applied directly on their skin and held there for a half hour developed skin irritation. When the skin was looked at under a microscope, some of the skin cells were damaged.

Animals briefly exposed to high levels of acetone in the air also had lung irritation and became unconscious; some died. Exposure at lower levels for short periods also affected their behavior. Pregnant animals that were exposed to high levels of acetone in air had livers that weighed more than usual and had fewer fetuses. The fetuses weighed less than normal and had delayed bone development. We do not know how exposure to acetone in air for longer than 2 weeks affects animals.

Animals given large amounts of acetone to swallow or drink for short periods had bone marrow hypoplasia (fewer new cells being made), degeneration of kidneys, heavier than normal livers and bigger liver cells, and collapse and listlessness. Pregnant mice that swallowed acetone had lower body weights and produced fewer newborn mice. More of the newborns of mice that had swallowed

acetone died than newborns of mice that were not given acetone.

Male rats that swallowed or drank even small amounts of acetone for long periods had anemia and kidney disease. The female rats did not have anemia, but they had kidney disease when they swallowed a much larger amount of acetone than the male rats swallowed. The female rats had livers and kidneys that weighed more than normal, and so did the male rats, but only when they swallowed larger amounts of acetone than the females swallowed. The male rats also had abnormal sperm. The female rats did not have any effects in their reproductive organs. Rats also had signs that acetone caused effects on their nervous systems.

Acetone is irritating to the skin of animals when it is placed directly on their skin, and it burns their eyes when placed directly in their eyes. One kind of animal (guinea pigs) even developed cataracts in their eyes when acetone was placed on their skin.

We do not know whether many of the effects seen in animals would occur in humans. People exposed to acetone were not examined for some effects or could not be examined for effects that can be seen only by looking at internal organs under a microscope. The findings in animals show that male rats are more likely than female rats to get blood and kidney disease and effects on reproductive organs after exposure to acetone. This suggests that men might be more likely to have effects of exposure to acetone than women.

One effect of acetone seen in animals is an increase in the amount of certain enzymes (chemicals in the body that help break down natural substances in the body and chemicals that enter the body). The increase in these enzymes caused by acetone exposure can make some chemicals more harmful. This is one reason that people should be concerned about being exposed to acetone; exposure is very likely to mixtures of chemicals in the environment, near hazardous waste sites, or in the workplace is very likely.

Acetone does not cause skin cancer in animals when it is applied to their skin. We don't know whether acetone would cause cancer after breathing or swallowing it for long periods, because no tests have been done. The Department of Health and Human Services and the International Agency for Research on Cancer have not classified acetone for carcinogenic effects. The EPA has determined that acetone is not classifiable as to its human carcinogenicity.

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

Acetone can be measured in the air you breathe out, in the blood, and in the urine. Methods for measuring acetone in breath, blood, and urine are available at most modern testing labs. Doctors' offices may not have the necessary equipment, but your doctor can take blood and urine samples and send them to a testing lab. The measurement of acetone in breath, blood, and urine can determine whether you have been exposed to acetone if the levels are higher than those normally seen. They can even predict how much acetone you were exposed to. However, normal levels of acetone in breath, blood, and urine can vary widely depending on many factors, such as infancy, pregnancy, lactation, diabetes, physical exercise, dieting, physical trauma, and alcohol. The odor of acetone

on your breath can alert a doctor that you have been exposed to acetone. An odor of acetone on your breath could also mean that you have diabetes. Because acetone leaves your body within a few days after exposure, these tests can tell only that you have been exposed to acetone within the last 2 or 3 days. These tests cannot tell whether you will experience any health effects related to your exposure.

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

EPA requires that spills of 5,000 pounds or more of acetone be reported. To protect workers, the Occupational Safety and Health Administration (OSHA) has set a legal limit of 750 ppm of acetone in workroom air. The regulation means that the workroom air should contain no more than an average of 750 ppm of acetone over an 8-hour working shift or over a 40-hour workweek.

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). 1994. Toxicological profile for acetone. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.