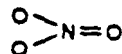


# **EPA National Pesticide Survey**

## **Nitrate**

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**Nitrate**

The U.S. Environmental Protection Agency (EPA) has completed its five-year National Survey of Pesticides in Drinking Water Wells (NPS), a study of the presence of 127 pesticides, pesticide degradates, and nitrate in community water system (CWS) wells and rural domestic drinking water wells. Nitrate was the contaminant most detected in the Survey. This fact sheet provides an overview of nitrate and its potential health effects, a summary of the concentrations of nitrate detected in CWS wells and rural domestic drinking water wells, and guidance on both treating and preventing well contamination.

The method selected by EPA for nitrate analyzed samples for the combined presence of nitrate and nitrite, which are reported as a single concentration of nitrate measured as nitrogen. Therefore, the analytical results for nitrate in this Fact Sheet do not distinguish between nitrate and nitrite.

### **What is Nitrate?**

Nitrate, typically found in soil and water, is a naturally occurring inorganic ion. Nitrate also occurs naturally in a number of foods, particularly vegetables. The major source of nitrate in cultivated soils is from inorganic fertilizers. Fertilizers containing nitrogen are applied to soils to enhance plant growth and are necessary in the synthesis of plant proteins. Other sources of nitrate in soil and water include septic systems, animal wastes, plant residues, and fixation from the atmosphere.

### **How Does Nitrate Behave in Soil and Ground Water?**

Nitrate is normally more stable than nitrite and is therefore much more abundant in the soil. Because nitrate is weakly retained by the soil, it is mobile and moves at virtually the same speed as water through soil. Nitrate is very soluble in water and has a very high potential to migrate through soil to ground water. Nitrate is not volatile, meaning that it does not readily evaporate from water into the air. Once it enters water, it is likely to remain there until it is used by plants or other organisms.

### **How Does Nitrate Get into Ground Water?**

Among the major sources of nitrate in soil and water are agricultural and home lawn and garden uses of nitrate fertilizers. Other nitrogen-containing fertilizers such as manure, ammonium sulfate, and urea also contribute nitrate to soil and water. Additional important sources of contamination by nitrate include the following:

- runoff from fields treated with nitrogen fertilizer;
- animal manure from feedlots, dairies, and poultry farms;
- leaching from irrigated fields;
- septic tank wastes; and
- sewage sludge.

### **Findings of the National Pesticide Survey**

Nitrate (measured as nitrogen) was the most commonly detected analyte in NPS wells. Based on the results of the NPS, EPA estimates that nitrate is present, at or above the analytical detection level of 0.15 mg/L used in the Survey, in about 49,300 (52.1%) CWS wells and 5,990,000 (57.0%) rural domestic wells nationwide. Considering the precision of the Survey, EPA estimates that the number of CWS wells

6,700,000. Nitrate is measured in milligrams per liter (mg/L) which is equivalent to parts per million (ppm). Nitrate concentration can be reported either as nitrogen (the nitrogen portion of nitrate) or as nitrate ion (10 mg/L of nitrogen is equivalent to 45 mg/L of nitrate). The maximum concentrations of nitrate detected were 13 mg/L in CWS wells sampled by the Survey and 120 mg/L in rural domestic wells sampled by the Survey. The median concentrations of detectable nitrate in CWS wells and rural domestic wells nationwide was approximately 1.6 mg/L.

EPA estimates that about 1,130 (1.2%) CWS wells and 254,000 (2.4%) rural domestic wells nationally contain concentrations that exceed EPA's proposed Maximum Contaminant Level (MCL) and Health Advisory Level (HAL) of 10 mg/L. MCLs are discussed more fully under Health Effects. EPA notified well owners and operators within 24 hours when detections were above health-based guidelines or standards. Considering the precision of the Survey, EPA estimates that the number of CWS wells with detectable levels of nitrate above the MCL could be as low as 370 or as high as 2,600, and the number of rural domestic wells could be as low as 122,000 or as high as 464,000.

### **What Health Effects Might Be Caused by Nitrate in Drinking Water?**

**Non-Cancer Effects:** EPA has set a regulatory level for nitrate (as nitrogen) in drinking water at 10 mg/L. This level includes a margin of safety to protect human health. EPA believes that water containing nitrate at or below this level is acceptable for drinking every day over the course of one's lifetime, and does not pose any health concerns.

In infants, exposure to nitrate levels in excess of 10 mg/L may result in a blood condition called methemoglobinemia. Methemoglobinemia, also known as blue baby syndrome, is characterized by a reduced ability of the blood to carry oxygen. This could result in a severe oxygen deficiency, and could lead to death. Methemoglobinemia related to drinking water contaminated with nitrate has only been observed in infants, especially those with gastrointestinal disorders, up to the age of 3 - 6 months.

**Cancer effects:** Data from laboratory studies are inadequate for EPA to determine if nitrate can increase the risk of cancer in humans.

**Standard:** EPA sets enforceable standards for public water systems, called MCLs. These regulatory standards set achievable levels of drinking water quality to protect human health. The proposed MCL for nitrate (as nitrogen) is 10 mg/L (proposed as of May 22, 1989). EPA has also proposed MCLs for Nitrite (as nitrogen), 1 mg/L, and for both nitrate and nitrite (as nitrogen), 10 mg/L.

### **How is Water Treated to Remove Contaminants?**

Nitrate can be detected in drinking water by a laboratory using an EPA method such as #353.2. If nitrate (as nitrogen) is detected in well water, and confirmed by retesting to be above 10 mg/L, consult your State or County health officials. They may advise periodic retesting to get an accurate overall picture of the water quality because seasonal precipitation changes and changes in fertilizer use can cause variations in the amount of chemicals found in drinking water wells. They may also advise using an alternative drinking water supply (such as bottled water) on a temporary basis (especially for infants), treating the water, or drilling a new or deeper well. If you receive your well water from a community water system, and suspect that your water is contaminated, contact your State public water supply agency. Public water suppliers are required to notify customers if the drinking water that they deliver contains a contaminant that exceeds its MCL.

You may also be able to treat your well water to remove nitrate and other contaminants. Treatment technologies that are currently used to remove nitrate from water include ion exchange, distillation, and reverse osmosis. These techniques are not necessarily appropriate in every situation. Conventional coagulation and lime softening are not effective treatment methods for the removal of this contaminant.

State or County health officials should be able to provide advice on the best approach to follow.

## **How Can Water Contamination be Prevented?**

Several steps may be taken to prevent nitrate from entering wells, such as eliminating its direct entry through the well wall, drilling a new well, modifying or reducing fertilizer use, improving management of animal wastes in feed lots and other locations, properly locating, installing and operating septic systems, or hooking up to municipal sewage systems.

### ***Eliminate Direct Entry Through the Well Wall***

If nitrate is detected in well water, it may be entering the ground water through the well itself rather than through the soil. If the well is old or poorly constructed, or if there are visible cracks in the casing, obtain expert advice on whether or not improvements can be made to the well. In addition, investigate simple methods of capping the well or sealing it at the surface to prevent entry. Do not conduct any chemical mixing activities near the well and use check valves to prevent back siphonage if you use well water to mix fertilizers (a spill could lead to direct contamination of the well).

### ***Drill a New Well***

If the soil surrounding the well is the source of contamination, drilling a new or deeper well may make sense if water can be drawn from a deeper, uncontaminated aquifer. Unfortunately, it often is difficult to know the quality of the ground water without drilling or extensive testing. Seek expert advice before you drill.

### ***Learn More about Fertilizer Use and Proper Manure Management***

If you or others living near you use fertilizers extensively or keep animals on the land, you should consider attending training courses on how to reduce practices that can degrade ground water quality. You may find that you can eliminate or lessen the frequency or quantity of your fertilizer usage by choosing alternative methods. Contact your State or County agriculture department for schedules and additional information.

### ***Properly Locate, Install, and Operate Septic Systems***

Improperly located, installed, and operated septic systems are frequently identified as the cause of ground-water contamination. Because local conditions and system design, use, and maintenance vary greatly, it is difficult to take one single action to ensure that your septic tank is not a source of ground-water contamination. You may minimize the potential for contamination by observing the following general rules:

- locate the septic system downgradient from nearby wells (the minimum safe distance is generally 100 feet);
- take into account the type of soil in which the waste water will drain;
- ensure that there is adequate distance between the bottom of the drain field and the underlying water table;
- provide an adequately sized area for the drain field;
- switch drain fields annually if the system is provided with alternate drain fields;
- ensure that the volume and type of discharges are compatible with the design of the septic system;
- pump the septic tank regularly; and
- do not use solvents to clean drain pipes.

## Why Was the National Pesticide Survey Conducted?

EPA conducted the Survey to determine the frequency and concentration of pesticides, pesticide degradates, and nitrate in drinking water wells nationwide and to examine the relationship between the presence of pesticides in drinking water wells and patterns of pesticide use and ground-water vulnerability. The Survey sampled 566 community water system wells and 783 rural domestic wells for 127 pesticides, pesticide degradates, and nitrate. The wells were selected as a representative statistical sample to provide nationwide estimates of the presence of pesticides and nitrate in drinking water wells, and are not meant to provide an assessment of pesticide contamination at the local, County, or State level.

## Where to Go for More Information

This fact sheet is part of a series of NPS outreach materials, fact sheets and reports. The following additional fact sheets are available through EPA's Public Information Center (401 M Street SW, Washington, DC 20460, (202) 382-2080):

<b>Survey Design</b>	<b>Analytical Methods</b>	<b>Project Summary</b>
<b>Survey Analytes</b>	<b>Summary Results</b>	<b>Glossary</b>
<b>Quality Assurance/ Quality Control</b>	<b>Fact Sheet for each detected analyte</b>	<b>How EPA Will Use The NPS Results</b>

Additional information on the Survey and on pesticides in general can be obtained from the following sources:

U.S. EPA Safe Drinking Water Hotline 1-800-426-4791 (In Washington, DC (202) 382-5533) Monday-Friday, 8:30 am to 4:30 pm Eastern Time	Information on regulation of pesticides in drinking water
National Pesticide Telecommunications Network 1-800-858-7378 24 hours a day	Information on health effects and safe handling of pesticides
U.S. EPA Office of Pesticide Programs (OPP) Docket Public Information Branch (R7506C) 401 M Street, SW Washington, DC 20460 Telephone: (703) 557-2805 National Technical Information Service (NTIS) 5285 Port Royal Road Springfield, VA 22161 (703) 487-4650	Background documents for Survey (available for review)  Copies of the <u>NPS Phase I Report</u> (available 1991) and <u>NPS Phase II Report</u> (when available)

If you are concerned about the presence of pesticides and nitrate in your private water well, contact your local or State health department. Other experts in your State environmental agency or agriculture and health departments may also be helpful to you. If you receive your drinking water from a community water system and have questions about your water quality, contact your local community water system owner/operator or the State water supply agency.

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- U.S. Environmental Protection Agency, Office of Ground-Water Protection, Septic Systems and Ground-Water Protection: A Program Manager's Guide and Reference Book, July 1986. EPA 440/6-86-006.
- U.S. Environmental Protection Agency, Office of Ground-Water Protection, Septic Systems and Ground-Water Protection: An Executive's Guide, July 1986.