

## 1. PUBLIC HEALTH STATEMENT

This Statement was prepared to give you information about HMX and to emphasize the human health effects that may result from exposure to it. The Environmental Protection Agency (EPA) has identified 1,416 hazardous waste sites as the most serious in the nation. These sites make up the National Priorities List (NPL) and are the sites targeted for long-term federal cleanup activities. HMX has been found in at least 10 of the sites on the NPL. However, the number of NPL sites evaluated for HMX is not known. As EPA evaluates more sites, the number of sites at which HMX is found may increase. This information is important because exposure to HMX may cause harmful health effects and because these sites are potential or actual sources of human exposure to HMX.

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 can be exposed to a substance only when you come in contact with it. You may be exposed by breathing, eating, or drinking substances containing the substance or by skin contact with it.

If you are exposed to a substance such as HMX, many 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, gender, nutritional status, family traits, life-style, and state of health.

### 1.1 WHAT IS HMX?

HMX, an acronym for High Melting eXplosive, is also known as octogen and cyclotetramethylene-tetranitramine, as well as by other names. It is a colorless solid that dissolves slightly in water. Only a very small amount of HMX will evaporate into the air; however, it can occur in air attached to suspended particles or dust. The taste and smell of HMX are not known.

HMX is a manmade chemical and does not occur naturally in the environment. It is made from other chemicals known as hexamine, ammonium nitrate, nitric acid, and acetic acid. HMX explodes

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violently at high temperatures (534°F and above). Because of this property, HMX is used in nuclear devices, plastic explosives, rocket fuels, and burster chargers. A small amount of HMX is also formed in making cyclotrimethylene-trinitramine (RDX), another explosive similar in structure to HMX. The amount of HMX made and used in the United States at present is not known, but it is believed to be greater than 30 million pounds per year.

More information about the chemical names, properties, and uses of HMX is in Chapters 3 and 4.

### 1.2 WHAT HAPPENS TO HMX WHEN IT ENTERS THE ENVIRONMENT?

Most of the HMX that enters the environment is released into waste water from places that make or use HMX. A small amount of HMX can be released to the air as dust or ash from facilities that burn waste contaminated with HMX. Some HMX may be released to soil as a result of accidental spills, the settling of HMX-containing dust particles from the air, or the disposal of waste that contains HMX in landfills.

Dust particles containing HMX may be carried by the wind for some distance. The distance depends on a number of factors, including particle size, wind velocity, and weather conditions. Eventually, these particles settle to the earth, depositing on soil and surface waters. The length of time that HMX remains in the air is not known.

In surface water, HMX does not evaporate or bind to sediments to any large extent. Sunlight breaks down most of the HMX in surface water into other compounds, usually in a matter of days to weeks. The amount of time HMX remains in surface water depends on how much light-absorbing material is present. A small amount of HMX may also be broken down by bacteria in the water. Some of the breakdown products of HMX (nitrite, nitrate, formaldehyde, 1,1-dimethylhydrazine) are also harmful to your health, although the amounts you may be exposed to as a result of HMX in your drinking water are not expected to be above trace levels.

Laboratory studies show that HMX is likely to move from soil into groundwater, particularly in sandy soils. For most soils, however, the movement of HMX into groundwater is expected to be slow. Bacteria in the soil are not expected to break down HMX to any large extent. Exactly how long HMX

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will remain in the environment is not known; however, HMX in soil and groundwater is expected to stay there for a long time.

It is not known if plants, fish, or animals living in areas contaminated with HMX build up high levels of the chemical in their tissues.

More information on what happens to HMX when it enters the environment is in Chapters 4 and 5.

### **1.3 HOW MIGHT I BE EXPOSED TO HMX?**

There is no information on how often you might be exposed to HMX in the environment or to how much. Most people, however, probably won't be exposed to HMX from the environment. People who work at facilities that make or use HMX or RDX, such as military personnel, may be exposed. These workers may be exposed by inhaling dusts that contain HMX or by getting HMX-containing liquids on their skin. People who live near facilities that make or use HMX, or near hazardous waste sites that contain HMX, may also be exposed. For these residents, exposure (if any) is most likely to occur from contaminated groundwater. However, exposures to small amounts of HMX from contaminated surface water, soil, and air are also possible.

More information on how you can be exposed to HMX is in Chapter 5.

### **1.4 HOW CAN HMX ENTER AND LEAVE MY BODY?**

HMX can enter your body if you breathe contaminated air, swallow contaminated water or soil, or get substances that contain HMX on your skin. Very little is known about how much and how fast HMX enters your body after you are exposed.

Limited information from laboratory studies in animals suggests that if you swallow HMX, only a small amount (less than 5 percent) will be absorbed into your blood. The rest of the HMX that is not absorbed leaves your body in your feces, usually within a day or two after you are exposed. Your blood carries the small amount of absorbed HMX to your tissues. Animal studies suggest that the

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resulting concentrations of HMX in your lungs, liver, heart, and kidneys may be slightly higher than the concentrations in other tissues.

HMX does not remain in any of your tissues for very long. Information from animal studies suggests that your body can transform HMX into other compounds called metabolites. At present, the identity and toxicity of these metabolites are not known. Most of these metabolites leave your body in your urine, usually within a few days after you are exposed. Smaller amounts of these metabolites may be released in your feces or in the air you breathe out.

More information on how HMX enters and leaves your body is in Chapter 2.

### 1.5 HOW CAN HMX AFFECT MY HEALTH?

Information on the adverse health effects of HMX is limited. In one human study, no adverse effects were reported in workers exposed to HMX in air. However, the concentrations of HMX in the workplace air were not reported in this study, and only a small number of workers and effects were investigated.

Studies in rats, mice, and rabbits indicate that HMX may be harmful to your liver and central nervous system if it is swallowed or gets on your skin. The lowest dose producing any effects in animals was 100 milligrams per kilogram of body weight per day (mg/kg/day) orally and 165 mg/kg/day on the skin. Limited evidence suggests that even a single exposure to these dose levels harmed rabbits. The mechanism by which HMX causes adverse effects on the liver and nervous system is not understood.

The reproductive and developmental effects of HMX have not been well studied in humans or animals. At present, the information needed to determine if HMX causes cancer is insufficient. Due to the lack of information, EPA has determined that HMX is not classifiable as to its human carcinogenicity.

More information on how HMX can affect your health is in Chapter 2.

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**1.6 IS THERE A MEDICAL TEST TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO HMX?**

You can find out if you have been exposed to HMX by having your blood, urine, or feces tested for HMX. Since HMX is poorly absorbed after it is swallowed, the levels of HMX in your blood and urine are likely to be lower than those in your feces. For best results, tests for HMX should be done within a few days after you are exposed. These tests cannot be used to tell how much HMX you have been exposed to or to predict whether or not you will experience adverse health effects. These tests are not usually done in a doctor's office, but require that the samples be sent to a laboratory for testing.

More information on medical tests to determine whether you have been exposed to HMX is in Chapters 2 and 6.

**1.7 WHAT RECOMMENDATIONS HAS THE FEDERAL GOVERNMENT MADE TO PROTECT HUMAN HEALTH?**

The federal government has made several regulations and guidelines to protect human health. EPA recommends that the concentration of HMX in an adult's drinking water be less than 0.40 milligrams per liter (mg/L) for a lifetime exposure. EPA regulates waste containing HMX as hazardous and has set restrictions on its disposal in landfills. The Department of State regulates the exportation of HMX, and the Department of Transportation regulates its transportation. The Bureau of Alcohol, Tobacco, and Firearms regulates the importation, manufacture, distribution, and storage of HMX.

More information on government regulations and guidelines for HMX is in Chapter 7.

**1.8 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:

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Agency for Toxic Substances and Disease Registry  
Division of Toxicology  
1600 Clifton Road NE, E-29  
Atlanta, Georgia 30333  
(404) 639-6000

This agency can also provide you with information on the location of occupational and environmental health clinics. These clinics specialize in the recognition, evaluation, and treatment of illness resulting from exposure to hazardous substances.