

1. PUBLIC HEALTH STATEMENT

This Statement was prepared to give you information about vanadium 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). Vanadium has been found at 23 of these sites. However, we do not know how many of the 1,177 NPL sites have been evaluated for vanadium. As EPA evaluates more sites, the number of sites at which vanadium is found may change. The information is important for you because vanadium may cause harmful health effects and because these sites are potential or actual sources of human exposure to vanadium.

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 vanadium, 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 VANADIUM?

Vanadium is a natural element in the earth. It is a white to gray metal, often found as crystals. It has no particular odor. Vanadium occurs naturally in fuel oils and coal. In the environment it is usually combined with other elements such as oxygen, sodium, sulfur, or chloride. The forms of vanadium most likely to be found at waste sites are not well known. One manmade form, vanadium oxide (vanadium bound to oxygen), is most often used by industry, mostly in making steel. Vanadium oxide can be a yellow-orange powder, dark-grey flakes, or yellow crystals. Much smaller amounts are used in making rubber, plastics, ceramics, and certain other chemicals. The most likely way for the chemical to get into the air is when fuel oil is burned. When rocks and soil containing vanadium are broken down into dusts by wind and rain, vanadium can get into the air, groundwater, surface water, or soil. It does not dissolve well in water, but it can be carried by the water, much as particles of sand might be carried. For more information on its forms and uses, see Chapters 3 and 4.

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1.2 HOW MIGHT I BE EXPOSED TO VANADIUM?

Most people are exposed daily to very low levels of vanadium in food, drinking water, and air. Most of your intake is from food, and you eat about 10-20 micrograms daily. The vanadium in these sources is at least partially due to naturally occurring vanadium in rocks and soil. Vanadium is naturally found in soil and rocks at about 150 parts of vanadium per million parts of soil (150 ppm) in the earth's crust. Vanadium combined with oxygen (vanadium oxide) gets into the air when people burn fuel oil or coal. You can be exposed to vanadium if you breathe in this air. Vanadium pentoxide is in dusts in some factories that use it for making steel. Ash from burning fuel oil or the leftover products from processing vanadium-containing ore can be put into landfills following proper treatment procedures. If these products are crushed, it is possible that you might breathe in some dusts containing vanadium. Also, the action of rain and wind may cause some vanadium to move out of a landfill and onto nearby soil, food crops, and water supplies. Some foods contain either naturally occurring vanadium or vanadium from man-made sources; you can be exposed to vanadium when you eat these foods. Vanadium has been found in groundwater and at hazardous waste sites throughout the United States. The exposure routes most likely at hazardous waste sites are not well known. For more information on how you might be exposed to vanadium, see Chapter 5.

1.3 HOW CAN VANADIUM ENTER AND LEAVE MY BODY?

If vanadium is in the air, you can breathe it into your lungs. Most of it leaves your body in the air you breathe out, but some stays in your lungs. The part that isn't breathed out can go through your lungs and get into your bloodstream. You may eat or drink small amounts of vanadium in food and water. Most of this does not enter your bloodstream, but leaves your body in your feces. However, small amounts that you swallow can enter your bloodstream. Most of the vanadium that enters your bloodstream leaves your body quickly in the urine. If you get vanadium on your skin, it is unlikely that it will enter your body by passing through your skin. For more information about how vanadium enters and leaves your body, see Chapter 2.

1.4 HOW CAN VANADIUM AFFECT MY HEALTH?

If you breathe large amounts of vanadium dusts for short or long periods, you will have lung irritation that can make you cough, and you can also have a sore throat and red irritated eyes. These effects stop soon after you stop breathing it. People who breathed 0.1 milligram (mg) of vanadium per cubic meter (m³) of air for 8 hours coughed for about 1 week and had irritated eyes. No studies designed to look for cancer in laboratory animals exposed to vanadium were found. In studies that looked for health effects other than cancer, rats and mice that drank water containing vanadium or breathed in air containing vanadium throughout their lives did not have more tumors than animals that were not exposed to vanadium. Some minor birth defects (such as

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slightly smaller offspring, offspring with broken blood vessels on parts of their bodies or chemical changes in their lungs) occurred when female rats drank vanadium in water when they were pregnant. We do not know if vanadium would cause birth defects in people because these effects may occur only in animals. Monkeys and rats that breathed the dusts of vanadium compounds had changes in the cells in the lungs. Rats that drank sodium metavanadate in the water had minor kidney damage. Rabbits that breathed large amounts of vanadium dust died, as did rats and mice that drank large amounts. For more information on health effects in people and animals after breathing, eating, or touching vanadium, see Chapter 2.

1.5 IS THERE A MEDICAL TEST TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO VANADIUM?

Since vanadium is a natural element in the earth, we all have a small amounts in our bodies. There are some tests to show whether you have been exposed to larger than normal amounts of vanadium. Vanadium can be measured in the urine and blood. People exposed to larger than normal amounts will show larger than normal amounts in their urine and blood for a few days. Some workers who have been exposed to large amounts of vanadium may have a green color on the tongue. None of these tests can tell if you will become sick from the vanadium but they are specific for vanadium exposure. For more information on ways to tell whether you have been exposed to vanadium see Chapters 2 and 6.

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

Releases to the environment of more than 1,000 pounds of vanadium pentoxide must be reported to the National Response Center. EPA has decided that if you eat less than 9 micrograms (μg) of vanadium pentoxide per kilogram (kg) of your body weight, your health is protected. The Occupational Safety and Health Administration (OSHA) has set a legal limit of 0.05 mg of vanadium pentoxide respirable dust per m^3 of air ($0.05 \text{ mg}/\text{m}^3$) for workers who are exposed to vanadium in workroom air during an 8-hour shift for a 40-hour workweek. Respirable dust is dust small enough to enter the lungs when breathed in. For more information on regulations and guidelines, see Chapter 7.

1.7 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:

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

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