



# PUBLIC HEALTH STATEMENT

## NITROPHENOLS

CAS#: 2-Nitrophenol 88-75-5

4-Nitrophenol 100-02-7

**Division of Toxicology**

**July 1992**

This Public Health Statement is the summary chapter from the Toxicological Profile for Nitrophenols. 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 Statement was prepared to give you information about 2-nitrophenol and 4-nitrophenol and to emphasize the human health effects that may result from exposure to them. The Environmental Protection Agency (EPA) has identified 1,177 National Priorities List (NPL) sites. Nitrophenols have been found at 14 of these sites. However, we do not know how many of the 1,177 NPL sites have been evaluated for 2-nitrophenol and 4-nitrophenol. As EPA evaluates more sites, the number of sites at which nitrophenols are found may change. This information is important for you because nitrophenols may cause harmful effects and because these sites are potential or actual sources of human exposure to 2-nitrophenol and 4-nitrophenol.

When a chemical 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 as a chemical emission. This emission, which is also called a release, does not always lead to exposure. You can be exposed to a chemical only when you come into contact with it. You may be exposed to it

in the environment by breathing, eating, or drinking substances containing the chemical, or from skin contact with it.

If you are exposed to a hazardous substance such as nitrophenols, several 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, sex, nutritional status, family traits, life style, and state of health.

### 1.1 WHAT ARE NITROPHENOLS?

The two nitrophenols are very similar in their chemical properties. The manufacture of one almost always produces at least a little of the other. Therefore, we include them both in one profile. 2-Nitrophenol is a light yellow solid with a peculiar aromatic smell. 4-Nitrophenol is a colorless to light yellow solid with very little odor. 2-Nitrophenol is slightly soluble in cold water, but 4-nitrophenol is moderately soluble in cold water. Neither chemical evaporates at room temperature. These are man-made chemicals with no evidence of their formation from any natural source. Therefore, humans are solely responsible for the presence of the chemicals in the environment. The main sources of the two chemicals are industrial manufacturing and processing. 2-Nitrophenol is used mainly to produce dyes, paint coloring, rubber chemicals, and substances that kill molds (fungicides). 4-Nitrophenol is used mainly to manufacture drugs, fungicides, and dyes, and to

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darken leather. The time needed for these two chemicals to disappear chemically in air is not known. They both break down (degrade) in water and surface soil, but the breakdown takes longer at lower soil depths and in groundwater. Therefore, they are expected to stay longer in the deep soil of dump sites compared to surface soil and may even stay indefinitely in these soils

### 1.2 HOW MIGHT I BE EXPOSED TO NITROPHENOLS?

Small amounts of the two substances can be found in the air, water, and soil. Therefore, breathing air, drinking water, and eating foods grown in soils that contain these substances can expose you to them. The background levels (when no apparent sources of pollution are present) of the two nitrophenols in air are not known. However, in one case, the level of 2-nitrophenol in the air in Portland, Oregon, was 4 parts per trillion (ppt by volume). Its level in the air in Dubendorf, Switzerland, was 61 ppt. These are very small numbers, and exposure from breathing air containing such low levels of these substances may not be very harmful. Except for one case of polluted water, these two substances have not been found in U.S. public drinking waters. The background levels of these compounds in foods eaten by humans are not known either. Because the chemicals break down rapidly, any exposure from these levels will be small. 4-Nitrophenol has been found in the urine of people who did not have any known exposure to this substance. The 4-nitrophenol found in human urine comes from the breakdown within the body of a pesticide, parathion, that is commonly used on certain agricultural products that many of us eat.

Some people may be exposed to higher than background levels of nitrophenols. Workers who produce or process these chemicals may be exposed to higher doses, particularly during spills or accidents. Workers involved in cleaning up hazardous waste or spills that contain these chemicals and pesticide applicators are especially subjected to higher than background levels of exposure. People who use certain pesticides or who drink well water near farming areas where certain pesticides are used may also be exposed to higher than background levels of 4-nitrophenol. The two nitrophenols and their mixture have been found in at least 14 of the 1,177 hazardous waste sites on the National Priorities List (NPL). People who live near these sites may be subjected to exposure at higher doses than background. Except for the high levels of 4-nitrophenol found in the urine of persons exposed to the pesticide, parathion, we have no evidence of exposure to 2-nitrophenol and 4-nitrophenol that is higher than background levels.

### 1.3 HOW CAN NITROPHENOLS ENTER AND LEAVE MY BODY?

2-Nitrophenol and 4-nitrophenol can enter your body through your lungs and pass into the blood stream if you breathe contaminated air. If you swallow 2-nitrophenol or 4-nitrophenol, most of it probably enters your body and passes from the stomach into the blood stream very quickly (in minutes). If you spill 2-nitrophenol or 4-nitrophenol on your skin, some of it might pass through the skin into the blood stream, but we do not know how much or how fast. Once inside your body, 2-nitrophenol and 4-nitrophenol change (we call this change metabolism)

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into other chemicals that will be quickly (in hours) released from the body in your urine. We do not have enough information available to determine which will be the most likely way that 2-nitrophenol or 4-nitrophenol will enter your body if you are exposed at hazardous waste sites.

### 1.4 HOW CAN NITROPHENOLS AFFECT MY HEALTH?

How a chemical affects your health depends on how much you are exposed to and for how long. As the level and length of your exposure increase, the effects are likely to become more severe. Rats that breathed dusts of 4-nitrophenol for 2 weeks developed a blood disorder which reduces the ability of the blood to carry oxygen to tissues and organs. However, these abnormalities disappeared a few days after exposure stopped. Chemicals like the nitrophenols cause a similar blood disorder in humans, and so humans exposed for weeks or longer to high levels of nitrophenols may develop the same types of blood disorders that animals do. Experimental studies have shown that 4-nitrophenol is more harmful than 2-nitrophenol in animals. There is no information on the effects on human health from breathing dusts of 2-nitrophenol or 4-nitrophenol.

Some rats, mice, and rabbits that swallowed large amounts of 2-nitrophenol or 4-nitrophenol died within a few days, but we do not know the exact cause of death. Some rats that swallowed smaller amounts of 4-nitrophenol for a few weeks also died, but those that survived had no apparent harmful health effects. No birth defects were found in the offspring of pregnant mice that swallowed 4-nitrophenol. We do not know if swallowing very

small amounts of 2-nitrophenol or 4-nitrophenol for many months or years leads to serious disease or death. There is no information on their health effects from humans who ate food or drank water contaminated with these chemicals.

Rats and rabbits that had relatively large amounts of 4-nitrophenol applied to their skin for a day or less had skin irritation. Rats that had a small amount of 4-nitrophenol on their skin for a few months also had skin irritation. 4-Nitrophenol also caused eye irritation in rabbits when it was applied to the eye. It appears that exposure of animals to very small amounts of 2-nitrophenol or 4-nitrophenol by skin contact for many months does not lead to serious disease or death. We do not know whether breathing dusts of these chemicals or spilling them on your skin can cause birth defects, affect fertility, or cause cancer.

### 1.5 IS THERE A MEDICAL TEST TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO NITROPHENOLS?

Although methods are available for measuring levels of 4-nitrophenol in the urine and blood, they are probably not useful unless the exposure was very recent. 4-Nitrophenol passes out of the body through urine within a few hours. Because the effects usually seen on the blood may also result from causes besides 4-nitrophenol, these effects alone cannot be used to prove exposure. No tests are available to tell whether you have been exposed to 2-nitrophenol.

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

In order to minimize exposure to nitrophenols by humans the Environmental Protection Agency (EPA) says that industry must tell the National Response Center when 100 pounds or more of 2-nitrophenol or 4-nitrophenol have been disposed of.

### 1.7 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). 1992. Toxicological profile for nitrophenols. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

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