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G89-907 Drinking Water: Testing for Quality (Revised April 2005)

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Drinking Water: Testing for Quality

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Why test water quality?

Concern about water quality often leads consumers to ask questions such as "What is in my water?" or "Is my drinking water safe?"

All water from natural sources contains dissolved substances. These substances are often called contaminants, especially when the amounts present are at possibly harmful or problematic levels. The substances in water can result from either natural processes or human activities. At low concentrations, many do not cause known harmful effects and may be beneficial. Research shows some substances may be harmful only when present at high enough concentrations.

The only way to know if the water you use for drinking and cooking contains potentially harmful substances at levels high enough to be of concern is to have the water tested. Analytical testing can determine what substances are present and their concentration levels.

Testing Public Water Supplies

A public water supply is defined as a system that provides piped water for human consumption to at least 15 service connections or regularly serves at least 25 individuals. The U.S. Congress enacted a program to ensure that 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 for potential contaminants. In Nebraska, the Nebraska Health and Human Services System (HHSS) administers the Safe Drinking Water Act.

Public drinking water standards established by EPA fall into different categories — Primary Standards, Action Levels, Secondary Standards, and Health Advisories (see *Table I*). Primary Standards and Action Levels are based on health considerations and designed to protect human health against three classes of toxic pollutants: pathogens, radioactive elements, and toxic chemicals. Primary Standards and Action Levels are enforced by the EPA. If a contaminant exceeds the maximum level allowed, the water supplier must reduce the level. Water suppliers must notify consumers if a drinking water standard is violated. Secondary Standards are based on aesthetic factors such as taste, odor, color, corrosivity, foaming, and staining properties that may affect the suitability of a water supply for drinking and other domestic uses. They serve as guidelines for water treatment plant operators attempting to provide the best quality water possible and are not enforceable. 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. These are not enforceable but serve as guidance to water suppliers.

Table I. Public drinking water standards by EPA.		
Environmental Protection Agency Designation	*Criteria For Designation*	*Public Water Supply Requirements Associated with Designation*
Primary Standards	Human health protection	Enforced
Action Levels	Human health protection	Enforced
Secondary Standards	Aesthetic properties of water	Not enforced (guidelines)
Health Advisories	Estimate of long-term human health protection	Not enforced (guidance)

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 contaminant level above the standard is automatically unsafe in all instances. Current drinking water standards reflect scientific judgement and expertise based on all available knowledge.

Current EPA regulations cover about 100 potential contaminants. All public water supplies are required by law to be tested on a scheduled basis for these. 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 document more frequent testing.

The Safe Drinking Water Act was revised to require that public water supply systems provide annual water quality reports, referred to as consumer confidence reports (CCRs). These indicate what regulated contaminants are present in the water, the concentration of the contaminants, and if contaminants exceed the maximum contaminant level allowed. If your water comes from a public system, you can contact the water supplier and ask for a copy of the latest annual CCR. Check your water bill or the yellow pages in your phone book, or contact a city hall representative or a village board member to determine how to contact your water supplier.

Testing Private Water Supplies

The Safe Drinking Water Act requirements for testing public water supplies do **not** apply to private drinking water supplies. In addition, Nebraska HHSS does **not** require testing of private drinking water supplies. **Thus, testing a private water supply is not regulated in Nebraska and is at the discretion of the water user**. Regulatory exceptions occur where state licensing may be required for a specific activity.

Although not required by regulations, testing a private water supply is recommended. Annual tests for bacteria and nitrate are suggested as general indicators of the safety of private well water.

There is no single test to determine the safety of drinking water. As with public drinking water, many contaminants can present a health risk if present in sufficient concentrations. These include biological contaminants such as bacteria or viruses; inorganic chemicals such as lead, nitrate or sulfate; and organic chemicals such as insecticides, herbicides, fuel and solvents. Other contaminants, while not

a health risk, can make water less desirable for domestic use. These are referred to as nuisance contaminants and include calcium, magnesium, iron, manganese and hydrogen sulfide. It would be costly, and in most cases unnecessary, to test private water supplies for the nearly 100 contaminants for which public water supplies are required to test.

Users of private drinking water wells must decide which contaminants to test for and must order tests accordingly. A water testing laboratory only tests for specifically requested contaminant analysis. Reports will indicate if the contaminant is present in the water and at what concentration. Information will **not** be provided on contaminants for which analysis was not specifically requested.

Testing for Nitrate and Bacterial Contamination

Generally, private water supplies should be tested annually for nitrate and bacterial contamination. These tests also should be considered after flooding or when any noticeable change in taste, color or smell is detected. These changes may also indicate the need for other tests. Testing for bacterial contamination should occur any time users of the water supply experience recurring bouts of intestinal illness or when an infant, person with a compromised immune system or elderly person becomes a water user. In addition, testing for bacterial contamination should occur when repairs or alterations are made to the well or water system, when activating a well or water system that has not been used for an extended period of time and following shock chlorination. Testing for nitrate should occur any time a pregnant woman, woman anticipating pregnancy or infant under 6 months old becomes a water user.

Coliform bacteria is most likely to be found during periods of wet weather when the soil is warm. Runoff and excess soil moisture carry contaminants into shallow groundwater sources or through well defects. To assess the year-round safety of drinking water, test for bacteria in the late spring or early summer during wet weather. Testing during extremely dry weather or when the ground is frozen may be less desirable. Lack of moisture migration through the soil reduces the likelihood of finding high contaminant levels.

The best location to collect a water sample is at the tap used most frequently for drinking and cooking. If contaminants are found, inspect the water system for defects and, if necessary, collect additional samples at other locations to determine if the impurities are entering at the well or through defects in the plumbing system.

Take care when sampling for bacterial contaminants. Because bacteria are commonly carried on dust and dirt particles, avoid drawing a sample in extremely dirty locations where dust could accidentally enter the sterile sample container. Clean, indoor locations are best. If an outdoor sampling location must be used, avoid drawing samples from frost-proof hydrants. The buried valve allowing them to drain and avoid freezing can allow bacterially contaminated water to be drawn into the riser pipe leading to the hydrant. Do not touch the inside of the bottle or lid when taking the sample. Most laboratories recommend removing the aerator from an interior faucet before collecting a bacteria water sample, and some recommend disinfecting the faucet with heat or chlorine before collection. Follow directions carefully or solicit the services of a professional.

Testing for Other Suspected Contaminants

Testing for nitrate and bacteria does not guarantee the water is safe, as other contaminants could be present. Aquifers, which supply groundwater, are vulnerable to many types of contamination. Contaminants can enter aquifers and groundwater from septic systems, landfills, fertilizers and

pesticides, sewage, animal waste, fuel storage tanks, and many other sources. Even distant contamination can negatively impact a water supply given time, as groundwater moves slowly. In addition, some contaminants are introduced to groundwater from naturally occurring sources such as the rock and minerals that make up the aquifer. Test for substances when specific contamination is suspected. This might be the result of a spill, backflow, use of product in close proximity to the well or other such event. If any contaminant is detected in a nearby private or public well, private water users in close proximity should consider testing their water supply for the contaminant. Collect a water sample at a time when the suspected contaminant is most likely to be present if this information is known. The information in *Table II* may be helpful in determining what analysis to request for private drinking water.

Table II. Summary of home water quality problems and possible source or cause (not a complete list).

Symptom	***Possible Source To Test For***
Hard water, staining, deposits or degradation of household plumbing	
White scaly deposits in pipes or appliances; soap scum in sinks and bathtubs	Calcium and magnesium (water hardness)
Green stains on fixtures, blue-green tint to water	Copper
Reddish-brown stains on sinks, porcelain fixtures, or laundry	Iron
Brownish-blackish stains on fixtures and laundry; affects the flavor and color of food and water	Manganese
Reddish-brown slime	Iron bacteria
Brownish-black slime	Manganese bacteria
Taste	
Soda taste, slippery feel	Total dissolved solids that are alkaline
Salty or brackish water; blackening and pitting of stainless steel sinks and kitchen utensils	Total dissolved solids, chloride, sodium, sulfate
Odors	
Gasoline or oil smell*	Volatile organic chemicals
Rotten egg odor	Dissolved hydrogen sulfide (difficult to test for), sulfate-reducing bacteria
Septic, musty or earthy*	Coliform bacteria, iron bacteria, manganese bacteria, sulfur bacteria
Appearance	
Water appears clear when first drawn; turns reddish-brown during cooking/heating, or water is discolored when drawn	Iron
Other occurrence or event without observable indicators in the water	
Arsenic suspected or detected in the aquifer*	Arsenic
Uranium suspected or detected in the aquifer*	Uranium

High fluoride suspected or detected in the aquifer*	Fluoride
Heavy fertilization in close proximity to the water source or well*	Nitrate
Animal manure in close proximity to the water source or well*	Nitrate and bacteria
Use, storage, or mixing of herbicide, insecticide, rodenticide, or fungicide in close proximity to the water source or well*	Herbicide, insecticide, rodenticide, or fungicide identified
Dry-cleaning operation, private dump, junkyard, landfill, manufacturing facility, or gas station in close proximity to the water source or well*	Volatile organic chemicals and heavy metals
Possible incomplete sewage treatment due to failing septic system in close proximity to the water source or well*	Nitrate and bacteria
Contaminant detected in nearby private or public well*	Contaminant identified
Household contains lead or brass plumbing*	Lead
Recurring gastrointestinal illness of residents, or gastrointestinal illness of visitors*	Coliform bacteria
*If water testing for these chemicals returns a positive reading above levels enforced by the EPA for public water supplies, additional action should be pursued to assure a safe private drinking water supply. Actions to consider may include obtaining an alternate water supply, connecting to a public or rural water supply, using appropriate treatment to remove or reduce the contaminant, using bottled water for cooking and drinking, or other options. Each situation should be thoroughly investigated and informed decisions should be made.	

Options for Having Water Tested

Many Nebraska laboratories offer testing services including water analyses. Some laboratories are operated by government agencies, others are private commercial laboratories. Some agencies and organizations may offer limited screening tests outside of a laboratory setting.

Other sources of water testing include water treatment equipment dealers who often provide testing services through contracts with private laboratories or with the use of test kits. You also may purchase do-it-yourself test kits. Tests done in the home, either by a water equipment dealer or yourself, are usually for nuisance contaminants such as hardness and total dissolved solids. In-home demonstrations that cause precipitates to form in water or cause color changes can be dramatic but may not provide useful, accurate information. Greater reliability and accuracy can be expected with laboratory testing. However, results from test kits may indicate the need for a more accurate analysis.

HHSS approves laboratories to test drinking water samples. Not all laboratories are approved to test for all drinking water contaminants. Rather, approval must be obtained for each specific contaminant. To receive approval for a contaminant, a laboratory must use approved testing methods and equipment.

Approval provides some assurance that the laboratory has the capability to perform water quality analysis within an acceptable range of accuracy and will provide reliable results. It does not guarantee a specific water sample analysis has been or will be performed accurately. Use an approved laboratory when accurate, reliable test results are needed and any time test results might be used for legal action involving contamination. In this case, the strongest evidence is presented when an independent party collects the sample, documents the correct and appropriate sampling procedure and delivers the sample to the approved laboratory.

Nonapproved laboratories may use the same equipment and procedures as approved laboratories and may provide accurate analysis, but there is no independent information about the laboratory's ability to obtain reliable results. When results from a nonapproved laboratory indicate a contaminant concentration may affect human health, obtain a second analysis performed by an approved laboratory. In situations where considerable investment is necessary to correct a nuisance or groundwater contamination problem, verification of the severity of the problem by an approved laboratory may be advisable.

The Nebraska Health and Human Services System Public Health Laboratory either is approved or has a contract with an approved laboratory to test for every EPA publicly regulated contaminant. In addition, it can provide information on request regarding all laboratories located and approved in Nebraska, and can provide information on the specific contaminants for which each is approved. For more information contact:

Nebraska Health and Human Services System
3701 South 14th
Lincoln, NE 68502
(402) 471-8426

Contact information for all approved laboratories is available in NebFact 05-635, *Drinking Water: Approved Water Testing Laboratories in Nebraska*.

Always contact the individual laboratory and discuss the analysis desired. Ask about test fees, sampling bottles or kits, and sampling instructions. Typically there is a fee for each contaminant tested, however some laboratories offer package tests which include testing for a number of contaminants for a specified fee. For many contaminants there are special sample containers, preservatives and sampling procedures that must be used. Always follow sampling instructions provided by the laboratory.

When it comes to private drinking water wells, HHSS regulates water well construction and location, but they do **not** regulate the safety or quality of water provided by private wells. In addition, while the EPA has the authority to enforce Safe Drinking Water Act standards for public water supplies, they do **not** have the authority to regulate the safety or quality of water provided by private wells. Thus, the quality and safety of water provided by private wells in Nebraska is not regulated and is at the discretion of the water user. Since EPA drinking water standards are designed to ensure safe drinking water for public water supply users, the standards can serve as a voluntary guide for private system users evaluating the safety of their drinking water. In addition, water test results provide valuable information from which to make informed decisions. Users of private drinking water can compare their water test results with the EPA water quality guidelines to assess the quality and risk associated with their water supply. Some lending agencies may require a private water supply meet Safe Drinking Water Act nitrate and bacteria standards prior to approving a real estate loan.

Summary

All water from natural sources contains dissolved substances. At high enough concentrations, some substances may be harmful. The only way to know if water contains potentially harmful substances at levels high enough to be of concern is for the water to be tested. The quality of public water supplies is regulated by the EPA Safe Drinking Water Act. Public drinking water supplies must be tested for nearly 100 potential contaminants. The quality of private water supplies is not regulated in Nebraska. Testing private water supplies is highly recommended but is entirely at the discretion of the water user. There is no single test to determine the safety of private drinking water. Generally, private water supplies should

be tested annually for nitrate and bacterial contamination, and as needed for other suspected contaminants.

Related Drinking Water Publications

G04-1539	*An Introduction To Drinking Water*
G02-1471	*Decommissioning Water Wells: An Owner's Guide*

Related Drinking Water Contaminant Publications

NF05-635	*Drinking Water: Approved Water Testing Laboratories in Nebraska*
G90-989	*Drinking Water: Bacteria*
G96-1274	*Drinking Water: Hard Water*
G96-1275	*Drinking Water: Sulfates and Hydrogen Sulfide*
G96-1279	*Drinking Water: Nitrate-Nitrogen*
G96-1280	*Drinking Water: Iron and Manganese*
G96-1282	*Drinking Water: Man-made Chemicals*
G97-1333	*Drinking Water: Lead*
G98-1360	*Drinking Water: Copper*
G98-1376	*Drinking Water: Fluoride*
G98-1369	*Drinking Water: Nitrate and Methemoglobinemia*
G02-1448	*Drinking Water: Bottled or Tap?*
G04-1536	*Drinking Water: Storing An Emergency Supply*
G04-1552	*Drinking Water: Arsenic*

Related Drinking Water Treatment Publications

EC03-703	*Drinking Water Treatment: An Overview*
G03-1488	*Drinking Water Treatment: What You Need To Know When Selecting Water Treat 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*
G04-1496	*Drinking Water Treatment: Continuous Chlorination*
G95-1255	*Shock Chlorination of Domestic Water Supplies*
NF02-505	*Drinking Water: Chloramines Water Disinfection in Omaha Metropolitan Utilities*

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