

1. PUBLIC HEALTH STATEMENT

This public health statement tells you about acrolein and the effects of exposure to it.

The Environmental Protection Agency (EPA) identifies the most serious hazardous waste sites in the nation. These sites are then placed on the National Priorities List (NPL) and are targeted for long-term federal clean-up activities. Acrolein has been found in at least 32 of the 1,684 current or former NPL sites. Although the total number of NPL sites evaluated for this substance is not known, the possibility exists that the number of sites at which acrolein is found may increase in the future as more sites are evaluated. This information is important because these sites may be sources of exposure and exposure to this substance may harm you.

When a substance is released either from a large area, such as an industrial plant, or from a container, such as a drum or bottle, it enters the environment. Such a release does not always lead to exposure. You can be 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 acrolein, many factors will determine whether you will be harmed. These factors include the dose (how much), the duration (how long), and how you come in contact with it. You must also consider any other chemicals you are exposed to and your age, sex, diet, family traits, lifestyle, and state of health.

1.1 WHAT IS ACROLEIN?

Acrolein is a clear or yellow liquid with a burnt, sweet, pungent odor. Most people begin to smell acrolein in air at concentrations of 0.25 parts acrolein per million parts of air (ppm). It ignites and burns easily in air. Acrolein changes into a vapor much faster than water does at normal temperatures. The change of acrolein from a liquid to a vapor becomes faster as temperature increases. Acrolein might be found in the air, water, or soil near hazardous waste sites if it was not properly stored. Although acrolein may be found in surface water and soil, it can quickly evaporate or can be rapidly inactivated by binding to materials in soil; as such, it is not likely to last a long time in the environment.

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Acrolein is primarily used to make other chemicals and may also be found in some livestock feed. Acrolein is itself a pesticide and is added to irrigation canals and the water supplies of some industrial plants to control underwater plant, algae, and slime growth. At much higher concentrations, it is used to make chemical weapons.

Small amounts of acrolein can be formed and can enter the air when organic matter such as trees and other plants (including tobacco) are burned and also when fuels such as gasoline and oil are burned. Acrolein is also formed in building fires at concentrations that can be deadly for occupants. Please refer to Chapters 4, 5, and 6 for more information.

1.2 WHAT HAPPENS TO ACROLEIN WHEN IT ENTERS THE ENVIRONMENT?

Acrolein can enter the environment as a result of burning wood, tobacco, vehicle fuels; overheating of cooking oils; and accidental release from chemical plants or release from a hazardous waste site. Acrolein that enters the air as a vapor changes into other chemicals within days. When acrolein is introduced into water, it dissolves easily. Some of the acrolein in water changes into a vapor and enters the air. The acrolein left in the water is changed into other chemicals, which are rapidly broken down, or it may be removed by binding to substances in water.

Acrolein that enters the soil can change into vapor and enter the air, be washed out with water, or may bind to soils in such a way as to make it non-toxic. Please refer to Chapter 6 for more information.

1.3 HOW MIGHT I BE EXPOSED TO ACROLEIN?

If you live near a hazardous waste site in which acrolein is not stored properly, you could be exposed to acrolein from breathing air or drinking water that contains acrolein. Because acrolein easily changes into a vapor, you are more likely to be exposed to it from breathing air than from drinking water. A child playing in this hazardous waste site could be exposed to acrolein by drinking surface water, eating soil, or having skin contact with soil that contains acrolein.

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However, unless a large amount of acrolein was released at the site, it is unlikely that children would be exposed to acrolein in soil given that the acrolein vaporizes from the surface of the soil or is changed by binding with soil.

Acrolein is formed by the breakdown of many pollutants found in outdoor air. Burning tobacco and other plants forms acrolein. You breathe in acrolein when you smoke tobacco or when you are near someone who is smoking (secondhand smoke). You also breathe in acrolein when you are near automobiles, because burning gasoline forms acrolein which enters the air. However, the amount of acrolein in automobile exhaust tends to be very low. Your own body can produce very small amounts of acrolein when certain fatty molecules or amino acids are broken down. If you live near an oil or coal power plant, you breathe in small amounts of acrolein. You could breathe in acrolein if you work in an industry that uses acrolein to make other chemicals.

Acrolein is formed when fats are overheated. Small amounts of acrolein may also be found in foods such as fried foods, cooking oils, and roasted coffee. Although we know acrolein is in certain foods, the amount that is in the foods that you eat is not known.

The levels of acrolein are usually low in outside air, averaging around 0.20 parts acrolein in one billion parts air (0.2 ppb) in urban air and 0.12 ppb in rural air. However, in several large cities acrolein has been measured at levels of 5.6 ppb. The levels of acrolein within the air of a typical home range between less than 0.02 and 12 ppb but can be higher if you smoke tobacco in your home.

Acrolein has not been found in drinking water, and it is not commonly found in surface waters such as lakes and streams. The background levels of acrolein in these waters or in soil are not known.

Please refer to Chapter 6 for more information on how you might be exposed to acrolein.

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1.4 HOW CAN ACROLEIN ENTER AND LEAVE MY BODY?

If you breathed in acrolein, most of it would enter your body's tissues within seconds. If you swallowed acrolein or spilled it on your skin, some of it would rapidly enter your body's tissues, but we do not know how much. Once in your body tissues, acrolein changes into other chemicals called metabolites. This probably occurs within minutes or hours. Some of these metabolites leave your body in your urine. It is not known how long this takes. For further information on how acrolein can enter and leave your body, see Chapter 3.

1.5 HOW CAN ACROLEIN AFFECT MY HEALTH?

Scientists use many tests to protect the public from harmful effects of toxic chemicals and to find ways for treating persons who have been harmed.

One way to learn whether a chemical will harm people is to determine how the body absorbs, uses, and releases the chemical. For some chemicals, animal testing may be necessary. Animal testing may also help identify health effects such as cancer or birth defects. Without laboratory animals, scientists would lose a basic method for getting information needed to make wise decisions that protect public health. Scientists have the responsibility to treat research animals with care and compassion. Scientists must comply with strict animal care guidelines because laws today protect the welfare of research animals.

How a chemical affects your health depends on the amount and length of time of exposure. As you are exposed to more acrolein, and for a longer period of time, the effects that you experience are likely to become worse. If you breathed in low levels of acrolein for a short time, your eyes might water and your nose and throat might become sore. These effects disappear within minutes after the exposure stops. However, if you were exposed to higher levels, your lungs might be affected more severely and for a longer time. Breathing in very high levels of acrolein might affect your lungs so severely that you might die.

We do not know if eating food or drinking water containing acrolein affects your health.

However, animals that swallowed acrolein had stomach irritation, vomiting, stomach ulcers, and

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bleeding. No one knows if breathing or eating acrolein or spilling it on your skin causes birth defects, affects your ability to have children, or causes cancer. The Department of Health and Human Services (DHHS) has not classified acrolein as to its carcinogenicity. The International Agency for Research on Cancer (IARC) has determined that acrolein is not classifiable as to carcinogenicity in humans. The EPA has stated that the potential carcinogenicity of acrolein cannot be determined based on an inadequate database. For further information on the health effects of acrolein in animals and humans, see Chapters 2 and 3.

1.6 HOW CAN ACROLEIN AFFECT CHILDREN?

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

Acrolein is very irritating to the eyes, nose, throat, lungs, stomach, and skin. In general, children are not likely to be affected by acrolein more than adults. However, children who are sensitive to irritants in the air (such as children with asthma) may be more sensitive to lung irritation from acrolein.

In animal studies, ingestion of very large amounts of acrolein during pregnancy caused reduced birth weights and skeletal deformities in newborns. However, the levels causing these effects were often fatal to the mother. These effects were not seen at levels that were also not toxic to the mother.

More information on the effect of acrolein in children can be found in Section 3.7.

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

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

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Children are expected to be exposed to acrolein in the same ways that adults are exposed. Like adults, children may be exposed to unknown levels from inhaling second-hand tobacco smoke. Children's exposure from eating or touching contaminated soil is not likely to differ from that of adults, because acrolein evaporates quickly, does not move well in soil, and doesn't last long in the environment. You can reduce your family's exposure to acrolein by reducing their exposure to tobacco smoke, smoke from burning wood products or cooking oils and grease, and exhaust from diesel or gasoline vehicles.

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

Tests have been developed that can measure acrolein or its breakdown products in blood or urine. These tests require specialized laboratory equipment and cannot be performed in a physician's office. These tests also cannot be used to determine whether or not you have been exposed to acrolein in the environment, because acrolein can be produced by the breakdown of other chemicals in the body. For more detailed information, see Chapters 3 and 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. The EPA, the Occupational Safety and Health Administration (OSHA), and the Food and Drug Administration (FDA) are some federal agencies that develop regulations for toxic substances. Recommendations provide valuable guidelines to protect public health, but *cannot* be enforced by law. The Agency for Toxic Substances and Disease Registry (ATSDR) and the National Institute for Occupational Safety and Health (NIOSH) are two federal organizations that develop recommendations for toxic substances.

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 that is usually based on levels that affect animals; they are then adjusted to levels that will help protect humans.

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Sometimes these not-to-exceed levels differ among federal organizations because they used different exposure times (an 8-hour workday or a 24-hour day), different animal studies, or other factors.

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 provides it. Some regulations and recommendations for acrolein include the following:

The EPA:

- has restricted the use of all pesticides containing acrolein and has also identified acrolein as a toxic waste;
- requires that companies that make, transport, treat, store, or dispose of acrolein comply with the regulations of a federal hazardous waste management program;
- has also proposed standards that limit the amount of acrolein put into publicly owned waste water treatment plants; and
- requires that releases or spills of one pound or more be reported to the National Response Center.

The FDA has determined that levels of acrolein used to prepare modified food starch must not be more than 0.6%.

OSHA has set a limit of 0.1 ppm acrolein in workroom air to protect workers during an 8-hour shift over a 40-hour workweek. NIOSH recommends that the concentration in workroom air be limited to 0.1 ppm averaged over a 10-hour shift.

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.

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ATSDR can also tell you the location of occupational and environmental health clinics. These clinics specialize in recognizing, evaluating, and treating illnesses that result 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 toll-free information and technical assistance number at 1-800-CDCINFO (1-800-232-4636), by e-mail at cdcinfo@cdc.gov, or by writing to:

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Environmental Medicine
1600 Clifton Road NE
Mailstop F-32
Atlanta, GA 30333
Fax: 1-770-488-4178

Organizations for-profit may request copies of final Toxicological 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/>