1. PUBLIC HEALTH STATEMENT FOR DINITROTOLUENES

Overview
We define a public health statement and show how it can help you learn about dinitrotoluenes (DNTs).

Introduction
A public health statement summarizes information about a hazardous substance. The information is taken from a toxicological profile developed by the Agency for Toxic Substances and Disease Registry’s (ATSDR’s) Division of Toxicology and Human Health Sciences (DTHHS). A toxicological profile is a thorough review of a hazardous substance.

This toxicological profile examines DNTs. This public health statement summarizes the DTHHS’s findings on DNTs, describes the effects of exposure to them, and describes what you can do to limit that exposure.

DNTs at hazardous waste sites
The U.S. Environmental Protection Agency (U.S. EPA) identifies the most serious hazardous waste sites in the nation. U.S. EPA then includes these sites the National Priorities List (NPL) and targets them for federal clean-up activities. U.S. EPA has found DNT in at least 98 of the 1,699 current or former NPL sites.

The total number of NPL sites evaluated for DNT is not known. However, the possibility remains that as more sites are evaluated, the number of sites at which DNT is found may increase. This information is important; these future sites may be sources of exposure, and exposure to DNT may be harmful.

Why a DNT release can be harmful
When a contaminant 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. However, such a release doesn’t always lead to exposure. You can only be exposed to a contaminant when you come in contact with it. That contact—and therefore that exposure—can occur when you breathe, eat, or drink the contaminant, or when it touches your skin.

Even if you’re exposed to DNTs, you might not be harmed. Whether you are harmed will depend on such factors as the dose (how much), the duration (how long), and how you happen to contact it. Harm might also depend on whether you’ve been exposed to any other chemicals, as well as your age, sex, diet, family traits, lifestyle, and state of health.
A Closer Look at DNTs

Overview
This section describes DNTs in detail and how you can be exposed to them.

What is DNT?
DNT is comprised of a mixture of isomers. These particular isomers have the same molecular weight and molecular formula and the same organic functional groups. However, the organic functional groups are at different positions of the benzene ring. Two of the isomers of DNT, 2,4-DNT and 2,6-DNT, make up 95% of DNT. The other 5% is predominantly comprised of four other isomers (2,3-, 2,5-, 3,4-, and 3,5-DNT). DNT is not a natural substance and is commercially produced by reacting concentrated sulfuric and nitric acid with toluene.

How are DNTs used?
DNT is a substance produced during the conversion of toluene to toluene diisocyanate (TDI), a precursor to polyurethane polymers. It is also used to make trinitrotoluene (TNT).

Where are DNTs found?
DNT can be released into the air, water, and soil at places where it is produced or used. It is not commonly found outside of source areas or, in other words, its manufacturing facilities or contaminated waste sites.

<table>
<thead>
<tr>
<th>Possible Sources</th>
<th>Outcome</th>
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<tr>
<td><strong>Air:</strong> DNT is rarely detected in ambient air, but is detected in workplace air where it is manufactured or used.</td>
<td>Occupational exposure is possible, but DNT inhalation exposure to the general population is very low.</td>
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<td><strong>Water:</strong> Military and industrial activities have lead to reported release of DNT into soil, groundwater or surface water. DNT levels as high as 10,000 μg/L were reported in potable groundwater at the Joliet Army Ammunition Plant located in Illinois.</td>
<td>DNT is slowly broken down in water by microbial organisms and it can be broken down by sunlight in surface water.</td>
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<tr>
<td><strong>Soil:</strong> DNT has been detected in soil at levels of ~100 mg/kg at areas like ammunition sites and military firing ranges.</td>
<td>DNT does not adsorb strongly to soil. Therefore, it can move from soil into groundwater, where it can contaminate drinking water.</td>
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<td><strong>Consumer Products:</strong> DNT is not used extensively in consumer products and is not often detected in food samples.</td>
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How DNT Can Affect Your Health

Overview
This section looks at how DNTs enter your body and potential DNT health effects found in human and animal studies.

How DNTs enter your body
DNTs can enter your body from the air or water.

<table>
<thead>
<tr>
<th>Possible Sources</th>
<th>Possible Exposure Pathway</th>
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<tbody>
<tr>
<td>Air</td>
<td>If you breathe air containing DNT, it will enter your body through your lungs.</td>
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<tr>
<td>Water</td>
<td>If present in drinking water, DNT will rapidly enter your body through the digestive tract.</td>
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<tr>
<td>Soil</td>
<td>Some soil samples may contain a high level of DNT. You can be exposed dermally if you come into contact with soil contaminated with DNT.</td>
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How DNTs leave your body
DNTs leave your body rapidly. They break down into other chemicals that leave your body in the urine within 24 hours. Small amounts of the DNTs may also be present in the feces.

Introduction to DNT health effects
The health effects of DNTs depend on how much DNT you are exposed to and the length of that exposure. Environmental monitoring data are limited, but they do suggest that any DNT levels the public might encounter by contact through air, water, or soil are generally much lower than animal-study levels.

Short-term exposure effects
Animal studies show that ingestion of DNTs can cause anemia, and damage to the nervous system, male reproductive system, and liver. Animal studies have shown that breathing vapors or aerosols of DNTs can cause damage to the lungs. Breathing or ingesting very high levels of DNTs may cause death.

Long-term exposure effects
A study using workers reported a relationship between heart disease and long-term exposure to DNT. Animal studies have shown that ingesting DNTs over long periods causes anemia, and damage to the nervous system, male reproductive system, and liver. Ingestion of DNTs over long periods may also cause death.
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DNTs and cancer

Several studies in workers have looked for an association between DNT exposure and cancer. No increases in the risk of liver or kidney cancer were found. Two studies did find an increased risk of urothelial cancers in workers. Studies using workers have not indicated whether DNTs cause cancer. Laboratory animals ingesting DNTs during most of their lives developed cancer of the liver and tumors in the kidneys.

Some cancer findings by government and other agencies

- The U.S. EPA says a mixture of 2,4- and 2,6-DNT is a probable human carcinogen, based on findings of cancer in animal studies.
- The International Agency for Research on Cancer says 2,4- and 2,6-DNT are possibly carcinogenic to humans, but that carcinogenicity for 3,5-DNTs in humans cannot be determined due to a lack of information.

See Chapters 2 and 3 for more information on health effects of DNTs.

Children and DNTs

Overview

This section discusses potential health effects of DNT exposure in humans from when they’re first conceived to 18 years of age, and how you might protect against such effects.

Exposure effects for children generally

No data describe the effects of exposure to DNTs on children or young animals. Although we think that children would likely show the same health effects as adults, we don’t know whether children are more susceptible than adults to DNT effects.

What about birth defects?

We don’t know whether DNTs can harm an unborn child. Results of animal studies show that newborns of mothers exposed to DNTs during pregnancy can have anemia and nervous system damage at birth. These effects are similar to those seen in adult animals.

Drinking water

Limit exposure to contaminated drinking water. DNT is not often detected in drinking water supplies.

Medical Tests to Determine DNT Exposure

Overview

We identify medical tests that can detect whether DNTs are in your body, and we recommend safe toxic-substance practices.
DNTs can be measured in urine

DNT and its breakdown products (metabolites) can be measured in urine. However, the detection of DNTs or metabolites cannot predict the kind of health effects that might develop from that exposure. Because DNTs and their metabolites leave the body fairly rapidly, the tests need to be conducted within days after exposure.

For more information on the different substances formed by DNT breakdown and on tests to detect these substances in the body, see Chapters 3 and 7.

Federal Government Recommendations to Protect Human Health

Overview
One way the federal government promotes public health is by regulating toxic substances or recommending ways to handle or to avoid toxic substances.

The federal government regulates toxic substances
Regulations are enforceable by law. The U.S. EPA, the Occupational Safety and Health Administration (OSHA), and the Food and Drug Administration (FDA) are some federal agencies that have adopted toxic substances regulations.

The federal government recommends safe toxic substance practices
ATSDR and the National Institute for Occupational Safety and Health (NIOSH) have made recommendations about toxic substances. Unlike enforceable regulations, these recommendations are advisory only.

Toxic substance regulations
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 usually based on levels that affect animals); levels are then adjusted to help protect humans. These not-to-exceed levels sometimes differ among federal organizations. Different organizations use different exposure times (an 8-hour workday or a 24-hour day), different animal studies, or emphasize some factors over others, depending on their mission.

Check for regulation updates
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 issued the regulation or recommendation.
Some regulations and recommendations for DNTs include

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<th>Federal Organization</th>
<th>Regulation or Recommendation</th>
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<tr>
<td>U.S. Environmental Protection Agency (U.S. EPA)</td>
<td>The U.S. EPA has determined that exposure to 2,4-DNT in drinking water at concentrations of 1 mg/L for 1 or 10 days is not expected to cause any adverse effects in a child.</td>
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<tr>
<td>Occupational Safety and Health Administration (OSHA)</td>
<td>OSHA set a legal limit of 1.5 mg/m³ DNT in workplace air averaged over an 8-hour work day.</td>
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<tr>
<td>National Institute for Occupational Safety and Health (NIOSH)</td>
<td>NIOSH recommends a limit of 1.5 mg/m³ DNT in workplace air averaged over a 10-hour work day.</td>
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**Additional Information**

**Overview**
Where to find more information about DNTs.

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**Whom to contact first**
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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**Additional information from ATSDR**
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.

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**Where to obtain toxicological profile copies**
Toxicological profiles are also available online at www.atsdr.cdc.gov and on CD-ROM. 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),
- E-mailing cdcinfo@cdc.gov, or
- Writing to:

  Agency for Toxic Substances and Disease Registry  
  Division of Toxicology and Human Health Sciences  
  1600 Clifton Road NE  
  Mailstop F-57  
  Atlanta, GA 30333  
  Fax: 1-770-488-4178

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For-profit organizations should request final toxicological profile copies from:

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/