1. PUBLIC HEALTH STATEMENT

This public health statement tells you about hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) 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. RDX has been found in at least 31 of the 1,699 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 RDX 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 be harmful.

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 RDX, 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 RDX?

Other names for RDX	RDX stands for Royal Demolition Explosive, also known as cyclonite, hexogen, and hexahydro-1,3,5-trinitro-1,3,5-triazine.
White crystalline solid	RDX is an explosive on its own, and can be combined with other ingredients to make plastic explosives (C-4 contains 91% RDX). Its odor and taste are unknown. When heated, acrid fumes may be released.

Used in explosives	RDX is used as an explosive. It is a synthetic product that does not occur naturally in the environment.

1.2 WHAT HAPPENS TO RDX WHEN IT ENTERS THE ENVIRONMENT?

Found in water, soil, and air	RDX particles can enter air when it is disposed of by burning. RDX can enter water from disposal of waste water from ammunition plants. RDX can enter water or soil from spills or leaks from improper disposal at plants or hazardous waste sites and at current and former military installations.
Removal from soil, water, and air	RDX is slow dissolving in water. It does not bind significantly to soils and can leach to groundwater from soil. In water and air, RDX can break down in hours, but breaks down more slowly in soil. It does not build up in fish or people.

1.3 HOW MIGHT I BE EXPOSED TO RDX?

Air	You may be exposed to RDX by the inhalation, oral, or dermal routes, or by any combination of these routes. Typically, only people who work with RDX can potentially breathe RDX dust or get it on their skin. You can be exposed if you breathe RDX fumes from explosions or bombing ranges of burning RDX.
Water and soil	You may be exposed to RDX by drinking contaminated water or by touching contaminated soil if you live near facilities that produce or use RDX. RDX has been found in water and soil near some ammunition plants, current or former military installations and storage areas.
Food	You may be exposed to RDX by ingesting agricultural crops grown in contaminated soils irrigated with contaminated water.

1.4 HOW CAN RDX ENTER AND LEAVE MY BODY?

Enter the body **• Inhalation** **• Oral** **• Dermal contact**	RDX can enter your body if you breathe in fumes of burning RDX or from the detonation of munitions containing RDX or if you breath in the dust from powdered RDX. It can also enter the body if you drink water contaminated with RDX or accidentally or intentionally ingest explosives containing RDX. Much less RDX can enter the body through the skin if you come in contact with dusts of RDX or with liquids containing RDX.
Leave your body	Based on observations made in humans and results from studies in animals, most of the RDX appears to be broken down rapidly in the body. These products, as well as unchanged RDX, are eliminated in the urine and exhaled air in a few days. RDX is not expected to accumulate in the body.

1.5 HOW CAN RDX AFFECT MY HEALTH?

Humans	If you breathe in dusts of RDX or intentionally or accidentally swallow large amounts of RDX, you may develop seizures. The seizures are temporary and will stop after the RDX is eliminated from your body. Some people exposed to large amounts of RDX also have alterations in blood pressure and in some components of the blood, but these effects may be secondary to the seizures. We do not know the effects of long-term, low-level exposure to RDX.
Laboratory animals	Animals that had large amounts of RDX placed in the stomach with a tube or that ate food mixed with RDX for longer periods of time suffered seizures. Rats and mice that ate RDX for 3 months or longer had decreased body weights and slight liver and kidney damage.
Cancer	There are no studies reported of cancer in people exposed to RDX. The EPA has determined that RDX is a possible human carcinogen based on the presence of liver tumors in mice that were exposed to RDX in the food for 1–2 years.

1.6 HOW CAN RDX AFFECT CHILDREN?

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

Effects in children	There are no studies of children exposed to RDX, but a child who accidentally ingested RDX had seizures, which is the same effect that occurs in adults exposed to high amounts of RDX. We do not know whether children are more susceptible to the effects of RDX than adults. We do not know whether RDX causes birth defects in humans.
Laboratory animals	Exposure of animals to RDX during pregnancy has not caused birth defects in newborn animals. However, rats exposed to RDX during gestation gave birth to babies with smaller weight and length than rats not exposed to RDX. In rats exposed to RDX during pregnancy, RDX was able to pass through the placenta and reached the fetus. Young deer mice (21 days old) were more sensitive than older deer mice (50 days old) to the acute toxic effects of RDX.
Breast milk	There are no studies that looked for RDX in human breast milk. However, rats exposed to RDX during pregnancy had RDX in their milk, suggesting that the same can occur in humans. This means that women exposed to RDX who nurse their babies could transfer RDX to the babies in the milk.

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

Consumer products	RDX is not found in consumer products. Therefore, families are not expected to have contact with RDX through the use of consumer products.
Drinking water	Families whose tap or well water may be contaminated with RDX may choose to drink or cook with bottled water or to install activated carbon water filters.

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

Detecting exposure	RDX can be measured in blood and urine, but these are not routine tests that can be performed in a doctor's office. We do not know whether the presence of RDX in the blood indicates that you were exposed briefly a few days before the blood was collected or that you are experiencing constant exposure.
Measuring exposure	The tests for RDX in blood and urine cannot be used to determine how much RDX entered your body. The presence of RDX in your blood does not necessarily mean that you will suffer adverse health effects. The usual immediate health effects are seizures, muscle twitching, or vomiting from very high exposures. These would probably occur before you had the blood or urine test.

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. These are levels of a toxic substance in air, water, soil, or food that do not exceed a critical value. This critical value 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 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 RDX include the following:

Levels in drinking water set by EPA	The EPA has determined that exposure to RDX in drinking water at concentrations of 0.1 mg/L for one day or 0.1 mg/L for 10 days is not expected to cause any adverse effects in a child. The EPA has determined that lifetime exposure to 0.002 mg/L RDX is not expected to cause any adverse effects.
Levels in workplace air set by OSHA	OSHA had previously set a legal limit of 1.5 mg/m^3 for RDX in March 1989; however, the standard was vacated in 1992. NIOSH has set a 10-hour time-weighted average recommended exposure limit of 1.5 mg/m^3.

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-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-62
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/