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Contaminants in Alaska's Water Resources

Our urban centers and rural communities and populations are changing. Understanding how this affects water quality, habitat and other resources can help us maintain our quality of life.

What is a watershed?

A watershed is an area of land that drains into a common body of water. What goes into the watershed determines the quality of your well water and the water found in local rivers, creeks and groundwater supplies.

Surface water and groundwater

Surface water is the water above ground (e.g., rivers, lakes and streams). Groundwater is the water stored underground, saturating small spaces between particles of soil and rock. Groundwater is available year-round and is used in 80 percent of Alaska public water systems.

How does water become polluted?

Dumps and landfills generate a liquid called leachate from rain and snowmelt filtering down through decomposing materials, releasing and entraining soluble materials along the way. Leachate can seep downward into the groundwater, or it can leak into the surface water. Areas near landfills and dumps are more susceptible to this type of groundwater contamination.

Underground storage tanks are a potential groundwater contamination source when they corrode or leak. Unstable and corrosive soils in many parts of Alaska make this an especially serious problem. Fuel that has leaked into the ground moves through the soil, leaving a residue trapped between soil particles. Water that contacts this residue becomes contaminated; as it moves downward from the surface, it can eventually contaminate the groundwater, which moves toward discharge areas and then into surface waters. Individuals who use groundwater or surface water can be affected when even a small amount of fuel leaks into nearby soil.

Septic systems that are poorly designed or located or systems that are incorrectly used can become sources of groundwater contamination. Such systems may contain harmful bacteria, nitrates, effluents or other introduced substances that could seep into the groundwater and contaminate it.

Other common contaminants, such as excess dissolved minerals, excess fertilizers, road salt, organic solvents (both household and industrial), fuels, oils and some pesticides are some of the more common contaminants of groundwater. These substances can affect the groundwater when they are used irresponsibly.

Soil type plays an important role in determining how, where and when contaminants travel. Clay soils, which are made up of tiny particles, slow or block downward movement of water. Sandy soils are made up of large particles and water seeps through easily without filtering out or decomposing pollutants.

Why protect Alaska's water resources?

Through careful planning and good stewardship of the land, we increase the likelihood that water quality is maintained during our lifetime and for future generations. Protecting water resources is cost effective — fixing contamination problems is expensive and cleanup is rarely completely satisfactory.

Things you can do to protect water resources

- Reduce and ensure proper use, storage and disposal of water-polluting chemicals, such as household cleaners, lawn and garden fertilizers, pesticides, phosphate detergents, solvents, paints and preservatives. These chemicals exact a cost on water quality and beneficial organisms.
- Watch out for petroleum products. Spills and leaks may appear small, but cumulatively they cause considerable degradation to our waterways.

- Check fuel storage tanks regularly for leaks, and dispose of all petroleum products correctly.
- When topping off engines with oil or fuel, take the time to use a funnel so as to hit the mark every time.
- Avoid pouring oil products and solvents onto the ground or into a storm drain.
- Wash your vehicle at a local car wash where specialized separators reduce the by-products that would otherwise enter local water bodies.
- Pay close attention to water usage in the home and garden.
- Use less, reuse and recycle in that order and you help to limit landfill space, cut natural resource and water use, and prevent contamination.
- Scoop pet waste to prevent unwanted nutrients and bacteria in public places and nearby water bodies. Bag it and dispose of it by flushing it down the toilet, by burying it or by placing it in the trash.

Naturally occurring contaminants

Arsenic

Arsenic is a naturally occurring toxic element commonly found in groundwater. Although it is generally present through natural means, there are industrial and agricultural practices that can lead to groundwater contamination with arsenic-containing compounds.

The maximum contaminant level (MCL), set by the Environmental Protection Agency (EPA), is 10 parts per billion (ppb) for drinking water, 100 ppb for gardening and 500 ppb for hand washing.

Arsenic is a health concern in low long-term exposure and in high short-term exposure. Potential health effects include skin damage, circulatory problems and increased cancer risk.

Because private wells are not regulated, it is the consumers' responsibility to get their wells tested.

Arsenic must be tested for since it does not give the water a detectable taste, smell or color. Well water consumers should contact a laboratory that is certified for the chemical analysis of drinking water.

If water is treated with an effective oxidant such as free chlorine, the arsenic is more easily removed from drinking water.

Water can be treated for arsenic contamination in several ways, or alternate sources of water can be used. Although arsenic cannot be removed by boiling — in fact, it is concentrated by boiling — it can be removed by a variety of processes. Look for an arsenic system that is certified to remove arsenic by NSF International (www.nsf.org).

There are two main types of arsenic removal systems: point-of-use and point-of-entry. Point-of-use systems are designed to be used at the tap and provide treated water for cooking and drinking. Since the health concerns associated with arsenic are due to ingestion, a point-of-use system is often adequate. This type of system is often less expensive to buy and easier to maintain. The point-of-entry system treats all water as it enters the house.

The two most common and cost-effective methods for arsenic removal are adsorptive media and reverse osmosis.

Adsorptive media removes arsenic as the water moves through a cartridge. The arsenic sticks to the media and the water passes through. Other dissolved minerals may also stick to the media.

Reverse osmosis removes arsenic when water flows through a membrane that allows water molecules to pass through but not arsenic and other mineral contaminants.

Arsenic can also be precipitated to iron, which can then be removed.

Nitrate

Nitrate is a nitrogen compound that is a potential health hazard. It is highly soluble in water and can seep into groundwater from septic tanks, animal waste, fertilizers (manufactured and compost) and sewage sludge. It is a serious health concern for infants under 6 months of age. Nitrate can be removed from water by distillation, reverse osmosis and ion exchange, or bottled water can be used for drinking and cooking.

The most common forms of nitrogen contaminants that are found in groundwater are nitrate (NO_3) and nitrite (NO_2). The EPA is required to determine safe levels of chemicals in drinking water. The EPA MCL for nitrate (NO_3-N) is 10 ppm and for nitrite (NO_2) it is 1 ppm.

Nitrate is a health concern for infants under 6 months old, pregnant women and people with low stomach acid.

Infants under 6 months of age can develop blue baby syndrome, or methemoglobinemia. Symptoms of methemoglobinemia are bluish skin color, especially around the nose and mouth, fussiness, tiredness, diarrhea or vomiting. The symptoms can be similar to a

common cold. There is a simple blood test for methemoglobinemia. Once diagnosed, methemoglobenemia is easily remedied.

In healthy adults and children, nitrate is absorbed and excreted rapidly. There are rarely any known effects for short-term exposure of a healthy adult or child to nitrate. It is not known what the health effects are of long-term consumption of nitrate.

Test wells for nitrate. Generally, certified labs report nitrate content in ppm of NO_3. If the test comes in over 5 ppm, test the nitrate levels once or twice a year to make sure that they are not increasing. If the well test results are above 10 ppm, install a water treatment system or switch to another source of water for drinking and cooking. Another option is to drill a new well that is either deeper or in a different location to tap into water that is not contaminated by nitrate.

If the well is contaminated with nitrate, there could also be microbial contamination. If the source of contamination is a septic system, sewage line or animal feces, the well could be contaminated by a variety of microbial pathogens. Microbial testing would be recommended.

There are three main treatment options for removing nitrate: distillation, reverse osmosis and ion exchange. Since nitrate is only harmful if consumed, a point-of-use water treatment system is adequate and more affordable than a whole-house system.

- *Distillation* involves boiling the contaminated water. The nitrate does not evaporate with the water. The steam is cooled and the purified water condenses and is funneled into a separate tank for use.
- *Reverse osmosis* moves water from one side of a membrane to the other, thereby purifying the water. The contaminants are left on one side and the purified water gets collected for use.
- *Ion exchange* purifies contaminated water by trading nitrate molecules for chloride molecules that are on special resin beads.

Do not boil the water. Boiling just concentrates the nitrate. Nitrate is very soluble in water and difficult to remove. Bottled water for cooking and drinking is a good short-term strategy; over the long-term ,it would be costly.

Protect your well from contamination. Wellhead protection can help prevent wells from being contaminated with nitrate or other contaminates. A properly constructed and maintained wellhead will keep drinking water safe. Potential sources of nitrate include septic systems, animal waste and fertilizer. Properly maintain your septic system: protect the drain field and pump your tank regularly. Keep animal waste away from your wellhead.

Watch out for potential sources of contamination.

- Shallow well (less than 50 feet deep)
- Feed lots
- Agriculture
- Golf courses and lawns
- Septic systems (failing)

Radon

Radon is a naturally occurring radioactive gas that can cause cancer. It can't be seen, smelled or tasted. Radon can enter a home from the soil below your home and/or the tap water. Groundwater (well water) poses a greater risk for radon contamination than surface water.

Radon is formed by the decay of uranium, which is present in small amounts in soil and water. There are uranium deposits in the soil that can contribute significant amounts of radon gas to the soil and groundwater. Radon gas can seep into cracks in a foundation or be introduced to the building via well water.

Radon in water could pose a risk for health by inhalation and ingestion. Radon is released from the water to the air by showering or other household uses. Airborne radon is the second leading cause of lung cancer in the United States, contributing to 15,000–22,000 deaths per year. Thankfully, there is almost no detectable radon in Alaska waters.

Water is the foundation of life. While some contaminants are natural and need to be pulled out of the water, other manmade contaminants must be kept out of the water cycle to keep surface water and groundwater as clean as possible.

For more information

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Resources

Alaska Association of Conservation Districts
www.alaskaconservationdistricts.org
907-373-7923

Alaska Department of Environmental Conservation
www.dec.alaska.gov/water
907-465-5257

Alaska Department of Natural Resources
www.dnr.alaska.gov
Anchorage: 907-269-8400
Fairbanks: 907-451-2705
Juneau: 907-465-3400

Alaska Rural Water Association
http://www.arwa.org/
Wasilla: 907-357-2792

Anchorage Waterways Council
www.anchoragecreeks.org
907-272-7335

EPA Alaska Operations Office
www.epa.gov/aboutepa/epa-alaska
907-271-5083

USDA Natural Resource Conservation Service
www.ak.nrcs.usda.gov
907-761-7760

USDA Natural Resource Conservation Service
http://alaska.usgs.gov
Anchorage: 907-786-7000
Fairbanks: 907-479-5645
Juneau: 907-586-7216

www.uaf.edu/ces or 1-877-520-5211

Art Nash, Extension Energy Specialist. This publication is based on publications originally written by Fred Sorensen, Extension Faculty, Natural Resources and Community Development, and Lisa Wedin, Research Technician.

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