DEPARTMENT OF HEALTH

Analytical Methods for Radiochemistry in Drinking Water

Questions and Answers for Community Water Systems

Analytes

What analytes are typically part of radiochemistry analysis for community water systems?

The federal Safe Drinking Water Act (SDWA) sets monitoring requirements for radioactive forms of elements (radionuclides) including gross alpha, gross beta, radium 226/radium 228, and uranium, along with maximum contaminant levels (MCLs) for these. These drinking water standards apply to all community water systems (CWSs). The specific monitoring scope and schedule for monitoring radionuclides for each CWS will depend on several factors, including previous monitoring results.

MDH also has detailed information about radium in the fact sheet Radium in Drinking Water (PDF).

Labs and accreditation

What labs can perform radiochemistry analyses for drinking water?

Radiochemical tests are performed by the Minnesota Department of Health Public Health Laboratory (MDH-PHL), as well as private and public labs accredited to test for radiochemical analytes.

What does accreditation mean and who accredits the lab(s) that report my results?

The Minnesota Department of Health's Environmental Laboratory Accreditation Program (MNELAP) issues accreditation to independent labs. This accreditation is granted to labs that apply, comply with regulatory requirements, and can document testing capability through on-site evaluations and passing proficiency tests. Note that the MDH-PHL is not accredited by MNELAP, but instead is certified by the United States Environmental Protection Agency (U.S. EPA).

How do I look up what labs are accredited to run radiochemistry samples for drinking water?

You can look up labs accredited for Radiochemistry in Drinking Water by using the Search for Accredited Laboratories webpage. You will need to navigate to the "Customized Searches" tab and select, for the *Program* dropdown, "Safe Drinking Water Program." Additionally, under the *Category* dropdown, you will need to select "Radiochemistry" and click then click the *Search* button.

Methods and analyses across labs

What methods does MDH-PHL use? Do other labs run different methods for the same analytes?

There are numerous methods approved under the SDWA to determine an analyte. As of 2024, MDH-PHL is running the following radiochemistry methods:

- EPA Method 900.0, Rev 1.0 Gross Alpha and Gross Beta in Drinking Water,
- EPA Method 903.0 Rev 1.0 Alpha-Emitting Radium Isotopes in Drinking Water,
- EPA Method 904.0 Radium 228 in Drinking Water,
- EPA Method 200.8 Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma-Mass Spectrometry Uranium.

Other accredited labs may use other methods, and these are indicated in the accredited lab search.

What may be differences among methods? Can this affect results?

Methods may vary based on the type of instrument detection, extraction methods, calibration standards, calculations, and the level of solids in a sample.

Method choice can affect results, especially if a laboratory is using older methods. Many of the older methods do not have requirements for instrument calibration and quality control. This could allow labs to differ from the most current practices while still adhering to SDWA requirements.

Can holding time for samples make a difference in results?

Yes, holding time for samples can affect results. For gross alpha and radium-226, the methods cannot separate all analytes. Therefore, samples may need to be held for days or weeks to allow interfering analytes to decay. However, the U.S. EPA requires that all radiochemical samples must be analyzed within six months of sample collection.

Do results tend to be higher or lower from one lab or method to another?

Labs certified to test drinking water samples are required to pass annual proficiency testing (PT). Results from labs around the nation can be both above and below the true value of this PT, while still meeting accreditation requirements. There is no indication that any particular labs or methods produce results that are consistently higher or lower than other labs or methods.

Turnaround times

Why do radiochemistry results take so long?

Radiochemistry methods typically take longer than other laboratory methods for several reasons. The low levels of detection, and interference from other analytes may require samples to be held for days or weeks. The extraction process must separate and eliminate all other alpha or beta emitters in the sample. Extraction and separation of such small concentrations require significantly longer extraction times.

Can the labs do anything to cut down on the amount of time it takes to get results?

Labs do their best to balance tradeoffs, but it is challenging to reduce turnaround time for radiochemistry. Additionally, in some situations, samples need to be re-analyzed to meet quality requirements. Decreasing the decay time can reduce the accuracy of results. Labs seek to balance accuracy and processing time while still operating within method requirements.

MDH prioritizes sample analysis from CWSs on quarterly monitoring over those on annual monitoring schedules. This provides timely results to systems on the shortest compliance schedules.

Working with an accredited lab

As a water system, if I choose to work with an accredited lab for investigative sampling, what are some considerations I should have in mind?

First, if a water system is considering contracting with an accredited lab, the operator should review key aspects of the laboratory's analytic procedures. Find out:

- which method for analyzing radionuclides is used,
- how samples are prepared,
- what the holding time is prior to analysis, and
- what the analysis counting time is.

Systems may compare this information to MDH-PHL's methods and practices to understand similarities and differences.

Systems can include specifications about analytical processes in their contracts with accredited labs. The accreditation process requires that labs review their services to their clients. The laboratory must be willing to cooperate with customers/representatives in clarifying requests and monitoring the laboratory's performance on contracted work. Additionally, MNELAP requires labs to seek feedback from customers and use it to improve their management system, testing activities, and customer service. Finally, the lab must also have procedures for complaint resolution.

Understanding results

What does uncertainty mean in my reported results and how do I use it?

Results will vary when a measurement is repeated, even if it is done by the same person. Standard deviation describes the variability of individual measurements. General sources of deviation include, but are not limited to: self-absorption, geometry, backscatter, resolving time, and statistical variations (random disintegration of radioactive atoms). Systematic errors are uncertainties in the bias of the data such as from instrument miscalibration.

What do other commonly used terms mean?

- The critical level (LC) is the level at which there is statistical probability of incorrectly identifying a background value as "greater than background."
- The LD, or limit of detection, is a theoretical estimate of the detection capability of a measurement system.

- The SDWA detection limit is the required detection limit that must be achieved for that sample.
- The Minimum Detectable Activity Concentration (MDC/MDA) The minimum detectable concentration (MDC/MDA) is the LD in counts multiplied by an appropriate conversion factor to give units consistent with a required measurement.

Minnesota Department of Health
PO Box 64975
St. Paul, MN 55164-0975
651-201-4700
health.drinkingwater@state.mn.us
www.health.state.mn.us

8/5/2024

To obtain this information in a different format, call: 651-201-4700.