

## **Nitrate (NO<sub>3</sub><sup>-</sup>) and Nitrite (NO<sub>2</sub><sup>-</sup>) Fact Sheet**

### **What are nitrate and nitrite compounds?**

- Nitrate and nitrite are naturally occurring compounds containing nitrogen and oxygen in different combinations.

### **Are there commercial uses for these compounds?**

- Nitrates are used primarily as fertilizers. They are also used in making glass, explosives, and some medicines.
- Nitrates and nitrites are used to enhance color in foods and to extend the shelf life of processed meats.

### **Are nitrates and nitrites present in the environment?**

- Nitrates are naturally present in soil, water, and food.
- Because nitrite is easily converted to nitrate, nitrate is the compound more commonly found in surface water and groundwater.
- Shallow, rural domestic wells are often contaminated with nitrates, especially in areas where nitrogen-based fertilizers are used.
- In Pennsylvania, concentrations of nitrate in groundwater are highest in agricultural areas.
- Water from wells in Pennsylvania's Lower Susquehanna River Basin commonly contains nitrate at concentrations exceeding the U. S. Environmental Protection Agency's (EPA) drinking water standard.

### **How are people exposed to nitrates and nitrites?**

People can be exposed to nitrates and nitrites by eating foods, drinking water, and using medicines that contain these compounds.

- 70% of the nitrates in the diet come from eating vegetables. Cauliflower, spinach, collard greens, broccoli, and root vegetables have naturally greater nitrate content than other plants.
- About a fifth of the nitrate in the diet comes from drinking water that contains this compound.

- About 6% of the nitrate in the diet comes from eating treated meats and meat products.
- The main source of nitrate exposure for infants is from well water containing this compound that is used to prepare formula and other baby foods.
- Some burn creams, poison antidotes, and other medicines contain nitrates.
- Intentional abuse of medicinal volatile nitrite inhalants.

### **What happens to nitrates and nitrites once they enter the body?**

- Nitrate is rapidly absorbed into the blood through the digestive system and distributed throughout the body.
- Approximately 60 – 70% of absorbed nitrate is excreted in the urine within the first 24 hours.
- Approximately 25% of nitrate is excreted in the saliva and then potentially reabsorbed.
- About 5% of nitrate that enters the body is changed to nitrite in areas of the digestive system where large numbers of bacteria are found.
- Nitrite reacts with hemoglobin in red blood cells to form methemoglobin.
- Pregnant women can pass methemoglobin on to developing fetuses.
- Nitrite can also react with compounds known as amines to produce new compounds called nitrosamines.
- When contaminated well water is used to make baby formula, the intestinal bacteria in infants are capable of converting nitrate to nitrite and cause elevated blood levels of methemoglobin. This condition is called methemoglobinemia and is often referred to as "blue baby syndrome".
- Nitrate and nitrite are excreted in the saliva, sweat, feces, and urine.

### **How harmful is exposure to nitrates and nitrites?**

- Nitrates are relatively nontoxic. However, once they enter the body, they are converted to nitrites which are potentially toxic.
- The methemoglobin formed when hemoglobin reacts with nitrite cannot carry oxygen to body tissues.
- Infants suffering from blue baby syndrome may seem healthy but show occasional signs of blueness around the mouth, hands and feet. They may develop diarrhea, vomiting, and difficulty breathing. In some cases, infants may develop a peculiar lavender color but show little distress.

- When methemoglobin levels are high, infants can show lethargy, excessive salivation, and loss of consciousness. Convulsions and death can occur with extremely high levels of methemoglobin.
- Low birth weights have also been attributed to nitrates in water.

### **What blood levels of methemoglobin cause symptoms?**

Normal individuals have low levels of methemoglobin (0.5 to 3%) in their blood. When these levels increase to:

- 10%, the skin and lips may take on a bluish tinge.
- 25%, the person may experience weakness and a rapid pulse.
- 50 – 60%, a person may lose consciousness, experience a coma, and die.

### **Can exposure to nitrates and nitrites cause cancer?**

- Nitrate and nitrite exposure has not been shown to cause cancer in animals. Human health studies do not support a direct association between nitrate and nitrite exposure and cancer. However, when nitrosamines are formed, some of these compounds may increase the risk of cancer.

### **Are some people at greater risk of harm from nitrates and nitrites than others?**

- Infants are much more sensitive to nitrates and nitrites than adults.
- Premature infants and infants younger than 4 months of age who are fed formula diluted with water from rural domestic wells that contain fertilizer are especially prone to becoming ill.
- Virtually all deaths from nitrate/nitrite poisoning have been in infants.
- Most reports of methemoglobin have occurred in infants exposed to drinking water containing nitrate at concentrations greater than 50 milligrams per liter or 50 parts per million (ppm).
- Studies by the National Academy of Sciences and the WHO reveal that the consumption of nitrates in drinking water usually does not represent a significant health risk to the adult population.

### **Is there a medical test to show whether I've been exposed to nitrates/nitrites?**

- Twenty-four hour urine collection and analysis is an accurate and reliable measure of nitrate exposure.
- A blood test can be used to diagnose methemoglobin.

### **Has the federal government made recommendations to protect public health?**

- The U.S. Environmental Protection Agency has set a maximum contaminant level (MCL) for nitrates in drinking water at 10 ppm and 1 ppm for nitrites. EPA believes that exposure to levels equal to or below this drinking water standard is protective of infants from methemoglobinemia and appears to be adequately protective of the health of even sensitive individuals.

### **What methods are available to remove nitrate in drinking water?**

- Ion exchange units, reverse osmosis, or distillation remove varying amounts of nitrate from drinking water. Distillation is the most effective method of nitrate removal.

### **What methods do not remove nitrate in drinking water?**

- Boiling water does not remove nitrates and is not a treatment alternative. As evaporation occurs during boiling, it increases nitrate concentration in the remaining water.
- Water softeners, carbon and mechanical filters or chemical disinfection, such as chlorination, also do not remove nitrate from water.

### **Where can I get more information?**

For more information, contact:

The Pennsylvania Department of Health, Division of Environmental Health Epidemiology, P.O. Box 90, Harrisburg, Pennsylvania, 17108. Telephone number: 717-787-1708.

### **References**

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