Applying knowledge to improve water quality

Pacific Northwest

Regional Water Program

A Partnership of USDA NIFA
& Land Grant Colleges and Universities

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# Safe Drinking Water:

# *Nitrates in Drinking Water*

Nitrate is the most common inorganic contaminant in drinking water in the four Pacific Northwest states. If you obtain your drinking water from a public supply system (city, town, etc) your drinking water has already been tested and, if needed, treated to remove nitrates. However, if you get your water from a private source (well or pond) you should be concerned about nitrates in your drinking water. Nitrate-nitrogen levels in drinking water should never exceed 10 part per million (ppm).

## *Health Concerns*

Humans ingest nitrate in food and water. In older children and adults, nitrate is ingested, absorbed from the digestive tract, and excreted rapidly in the urine. Healthy human adults can consume fairly large amounts of nitrate with few, if any, known short-term adverse effects. The health effects of chronic, long-term consumption of high levels of nitrate are uncertain.

***Blue-baby syndrome.*** Infants younger than 6 months old are susceptible to nitrate poisoning. Newborn infants have little acid in their digestive tracts for digesting food. Instead, they depend on bacteria present in their digestive tracts at birth to help them digest food. These bacteria also change nitrate to toxic nitrite ($NO_2$). Generally, by the time infants reach the age of 6 months, hydrochloric acid levels in their stomachs rise and kill most of the bacteria that convert nitrate to nitrite. Once formed, nitrite enters the baby's bloodstream. There it reacts with hemoglobin, the molecule that carries oxygen in the bloodstream, to form a new compound called methemoglobin. This compound interferes with the blood's ability to carry oxygen. As oxygen levels decrease, babies may show signs of suffocation. This condition is called "methemoglobinemia" or "blue baby syndrome."

The major symptom of methemoglobinemia is bluish skin color, most noticeably around the eyes and mouth. Infant deaths from blue baby syndrome are rare. Doctors recommend using bottled water to make formula when nitrate-nitrogen levels exceed the U.S. Public Health Service drinking water standard of 10 parts per million (ppm) $NO_3$-N.

## *Water testing*

If you suspect nitrate in drinking water, start a routine (once a year) water sampling and testing program to monitor nitrate levels. Nitrate is detectable in water only by chemical testing. It is colorless, odorless, and tasteless. Check with your local Extension office in your county for a list of certified private laboratories.

Guidelines for the use of water with known nitrate-nitrogen concentrations are shown in the table. Water containing less than 10 ppm $NO_3$-N is considered safe for all humans. Water containing between 11 and 20 ppm $NO_3$-N is generally safe for adults; however, it should not be given to infants. Do not drink water with nitrate-N concentrations exceeding 20 ppm.

Washington State University
Oregon State University OSU
University of Idaho
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Northwest Indian College
UAF University of Alaska Fairbanks
United States Environmental Protection Agency
National Institute of Food and Agriculture USDA

## Pacific Northwest Regional Water Quality Coordination Project Partners

### *Land Grant Universities*

***Alaska***
Cooperative Extension Service
Contact Fred Sorensen:
907-786-6311
http://www.uaf.edu/ces/water/
University Publications:
http://www.alaska.edu/uaf/ces/publications/

***Idaho***
University of Idaho
Cooperative Extension System
Contact Bob Mahler: 208-885-7025
http://www.uidaho.edu/wq/wqhome.html
University Publications:
http://info.ag.uidaho.edu/Catalog/catalog.htm

***Oregon***
Oregon State University
Extension Service
Contact Mike Gamroth: 541-737-3316
http://extension.oregonstate.edu/
University Publications:
http://extension.oregonstate.edu/catalog/

***Washington***
Washington State University
WSU Extension
Contact Bob Simmons:
360-427-9670 ext. 690
http://wawater.wsu.edu/
University Publications:
http://pubs.wsu.edu/

Northwest Indian College
Contact Charlotte Clausing:
360-392-4319
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http://www.nwic.edu/

### *Water Resource Research Institutes*

Water and Environmental Research Center (Alaska)
http://www.uaf.edu/water/

Idaho Water Resources Research Institute
http://www.boise.uidaho.edu/

Institute for Water and Watersheds (Oregon)
http://water.oregonstate.edu/

State of Washington Water Research Center
http://www.swwrc.wsu.edu/

### *Environmental Protection Agency*

EPA, Region 10
The Pacific Northwest
http://www.epa.gov/r10earth/

Office of Research and Development, Corvallis Laboratory
http://www.epa.gov/wed/

For more information contact
Jan Seago at 206-553-0038 or
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## *The Project*

Land Grant Universities, Water Research Institutes, and EPA Region 10 have formed a partnership to provide research and education to communities about protecting or restoring the quality of water resources. This partnership is being supported in part by the USDA's National Institute of Food and Agriculture (NIFA).

## *Our Goal and Approach*

The goal of this Project is to provide leadership for water resources research, education, and outreach to help people, industry, and governments to prevent and solve current and emerging water quality and quantity problems. The approach to achieving this goal is for the Partners to develop a coordinated water quality effort based on, and strengthening, individual state programs.

## *Our Strengths*

The Project promotes regional collaboration by acknowledging existing programs and successful efforts; assisting program gaps; identifying potential issues for cross-agency and private sector collaboration; and developing a clearinghouse of expertise and programs. In addition, the Project establishes or enhances partnerships with federal, state, and local environmental and water resource management agencies, such as by placing a University Liaison within the offices of EPA Region 10.

***Drinking water guidelines for water with known concentrations of nitrate.***

| $NO_3$-N concentration (ppm) | Guideline |
|---|---|
| 0 to 10 | Safe for all humans |
| 10 to 20 | Generally safe for adults. Do not use for infants |
| 20+ | Do not use |

## *Treatment Options*

Nitrate easily dissolves in water, and it is very difficult to remove. If water contains more than 10 ppm (milligrams per liter, or mg/L) of nitrate-nitrogen, the viable options for reducing health risks are drinking water replacement or in-home treatment. Unfortunately, simple household treatment methods used for other contaminants—such as boiling, filtration, disinfection, and water softening—are not effective for nitrate removal. Boiling will actually increase the nitrate concentration of the remaining water.

The use of bottled water for cooking and drinking is a relatively inexpensive method for reducing the health risks associated with nitrate intake.

The three in-home water treatment methods that can effectively remove nitrate are distillation, reverse osmosis, and ion exchange. Treatment of drinking water to remove nitrate is expensive. Factors to consider when purchasing a treatment system are the initial purchase price, the cost of regular maintenance, electricity rates, and the quantity of drinking and cooking water desired. Always test your water before purchasing water treatment equipment.

## *National Water Quality Program Areas*

The four land grant universities in the Pacific Northwest have aligned our water resource Extension and research efforts with eight themes of the USDA's National Institute of Food and Agriculture.

1. Animal Waste Management
2. Drinking Water and Human Health
3. Environmental Restoration
4. Nutrient and Pesticide Management
5. Pollution Assessment and Prevention
6. Watershed Management
7. Water Conservation and Management
8. Water Policy and Economics

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