Geohazards in Nova Scotia – Overview of Program Activities, April 2018 to March 2019

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Introduction

Geohazards are natural geological hazards that are caused by the earth and have potential to cause harm to humans, infrastructure, and the environment. There are several important geohazards in Nova Scotia. Examples include radon gas in indoor air, sinkholes in karst terrain, and historical mine tailings. The Nova Scotia Department of Energy and Mines' (NSDEM) geohazard work focuses on identifying and mapping the most significant geohazards in the province to ensure they are understood and mitigated. Selected activities undertaken within the Geohazard Program for the period from April 1, 2018 to March 31, 2019 are highlighted below.

Radon in Indoor Air

Radon gas occurs naturally in soil, rock, and groundwater and can migrate through cracks and openings in foundations and accumulate inside buildings. Radon in indoor air is the second leading cause of lung cancer after smoking. Health Canada estimates that radon causes more than 3,000 deaths each year in Canada (Health Canada, 2015). In Nova Scotia, it is estimated that 11% of homes exceed the indoor air radon guideline and that more than 100 people die each year due to radon exposure (CAREX Canada, 2016).

In 2018–19, the department's radon work focused on developing and maintaining the provincial radon database, participating on the Nova Scotia Radon Working Group, and conducting research on seasonal variations of indoor radon levels. We also supported the Nova Scotia Public Libraries radon detector loan program.

The program to loan radon detectors through libraries was launched in November 2017. The goals of the program are to help raise awareness about radon, promote radon testing, and highlight the easy and inexpensive ways it can be done. The program is the first of its kind in Canada and was led by the Lung Association of Nova Scotia with support from the Province, Nova Scotia Public Libraries, and Health Canada. The program initially involved the placement of 50 user-friendly digital radon detectors in public libraries for homeowners to borrow. Additional detectors were added in 2018 bringing the total to 146. The program has been very popular (CBC, 2018), and as of March 2019 there were over 1,100 people on the wait list to borrow a detector. In March 2019, NSDEM purchased an additional 21 radon detectors to help meet the demand. This will bring the total number of detectors available at public libraries to 167.

As part of the library loan program, homeowners can send their radon results on a volunteer basis to the Department of Energy and Mines via a dedicated email address (radon@novascotia.ca). The results are compiled into a database and used to map radon risk throughout the province. As of March 2019, there have been 83 results received (Table 1). Approximately 18% of these exceed the Canadian radon guideline of 200 Bq/m^3 (Health Canada, 2014). Homeowners with radon results that exceed the guideline were provided information on how to reduce radon levels in their homes.

Radon levels in buildings are known to vary seasonally due to seasonal weather changes (e.g. temperature, wind patterns) and the seasonal habits of building occupants (e.g. doors and windows may be left open more often in the summer than winter, affecting air-exchange rates). Indoor radon levels are typically higher in winter than summer. When testing radon levels in a building, it is helpful to know how seasonal variations can affect the estimate of the annual average radon level. This is important because the radon guideline is based on the average annual radon level. However, most homeowners run their radon tests for three months or less, rather than one year. Several jurisdictions have published seasonal radon correction factors so that short-term tests can be adjusted to reflect the

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Table 1. Voluntary radon test results received from homeowners (Nov 2017 to Mar 2019)

Description	Value
Number of samples, n	83
Number exceeding Canadian guideline of 200 Bq/m^3	15 (18%)
Maximum (Bq/m^3)	5,012
Minimum (Bq/m^3)	3
Average (Bq/m^3)	221
Median (Bq/m^3)	70
Average length of test (weeks)	5
Number of tests that were at least 4 weeks long	74 (89%)

average annual radon level in a building. These are not currently available for Nova Scotia and, therefore, a project was initiated in 2019 to monitor seasonal changes to indoor radon levels. The project will use continuous radon detectors in 10 volunteer homes for one year. The radon detectors will be installed in 10 different homes each year until enough data are available to calculate seasonal radon correction factors. Figure 1 shows preliminary results from an eight-week test in a basement of a residential home in Halifax between January 2019 and March 2019. During this test, the radon level varied from approximately 100 Bq/m^3 to 480 Bq/m^3 and averaged 258 Bq/m^3. Additional results from this study will be reported in subsequent years as the study progresses.

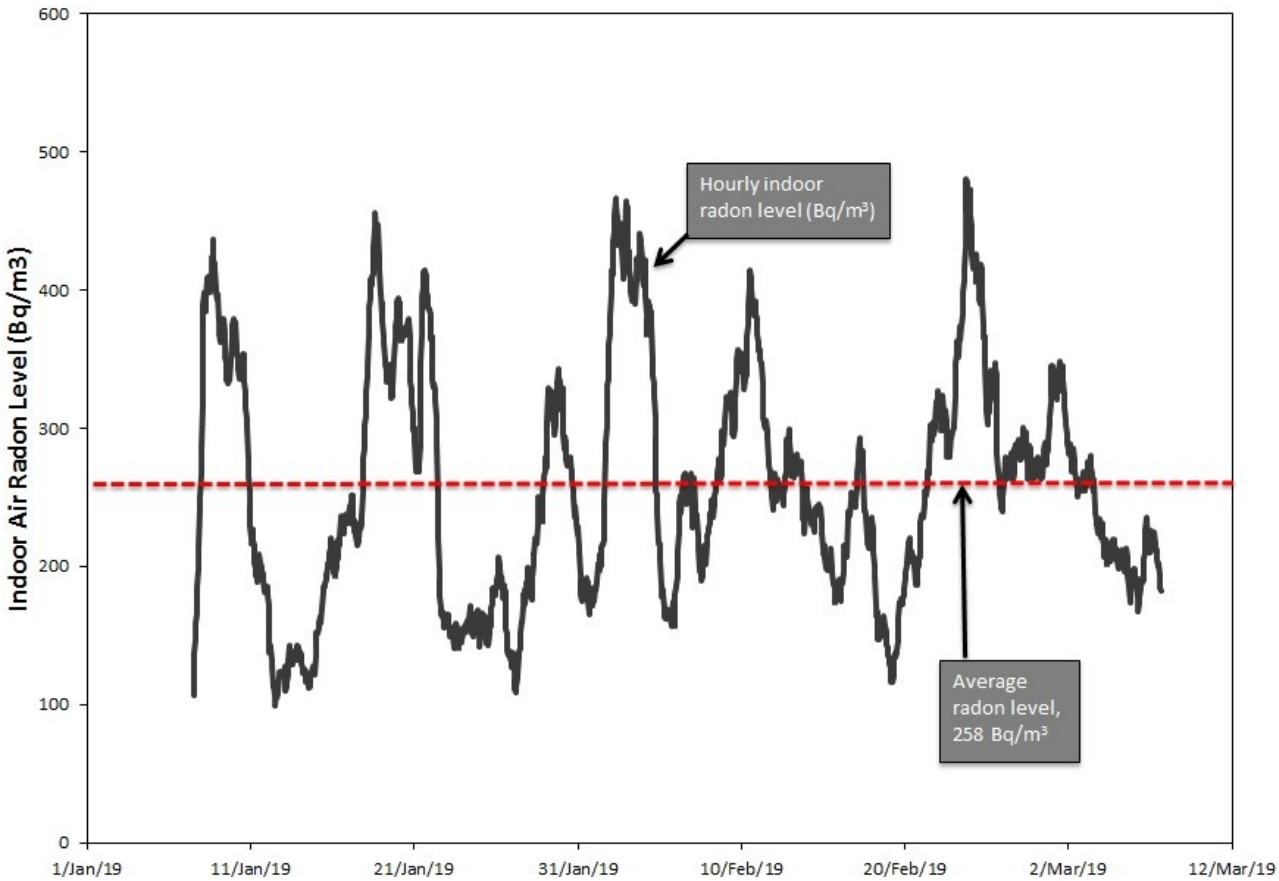

Figure 1. Hourly indoor radon levels from a residential basement in Halifax (Jan-Mar 2019).

For further information about radon, please visit the Nova Scotia radon risk map, which includes links to information on how to purchase radon test kits and how to find certified radon contractors for mitigation work (Nova Scotia Department of Energy and Mines, 2009).

Karst Risk Map

Sinkhole development in karst terrain can cause extensive damage to buildings, roads, and other infrastructure. In Nova Scotia, most natural sinkholes associated with karst are formed in areas where gypsum occurs, although other rock types in the province are also known to have sinkholes. In 2015, a project was initiated to develop a new provincial karst risk map. The work involved the compilation of existing geology maps and karst occurrence data, review of lidar data, and field verification of sinkhole occurrences. The resulting database contains over 1,000 records of known locations with karst topography, sinkholes, and karst springs. The new interactive karst risk map and associated open file report were released in February 2019. The new karst risk map is shown in Figure 2. The map (Nova Scotia Department of Energy and Mines, 2019) and open file report (Drage, 2019) can be accessed from the Geoscience and Mine Branch's sinkhole webpage (Nova Scotia Department of Energy and Mines, 2013). In addition to completing the new karst risk map, the department assisted with the evaluation of a significant sinkhole that developed in the Town of Oxford in July 2018. A separate report on the Oxford sinkhole can be found in this issue of Report of Activities (please see page 63).

Other Activities

Gold mining that occurred in Nova Scotia between the 1860s and the 1940s produced over three million tonnes of tailings at 64 historical gold-mining districts. During this period, no environmental regulations were in place and tailings were

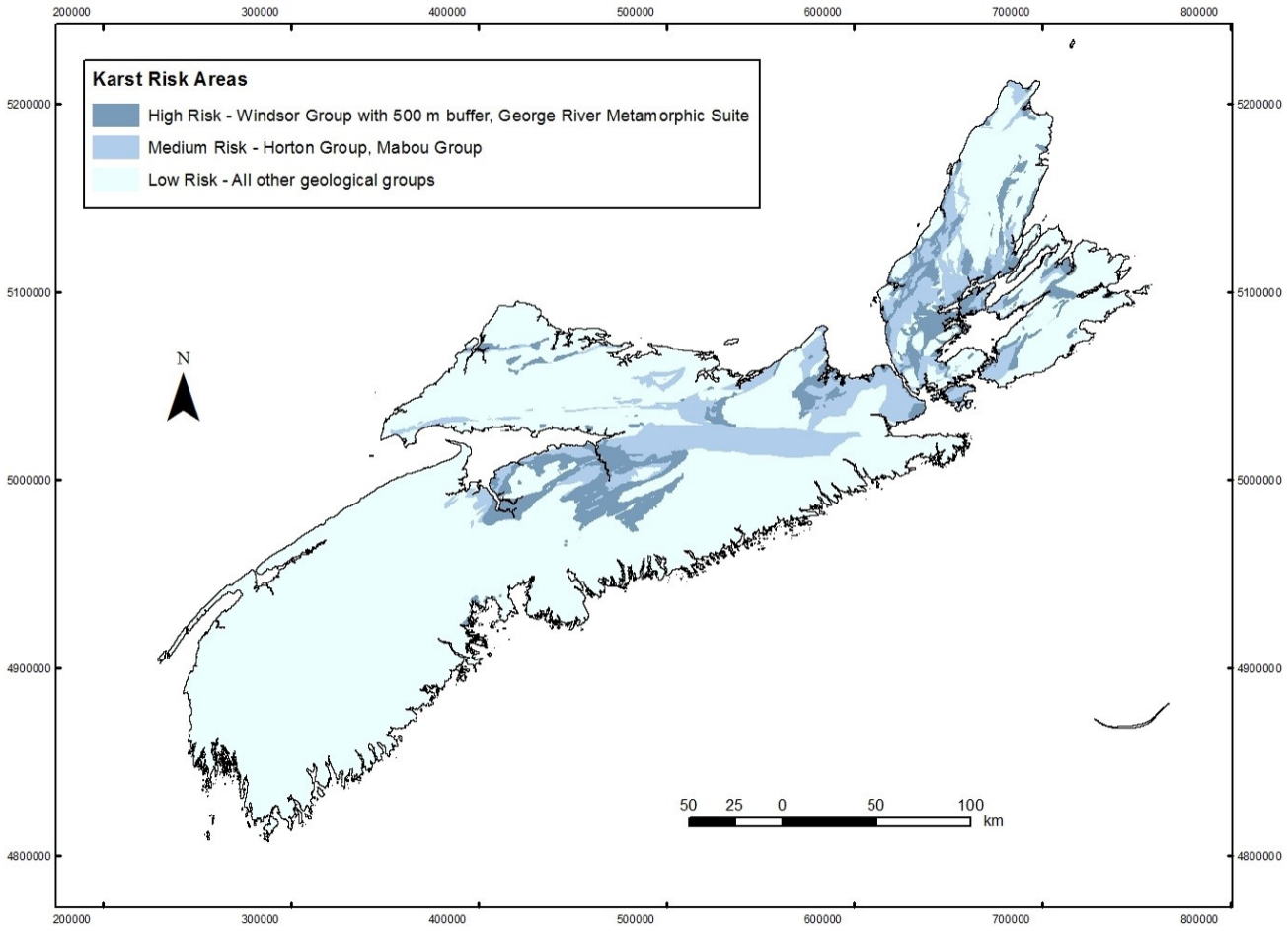

Figure 2. A karst risk map of Nova Scotia.

commonly discharged into streams, ponds, rivers, wetlands, and surface depressions. This resulted in the formation of tailing deposits with high concentrations of arsenic, mercury, and other metals. In 2018-19, NSDEM continued to support research by St. Mary's University to advance the understanding of the impacts of historical gold-mine tailings on aquatic wetland ecosystems. In particular, the department supported an M.Sc. project that aims to identify invertebrate species that can serve as biomonitors of contaminants in impacted wetlands, and to assess the risk of biotransport of arsenic and mercury from key aquatic insect species to terrestrial organisms that consume the insects. Further information about the tailings is available in government reports and webpages (Drage, 2015; Nova Scotia Environment, 2017).

The department continued efforts to develop quantitative information on background concentrations of chemicals in soils in both rural and urban areas. This information is needed to develop appropriate soil quality standards and to enhance science- and evidence-based decision making in relation to contaminated sites. In 2015, the department participated in a project with Dalhousie University and Nova Scotia Environment to conduct soil sampling in urban areas of the Halifax Regional Municipality. Samples were analyzed for metals and polycyclic aromatic hydrocarbons. In 2018, the soil sample results were released in digital format (Kennedy et al., 2018).

Acknowledgments

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