1. PUBLIC HEALTH STATEMENT

This Statement was prepared to give you information about radium 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). Radium has been found above background levels at 18 of these sites. However, we do not know how many of the 1,177 NPL sites have been evaluated for radium. As EPA evaluates more sites, the number of sites at which radium is found above background levels may change. The information is important for you because radium may cause harmful health effects and because these sites are potential or actual sources of human exposure to radium.

When a radioactive 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 radioactive chemical emission. This emission, which is also called a release, does not always lead to exposure. You can be exposed to a radioactive chemical when you come into contact with that chemical alone or with a substance that contains it. You may be exposed to it in the environment by breathing, eating, or drinking substances containing the radioactive chemical or from skin contact with it. Exposure can also occur by being near radioactive chemicals at concentrations that are found at hazardous waste sites or industrial accidents.

If you are exposed to a hazardous substance such as radium, 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 RADIUM?

Radium is a naturally-occurring silvery white radioactive metal that can exist in several forms called isotopes. It is formed when uranium and thorium (two other natural radioactive substances) decay (break down) in the environment. Radium has been found at very low levels in soil, water, rocks, coal, plants, and food. For example, a typical amount might be one picogram of radium per gram of soil or rock. This would be about one part of radium in one trillion (1,000,000,000,000) parts of soil or rock. These levels are not expected to change with time.

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Some of the radiation from radium is constantly being released into the environment. It is this release of radiation that causes concern about the safety of radium and all other radioactive substances. Each isotope of radium releases radiation at its own rate, One isotope, radium-224 for example, releases half of its radiation in about three and a half days; whereas another isotope, radium-226, releases half of its radiation in about 1,600 years.

When radium decays it divides into two parts. One part is called radiation, and the second part is called a daughter. The daughter, like radium, is not stable; and it also divides into radiation and another daughter. The dividing continues until a stable, nonradioactive daughter is formed. During the decay process, alpha, beta, and gamma radiations are released. Alpha particles can travel only a short distance and cannot travel through your skin. Beta particles can penetrate through your skin, but they cannot go all the way through your body. Gamma radiation, however, can go all the way through your body. Thus, there are several types of decay products that result from radium decay.

More information about the properties and uses of radium is found in Chapters 3, 4, and 5.

1.2 HOW MIGHT I BE EXPOSED TO RADIUM?

Because radium is present, usually at very low levels, in the surrounding environment, you are always exposed to it and to the small amounts of radiation that it releases to its surroundings. You may be exposed to higher levels of radium if you live in an area where it is released into the air from the burning of coal or other fuels, or if your drinking water is taken from a source that is high in natural radium, such as a deep well, or from a source near a radioactive waste disposal site.

Levels of radium in public drinking water are usually less than one picocurie per liter of water (about one quart), although higher levels (more than 5 picocuries per liter) have been found. A picocurie (pCi) is a very small amount of radioactivity, and it is associated with about a trillionth of a gram (a picogram) of radium. (There are approximately 28 grams in an ounce.) No information is available about the amounts of radium that are generally present in food and air. You may also be exposed to higher levels of radium if you work in a uranium mine or in a plant that processes uranium ores.

You will find more information on how you can be exposed to radium in Chapter 5.

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1.3 HOW CAN RADIUM ENTER AND LEAVE MY BODY?

Radium can enter the body when it is breathed in or swallowed. It is not known if it can be taken in through the skin. If you breathe radium into your lungs, some may remain there for months; but it will gradually enter the blood stream and be carried to all parts of the body, especially the bones. For months after exposure, very small amounts leave the body daily through the feces and urine.

If radium is swallowed in water or with food, most of it (about 80%) will promptly leave the body in the feces. The other 20% will enter the blood stream and be carried to all parts of the body, especially the bones. Some of this radium will then be excreted in the feces and urine on a daily basis.

You will find more information on this subject in Chapter 2.

1.4 HOW CAN RADIUM AFFECT MY HEALTH?

There is no clear evidence that long-term exposure to radium at the levels that are normally present in the environment (for example, 1 pCi of radium per gram of soil) is likely to result in harmful health effects. However, exposure to higher levels of radium over a long period of time may result in harmful effects including anemia, cataracts, fractured teeth, cancer (especially bone cancer), and death. Some of these effects may take years to develop and are mostly due to gamma radiation. Radium gives off gamma radiation, which can travel fairly long distances through air. Therefore, just being near radium at the high levels that may be found at some hazardous waste sites may be dangerous to your health.

More information on this subject is presented in Chapter 2.

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

Radium has been shown to cause adverse health effects such as anemia, cataracts, fractured teeth, cancer and death. As shown in Tables l-l through l-4, the relationship between the amount of radium that you are exposed to and the amount of time necessary to produce these effects is not known. Although there is some uncertainty as to how much exposure to radium increases your chances of developing a harmful health effect, the greater the total amount of your exposure to radium, the more likely you are to develop one of these diseases. More information on this subject is presented in Chapter 2.

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

Short-term Exposure (less than or equal to 14 days)		
Levels in Air	Length of Exposure	Description of Effects
		The health effects resulting from short-term exposure of humans breathing specific levels of radium are not known.
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 breathing specific levels of radium are not known.

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

TABLE 1-2. Animal Health Effects from Breathing Radium

Short-term Exposure (less than or equal to 14 days)		
Levels in Air	Length of Exposure	Description of Effects
		The health effects resulting from short-term exposure of animals breathing specific levels of radium are not known.
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 animals breathing specific levels of radium are not known.

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

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 radium are not known.
Levels in Water		The health effects resulting from short-term exposure of humans to water containing specific levels of radium are not known.
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 radium are not known.
Levels in Water		The health effects resulting from long-term exposure of humans to water containing specific levels of radium are not known.

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

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

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 radium are not known.
Levels in Water		The health effects resulting from short-term exposure of animals to water containing specific levels of radium are not known.
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 animals to food containing specific levels of radium are not known.
Levels in Water		The health effects resulting from long-term exposure of animals to water containing specific levels of radium are not known.

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

There are few medical tests to determine if you have been exposed to radium. There is a urine test to determine if you have been exposed to a source of radioactivity such as radium. There is also a test to measure the amount of radon, a breakdown product of radium, when it is exhaled. These tests require special equipment and cannot be done in a doctor's office. Another test can measure the total amount of radioactivity in the body; however, this test is not used except in special cases of high exposure.

More information on the methods used to determine levels of exposure to radioactivity can be found in Chapters 2 and 6.

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

The Environmental Protection Agency (EPA) regulates the amount of radium in drinking water so that it will not contain more than 5 pCi of combined radium-226 and radium-228 per liter of water. The amount of radioactivity from all sources that is allowed in drinking water and the amount that workers may be exposed to in nuclear plants is regulated.

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 Department 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.