



# PUBLIC HEALTH STATEMENT

## 2,4- and 2,6-DINITROTOLUENE

CAS#: 2,4-Dinitrotoluene 121-14-2  
2,6-Dinitrotoluene 606-20-2

Division of Toxicology

December 1998

This Public Health Statement is the summary chapter from the Toxicological Profile for 2,4-dinitrotoluene and 2,6-dinitrotoluene. 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 2,4-dinitrotoluene (2,4-DNT) and 2,6-dinitrotoluene (2,6-DNT) 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. 2,4-DNT and 2,6-DNT have been found in at least 122 of the 1,467 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 2,4-DNT and 2,6-DNT 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 2,4-DNT or 2,6-DNT, 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. 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 ARE 2,4- AND 2,6-DINITROTOLUENE?

2,4-DNT and 2,6-DNT are pale yellow solids with a slight odor and are two of the six forms of the chemical called dinitrotoluene (DNT). The other four forms (2,3-DNT, 2,5-DNT, 3,4-DNT, and 3,5-DNT) only make up about 5% of the technical grade DNT. DNT is not a natural substance but rather is usually made by reacting toluene (a solvent) with mixed nitric and sulfuric acids, which are strong acids. DNT is used to produce flexible polyurethane foams used in the bedding and furniture industry. DNT is also used to produce ammunition and explosives and to make dyes. It is also used in the air bags of automobiles. It has been found in the soil, surface water, and groundwater of at least 122 hazardous waste sites that contain buried ammunition wastes and wastes from manufacturing facilities that release DNT. DNT does not usually evaporate and is found in the air only in manufacturing plants. DNT also does not usually remain in the environment for a long time because it is broken down by sunlight and bacteria into substances such as carbon dioxide, water, and nitric acid.

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### 1.2 WHAT HAPPENS TO 2,4- AND 2-6-DINITROTOLUENE WHEN THEY ENTER THE ENVIRONMENT?

DNT can be found in air, surface water, groundwater, and soil. Releases to the air are usually in the form of dusts or aerosols from manufacturing plants. Evaporation from water containing DNT is not a likely means of release to the air. DNT is thought to break down in air by a variety of chemical reactions that take place upon exposure to sunlight.

In water, DNT can be broken down by sunlight. Under conditions without oxygen or without light, DNT may be broken down by biological degradation, whereby microbes utilize the chemical as a source of energy and convert it into chemicals such as carbon dioxide and water. DNT in surface water from rivers and streams and groundwater from wells can result from releases of waste water from trinitrotoluene (TNT) manufacturing facilities and from buried munition wastes.

No information was located regarding the changing of DNT to other chemical substances in soil. DNT is unlikely to build up in animal tissues after animals are exposed by eating impacted soil, water, or vegetation, or by inhaling contaminated air. However, since DNT is quite soluble in water, it can be transferred to plants via root uptake from soil or irrigation with contaminated water, although no direct measurements have been found. It is, however, expected to accumulate readily in plant materials, although no direct measurements have been found.

### 1.3 HOW MIGHT I BE EXPOSED TO 2,4- AND 2-6-DINITROTOLUENE?

Members of the general population are likely to be exposed only if they are near a DNT contaminated waste site or manufacturing facilities that release DNT.

2,4- or 2,6-DNT may enter the environment from waste waters that industries discharge into rivers and streams or from the improper disposal of wastes. However, regular testing of water in the United States shows that 2,4- and 2,6-DNT were found in less than 2% of the water samples. Testing of hazardous waste sites shows that 2,4- and 2,6-DNT are present at less than 8.5% of these sites. Available information indicates that DNT does not appear to be widespread in the environment.

### 1.4 HOW CAN 2,4- AND 2-6-DINITROTOLUENE ENTER AND LEAVE MY BODY?

When industrial workers are exposed to 2,4- or 2,6-dinitrotoluene, the major ways that these chemicals enter their bodies are by breathing or absorbing small amounts of the chemical through the skin. Some ingestion may also occur as the result of eating or smoking without prior handwashing.

After individuals breathe air, drink water, or eat food contaminated with 2,4- or 2,6-DNT, these chemicals are changed into different substances by the liver and in the intestines. After this, most of these chemicals leave the body within 24 hours in the urine, with a small amount in the feces. This information comes from animal experiments done

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in laboratories and from studies of industrial workers.

### 1.5 HOW CAN 2,4- AND 2,6-DINITROTOLUENE 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.

Increases in death rate due to heart disease have been seen in workers exposed to 2,4-DNT or technical grade DNT (Tg-DNT), but these workers may also have been exposed to other chemicals. 2,4- and 2,6-DNT may also affect the nervous system and the blood of exposed workers. One study showed that male workers exposed to 2,4- and 2,6-DNT had reduced levels of sperm, but later studies did not confirm the finding.

Exposure to high levels of these compounds in animals regularly causes lowered numbers of sperm and reduced fertility. Studies of animals have also

shown that nervous system disorders, liver damage, and kidney damage can occur, as well as a reduction in the numbers of red blood cells. Both 2,4- and 2,6-DNT can cause liver cancer in laboratory rats and may produce the same effect in humans. More information on the health effects of DNT is given in Chapter 2. The International Agency for Research on Cancer (IARC) has determined that 2,4- and 2,6-DNT are possibly carcinogenic to humans.

### 1.6 HOW CAN 2,4- AND 2,6-DINITROTOLUENE AFFECT CHILDREN?

This section discusses potential health effects from exposures during the period from conception to maturity at 18 years of age in humans. Potential effects on children resulting from exposures of the parents are also considered.

2,4- and 2,6-DNT are not widespread throughout the environment. If you do not live near a plant or a waste site that contains DNT, it is unlikely that your children would be exposed to DNT. DNT is normally associated with industrial or military production plants or munitions storage sites. DNT is water soluble, so if contamination has occurred it will usually be carried in water. Children are at risk for exposure if DNT has leached into a community's drinking water supply from a nearby hazardous site since they drink more fluid in proportion to their body weight than adults. Children playing in DNT-contaminated surface water might be more exposed than adults, both because of this behavior and because of their larger skin area in proportion to their body weight.

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Since DNT exposure is usually related to adult workers, health effects on children have not been studied. It is not known if DNT affects children differently than adults, or what long term effects might appear in adults exposed as children.

No studies have investigated effects of DNT on the developmental process in humans, and few studies have focused on animals. No studies have been done to see if DNT or its toxic breakdown products cross the placenta, or get into breast milk.

### 1.7 HOW CAN FAMILIES REDUCE THE RISK OF EXPOSURE TO 2,4- AND 2-6-DINITROTOLUENE?

If your doctor finds that you have been exposed to significant amounts of 2,4-DNT or 2,6-DNT, ask if children may also be exposed. When necessary your doctor may need to ask your State Department of Public Health to investigate.

If you live near a site that could be contaminated with DNT you should discourage your children from putting foreign objects, groundwater, and dirt in their mouths since DNT is quite water soluble. Make sure they wash their hands frequently and before eating. Discourage your children both from putting their hands in their mouths and from other hand-to-mouth activities

### 1.8 IS THERE A MEDICAL TEST TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO 2,4- AND 2-6-DINITROTOLUENE?

Both 2,4- and 2,6-DNT and the chemicals they are changed into by the body can be measured in the

blood and urine of exposed individuals (if urine is collected within 24 hours). The tests cannot show how much 2,4- or 2,6-DNT an individual has been exposed to. These tests are not usually available in doctors' offices but can be performed by special laboratories.

### 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

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available. For the most current information, check with the federal agency or organization that provides it. Some regulations and recommendations for 2,4- and 2,6-DNT include the following:

EPA recommendations define the safe lifetime daily maximum oral dose for 2,4-DNT as 0.002 milligram per kilogram per day for 2,4-DNT, and 0.001 milligram per kilogram per day for 2,6-DNT. In addition to EPA recommendations, OSHA regulations state that an average 8-hour exposure to total DNT in workplace air should not be more than 1.5 milligrams per cubic meter of air ( $\text{mg}/\text{m}^3$ ). NIOSH has published a Recommended Exposure Limit (REL) guideline of 1.5  $\text{mg}/\text{m}^3$ . An REL is an average concentration for a 10-hour workday over a 40-hour workweek. Spills or releases to the environment of more than 1,000 pounds of DNT must be reported immediately to the federal government.

### 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:**

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). 1998. Toxicological profile for 2,4- and 2,6-dinitrotoluene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

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