POLONIUM-210 AND DRINKING WATER: OCCURRENCE IN MINNESOTA AND HEALTH RISK IMPLICATIONS

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Groundwater is a vital drinking-water resource across Minnesota for communities and private well owners. Elevated levels of anthropogenic or naturally occurring elements can present significant health risks in drinking water. Radionuclides produced by the decay of uranium and thorium in soil are known to occur in some of Minnesota's important drinking water aquifers, and many communities undergo significant expense to remove radionuclides. Quantification of specific alpha-emitting radionuclides is needed to accurately understand both risk and possibly reduce unnecessary treatment costs. The goal of this pilot study was to determine if the potent, but rarely quantified, alpha-emitting radionuclide polonium-210 (Po-210) occurs at measureable levels in community water supply wells with gross alpha activity above 15 pCi/L. Thirty-six wells across eleven major aquifers were assessed for Po-210 and gross alpha activity, along with quantification of lead-210 (Pb-210) at ten wells.

Results show that Po-210 was detected in over 60% of wells. The median activity was just above 0.1 pCi/L, while three wells contained Po-210 in excess of 1 pCi/L. The maximum activity found was 4.99 pCi/L, which if consumed over a lifetime at this level would represent a 1:2,000 cancer risk. The Mt. Simon sandstone aquifer contributed the overall highest activities, but even within this aquifer Po-210 activity was variable. Pb-210 was also detected, with highest activities (2.9 and 1.5 pCi/L) found following water treatment in two locations. Importantly, Pb-210 activity was often less than Po-210 activity from the same sample of raw water, suggesting that Po-210 is not derived in large extent from soluble Pb-210. Naturally occurring radionuclides continue to be important contaminants to consider as overall health risk drivers, especially in deep protected aquifers commonly assumed to be desirable for drinking water because anthropogenic contamination is less likely to occur. Further studies of Po-210 occurrence in groundwater and effects of water treatment on Po-210 and Pb-210 are vital future needs for the protection of public health in both community and domestic wells. Funding for this study was provided through the State of Minnesota Clean Water Fund of the Clean Water, Land and Legacy Amendment.