

## **The Port Hope Areas Initiative's Port Granby Project: Radiation Protection Program-17446**

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### **ABSTRACT**

The Port Granby Project is large remediation project currently underway. A comprehensive and effective radiation protection program has been developed and implemented for the Port Granby Project. The potential radiation hazards associated with this project include: external (gamma) radiation, radon, inhalation, contamination and ingestion. Processes to address each of these potential hazards are identified. Measures of the effectiveness of the radiation protection program are also included.

### **INTRODUCTION**

The Port Hope Area Initiative (PHAI) is the Government of Canada's response to the community-recommended solutions for the remediation and safe, long-term management of historic low-level radioactive waste (LLRW) that was the result of uranium and radium processing operations in the Municipality of Port Hope, Ontario from the 1930s to the 1980s. The Eldorado refinery, on the shores of Lake Ontario, began refining radium-226 from pitchblende ore, later transitioning to the refining of uranium ore. Process residues were deposited at the Welcome Waste Management Facility in Port Hope until the mid-1950s switching to the Port Granby Waste Management Facility (PGWMF), which continued to accept waste until the late 1980s.

The Port Granby Project involves the construction of a new, secure long-term waste management facility (LTWMF) and supporting infrastructure, and the excavation and relocation of approximately 450,000 m<sup>3</sup> of historic low-level radioactive waste and marginally contaminated soil from the PGWMF to the newly constructed LTWMF. The Project is regulated by a licence granted by the Canadian Nuclear Safety Commission (CNSC). More information on the Port Granby Project is available on the PHAI website [1]. A comprehensive radiation protection program is a necessary aspect of this remediation project.

### **STRUCTURE OF THE PORT GRANBY RADIATION PROTECTION PROGRAM**

The radiation protection (RP) program has been developed to meet the contractual and regulatory requirements for this project. The scope of the RP program includes:

- A high-level radiation protection plan that specifies responsibilities, authorities, limits, reporting and program assessment requirements.

- A suite of standard operating procedures that describe how the radiation protection program is implemented on a day-to-day basis.
- A comprehensive training program that addresses the training needs of both workers and visitors.
- Comprehensive means to measure and record radiation doses and radiation hazards.
- Response to unusual circumstances, incidents and emergencies.
- On-going auditing by internal resources, Canadian Nuclear Laboratories and the CNSC.

## **RADIATION HAZARDS AND MITIGATION**

The following potential radiation hazards have been identified at the Port Granby Project site as part of this remediation project:

1. External (gamma) radiation fields. That is, gamma radiation associated with the waste from where it is currently emplaced, while being excavated and transported and emplaced in the new waste management facility.
2. Radon. The waste includes natural uranium and natural thorium. Radon is produced as part of the decay of these isotopes.
3. Inhalation hazards. The excavated material may be in a respirable form as a result of excavation, transportation and emplacement activities.
4. Contamination. As the material is generally of a soil-like consistency, contamination hazards are anticipated.
5. Ingestion. Wherever there is contamination, the potential for ingestion exists.

The following mitigation methods have been developed in response to each of the identified hazards.

### **External (gamma) radiation fields**

- Twice-daily monitoring of gamma radiation fields in the work area.
- Site workers are provided with an optically stimulated luminescence (OSL) dosimeter. These are provided by Health Canada's National Dosimetry Service [2]. The "lower reporting limit" on these OSLs is 0.10 mSv.
- All non-escorted visitors are provided with either an electronic personal dosimeter (EPD) or an OSL.
- Non-essential personnel are restricted from entering the work site.
- Awareness of radiation fields is provided to workers who are trained to implement ALARA principles.

## **Radon**

- Environmental radon monitors are placed at strategic locations around the site. These are exchanged quarterly.
- Continuous real-time monitoring of radon levels.
- Key personnel are provided with individual passive radon monitors. These are provided by a commercial supplier [3] and are exchanged monthly.

## **Inhalation**

- The project is mandated to operate with “no visible dust”.
- Continuous real-time dust monitoring provided by the environmental monitoring group.
- All site heavy equipment has enclosed operator cabins with their own air circulation and filtration system. Operators are to use these air systems (i.e. not drive around with the windows open).
- Portable air pump and filter is deployed daily to monitor long-lived alpha in air. The pump and filter is rotated through various locations on a weekly schedule. The locations where air samples are obtained include: at the waste excavation site, at the waste emplacement site and inside heavy equipment operator cabins.

## **Contamination**

- Identification and demarcation of the radiation control area.
- Personnel entry and exit from the radiation controlled area is through a dedicated RP trailer. This trailer includes washing and contamination monitoring facilities.
- In the RP trailer, workers don and doff dedicated clothing. Site personal protective equipment includes high-visibility coveralls, boots, gloves, and head, hearing and eye protection.
- All vehicles and equipment leaving the radiation controlled area are scanned for possible contamination. Two decontamination facilities (capable of accommodating large construction equipment) are available on site.
- A vehicle wheel wash facility is available.
- Routine monitoring of the internal road between the excavation and emplacement (a distance of about 700 m) is performed using a ScanPlot™ trailer [4]. This consists of a large volume plastic scintillator connected to real-time display. No waste is transported on municipal roads.

## Ingestion

- No eating, drinking or smoking is permitted in the radiation controlled area except for designated areas. Routine contamination monitoring is performed in these designated areas.
- There is a dedicated lunch room that is routinely monitored for contamination.

## EFFECTIVENESS OF THE RADIATION PROTECTION PROGRAM

Effectiveness of the RP program is continuously evaluated through audits, oversight and review processes. Quantitative data collected measuring the effectiveness of the RP program is considered in two phases. The first phase (from approximately June to October 2016) was during the site preparation activities while the RP program was developed and implemented. The second phase is after commencement of waste hauling activities (this started 1 November 2016).

RP data for the site preparation phase of activities is summarized as follows:

- No measurable external radiation doses. For all the OSLs that were utilized (up to approximately 100 per month) there were no recordable doses above background (i.e. all dosimeters showed zero dose). For the EPDs, typically they showed zero dose. The maximum observed daily dose was 2  $\mu\text{Sv}$  (background included).
- Measured radon levels were essentially the same as background levels (in the order of tens of  $\text{Bq}/\text{m}^3$ ).
- No long lived alpha in air detected. That is, analysis of all filters (after allowing for radon decay) showed zero detectable activity.
- There were no contamination incidents.
- No detectable contamination measured on the internal haul route roadways.

The RP data for the waste hauling phase covers the period from 1 Nov 2016 to 31 December 2016 (the last period for which data are available to meet the submission requirements for this paper). The data are:

- No measurable external radiation doses. For all the OSLs that were utilized (up to approximately 100 per month) there were no recordable doses above background (i.e. all dosimeters showed zero dose). For the EPDs, typically they showed zero dose. The maximum observed daily dose was 6  $\mu\text{Sv}$  (background included).
- Measured radon levels were essentially the same as background levels.
- No long lived alpha in air detected.

- There were no contamination incidents.
- No detectable contamination measured on the roadways.

As of 31 December 2016, the total RP effort included:

- Completed approximately 900 gamma radiation surveys.
- Completed approximately 1,200 contamination surveys.
- Delivered RP training to 232 individuals.

As can be seen, the RP program has been effective in monitoring, mitigating and/or eliminating almost entirely all the site radiation hazards. The RP program has also been viewed positively by oversight staff, auditors, Canadian Nuclear Laboratories and the Canadian Nuclear Safety Commission.

## **REFERENCES**

1. <http://www.phai.ca/en/home/port-granby-project/default.aspx>.
2. <http://www.hc-sc.gc.ca/ewh-semt/occup-travail/radiation/dosim/index-eng.php>
3. <http://www.landauerradon.com/>
4. <http://www.amecfw.com/services/specialist-services/orion-technology>

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