Naturally Occurring Radionuclides in Nova Scotia's Rocks, Water and Air

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Few subjects catch the attention of the public more than radiation and radioactivity. The mere inference that radiation is an issue somewhere invokes an immediate, sometimes almost hysterical response that is sure to receive media attention. Nova Scotia has had its share of radiation issues involving elevated levels of radionuclides like uranium (U) and radon (Rn) in our waters and the air within our living spaces. These are naturally occurring phenomena and related to an interplay of bedrock geology with present-day, near-surface weathering conditions. They are not necessarily unique to our region.

Occurrences of uranium have been known in Nova Scotia since the early years of the 20th Century when pegmatites containing minor amounts of radioactive minerals were noted. During the 1950s, it was recognized that many of the sediment-hosted Cu deposits of the Carboniferous units in northern Nova Scotia also have anomalous levels of U and are typical 'roll front' deposits. The late 1970s saw a period of exploration for U deposits and recognition that the granites of our southern mainland host fracture-controlled, vein-type U deposits identical to those found in the similar granitic terrains of western Europe. Exploration also recognized the presence of minor U mineralization within reduced horizons at the base of the Carboniferous Windsor Group limestones and within Cambrian black shale units in southeast Cape Breton Island.

In 1978, elevated levels of U in well waters in the Harrietsfield area west of Halifax was recognized and the issue of the environmental and potential health impact of this phenomenon was first raised. Following the Harrietsfield recognition, a provincial government Uranium Task Force was formed that determined the levels of U, Ra and Rn in drinking water supplies in several selected regions of the province and found that elevated levels of U and Rn in groundwater is a naturally occurring phenomenon and widespread within some of our geological terrains, most notably the granites of the western mainland and the some of the Carboniferous sedimentary basins in Cumberland County.

Throughout the world, but particularly in the United States, the 1980s brought about an awareness that exposure to Rn in the air we breathe within our homes and work places is a significant contributor to non-smoking related lung cancers. Health Canada carried out a national survey of the level of Rn in air within buildings under their jurisdiction and found that several in the Ingonish Beach area had Rn levels well above the Health Canada guideline of 800 Bq/m^3. This recognition resulted in the province carrying out a reconnaissance testing of the air in homes in several regions known to be prone to elevated U and Rn in groundwater. Again, as with the Uranium Task Force findings in groundwater, it was found that elevated Rn in homes is a widespread phenomenon but is less directly correlative with geology.

In 2002, the province carried out environmental testing of Sir John A. MacDonald High School near Halifax in response to an abnormal number of complaints of illnesses among its students and staff. A total environmental screen of the school drinking water supply (drilled well) showed a level of Pb^{210} activity (a daughter radionuclide of the U^{238} decay series) exceeding the Guidelines for Canadian Drinking Water Quality limit of 0.1 Bq/l. The province formed a special advisory group on drinking water (SWAG) to examine this issue province-wide and recommend an appropriate course of action. As it turned out, Nova Scotia was the first jurisdiction world-wide to carry out such a comprehensive examination of the incidence of Pb^{210} in its water supplies, and SWAG found itself blazing the trail in determining how to evaluate the extent of the phenomenon. After two years of extensive sampling of a variety of water supply sources SWAG was able to conclude that, in fact, the anomalous level of Pb^{210} detected in the water is actually an artifact of using an inappropriate analytical testing method for the element. In reality, the elevated Pb^{210} levels noted were actually due to the water supplies in question having an initial high level of Rn, the U^{238} decay series daughter element from which Pb^{210} is derived.