NebGuide

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Drinking Water: Uranium

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University of Nebraska–Lincoln Extension and the Nebraska Department of Health and Human Services place a high priority on water quality and jointly sponsor this series of educational publications.

Uranium occurs naturally in soil and rocks. It can enter groundwater and contaminate drinking water, which, over time, can harm health. Learn what testing and treatment options are available.

Naturally occurring uranium has always been present in some drinking water supplies in Nebraska. It became a newly regulated substance in public community drinking water supplies when the Environmental Protection Agency revised the Radionuclides Rule, which took effect in December 2003.

Uranium in Drinking Water

Uranium is a naturally occurring radioactive mineral present in certain types of rocks and soils found throughout the United States, including Nebraska. It has been present in Nebraska groundwater for many years. Uranium was originally deposited in Nebraska soils as a component of some rocks carried to the state by glaciers and volcanic ash. As water containing oxygen passes through and over rock and soil formations, many compounds and minerals, including uranium, dissolve and go into the groundwater.

Uranium concentrations can also result from human activities such as mining, combustion from coal and other fuels, the use of phosphate fertilizers, and nuclear power production. Although human activities have the potential to result in uranium contamination of groundwater, their contribution to the total amount of uranium in Nebraska water supplies is negligible at the present time. Uranium is relatively common in Nebraska groundwater and does not move significantly. The result is that groundwater contamination comes from the aquifer from which the water is pumped.

Monitoring has shown that while groundwater in most areas of the state contains low to moderate levels of uranium, high levels are found in the groundwaters of the Republican, North Platte and portions of the Platte River valleys. The rocks and volcanic ash that contain uranium are thought to have been eroded and then deposited near these rivers and some of their tributary streams.

Uranium also occurs in some of Nebraska's surface waters. In 2001, Nebraska Department of Health and Human Services (DHHS) personnel collected samples from the Republican and Platte Rivers. Uranium concentrations in the rivers at the sampling locations were just below or exceeded the current uranium limit for drinking water.

Indications of Uranium in Water

Uranium cannot be detected by taste, sight, or smell. The only way to know the concentration is through sampling and testing, which is described in greater detail in a subsequent section.

Potential Health Effects

The health effects of uranium in drinking water are chronic (the delayed result of continuous consumption over a long period of time) rather than acute (the immediate result of consumption). Individual risk depends on the concentration,

how much water was consumed and for how long, as well as the age and general health of the individual.

Studies suggest that ingesting of high levels of uranium may be associated with an increased risk of kidney damage. Exposure to soluble uranium in drinking water has not been shown to increase the risk of developing cancer. The Environmental Protection Agency (EPA) has estimated that the additional lifetime risk associated with drinking water that contains uranium at the concentration allowed in a public water supply is about 1 in 10,000. This means that if 10,000 persons were to consume two liters of this water per day for 70 years, one additional fatal cancer in the 10,000 people exposed might occur.

This publication is not a substitute for professional medical advice. If you have any questions or concerns related to the potential health effects from consuming water containing uranium, consult your physician.

Sampling and Testing

Testing Public Community Water Supplies

The quality of water supplied by public water systems is regulated by EPA under the federal Safe Drinking Water Act. The Nebraska DHHS has the primary responsibility of implementing and enforcing Safe Drinking Water Act standards in Nebraska. Under these regulations, public water supplies classified as community water systems (CWS) are required to test for uranium. A CWS is a public water system that has at least 15 service connections or serves 25 persons on a regular, year-round basis (e.g., cities, villages, rural water districts, sanitary improvement districts, mobile home parks, etc., with their own water supplies). To request the uranium level in one of Nebraska's 597 public CWS, contact the water utility office.

Testing Public Noncommunity Water Supplies

While most Safe Drinking Water Act regulations apply to all public water supplies, the uranium regulation is an exception. It does not apply to public water supplies classified as noncommunity. A noncommunity water system (NCWS) is a public water system that is not a CWS (e.g., schools, factories, businesses, rest areas, convenience stores, camping facilities, etc. with their own water supplies). While NCWS are not required to test for uranium concentration, the person(s) responsible for the NCWS should contact DHHS for guidance.

Testing Private Water Supplies

Currently, water quality in private wells is not regulated; thus, regular testing is not required under state or federal law. If users want to know the concentration of uranium in a private water supply, like public water supplies they must pay to have the water tested. Since a number of CWS drinking water wells in Nebraska are known to have uranium levels above the maximum contaminant level (MCL), it is likely that some private drinking water wells might also have high levels. Monitoring community water systems in Nebraska indicates that water systems with elevated uranium concentrations tend to be located in the Republican River, North Platte River, or Platte River floodplains and in adjacent present or past waterways. Users in those areas might consider voluntarily having the water tested for uranium concentration.

Based on results of uranium monitoring since 2003, the analytical result of a single uranium sample is adequate to determine the degree of seriousness associated with the uranium level in a well. Uranium mass analysis is the appropriate water quality test to determine the level of uranium concentration in a Nebraska water supply system. The fee for a uranium mass test typically ranges between $10 to $25. Tests to determine the presence of uranium in drinking water should be done by a laboratory certified for uranium testing. Not all laboratories are certified to test for all drinking water contaminants. Rather, certification must be obtained for each specific contaminant. This certification means that recognized standard testing and quality control procedures are used. As of July 2014, water testing laboratories in or close to Nebraska that test private drinking water samples for uranium include:

Nebraska Department of Health and Human Services
Public Health Environmental Laboratory
3701 South 14th St.
Lincoln, NE 68505
(402) 471-2122

Energy Laboratories
2393 Salt Creek Highway (82601)
P.O. Box 3258
Casper, WY 82602-3258
(307) 235-0515
(888) 235-0515 (toll free)

This list does not constitute endorsement of any laboratory.

Laboratories not specifically certified to test for uranium may use the same equipment and procedures as certified laboratories. Such laboratories may provide accurate analysis, but there is no independent information about the laboratory's ability to obtain reliable results.

Contact the laboratory of your choice for a sample kit and instructions. Follow instructions carefully.

Interpreting Test Results

Public Community Water Supply Test Results

EPA public drinking water standards fall into different categories including Primary Standards. Primary Standards are based on health considerations and are designed to protect human health. The EPA issued the final Federal Radionuclides Rule establishing an enforceable Primary Standard for uranium in public CWS. The enforceable standard is 30 micrograms per liter (ug/L), which also can be expressed as 30 parts per billion (ppb). The Rule established enforceable standards for additional radionuclides which are not discussed in this publication.

Uranium concentrations can vary over time. For this reason, compliance is based on a running annual average, which is the average of four consecutive quarters of monitoring results. Results obtained during the Initial Monitoring Period, 2004 - 2007, were used to determine the sampling and monitoring frequency (three-year, six-year or nine-year) for uranium and other radionuclides. All new sources of water intended for use by a CWS undergo similar monitoring procedures.

Public Noncommunity and Private Water Supply Test Results

The Federal Radionuclides Rule did not make the uranium standard mandatory (enforceable) for NCWS systems. In addition, EPA and Nebraska uranium regulations do not apply to private drinking water wells. If uranium concentrations are found to be above 30 ppb, users of NCWS systems or private wells might voluntarily consider EPA guidelines and try to reduce the uranium concentration in the water

Options

Feasible options for decreasing uranium concentrations can vary based on the type of water supply. This section outlines alternatives for community, public noncommunity and private water supplies.

Options For Public Community Water Supplies

Community Water Supplies in Nebraska have five options for removing or reducing uranium concentrations in drinking water. They include:

- locating and developing a new source of drinking water;
- purchasing drinking water from another water system;
- blending water from a contaminated source with water from an uncontaminated source(s);
- building and operating a treatment plant to remove uranium; and
- installing and maintaining point-of-use (POU) treatment devices at each drinking water tap.

Nebraska DHHS suggests the system investigate the first three options before reviewing treatment options. Community treatment options may require expensive waste disposal.

Treatment processes available to CWS for uranium removal include (but are not limited to) reverse osmosis, anion exchange, special adsorbent media or lime softening.

Water users wishing to reduce uranium levels prior to a community achieving compliance can treat water as described below.

Options For Public Noncommunity Water Supplies

Noncommunity water systems in Nebraska are not required to meet the uranium standard. However, those systems wishing to do so should consider the same five options listed above for public community water supplies. Some municipal treatment methods, including lime softening, may not be viable treatment alternatives for public noncommunity water suppliers.

Depending on the size of the facility or facilities being served with water, treatment to remove uranium at a NCWS might be accomplished safely and economically with a point-of-entry (POE) system. A POE system is a small-scale water treatment unit that treats all of the water that enters the facility. POE systems for uranium removal often make use of anion exchange technology because of its comparatively lower cost. However, reverse osmosis POE systems are becoming more affordable and provide another option. Treatment options have the ability to remove an array of contaminants that may be present in the water supply besides uranium. The waste stream produced by the treatment unit should be considered before making any decision. While unlikely, it is possible that uranium and other contaminants removed from the water by a POE unit could result in waste that is regulated by various agencies as hazardous waste or low level radioactive waste.

It is strongly recommended that noncommunity water systems consult with Nebraska DHHS and the Nebraska Department of Environmental Quality in regard to the latest scientific and regulatory data related to the waste stream generated through water treatment and its proper disposal. In addition, a NCWS should work with reliable and competent professionals to select the best option for their situation.

Options For Private Water Supplies

Typically, the most feasible treatment alternative to remove uranium in private water supplies is the Point-of-use system. A POU system is usually placed under or near one faucet and treats only the water coming out of that tap for drinking or cooking. While no POU system is certified to remove uranium at this time, documentary proof exists to show that reverse osmosis, distillation, special adsorbent media (such as titanium dioxide) and anion exchange remove uranium and a variety of other contaminants. Boiling water is not an effective means of removing uranium. Pour-through, faucet-mounted and POU activated carbon filters also are not an effective means of removing uranium. For additional information on POU treatment options see NebGuide G1490 *Drinking Water Treatment: Reverse Osmosis* and NebGuide G1493 *Drinking Water Treatment: Distillation*.

Treatment options used to remove uranium likely will remove an array of additional contaminants if they are present in the water supply. Nebraska regulations allow homeowners with private wells to send the waste collected on water treatment filters or adsorbent material to a licensed landfill. Accumulation of low-level radioactive waste from uranium removed by reverse osmosis or distillation POU units is not likely to occur. Individuals should work with a reliable, competent water treatment dealer to select the best treatment method for a given situation.

To Obtain Additional Information

To find out the uranium level of a Nebraska CWS, contact the local water utility. To obtain additional information about the Radionuclides Rule and the uranium in Nebraska drinking water, contact DHHS at (402) 471-1009.

Summary

Uranium is a naturally occurring element present in rocks and soil. Water passing through and over geologic formations can dissolve uranium. The result is that uranium can be present in some water sources. Drinking water containing uranium can cause adverse health effects. Most notably, long-term ingestion of uranium may increase the risk of kidney damage. Public community water supplies must comply with the EPA standard of no more uranium than 30 ppb. Management of public noncommunity and private drinking water supplies for uranium is a decision made by the well owner and/or water users. Options exist for uranium removal, but the best treatment system or combination of systems for a given situation will depend on several factors.

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This publication has been peer reviewed.

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