RADIONUCLIDE SAMPLING AND EVALUATION

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Gross alpha is a type of ionizing radiation that emits alpha particles. Gross alpha serves as a screening test for other radionuclides that may be present in the water. Radionuclides such as radium, thorium and plutonium all emit alpha particles, as do uranium and radon. The analytical test that is conducted to determine gross alpha activity does not include analysis of [1]radon, but it does include uranium and radium 226.

The gross alpha MCL is equal to an **adjusted gross alpha** concentration of 15 pCi/L. To calculate an adjusted gross alpha concentration, the concentration of uranium in pCi/L should be subtracted from the unadjusted gross alpha analytical result. Sometimes, the analytical lab does this when reporting results of a gross alpha test and sometimes it does not, so it is very important to find out from the lab whether their results represent unadjusted or adjusted gross alpha. If the uranium concentration has not been subtracted by the lab, it should be subtracted from the gross alpha result prior to comparing the result to the gross alpha MCL.

For a public water supply, compliance is determined by the average of four quarterly samples over a year. Thus, a one-time exceedance of an MCL does not necessarily indicate that a system is out of compliance unless the radionuclide concentration is greater than four times an MCL. If testing results indicate that values exceed one or more MCLs, three more quarterly samples must be taken over the remaining three quarters of the year to determine compliance.

The following protocol should be used when evaluating gross alpha, uranium and radium:

- Measure gross alpha activity.
- If the gross alpha result is less than 5 picocuries per liter (pCi/L), (a unit of radioactive activity) then no testing for radium 226, radium 228, or uranium is needed.
- If the gross alpha result is equal to or greater than 5 pCi/L, then testing for radium 226 and radium 228 should be completed.
- Compare the adjusted gross alpha concentration to its MCL of 15 pCi/L. If the gross alpha result is equal to or greater than 15 pCi/L, then testing for uranium should also be completed. As discussed above, if uranium activity in pCi/L has not already been subtracted out by the lab, this should be done to get the adjusted gross alpha.
- Compare the total radium 226 and radium 228 concentrations to the radium MCL of 5 pCi/L, if the gross alpha result was high enough to warrant testing for them.
- Uranium is a toxic metal that also emits alpha radiation. The uranium MCL is expressed in micrograms per liter (ug/L), (a unit of mass). If the uranium concentration reported by the lab is expressed in pCi/L, convert the activity (in pCi/L) to uranium mass (ug/L) by dividing the activity by the [2]conversion factor of 0.67. For additional information on converting uranium activity to mass units, see https://www.mass.gov/info-details/uranium-guidance-for-radionuclides-form.
- Compare the uranium concentration in ug/L to its MCL of 30 ug/L. If this result is greater than the uranium MCL of 30 ug/L, ask the lab to reanalyze by a direct mass method, which should result in a more accurate and lower value.

[1] Radon should be analyzed separately and compared to MassDEP's radon ORSG.

[2] To convert uranium activity (pCi/L) to uranium mass (ug/L), use (pCi/L)/0.67 = ug/L; To convert uranium mass (ug/L) to uranium activity (pCi/L), use (ug/L)/1.49 = pCi/L.

- If the adjusted gross alpha, radium and/or uranium concentrations exceed their respective MCLs, three more quarterly water samples must be collected to determine compliance of the water system with the radionuclide MCLs.

For additional information on radionuclides in drinking water, please see MassDEP's Radionuclides FAQ page.