1. PUBLIC HEALTH STATEMENT

This Statement was prepared to give you information about acrylonitrile and to emphasize the human health effects that may result from exposure to it. The Environmental Protection Agency (EPA) has identified 1,177 sites on its National Priorities List (NPL). Acrylonitrile has been found at 3 of these sites. However, we do not know how many of the 1,177 NPL sites have been evaluated for acrylonitrile. As EPA evaluates more sites, the number of sites at which acrylonitrile is found may change. The information is important for you to know because acrylonitrile may cause harmful health effects and because these sites are potential or actual sources of human exposure to acrylonitrile.

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 the chemical. 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 acrylonitrile, 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 IS ACRYLONITRILE?

Acrylonitrile is a colorless, liquid, man-made chemical with a sharp, onion- or garlic-like odor. Acrylonitrile is used mostly to make plastics, acrylic fibers, and synthetic rubber. Because acrylonitrile evaporates quickly, it is most likely to be found in the air around chemical plants where it is made. Acrylonitrile breaks down quickly in the air. It has been found in small amounts in the water and soil near manufacturing plants and hazardous waste sites. In water, acrylonitrile usually breaks down in about 1 to 2 weeks, although this can vary depending on conditions. For example, high concentrations of acrylonitrile (such as might occur after a spill) tend to be broken down more slowly. In one case, measurable amounts of acrylonitrile were found in nearby wells 1 year after a spill. Further information on the properties and uses of acrylonitrile and how it behaves in the environment may be found in Chapters 3, 4, and 5.

1.2 HOW MIGHT I BE EXPOSED TO ACRYLONITRILE?

Unless you live near a factory where acrylonitrile is made or near a hazardous waste site that contains acrylonitrile, you are unlikely to be exposed to acrylonitrile in the air you breathe or the water you drink. Concentrations of acrylonitrile in average air samples are too low to be measured, and most water samples also have no measurable acrylonitrile. Measurable amounts of acrylonitrile are found primarily near factories and hazardous waste sites. Concentrations in the air near a factory producing or using acrylonitrile average less than 1 part per billion (ppb). Extremely small amounts of acrylonitrile may be found in water near some factories that make or use it, but acrylonitrile rapidly breaks down and disappears from water. Plastic food containers that are made from acrylonitrile are regulated by the Food and Drug Administration such that only 0.17 ppb can enter food; therefore, acrylonitrile intake from food packaging would be extremely low. Because acrylonitrile has been found in water and soil in some hazardous waste sites that contain this chemical, residents living very close to waste sites might possibly be exposed to acrylonitrile by breathing the air or drinking contaminated groundwater.

Further information on how you might be exposed to acrylonitrile is given in Chapter 5.

1.3 HOW CAN ACRYLONITRILE ENTER AND LEAVE MY BODY?

Acrylonitrile can enter your body if you breathe its vapors or eat or drink acrylonitrile-contaminated food or water. Acrylonitrile can pass through your skin, but how much gets through is not known. Inside the body, acrylonitrile is broken down into other chemicals, including cyanide. Most of these breakdown products are removed from the body in the urine. Overall, most acrylonitrile is removed from the body within 24 hours, but approximately 25% of what is taken in becomes attached to materials inside cells of the body. More information on how acrylonitrile enters and leaves the body is given in CLaapter 2.

1.4 HOW CAN ACRYLONITRILE AFFECT MY HEALTH?

The effects of acrylonitrile on your health depend on how much you take into your body and whether you are exposed for a short or long period of time. If the levels of acrylonitrile are high enough, or if the exposure is for a long enough period of time, acrylonitrile can cause death. Small children are more likely to be affected than adults. In several cases, children died following exposures that adults found only mildly irritating. It should be noted that specific levels of acrylonitrile causing death were not reported. Exposure to large amounts of acrylonitrile for a short period of time, as might occur in the case of an industrial accident, results mainly in effects on the

nervous system. Symptoms can include headache and nausea. At higher concentrations of acrylonitrile there may be temporary damage to red blood cells and the liver. These symptoms disappear when the exposure is stopped.

Direct contact of your skin with acrylonitrile will damage the skin so that it may blister and peel. Exposure of the skin to high concentrations of acrylonitrile in the air may irritate the skin and cause it to turn red. The redness may last for several days.

Long-term exposure to acrylonitrile in air or water may increase your chances of getting cancer. Humans who are repeatedly exposed to acrylonitrile in the workplace for many years may have a higher-than-average chance of developing lung cancer, although this is not clearly established. In animals, exposure to acrylonitrile in the air or in drinking water has been found to increase the number of tumors occurring in the brain, salivary glands, and intestines.

Birth defects have been seen in animals exposed to high concentrations of acrylonitrile in the air or drinking water. Reproductive effects have been seen in animals given acrylonitrile in drinking water for three generations. However, no birth defects or effects on reproduction have been reported in humans.

Further information on the health effects of acrylonitrile in humans and animals can be found in Chapter 2.

1.5 WHAT LEVELS OF EXPOSURE HAVE RESULTED IN HARMFUL HEALTH EFFECTS?

In humans, breathing acrylonitrile at a concentration of 16 parts of acrylonitrile per million parts of air (ppm) causes headaches, nausea, and disorientation (Table l-l). This concentration is close to that at which acrylonitrile can be smelled in air (about 21 ppm). Breathing acrylonitrile in air for long periods of time and at high concentrations can cause death. The actual concentrations of acrylonitrile and breathing times which cause death have not been measured. There is no information on human health effects from eating or drinking acrylonitrile. Acrylonitrile can be smelled at a concentration of 19 ppm when dissolved in water.

In animals, drinking water that contains 142 ppm of acrylonitrile has caused nervous system disorders leading to death (Table l-4). Birth defects and effects on reproduction have occurred in animals that breathed acrylonitrile in air at levels of 80 ppm or drank it in water at 180 ppm.

Tables 1-1 through 1-4 show the relationship between exposure to acrylonitrile and known health effects. Short-term and longer-term Minimal Risk Levels (MRLs) are also included in Tables 1-1 and 1-3. These MRLs were derived from animal and human data for both short-term and long-term exposure, as described in Chapter 2 and in Tables 2-1 and 2-2. The MRLs provide a basis for comparison with levels that people might encounter either in the air or in food or drinking water. If a person is exposed to acrylonitrile at an amount below the MRL, it is not expected that harmful (noncancer) health effects will occur. Because these levels are based only on information currently available, some uncertainty is always associated with them. Also, because the method for deriving MRLs does not use any information about cancer, an MRL does not imply anything about the presence, absence, or level of risk for cancer.

Additional information on the levels of exposure associated with harmful effects can be found in Chapter 2.

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

There is a test that can detect acrylonitrile in blood. In addition, the major breakdown products of acrylonitrile by the body (termed metabolites) can be measured in urine. Some breakdown products that can be measured are specific to acrylonitrile. However, one breakdown product of the body (cyanide) that is commonly measured is not specific to acrylonitrile exposure, and the results can be affected by cigarette smoking. Because special equipment is needed, these tests cannot be performed routinely in your doctor's office. There is not enough information at present to use the results of such tests to predict the nature or severity of any health effects that may result from exposure to acrylonitrile. Further information on how acrylonitrile can be measured in exposed humans is presented in Chapters 2 and 6.

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

The federal government has developed regulations and advisories to protect individuals from the potential health effects of acrylonitrile in the environment. The U.S. Environmental Protection Agency (EPA) recommends that acrylonitrile levels in water not exceed 0.058 ppb. Any release to the environment of more than 100 lb must be reported to the federal government. The Occupational Safety and Health Administration (OSHA) has established a legally enforceable maximum limit of 2 ppm in workplace air for an 8-hour exposure over a 40-hour work week.

TABLE 1-1. Human Health Effects from Breathing Acrylonitrile*

Short-term Exposure (less than or equal to 14 days)		
Levels in Air (ppm)	Length of Exposure	Description of Effects**
0.1		Minimal Risk Level (based on human studies; see Section 1.5 for discussion)
16	20-45 min	Headaches, nausea, diarrhea, apprehension and redness of the skin.
Long-term Exposure (greater than 14 days)		
Levels in Air	Length of Exposure	Description of Effects
		The health effects resulting from long-term exposure of humans to air containing specific levels of acrylonitrile are not known.

*See Section 1.2 for a discussion of exposures encountered in daily life.
**These effects are listed at the lowest level at which they were first observed. They may also be seen at higher levels.

TABLE 1-2. Animal Health Effects from Breathing Acrylonitrile

Short-term Exposure (less than or equal to 14 days)		
Levels in Air (ppm)	Length of Exposure	Description of Effects*
30	4 hours	Excessive watering of the mouth in dogs.
65	4 hours	Death in dogs.
80	10 days	Birth defects in rats.
90	4 hours	Reddened skin in monkeys.
Long-term Exposure (greater than 14 days)		
Levels in Air (ppm)	Length of Exposure	Description of Effects*
20	2 years	Premature death in some rats.
80	2 years	Brain tumors in rats.

*These effects are listed at the lowest level at which they were first observed. They may also be seen at higher levels.

TABLE 1-3. Human Health Effects from Eating or Drinking Acrylonitrile*

Short-term Exposure (less than or equal to 14 days)		
Levels in Food	Length of Exposure	Description of Effects
		The health effects resulting from short-term exposure of humans to food containing specific levels of acrylonitrile are not known.
Levels in Water (ppm) 3.0		Minimal Risk Level (based on animal studies; see Section 1.5 for discussion).
Long-term Exposure (greater than 14 days)		
Levels in Food	Length of Exposure	Description of Effects
		The health effects resulting from long-term exposure of humans to food containing specific levels of acrylonitrile are not known.
Levels in Water (ppm) 1.4		Minimal Risk Level (based on animal studies; see Section 1.5 for discussion).

*See Section 1.2 for a discussion of exposures encountered in daily life.

TABLE 1-4. Animal Health Effects from Eating or Drinking Acrylonitrile

Short-term Exposure (less than or equal to 14 days)		
Levels in Food	Length of Exposure	Description of Effects*
		The health effects resulting from short-term exposure of animals to food containing specific levels of acrylonitrile are not known.
Levels in Water (ppm)		
142	1 day	Death and nervous system disorders in mice.
180	10 days	Birth defects in rats.
Long-term Exposure (greater than 14 days)		
Levels in Food	Length of Exposure	Description of Effects*
		The health effects resulting from short-term exposure of animals to food containing specific levels of acrylonitrile are not known.
Levels in Water (ppm)		
35	2 years	Premature death in rats.
52	60 days	Low sperm count in mice.
100	19 months	Low red blood cell counts.
200	6 months	Ulcers in the throat and premature death in dogs.
500	220 days	Reduced reproductive capability in rats.

*These effects are listed at the lowest level at which they were first observed. They may also be seen at higher levels.

Additional information on governmental regulations can be found Chapter 7.

1.8 WHERE CAN I GET MORE INFORMATION?

If you have any more questions or concerns not covered here, please contact your State Health or Environmental Depart or:

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road, E-29
Atlanta, Georgia 30333

This agency can also give you information on the location of the nearest occupational and environmental health clinics. Such clinics specialize in recognizing, evaluating, and treating illnesses that result from exposure to hazardous substances.