

1. PUBLIC HEALTH STATEMENT

This public health statement tells you about cresols and the effects of exposure to them.

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. *o*-Cresol, *m*-cresol, *p*-cresol, and mixed cresols have been identified in at least 210, 22, 310, and 70 of the 1,678 current or former NPL sites, respectively. Although the total number of NPL sites evaluated for these substances is not known, the possibility exists that the number of sites at which cresols are 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 these substances 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 cresols, 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 them. 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 ARE CRESOLS?

Three types of closely related cresols exist: *ortho*-cresol (*o*-cresol), *meta*-cresol (*m*-cresol), and *para*-cresol (*p*-cresol). Each one is called an isomer. Pure cresols are colorless chemicals, but they may be found in brown mixtures such as creosote and cresylic acids (e.g., wood preservatives). Because these three types of cresols are manufactured separately and as mixtures, they can be found both separately and together. Cresols can be either solid or liquid, depending on how pure they are; pure cresols are solid, while mixtures tend to be liquid. Cresols

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have a medicinal smell (odor) and when dissolved in water, they give it a medicinal smell and taste. Once cresols are in groundwater, they may stay there for months without changing. Other common names for cresols include hydroxytoluene, methyl phenol, cresylic acids and cresylics.

Cresols are natural products that are present in many foods and in animal and human urine. They are also present in wood and tobacco smoke, crude oil, and coal tar. In addition, cresols can also be manufactured and used as disinfectants and deodorizers, to dissolve substances, and as starting chemicals for making other chemicals.

You will find more information on the chemical properties of cresols in Chapter 4. The uses of cresols are given in Chapter 5. More information on how cresols will behave in the environment is found in Chapter 6.

1.2 WHAT HAPPENS TO CRESOLS WHEN THEY ENTER THE ENVIRONMENT?

Cresols are released to the environment by the combustion of wood, coal, and fossil fuels, as well as from their manufacture and use. In the air, cresols are not very persistent because they are quickly degraded by reacting with compounds that are found in the atmosphere. Cresols can also be removed from the atmosphere by rain. Cresols evaporate slowly from soil and water surfaces. They do not adsorb strongly to soils; therefore, they may move into groundwater below the soil surface (a process called leaching). Dissolved cresols can pass through soil into underground water sources. This may be a problem at hazardous waste sites where cresols are buried. Cresols are quickly degraded by microorganisms (biodegradation) found in soils and water. Sunlight may also result in the degradation of cresols; however, this is expected to occur at a much slower rate than biodegradation and is probably not environmentally relevant. Cresols do not evaporate quickly from water, but in rivers and lakes, they can be removed quickly by bacteria.

You will find more about what happens to cresols when they enter the environment in Chapter 6.

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1.3 HOW MIGHT I BE EXPOSED TO CRESOLS?

People are most likely to be exposed to cresols by breathing air contaminated with cresols, eating foods containing these compounds, or drinking contaminated water. An estimated 11,000 tons/year of cresols were released from 1990 to 1998. EPA has assessed the national risk from cresols in air and found the overall risk to be low. The highest levels of cresol are expected at manufacturing sites where cresols are produced or used. Cresols in the air can come from car exhaust. People are likely to be exposed to cresols in cities and crowded neighborhoods where traffic is heavy. Houses that are heated with coal or wood also may send cresols into the air through chimneys. People who live near factories that burn trash and garbage may breathe cresols from the smokestacks. Smokestacks of factories, electrical power plants, and oil refineries may send cresols into the air, and people who live close to these places may breathe in cresols. People who work in places that use or make cresols may breathe cresols in the air or get cresols on their skin. Cigarette smoke contains cresols, so people who smoke cigarettes are likely to breathe in more cresols than people who do not smoke. Nonsmokers may also breathe in cresols from the cigarette smoke of nearby smokers.

You may eat cresols in your food. Some foods that contain cresols are tomatoes, tomato ketchup, asparagus, cheeses, butter, bacon, and smoked foods. Drinks can also contain cresols. Coffee, black tea, wine, Scotch whiskey, whiskey, brandy, and rum can contain small amounts of cresols. People who live near garbage dumps or places where chemicals are stored or were buried, including hazardous waste sites, may have unusual amounts of cresols in their well water. They may drink some cresols in the tap water. At work places where cresols are produced or used, people may be exposed to unusual amounts of cresols. You can find more information on how much cresol is in the environment and how you can be exposed to it in Chapter 6.

1.4 HOW CAN CRESOLS ENTER AND LEAVE MY BODY?

Cresols can enter your body tissues quickly if you breathe air containing cresol gas or mist (droplets of cresol-containing liquid in the air), drink water or eat food that contains cresols, or allow your skin to come into contact with substances that contain cresols. If you live near a

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hazardous waste site, you might come into contact with cresols by drinking water, touching substances, or breathing in air that contains cresols. Cresols may also be formed in your body from other compounds, such as toluene and the amino acid tyrosine, which is present in most proteins. Cresols that enter the stomach can pass rapidly (in minutes) to the blood. Once in the blood, cresols can be distributed to many organs in the body. Most of the cresols that enter your body are quickly changed to other substances (called metabolites) and leave your body in the urine within 1 day. More information on how cresols enter and leave your body can be found in Chapter 3.

1.5 HOW CAN CRESOLS 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.

If you were to eat food or drink water contaminated with very high levels of cresols, you might feel a burning in the mouth and throat as well as stomach pains. If your skin comes in contact with a substance containing high cresol levels, you might develop a rash or severe irritation. In some cases, a severe chemical burn might result. Cresols can also irritate the eyes. If you came into contact with high enough levels of cresols (for example, by drinking or spilling on your skin a substance containing large amounts of cresols), you might become anemic, experience kidney problems, become unconscious, or even die.

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Studies in animals have not found any additional effects that would occur after long-term exposure to lower levels of cresols except for lesions inside the nose after eating food contaminated mostly with *p*-cresol or with a mixture of *m*- and *p*-cresol. Effects on the nervous system, such as loss of coordination and twitching of muscles, are produced in animals after placing the cresols directly in the stomach by means of a feeding tube, but not when the cresols are given mixed with the food, which is a more natural means of simulating potential exposure. Cresols may enhance the ability of carcinogenic chemicals to produce tumors in animals, and they have some ability to interact with mammalian genetic material in the test tube, but they have not been shown to produce cancer in humans or animals. Finding inadequate data in humans and limited data in animals, the EPA has determined that cresols are possible human carcinogens. According to EPA's updated criteria for assessing the potential for a chemical to cause cancer, cresols fall in the category of chemicals for which there is "inadequate information to assess carcinogenic potential." Animal studies suggest that cresols probably would not produce birth defects or affect reproduction in humans.

1.6 HOW CAN CRESOLS AFFECT CHILDREN?

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

Children can be exposed to cresols the same way adults might be exposed. That is, by breathing air, drinking water, or eating food that contains cresols. Children also can be exposed to cresols by touching consumer products that contain cresols or by contact of the skin with contaminated water. There is no unique way of exposure for children.

Children play outdoors and can be exposed if they touch or eat contaminated soil or place objects in their mouths.

There are no studies of children exposed to cresols, but there is a report of a baby who had a solution of cresol accidentally spilled on his head. This caused serious damage to the skin, liver, and kidneys, coma, and eventually death within 4 hours of the accident. If a child drinks a high

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amount of cresols, he or she will probably suffer the same type of injuries that have been observed in adults who have drunk cresols accidentally or intentionally: corrosion of the digestive tract, liver and kidney effects, and possibly coma and death. However, adverse effects produced by skin contact with diluted solutions of cresols can be treated and do not seem to produce long-term consequences other than perhaps leaving a skin scar.

Scientists do not know whether exposure of pregnant women to cresols can harm the unborn child, or if so, what levels of maternal exposure might harm the fetus. Studies in animals indicate that exposure during pregnancy can adversely affect the fetus, but only when the exposure also harmed the mothers. Cresols do not build up in the body and there are no reports of cresols in maternal milk. More information regarding children's health and cresols can be found in Section 3.7.

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

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

Aside from worker exposure, gasoline, cigarette smoke, and combustion of biomass are the main sources of man-made exposure to cresols. Smoking in your house can increase your risk of exposure to cresols. Adults are encouraged not to smoke in their houses, in closed environments, or near children.

A higher risk of exposure to cresol may exist near gas stations and areas of high traffic. Parents are advised not to have their children play near gas stations, manufacturing plants, or hazardous waste sites.

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

Samples of your urine can be tested for the presence of cresols, although this test is not routinely available in hospitals and clinics. This test will not tell you whether or not you will have any adverse health effects. The urine sample would have to be taken within 1 day of your exposure to be valid. Because cresols occur naturally in people, and at levels that vary from one individual to the next, results from tests for cresol exposure should be compared to values obtained from the same individual either before exposure or several days after exposure. Small changes might be caused by variation in daily diet. You should also be aware that an increased presence of cresols in the urine could indicate exposure to toluene, a related compound, rather than to cresols. However, toluene exposure would also result in elevated urinary levels of hippuric acid; cresol exposure would not. See Chapters 3 and 7 for more information about tests for exposure to cresols.

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. Sometimes these not-to-exceed levels differ among federal organizations because they used

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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 cresols include the following:

OSHA sets rules for cresol levels in the workplace. OSHA has established a limit for cresols in workplace air of 5 parts of cresols per million parts of air (5 ppm) during 8-hour work days over a 40-hour work week. NIOSH recommends that workers be exposed to no more than 2.3 ppm of cresols in work place air as an average during a 10-hour work day. NIOSH also considers a concentration of 250 ppm of cresols in air as immediately dangerous to life or health. The EPA requires that releases of 100 pounds or more of cresols to the environment be reported to the Agency. See Chapter 8 for more information on regulations and guidelines for cresols.

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 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-CDC-INFO (1-800-232-4636), by e-mail at cdcinfo@cdc.gov, or by writing to:

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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/>