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An Introduction to Drinking Water

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Drinking water quality is a common concern among people today. This publication serves as an introductory reference on drinking water protection, quality and treatment.

How Much Do You Know About Your Drinking Water?

How much do you really know about the water you drink every day? Where does it come from? Is it safe to drink? Is a home water treatment system necessary? How can drinking water be protected? This publication will begin to answer those questions. In addition, it will reference more comprehensive University of Nebraska–Lincoln Extension publications on each topic covered.

Water Is Essential to Life

Water is second to oxygen as being essential for life. People can survive days, weeks, or even longer without food, but only about four days without water.

The average adult consumes and excretes about 2 1/2 to 3 quarts of water a day. Some of this water is supplied through foods but most is consumed through beverages. It is generally recommended that adults consume 6 to 8 cups (48 to 64 ounces) of liquids daily. Some beverages, such as coffee, tea, soda with caffeine, and alcohol are diuretic and increase urine excretion. These beverages, if consumed in large quantities, can upset the body water balance.

What's In Your Water And What Does It Mean To Your Health?

Drinking water is never pure. Water naturally contains minerals and microorganisms from the rocks, soil and air with which it comes in contact. Human activities can add many more substances to water. But drinking water does not need to be pure to be safe. In fact, some dissolved minerals in water can be beneficial to health. For example, the National Research Council (National Academy of Sciences) states that drinking water containing dissolved calcium and magnesium generally contributes a small amount toward calcium and magnesium human dietary needs. Fluoride, either naturally occurring or added to the water supply, can help protect against tooth decay. Whether or not drinking water is safe will depend on which impurities are present and in what amounts.

How Safe is Our Public and Private Drinking Water In Nebraska?

Public Drinking Water Safety

In 1974, the U.S. Congress enacted a program to ensure that our public drinking water is safe. The Safe Drinking Water Act directs the U.S. Environmental Protection Agency (EPA) to establish minimum national drinking water standards. Regulations set achievable levels of drinking water quality to protect health. These standards set limits on the amounts of various substances allowed in public drinking water. This means that every public water supply in the country serving at least 15 service connections or at least 25 people must ensure that its water meets these minimum standards. Even non-community supplies such as campgrounds and roadside motels with their own water supplies are covered by the regulations. Drinking water regulations established by EPA reflect the best available scientific and technical judgment. *The Nebraska Health and Human Services System (Regulation and Licensure Division) is the primary agency responsible for enforcing the federal drinking water regulations in Nebraska.*

EPA standards for public drinking water fall into different categories. Primary Standards and Action Levels are based on health considerations and are designed to protect people from three classes of pollutants: pathogens (disease-causing microbes), radioactive elements and toxic chemicals. Primary Standards and Action Levels are enforceable. Secondary Standards are based on taste, odor, color, corrosivity, foaming and staining properties of water. Secondary Standards are not enforceable, but serve as guidelines for water utilities attempting to provide the best quality water possible. Health Advisories are an estimate of acceptable drinking water levels for a chemical substance over a given period of time based on health effects information. Health Advisories are not enforceable, but serve as technical guidance. EPA regulations currently cover about 100 potential contaminants. The number of contaminants regulated is being increased, and standards are re-evaluated as new data become available.

Setting drinking water standards involves uncertainty. Data relating human health effects to chemicals in drinking water are limited, and scientists have difficulty predicting the effects of drinking small amounts of chemicals over a lifetime. In addition, regulatory decisions frequently incorporate economic, political and social considerations. Therefore, it is important to understand that standards for drinking water contaminants do not guarantee that water with a contaminant level below the standard is risk-free. Nor do the regulations

mean that water with a higher level is automatically unsafe. Current drinking water standards reflect scientific judgement based on all available knowledge.

All public water suppliers must supply water that is tested. There are specific requirements for the frequency of testing for each contaminant. Requirements vary — generally larger systems and systems serving permanent resident populations are required to have more testing done. If a contaminant is found to be above the maximum level allowed, the water supplier must reduce the level. Some options available include dilution with another water source, water treatment, or obtaining an alternate water source. Problem-solving when water has a contaminant above the maximum level allowed is often difficult and expensive. Therefore, protection of the current water sources from contamination is the best alternative and a high priority for public water suppliers.

Water suppliers must notify consumers if a drinking water standard is violated. If you hear or read an announcement that a drinking water standard has been violated, don't panic. The announcement will explain the problem and its potential adverse health effects. It will also explain what precautions you should take and what the system is doing to correct the problem. The problem may be at the water source, in the distribution system, or be the result of faulty testing procedures.

Private Drinking Water Safety

While the Nebraska Health and Human Services System (HHSS) Department of Regulation and Licensure regulates private drinking water well construction and location, it does not regulate the safety or quality of water provided by private wells. In addition, the Safe Drinking Water Act does **not** apply to private drinking water supplies. Thus, the safety and quality of private drinking water in Nebraska is not subject to any regulation, and is at the discretion of the water user except in cases where state licensing may be required for a specific activity. Lending agencies may require a private water supply meet Safe Drinking Water Act nitrate and bacteria standards prior to approving a real estate loan. In most cases, the well also must meet current HHSS construction and location standards before a loan will be approved.

Although not required by regulations, testing a private water supply may be justified. Testing a private water supply is a decision made by the water user. Since there are many potential water contaminants, it would be very costly — and in most cases unnecessary — to test for them all. Tests for nitrate and bacteria often are used as general indicators of the safety of private well water, and generally, private water supplies should be checked annually for these contaminants. Testing for nitrate and bacterial contamination should be considered after flooding or when any noticeable change in taste, color, or smell of the water is detected. These changes may also indicate the need for other tests. A test for bacterial contamination should be done if users experience unexplained and/or reoccurring flu-like illness. Any time a pregnant woman, woman anticipating pregnancy, or infant under the age of 6 months become a water user, a test for nitrate contamination should be done.

Tests for nitrate and bacteria do not guarantee the water is safe, as other contaminants could be present. Tests should be done for other substances when specific contamination is suspected. This might be the result of a spill, backflow, use of product near the well, the presence of industrial or commercial activities in the vicinity of the well, or other such events or situations.

Sources of Drinking Water In Nebraska

Water can be obtained from streams, rivers, lakes, or underground aquifers, which are used to supply private wells and public drinking water. In Nebraska, about 80 percent of the population consumes drinking water that was obtained from groundwater sources. The remaining 20 percent of the population obtains its water from surface water such as rivers or lakes.

Only five Nebraska public water systems obtain their water from surface water. These public water systems are Beaver Lake, Blair, Cedar-Knox Rural Water District, Chadron and Metropolitan Utilities District (MUD). MUD, which serves the Omaha metro area, currently operates two drinking water treatment plants; only one of these obtains its water from a surface water source. An additional 20 public water systems purchase their water from these five (including Crofton, Fordyce, Fort Calhoun, Kennard, Obert, St. Helena and Waterloo).

People in the rest of the state (both public supplies and private wells) drink water that originates from underground and is pumped to the surface through wells. Groundwater comes from natural under ground layers, often of sand or gravel, that contain water. These formations are called aquifers.

Some groundwater wells indirectly pull water from nearby rivers or lakes. These wells are classified regulatory as "groundwater under the influence of surface water". Communities such as Crawford, Kearney, Lincoln, Nebraska City, and Fairbury have wells with this classification. The water from these wells must be treated as if it is surface water.

Most public water systems in Nebraska that use groundwater as their water source do not treat the water before distributing it to their customers. In Nebraska, about 85 percent of public water systems that use groundwater do not treat their water beyond the natural treatment provided as the water moves through the soil and aquifer, *although since these tend to be small systems the majority of the state's population drinks treated water*. All water utilities that use surface water treat their water.

In Nebraska, public water systems that treat their water do so by:

- adding a disinfectant (e.g., chlorine or chloramines) to the water to inactivate microbial pathogens,
- improving the aesthetic quality of the water (e.g., reducing hardness), and
- removing (or reducing to allowable levels) specific contaminant(s) that have been detected (e.g., nitrate).

In order to keep costs down, treatment systems are designed only to remove the contaminants of current concern in the water. Most treatment systems for public water supplies were designed initially to improve aesthetic quality of water and to remove bacterial contamination. Although these treatment systems have since evolved to also remove some other contaminants, they cannot remove all contaminants that could enter the water if the water source is not protected.

Point-Of-Entry (POE) water treatment devices that treat water as it enters the household, and Point-Of-Use (POU) devices that treat water at a single tap are available for users of private well water. While several treatment systems are available, each has limitations. No treatment system can remove every potential impurity or solve every water problem. As with public water supplies, the source should be protected.

Working Toward Safe Drinking Water Is Everyone's Responsibility

Since the majority of Nebraska communities rely on groundwater for drinking water, the following discussion will focus on protection of groundwater. Although groundwater was once thought to be protected by layers of rock and soil, we now know that aquifers, which supply groundwater, are vulnerable to many types of contamination. Contaminants can enter aquifers and groundwater from landfills, fertilizers and pesticides, sewage, animal waste, fuel storage tanks, and many other sources. Even distant contamination can have negative impacts on a water supply given sufficient time. In addition, some contaminants are introduced to groundwater from naturally occurring sources, such as the rock and minerals that make up an aquifer.

Once groundwater becomes contaminated, clean-up is difficult (if not impossible) and expensive. In some cases, groundwater contamination has been so severe that the well must be abandoned. At the same time, it is well known that developing new sources of groundwater for drinking water supplies is very expensive. It is clear that good management of the land area around a water supply well to prevent groundwater contamination presents the best opportunity to preserve drinking water resources and save money. In fact, as modern society continues to advance and new chemicals and compounds are developed, prevention of pollution to drinking water supplies may be the only viable alternative for communities and individuals that wish to maintain their clean drinking water.

Public Drinking Water Protection

Nebraska has initiated a statewide effort to protect community drinking water supplies that rely on surface water and groundwater. In the case of groundwater, this effort is entitled the Nebraska Wellhead Protection Program, and is administered by the Nebraska Department of Environmental Quality (NDEQ) with assistance from the Nebraska Health and Human Services System. State and local agencies, and the Nebraska Rural Water Association (NeRWA) have worked hard to accomplish some of the initial critical steps in developing Wellhead Protection (WHP) in Nebraska. Surface water drinking supplies, such as river sources, have undergone the initial steps of a similar protection process.

One of the first steps to protect groundwater associated with drinking water supply systems is to determine, or map, the land area that supplies recharge to the groundwater that will eventually enter the water supply system. This land area is termed a Wellhead Protection Area (WHPA). The WHPA is usually represented as an area surrounding the well, or wells, that pump water to a community water supply distribution system. While this is a complex procedure, the NDEQ and NeRWA have been working to delineate the wellhead protection areas for virtually all of the public water supply systems in Nebraska. These maps are available to anyone who has a legitimate interest in using the maps. A request needs to be submitted to the NDEQ.

While the maps are extremely important, the next series of steps toward a successful wellhead protection program requires local, community-based action. Thus, it is everyone's responsibility to work toward safe and clean drinking water. This series of steps can be described as follows:

1) Form a local planning committee.
2) Locate and inventory potential sources of contamination within the wellhead protection area.
3) Identify and select appropriate management strategies to reduce the risk of potential contaminant sources.
4) Plan for sustained protection of water supplies through emergency and contingency planning, planning for new wells.
5) Educate the public about the need to protect groundwater resources.

You are encouraged to take a leadership role, or simply help, to make sure that the Wellhead Protection Program in your town is as successful as it can possibly be.

There are other public or nonprofit agencies or organizations that can provide information regarding wellhead protection. Examples include Natural Resources Districts and the Groundwater Foundation.

Private Drinking Water Protection

The University of Nebraska–Lincoln Extension and Natural Resources Districts offer a variety of local programs to help landowners ensure the protection of groundwater. These efforts have a direct impact on the protection of private drinking water supplies.

Remember that an ounce of prevention is worth a pound of cure, and when it comes to groundwater, it is everyone's responsibility to contribute toward the ounce of prevention.

Publications

Extension publications are available online at *http://extension.unl.edu/publications* or can be obtained through your local or state Extension office.

Drinking Water Contaminant Series

G89-907 Drinking Water: Testing for Quality
G96-1274 Drinking Water: Hard Water
G96-1275 Drinking Water: Sulfates and Hydrogen Sulfide
G96-1279 Drinking Water: Nitrate-Nitrogen
G97-1333 Drinking Water: Lead
G98-1360 Drinking Water: Copper
G98-1376 Drinking Water: Fluoride
G02-1448 Drinking Water: Bottled or Tap?
G04-1552 Drinking Water: Arsenic

Drinking Water Treatment Series

EC03-703 Drinking Water Treatment: An Overview
G03-1488 Drinking Water Treatment: What You Need To Know When Selecting Water Treatment Equipment
G03-1489 Drinking Water Treatment: Activated Carbon Filtration
G03-1490 Drinking Water Treatment: Reverse Osmosis
G03-1491 Drinking Water Treatment: Water Softening (Ion Exchange)
G03-1492 Drinking Water Treatment: Sediment Filtration
G03-1493 Drinking Water Treatment: Distillation
G03-1494 Drinking Water Treatment: Emergency Procedures
G03-1496 Drinking Water Treatment: Continuous Chlorination

Other Publications

G02-1471 Decommissioning Water Wells: An Owner's Guide

Other Educational Items

Sand Tank Groundwater Model and User Manual
Information available at http://groundwater.unl.edu

This publication has been peer-reviewed.

UNL Extension publications are available online at *http://extension.unl.edu/publications*.

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