

From Pushing Paper to Pushing Dirt - Canada's Largest LLRW Cleanup Gets Underway - 13111

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ABSTRACT

The Port Hope Project is the larger of the two projects in the Port Hope Area Initiative (PHAI), Canada's largest low level radioactive waste (LLRW) cleanup. With a budget of approximately \$1 billion, the Port Hope Project includes a broad and complex range of remedial elements from a state of the art water treatment plant, an engineered waste management facility, municipal solid waste removal, remediation of 18 major sites within the Municipality of Port Hope (MPH), sediment dredging and dewatering, an investigation of 4,800 properties (many of these homes) to identify LLRW and remediation of approximately 450 of these properties. This paper discusses the status of the Port Hope Project in terms of designs completed and regulatory approvals received, and sets out the scope and schedule for the remaining studies, engineering designs and remediation contracts.

INTRODUCTION

The Port Hope Area Initiative (PHAI) is Canada's largest Low Level Radioactive Waste (LLRW) remediation project. The PHAI is defined by a three phase process (Figure 1). Phase 1/1A consists of planning, environmental and regulatory approvals and detailed designs; Phase 2 of construction and development, and Phase 3 long-term monitoring and maintenance. The PHAI is currently in the early stages of Phase 2, and during the next 10 years will be subject of intense tendering, contracting, construction and remediation. This paper describes these Phase 2 activities and provides information about the upcoming construction projects.



Figure 1: Phasing of the Port Hope Area Initiative

The PHAI has been subdivided into two projects, the Port Hope Project (PHP) and the Port Granby Project, based on municipal boundaries and agreements that prevent the movement of waste between the two communities. At \$1 billion, the PHP is the larger of the two projects and although the source of waste is the same, the characteristics of the two are very different based on the nature of the LLRW and the geographic distribution of the LLRW.

LLRW in Port Hope is the result of the radium and uranium refining operations of the federal crown corporation Eldorado Nuclear Limited and its private sector predecessors between 1933 and 1955. Processing for radium was the initial focus of the refining operation until the early 1940s, at which time the focus shifted to the refining of uranium. LLRW in Port Hope is largely

soil-like process mine waste, and was distributed to several hundred locations within Port Hope during this period through managed and unmanaged activities. In contrast, LLRW management at Port Granby is focused at one site on the shores of Lake Ontario, approximately 15 kilometres to the west of Port Hope. Eldorado operated this site from 1955 to 1988. Wastes taken to the Port Granby site comprised a variety of forms including paste-like process residues, industrial trash, liquid wastes, and contaminated soils. The Port Granby Project is the subject of another paper in the Waste Management Symposium.

The residues generated by Eldorado contain many contaminants, including uranium, radium, thorium, arsenic, cobalt, lead and nickel, although the first four, specifically ^{226}Ra , ^{230}Th , uranium, and arsenic, are considered the “signature” LLRW parameters when they are found at levels above normal background in Port Hope.

Between 1933 and 1955 the residues were placed in various locations within the Municipality of Port Hope. During the first six years of production residues were stored on the plant site. When space became limited, the storage operation was moved west to the Lakeshore Residue Area until 1939. Once this site was filled, the residue storage operation was relocated to a new site, known as Monkey Mountain, approximately 1.5 km to the north of the plant site. In 1948, when the Monkey Mountain site was closed, the Welcome Residue Storage Area was created in the former Township of Hope, nearly 5 kilometres to the northwest of the Eldorado site. This area, now known as the Welcome Waste Management Facility, remained in operation for 6 years, until 1955. After 1955 waste was shipped to the Port Granby facility.

The Welcome Waste Management Facility currently contains 450,000 cubic metres of LLRW, which will need to be excavated and placed in future landfill cells to be constructed there. The Welcome Waste Management Facility currently includes a 30-year old waste water treatment plant which treats water by ferric chloride addition and settlement and discharges it through a 3 kilometre pipeline to Lake Ontario.

The residues and waste deposited in Port Hope are not limited to these four locations. LLRW is known to be present at 13 major sites around the community, shown on Figure 2. Descriptions of the major sites and the proposed remediation activities at each site are provided on Table 1 (LLRW sites) and Table 2 (non-LLRW industrial sites). Many more areas within the community were contaminated in a variety of ways, including:

- Spillage of wastes or residues during transport to the waste management sites which resulted in the contamination of 151 locations within municipal road allowances (not shown on Figure 2);
- Unrecorded, unmonitored, or unauthorized diversion of contaminated fill, building material and reclaimed materials to approximately 450 sites within the municipality, many of these residential, also not shown on Figure 2;
- Off-site transport from the Monkey Mountain Site and from the Eldorado plant sites due to wind and/or water erosion; and
- Contamination at temporary residue storage locations pending shipment for secondary processing.

Not included in the PHAI is work to be undertaken by Cameco Corp. which purchased the assets of Eldorado in 1988. Cameco, under its Vision in Motion project, will demolish existing buildings on the Centre Pier, remove drummed wastes contained in the buildings and demolish some buildings on their property to the west of the Port Hope Harbour. The resultant waste, with a combined volume of 150,000 cubic metres, will be placed in the PHAI's Long Term Waste Management Facility.



Figure 2: Major Remediation Site Locations

EARLY CLEAN-UP AND SUBSEQUENT PROGRESS

A Federal/Provincial Task Force on Radioactivity was established in 1976 to coordinate a national program of radioactive contamination assessment and remedial measures. One of several working groups set up by the Task Force developed a set of cleanup criteria to be applied

to existing and potential contamination situations. In April 1977 the working group presented the following criteria for radioactive cleanup in Canada:

- Radon and radon daughter levels inside buildings:
 - 0.02 Working Levels
 - 148 Bq/m³ for radon gas
- Gamma radiation outside buildings:
 - 0.10 mR/hr at 1 metre above bare ground
- Gamma radiation inside buildings:
 - 0.05 mR/hr at 1 metre above floor in centre of room

Using these 1977 Task Force Criteria, approximately 3,500 properties were surveyed in Port Hope and some 450 properties underwent remedial work to address gamma radiation and/or radon exceedences during the period of 1977 to 1981. As a result of these remedial activities, approximately 100,000 cubic metres of LLRW was removed from these properties and safely transported by truck to the Chalk River Laboratories operated by Atomic Energy of Canada Limited, 300 kilometres to the north. The capacity at the Chalk River site was limited to 100,000 cubic metres, therefore remedial activities were focussed on residential, commercial and public properties that were seen to present the greatest potential impact on the population. The remaining approximately 500,000 cubic metres of LLRW associated with ravines, vacant lands, roadways, the community landfill and harbour sediment were left for clean-up at a later time.

The Federal government established a “Construction Monitoring Program” (CMP) in 1982 to address ongoing LLRW management until a long-term solution was developed. Using the Federal/Provincial Task Force cleanup criteria, the CMP is mandated to monitor all construction and renovation projects in Port Hope which involve the excavation of soils or the renovation of structures, and to remove and manage LLRW not meeting the criteria in Temporary Storage Sites within Port Hope. Any project requiring a building permit is automatically referred to the CMP. The CMP is implemented by Atomic Energy Canada Limited (AECL) through the Low Level Radioactive Waste Management Office (LLRWMO). The LLRWMO maintains records of every property which was investigated and remediated between 1977 and 1981 and all properties monitored by the CMP. Through a Property Compliance Program, a Radiological Status Letter (RSL) can be provided for any property with a file summarizing previous remediation efforts and / or investigations.

A Legal Agreement addressing commitments of the various levels of governments based on community proposals was established between the Government of Canada and the Municipality of Clarington, the Town of Port Hope, and Hope Township (the latter two since amalgamated to form the Municipality of Port Hope). Signed in 2001, the Legal Agreement established the PHAI and commits Canada to the cleanup of all historic LLRW within these communities and the encapsulation of the contaminants in safe, long-term, storage facilities (one in each community). The Legal Agreement also allows for the remediation of up to five industrial sites (i.e. non-LLRW) containing no more than 51,250 cubic metres within the Municipality of Port Hope.

A federal environmental assessment of the Port Hope Project was initiated in late 2001. The environmental assessment is at a screening level under the Canadian Environmental Assessment

Act but the assessment has been scoped by the federal responsible authorities to include the same factors as a comprehensive study. The Environmental Assessment was completed in 2006.

A licence application for the Port Hope Project was originally submitted to the Canadian Nuclear Safety Commission (CNSC) in December 2004. In March 2007, the CNSC indicated their acceptance of the Environmental Assessment and that the Commission was in a position to continue its consideration of the licence application for the Port Hope Project. Following the August 2009 CNSC Hearing, AECL was granted a five-year Waste Nuclear Substance Licence, valid until December 2014 however including hold points that included not starting any remediation. In October 2012 the CNSC held a hearing to consider lifting hold points in the existing licence and in November 2012 the CNSC issued the amendment, authorizing construction and remediation work and extending the PHAI licence by 10 years to December 31, 2022.

In January 2012 the Federal government announced funding of \$1.28 billion for the PHAI of which approximately \$1.0 billion was for the Port Hope Project. This funding along with the completion of the Environmental Assessment in 2006 and the November 2012 amendment to the Waste Nuclear Substance License for Port Hope are cornerstones to advancing the Port Hope Project from design to implementation.

The Project has been subject to hundreds of studies and investigations, culminating in the completion of the detailed remediation designs for the 13 major LLRW sites and the 5 industrial sites, the Long-Term Waste Management Facility, and a new water treatment plant. The design effort commenced in 2010 and was completed in 2011 by MMM-CRA, the joint venture of the MMM Group and Conestoga-Rovers & Associates. The designs have been packaged into a number of bid documents which will be released to bidders through the MERX public tendering system. Tentative ¹schedules for the release of these documents are presented in the following sections.

ONGOING AND FUTURE STUDIES AND REMEDIATION

Although there have been many major achievements to date, as described above, much work is still required to define the extent and details of the small scale site remediations and to develop contracts to implement them. For the “small scale sites” every property in Ward 1 of the Municipality of Port Hope and selected properties in Ward 2, a total of approximately 4800 properties, will be studied and remedial designs completed where applicable. Tendering for remediation of the major sites and the small scale sites is largely in the future, with only a limited number of projects already completed (the Access Road between Toronto Road and the future Long Term Waste Management Facility) or currently under construction (the Water Treatment Plant). Table 3 summarizes future tendering opportunities and the estimated duration and time frame for the implementation of these contracts.

¹ Descriptions of all tenders and their schedules are considered tentative. It is the responsibility of potential bidders to monitor the MERX site for opportunities.

Ongoing Services

The beginning of Phase 2 in February 2012 initiated an intense period of Project activity which included the launching of many scopes of work to provide final definitions to the extent of LLRW and the designs for small scale sites. Contracts have recently been awarded for:

- Radon testing of approximately 450 properties (June 2012);
- Radiological survey and delineation of St. Mary's School, Caroline Street Park and Peter Street Mound (September 2012);
- Radiological survey and delineation of an abandoned discharge pipeline between the Welcome Waste Management Facility and Lake Ontario (September 2012);
- Environmental Site Assessments of the non-LLRW Industrial Sites to further define volumes (October 2012);
- Radiological survey of approximately 450 properties including interior and exterior gamma, exterior boreholes and swipe testing (October 2012); and,
- Radon testing of approximately 1,100 properties (December 2012).

Ongoing Remediation

Two contracts have recently been awarded for remedial works at the LTWMF:

- Construction of a water treatment plant with a capacity of 960 cubic metres per day, which includes ferric chloride preconditioning, plate and sand filters and a reverse osmosis (ROChem) filter (October 2012); and,
- Early Works 3A - Excavation and stockpiling of approximately 100,000 cubic metres of LLRW impacted surficial soil from parts of the Long term Waste Management Facility (February 2013).

Future Services

Future service contracts are focused on the assessment for presence and absence of LLRW on 4,800 properties in the Municipality of Port Hope as well as other opportunities. Estimated timeline for the tendering and the implementation of this work is presented in Table 3:

- Radiological survey of the remaining 4,350 properties in the Municipality of Port Hope including interior and exterior gamma, exterior boreholes, swipe testing and radon testing for all but 1150 properties which is being performed under a separate contract;
- Radiological survey of approximately 151 road allowance locations including gamma testing and borehole sampling and analyses;
- Remedial design of the small scale sites contaminated with LLRW, which is expected to include 450 properties, largely residential;
- Remedial design of the St. Mary's School, Caroline Street Park Mound and Peter Street Mound sites; and,
- Remedial design for the 151 road allowance locations.

Future Remediation

At least seven major remediation contracts will be released for tender in the next 4 years. Estimated timeline for the tendering and the implementation of this work is presented in Table 3:

- Early Works 1 - Cell 1 of the LTWMF involves the construction of the base liner of the central cell which consists of two leachate collection systems and a double composite liner (High Density Polyethylene (HDPE) / Geosynthetic Clay Liner (GCL) and HDPE/clay);
- Early Works 2 – Construction of an administrative building, a decontamination building and a security building and associated infrastructure;
- Long Term Waste Management Facility and Major Sites Remediation (Figures 2, 3 and 4) – Construction of the base liner of Cells 2 and 3 of the LTWMF, excavation of 450,000 cubic metres of LLRW already on the Welcome Waste Management Facility site and its placement into Cell 1, remediation of the major sites and the industrial sites and placement into the LTWMF, and capping of the cells with a protective cover and a drainage system and a composite liner (HDPE and GCL). Cell 3 will be used to contain municipal solid waste from the Highland Drive Landfill;
- Three contracts will be tendered to upgrade 8 kilometres of roads to facilitate travel of PHAI construction traffic within the Municipality of Port Hope. Upgrades vary from asphalt concrete overlays to pavement removal and replacement;
- Remediation of approximately 450 small scale sites will involve the removal of LLRW impacted soils and construction materials from small properties, largely residential. Cleanup will range from limited soil removal to complex replacements of structural building components. Contracting methodologies and strategies are still under consideration and may include elements of construction management approaches;
- Remediation of St. Mary's School, Caroline Street Park Mound and Peter Street Mound sites will involve the removal of approximately 25,000 cubic metres of soil. Remediation of buildings is not anticipated; and,
- Approximately 151 road allowance locations will be remediated to remove thin layers of LLRW from the road shoulders and under the asphalt concrete. Approximately 8 kilometres of road alignment is included in this program.



Figure 3: Port Hope Harbour Area Major Remediation Sites



Figure 4: Highland Drive Area Major Remediation Sites

CONCLUSION

The PHAI is in the early stages of Phase 2 in its life cycle, which will be a period of intense investigation, tendering, construction and remediation. Although Phase 1, which was completed in 2011, saw the completion of the major designs, much work still remains to be done to define the extent and nature of remediation on the Project's small scale sites, many of which are residential. During the next four years, approximately 9 construction contracts and 6 service contracts will be awarded that will define the progress of the Project.

Table 1
Summary of Major LLRW Sites

| Site Name | Description* | Volume (cubic metres)* |
|---|---|------------------------|
| Port Hope Harbour | Dredging / dewatering of sediment. Rebuilding 1,800m of harbour wall. Volume is after dewatering. | 111,000 |
| Viaducts Area | Former disposal area for dredged Harbour sediment and John Street remediation soil. Dredged Harbour sediment up to 1.3m thick and John Street soil up to 5 m thick. | 21,000 |
| Waterworks Site | Historic disposal site, previously remediated in 2003. | 13,000 |
| Alexander Street Ravine | Historic end dumping on slopes and base of the ravine to a depth of up to 2-3 metres. | 4,000 |
| Centre Pier Storage Site | Contains LLRW from the remediation of the Waterworks site. Enclosed by ring wall and covered by tarps. | 20,000 |
| Highland Drive Landfill | LLRW comingled with municipal solid waste placed in the 1940s. Approximately 135,000 cubic metres of MSW will need to be removed, managed and replaced in order to expose LLRW. | 52,000 |
| Highland Drive South Ravine | Result of precipitation of contaminants from groundwater seepage from Highland Drive Landfill into ravine and overland flow. Installation of three Permeable Reactive Barriers to manage seepage. | 6,000 |
| Highland Drive Roadbed | Result of historic spillage from trucks. Temporary road closure and excavation of roadbed to a depth of 1m. | 9,000 |
| Pine Street North Extension Roadbed | Result of historic spillage from trucks. | 7,000 |
| Pine Street North Extension Consolidation Site – CNSC licensed | Site of consolidation of LLRW from previous remediation sites. | 47,000 |
| Pine Street Extension North Temporary Storage Site – CNSC licensed site | Site of temporary storage of soils generated under the CMP. | 7,000 |
| Mill Street South Site | Dumping area to reclaim marshlands. | 12,000 |
| Strachan Street Consolidation Site – CNSC licensed site | Consolidation site from earlier Strachan Ravine Cleanup, site is capped by HDPE and soil cover. Volumes do not include cap. | 3,000 |
| Sewage Treatment Plant Temporary Storage Site - CNSC licensed site 2 | Historic temporary storage site containing soils and debris. | 2,000 |
| Existing WWMF | Contaminated due to mixing and contact with refinery waste. | 455,000 |
| Cameco Pre-1988 Waste | Allowance in LTWMF for waste stored at Cameco. Only disposal part of PHAI. | 150,000 |

* Remediation of all sites includes excavation of listed quantities and disposal at LTWMF.

**Table 2
Summary of Major Non-LLRW Industrial Sites**

| Site Name | Description* | Disposal at LTWMF* |
|---|---|---------------------------|
| Sewage Treatment Plant Storage Cells | This site was constructed in 1987 to contain dried sewage sludge from the Municipal Sewage Treatment Plant. | To Be Determined |
| Centre Pier (Industrial Site) | Metal impacted soil over much of surface of Centre Pier. Does not include surficial radiological impacts to be removed by Cameco. | To Be Determined |
| Lions Recreation Centre Park (Non-LLRW Industrial Site) | Metals impacted cinder 2-4 m in thickness. | To Be Determined |
| Coal Gasification Plant Site | Site of former coal gasification plant site containing metals, PAHs and petroleum. | To Be Determined |
| Chemetron Lagoon | Sludges from a waste water settling lagoon impacted by PCBs, VOCs, SVOCs and metals. . | To Be Determined |

* All Industrial Sites are currently the subject of Risk Assessments to determine quantities. Total quantity not to exceed 51,250 cubic metres.

**Table 3
Summary of Proposed Contracts for Services and Construction**

| Description* | Type | Tendering* | Implementation* |
|---|--------------|--|------------------------|
| Radiological Property Survey for 4,450 properties | Service | Winter 2013 | 2013 |
| Radiological survey of 151 road allowances | Service | Winter 2013 | 2013 |
| Laboratory testing of 1.3 million samples | Service | Spring 2013 | 2013-2020 |
| Remedial design of approximately 450 small scale sites | Service | Spring 2013 | 2013-2017 |
| Remedial design of the St. Mary's School, Caroline Street Park Mound and Peter Street Mound sites | Service | Winter 2013 (Existing PWGSC Standing Offer) | 2013 |
| Remedial Design of 151 road allowances | Service | Fall 2013 | 2014 |
| Early Works 1 – LTWMF Cell 1 Construction | Construction | Summer 2013 | 2013-2015 |
| Early Works 2 – Building Construction | Construction | Spring 2013 | 2013-2014 |
| Long Term Waste Management Facility and Major Sites Remediation | Construction | Summer/Fall 2013 | 2014 - 2020 |
| Road Upgrades | Construction | Spring 2014 | 2014 |
| 450 Small Scale Sites | Construction | To Be Determined | 2015 - 2019 |
| Road Upgrades | Construction | Spring 2015 | 2015 |
| Road Upgrades | Construction | Spring 2016 | 2016 |
| St. Mary's School, Caroline Street Park Mound and Peter Street Mound sites | Construction | Winter 2015 | 2016 |
| 151 Road Allowances | Construction | 2014/15 | 2015-2019 |

* The packaging and scheduling for tendering and implementation are still under development and the information presented in this paper should be considered only as indicative of general directions. Interested parties should make use of the MERX public tendering system (www.merx.com) to monitor tendering.