

**Port Hope Area Initiative – Community Based Concepts Become Reality-
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Craig Hebert, G. Glenn Case

Canadian Nuclear Laboratories

ABSTRACT

The Port Hope Area Initiative (PHAI) involves the cleanup of historic low-level radioactive waste (LLRW) resulting from radium and uranium processing by the former Crown Corporation, Eldorado Nuclear Limited, and its predecessor companies, during the period between 1932 and 1988. The PHAI, which is based on a legal agreement between the Government of Canada and the adjacent municipalities of Port Hope and Clarington in Ontario, Canada, comprises two separate community-initiated projects for the long-term management of the historic LLRW located in each of these municipalities.

The Port Hope Project involves the cleanup of approximately 1.2 million cubic metres of historic LLRW from various sites within the urban area of Port Hope, the construction and operation of an engineered aboveground mound where the waste will be safely contained, and the long-term maintenance and monitoring of the new waste management facility. The waste is currently located in 13 large-scale sites and an estimated 375 small-scale sites within the community.

In contrast, the Port Granby Project involves the relocation of approximately 450,000 cubic metres of historic LLRW from the existing waste site on the north shore of Lake Ontario in rural Clarington, to a new engineered aboveground mound to be built 700 metres north of the shoreline. The work also involves the restoration of the existing site and long-term maintenance and monitoring the new facility.

The PHAI entered Phase 2 (construction) of a three-phase program in early 2012, when \$1.28 billion (Canadian) in federal funding was announced by the Minister of Natural Resources Canada. The funding, together with regulatory approval from the Canadian Nuclear Safety Commission (CNSC), which granted 10-year waste management licences to both projects, have permitted the PHAI to move forward with construction and remediation.

Waste water treatment plants based on best-available technologies have been constructed for each project to remove a wide range of contaminants from

groundwater, surface water and leachate collected during construction and operation of the aboveground mounds. Each treatment process has been designed to ensure the quality of treated water being discharged into Lake Ontario meets or exceeds stringent regulatory requirements, resulting in the enhanced protection of the Great Lakes Basin ecosystem.

In 2015, the contract to build the Port Granby long-term waste management facility and remediate the existing waste site was awarded, and the long-awaited facility development will soon begin. The use of a dedicated internal waste transportation route along, which the LLRW will be trucked from the existing site to the new facility, is a key component of the design to minimize the impact on the local, rural community. In Port Hope, the removal of contaminated soil within the site for the new long-term management facility commenced in the fall of 2015. Over the next several years, multiple contracts will be awarded for construction and operation of the new waste management facility and remediation of the large and small-scale sites.

In short, the Port Hope and Port Granby community-based concepts have matured into tangible projects with appropriate regulatory approvals and federal funding in place. Ongoing communications with the two communities have resulted in a well-informed public that understands the work to be done and is eager to see their projects take shape and become reality. As Canada's largest environmental remediation and restoration undertaking, the PHAI has never been closer to fulfilling its vision – working with the local communities to fulfil Canada's commitment for the cleanup of historic waste in Port Hope and Port Granby to leave an honourable legacy for future generations.

History Behind Community Concepts

Under the direction of the Federal Provincial Task Force on Radioactivity (FPTFR), investigation and cleanup activities were conducted in Port Hope during the period of 1976 to 1981. The FPTFR was established in February 1976 to coordinate a national program of radioactive contamination assessment and remedial measures in communities associated with uranium mining and refining. In the province of Ontario, Port Hope, Bancroft and Elliot Lake were identified along with Uranium City in the province of Saskatchewan. In the case of Port Hope, investigations of the town identified low-level radioactive contamination in the form of soil and building materials on private and municipally owned sites. Initially, the volume of material to be addressed was estimated to be in the order of 100,000 m³, but as the investigations progressed, the volume increased to over 500,000 m³ as more sites were discovered and characterized.

To assist the FPTFR address the LLRW found in Port Hope, a waste management area (WMA) was established at the Chalk River Laboratories (CRL) facility operated

by Atomic Energy Canada Limited. The configuration of the WMA allowed for the receipt and management of approximately 100,000 m³ of LLRW in the form of bulk soil. During the period of 1977 to 1981 this WMA at the CRL site was filled to capacity with LLRW sourced primarily from residential sites within the Town of Port Hope that exceeded the FPTFR clean-up criteria. The basis of the clean-up criteria was the reduction of human exposure to gamma radiation and radon gas to regulatory accepted levels for members of the general public. Based on the limited capacity at the CRL site, remedial clean-up activities were primarily focussed on residential properties where radiation exposure from LLRW exceeded the criteria. During this period, some 450 private properties were remediated. The remaining larger-scale sites that had been identified in Port Hope would have to be addressed at a later date.

This LLRW contamination found in Port Hope was the result of poor waste management practices associated with radium and uranium ore refining and processing activities conducted by the former Crown Corporation, Eldorado Nuclear Limited, and its predecessor companies, during the period between 1932 and 1988. Processing pitchblende ore for the extraction of radium was the initial focus of the refining operation until 1941, when operations at the plant were expanded to accommodate the refining of uranium. By 1954 the radium refining operation had ceased, and the focus at the Port Hope plant was solely on uranium refining and processing. Figure 1 presents picture of early plant operations on the waterfront.

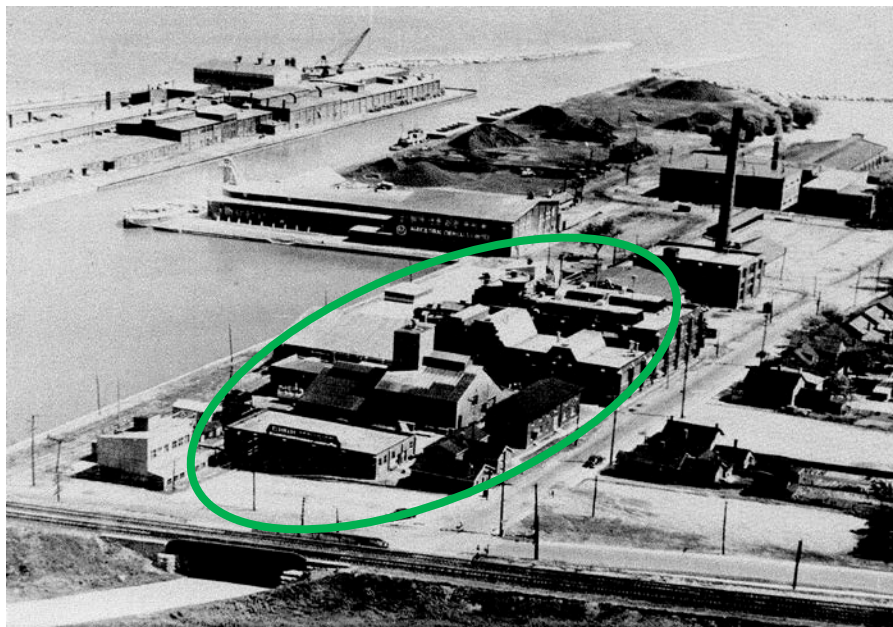


Figure 1 Original Eldorado Plant Circa mid 1950s

The residues, generated by Eldorado's radium and uranium refining of pitchblende ores from its mine at Port Radium in Canada's Northwest Territories, contain many

contaminants including antimony, arsenic, barium, cadmium, cobalt, copper, lead, molybdenum, nickel, silver, vanadium and zinc. Of these contaminants, arsenic as well as ^{226}Ra , ^{230}Th , and uranium are considered to be the “signature” indicators of historic LLRW when they are found at levels above normal background in Port Hope. It is important to note that the term historic LLRW refers to low-level radioactive waste for which the original producer cannot reasonably be held responsible and for which the Government of Canada has accepted responsibility.

For some 30 years, residues and wastes containing extraction and leaching chemicals as well as elements found in the native pitchblende ores, such as arsenic, silver, cobalt and antimony, were taken by the truckload from the Port Hope Eldorado refinery and dumped in locations within the community that were deemed appropriate at the time. From 1932- 1948, the Port Hope locations included the plant site itself, several ravines, the municipal landfill, numerous private properties and the harbour’s turning basin. Commencing in 1948, the processing wastes were taken to a designated site on the outskirts of Port Hope, where a residue storage area was established. However, when contaminated runoff from this site impacted a local creek, a new waste management site was put into operation at a site located in the neighboring rural hamlet of Port Granby, which is now part of the Municipality of Clarington. From 1956 to 1988, residues and industrial wastes were transported to the Port Granby Waste Management Facility site on the north shore of Lake Ontario. All residue and waste depositions ceased in 1988 when Eldorado was dissolved as part of a merger that created the private-sector company, Cameco Corporation.

At the time when the waste management area at CRL was nearing capacity in the early 1980s, the federal regulatory Atomic Energy Control Board (AECB) issued an order to Eldorado Nuclear Limited to identify long-term decommissioning plans for the Welcome and Port Granby Waste Management Facilities (WMFs). The order stipulated that Eldorado was to provide these plans to the AECB before the end of 1986. Eldorado met this commitment and presented its conceptual plans to the AECB that involved the development of waste management facilities at one of two potential sites in the Port Hope and Clarington area.

Federal Siting Task Force

The announcement of the proposed Eldorado decommissioning plans was not well received by members of the public in the area of the proposed sites. Their concerns were directed to the federal Minister of Energy, Mines and Resources, responsible for overseeing the operations of Eldorado. In response to this public concern, in the fall of 1986 the Minister announced the formation of a Federal Siting Task Force, whose mandate was to develop and implement a public participation process for the identification of a willing host community to site a new long-term

waste management facility for the LLRW currently located at the Welcome and Port Granby WMFs and at the many sites located within the Town of Port Hope.

During the period of 1986 to 1996, the Siting Task Force conducted consultation activities with communities that were interested in exploring the possibility of hosting an LLRW management facility. The Task Force provided information to some 850 communities in Ontario and, through the application of a screening process, narrowed down the interested and potentially viable communities to less than 10. Through focussed discussions with this small number of communities the list became smaller until only one community remained. However, it was not possible to negotiate a formally binding agreement between this last remaining community and the federal government so, after 10 years of consultation and investigations, the siting process ended unsuccessfully, unable to secure a willing host community.

Local Source Community Steps Forward as Potential Host Community

In July of 1997, the Council for the Township of Hope (in which the Welcome WMF is located) carried a resolution which prompted the consideration of Hope Township as a potential host for the historic LLRW from Port Hope, Port Granby and Hope Township. A discussion process was to be initiated to consider hosting the historic LLRW in an environmentally suitable, long-term storage, engineered aboveground mound, to be constructed at the present Welcome WMF. The resolution was forwarded to the Minister of Natural Resources Canada, the federal department responsible for historic LLRW. In December 1997 the Minister agreed to begin discussions with the Township of Hope and, in February 1998, Township of Hope Council established the Hope Township Ad Hoc Committee to investigate the potential for storage of the historic LLRW in the Port Hope area at the Welcome WMF. The terms of reference for the LLRW committee were as follows:

1. Investigation to cover only historic LLRW now contained in Hope Township, Town of Port Hope and Municipality of Clarington, if those municipalities also pass a similar resolution to that of July 1997
2. To review the location of all known historic LLRW in each site
3. To compile a detailed inventory of types of historic LLRW in each site
4. Determine quantities of each type of material at the various locations, along with possible additional volumes due to migration of contaminated materials
5. To investigate various sites in USA and elsewhere using aboveground storage technology
6. To investigate various environmental consequences and safety factors for cleanup
7. To review historic studies/literature relevant to storage of LLRW including Citizen Liaison Group (CLG) documentation
8. To review public responses of CLGs with respect to storage locally

9. To investigate how and when the AECB intends to enforce the decommissioning orders it has issued on the Hope Township Site (Welcome WMF)
10. In investigate the technical feasibility of long-term storage engineered surface mound storage
11. To advise on what funding/compensation might be appropriate
12. To obtain cost estimates for environmental reviews, costs of construction, including relocation of contaminated materials and cost of perpetuity surveillance of site(s)
13. To meet and communicate with government agencies and committees, be they federal, provincial, or other municipal governments upon receiving prior approval from Council. Such prior approval will not be necessary if the purpose of the communication is to simply obtain information.
14. To report to Hope Township Council on a monthly basis and to advise Council as requested
15. To assist Council as required, e.g., hosting of public information meetings
16. To investigate whether Federal Government Agencies will pay for an independent special consultant to work directly with Natural Resources Canada, AECB, AECL and other government agencies to assist this investigation
17. The Committee will establish a budget for Council approval

In July 1998 the committee was able to retain the services of an independent specialist team to assist the committee in addressing the technical items noted above. The committee established the following site performance objectives for incorporation in the conceptual design of the proposed long-term waste management facility (LTWMF):

- ✓ Background surface gamma radiation levels within the storage mound area
- ✓ Ability to walk over the surface of the storage mound with not potential for any additional radiation exposure
- ✓ No fences that would delimit the extent or boundaries of the storage mound
- ✓ Aesthetically compatible with local area land uses
- ✓ Physical appearance compatible with local area and topography
- ✓ Compatible with existing/proposed area land uses
- ✓ Minimal maintenance requirements for the site
- ✓ Exclusion of motorized vehicles from travelling over the surface of the storage mound

The committee also identified the following characteristics considered to be assets that would contribute to the successful future use of the site:

- ✓ Off-site well or a potable water supply from a source beyond the boundaries of the site (e.g. Town of Port Hope domestic water supply)

- ✓ Septic capacity for washrooms, snack bar and other small uses (possible via sewers)
- ✓ Adequate hydro service for lighting, buildings, etc.
- ✓ Access roads and parking areas
- ✓ Vehicle barriers to prohibit vehicles from straying from designated parking areas and access roads
- ✓ Portions of the site to be relatively flat and level that would be amenable for sports uses (e.g., baseball, soccer, etc.)
- ✓ Portions of the site to be sloped and/or terraced, possibly with an amphitheater shape to enhance the aesthetic quality of the site
- ✓ Final topography of the site to have an irregular shape so it does not look like a mound and will be more compatible with the neighbouring terrain
- ✓ Any buildings or structures on the site to be built without basements (i.e., must not compromise the cover/cap system) with subfloor ventilation system to prevent radon build-up inside the structure
- ✓ Construction of berm or natural sound barrier from Highway 401 traffic noise
- ✓ Vegetation introduced to the site comprising native species
- ✓ Institutional/educational/snack bar/parking facilities would not be permitted on the mound
- ✓ Retain as much of the existing (clean) vegetated area as possible, especially trees.

The committee examined several future site uses that would maximize the use of the site, which in their minds had long been only a wasted piece of property, counteract the stigma associated with the presence of this historic LLRW, and provide benefits to the entire community. The committee considered a number of end uses in eight broad categories based on the following general criteria:

- The proposed use is safe, and it is also perceived to be safe
- The proposed use is compatible with surrounding land uses
- The proposed use will not compromise the integrity of the storage mound
- The proposed use appeals to, and is accessible by, a broad cross-section of the community and visitors to the area
- The proposed use is not competitive with local business
- The proposed use would likely be permitted under the licence for the site issued by the Canadian Nuclear Safety Commission
- The proposed use does not burden the Township with excessive ongoing maintenance and/or upkeep

Of the eight potential categories of future use for the site, the following four were immediately dismissed as incompatible: i) residential, ii) agricultural, iii) industrial (heavy or light) and iv) commercial. However the following four were considered to have viability and were put forward for further consideration:

- v. Institutional/Educational – science museum or interpretive centre, agricultural museum, community hall
- vi. Cultural/Tourism – Welcome Centre to Hope Township or Northumberland County
- vii. Snack Bar
- viii. Recreational including green space – scenic lookout, walking/hiking trails, nature trails

Motivated by the success of the Hope Township Ad Hoc Committee, similar committees were established in Port Hope and Clarington for the wastes located in the Town of Port Hope and at the Port Granby Waste Management Site in the Municipality of Clarington. The work of these committees yielded conceptual designs for long-term waste management facilities similar in nature to the one proposed for the Welcome Waste Management Facility in Hope Township.

Legal Agreement and Port Hope Area Initiative

Three years later, in March 2001, an Agreement for the Cleanup and the Long-Term Safe Management of Low-Level Radioactive Waste Situate in the Town of Port Hope, Township of Hope and the Municipality of Clarington was signed by these three host communities and Her Majesty the Queen in Right of Canada (as represented by the Minister of Natural Resources). The Agreement defined the historic low-level radioactive waste and specified industrial waste to be remediated and managed, the parameters to be considered in the development and application of clean-up criteria, the requirements for federal environmental assessments and regulatory review, the project costs to be covered by the Government of Canada, and the requirement for specific programs related to communications, complaint and dispute resolution, and Property Value Protection. For the Township of Hope, the conceptual design was to be based on the work conducted by the ad hoc committee, which was described in the Agreement as “the construction of a waste containment mound that is partially below-grade with an appropriate liner and cover system”.

Through the course of the environmental assessment process, it was concluded that constructing a single facility at the site of the proposed Hope Township facility for the Port Hope wastes, rather than constructing two separate facilities, was a more environmentally responsible option. (This was made possible by the amalgamation of the Town of Port Hope and the Township of Hope between the time the community concepts were proposed and the Legal Agreement was signed). The community-based concept developed by the Hope Township Ad Hoc Committee formed the basis for the design of the Port Hope Project Long-Term Waste Management Facility.

Following the signing of the Legal Agreement in 2001, the environmental assessment for the construction and operation of the Port Hope and Port Granby long-term waste management facilities were successfully completed in accordance with the Canadian Environmental Assessment Act, ten-year Waste Nuclear Substance Licences were issued to Canadian Nuclear Laboratories for each project by the Canadian Nuclear Safety Commission, the designs for the remediation of the various waste sites and the construction of the Port Hope and Port Granby long-term waste management facilities were completed, and federal funding in the amount of \$1.28 billion dollars was secured for implementation of the projects in Port Hope and Clarington. Most recently, new waste water treatment facilities have been constructed at the sites of the new long-term waste management facilities and site preparation work is underway.

Concepts Become Reality

In the development of the conceptual design for the Hope Township facility, many of the items prescribed in the terms of reference, presented above, were addressed. For example: i) information related to the nature and inventory of the historic low-level radioactive wastes to be placed in the new facility was compiled; ii) Storage mound technology at existing waste sites in the United States at Canonsburg, PA, Fernald, OH and Weldon Springs, MO was reviewed, particularly in the context of the technical feasibility of long-term storage; and iii) discussions were held with various government agencies and committees to obtain information and develop an overview of the regulatory requirements that would accompany this type of project.

With respect to the committee's site performance objectives, most of the objectives have been incorporated in the current designs, where feasible. These are summarized in the following table:

Committee's Objective	Achieved	Comment
Background radiation levels on surface of mound	Yes	Cap design includes 1 metre thick layer of uncontaminated soil to attenuate gamma
Ability to walk over the surface of the storage mound with no potential for any additional radiation exposure	Yes	Modelling of surface gamma radiation levels based upon multi-layer cap design predicts background levels
No fences that would delimit the extent or boundaries of the storage mound	Pending	It is the intent not to fence the perimeter of the mound, however fencing of site will likely be required for access control purposes
Aesthetically compatible with local area land uses	Yes	Grass covered mound is compatible with rural agricultural setting
Physical appearance	Yes	Mound is compatible with other natural

compatible with local area and topography		features in local area such as drumlins
Compatible with existing/proposed area land uses	Yes	Mound is compatible with surrounding current and future rural agricultural land uses
Minimal maintenance requirements for the site	Yes	Grass cover for mound should require minimal maintenance
Exclusion of motorized vehicles from travelling over the surface of the storage mound	Pending	Final closure design will require this exclusion
Off-site well or a potable water supply from a source beyond the boundaries of the site (e.g. Town of Port Hope domestic water supply)	Yes	Potable water supply has been installed from existing Port Hope municipal system to long-term waste management facility site. No municipal system available for Port Granby.
Septic capacity for washrooms, snack bar and other small uses (possible via sewers)	Yes	Sewer pipeline has been installed from existing Port Hope municipal system to long-term waste management facility site. No municipal system available for Port Granby.
Adequate hydro service for lighting, buildings, etc.	Yes	Industrial level hydro service along with natural gas supply has been installed at the Port Hope long-term waste management facility site
Access roads and parking areas	Yes	Adequate space is available for these features following closure of the mound
Vehicle barriers to prohibit vehicles from straying from designated parking areas and access roads	Pending	Final closure design will require this exclusion
Portions of the site to be relatively flat and level that would be amenable for sports uses (e.g., baseball, soccer, etc.)	Yes	Excess adjacent lands purchased by project for construction of access road have been converted into soccer fields by the Municipality of Port Hope
Portions of the site to be sloped and/or terraced, possibly with an amphitheater shape to enhance the aesthetic quality of the site	Yes	Final configuration of Port Hope mound will be dependent of total volume of waste placed in the mound; however sides will be sloped.
Final topography of the site to have an irregular shape so it does not look like a mound and will be more compatible with the	Yes	Current Port Hope design is a trapezoidal shape that has been configured based upon the east to west downward sloped topography of the site and location of existing wastes to

neighbouring terrain		be excavated and placed into the mound
Any buildings or structures on the site to be built without basements (i.e., must not compromise the cover/cap system) with subfloor ventilation system to prevent radon build-up inside the structure	Pending	Final building layout following closure of the mound has not been developed.
Construction of berm or natural sound barrier from Highway 401 traffic noise	Yes	Port Hope mound itself will create sound barrier. Of note is sound and visual barrier included in design of access road to be used for delivery of waste material to the mound
Vegetation introduced to the site comprising native species	Pending	Vegetation restoration plan to be finalize following closure of mound
Institutional/educational/snack bar/parking facilities would not be permitted on the mound	Pending	Final building layout following closure of the mound has not been developed.
Retain as much of the existing (clean) vegetated area as possible, especially trees.	Yes	Clearing operations are based upon retention of as much existing vegetation as possible in light of security requirements.

After close to 15 years of investigations, characterization, monitoring, assessment, planning, public consultation, licensing and design work, the Port Hope and Port Granby community-based concepts have matured into tangible projects with appropriate regulatory approvals and adequate federal funding in place (see Figures 2 and 3 for conceptual renderings). Ongoing communications with the two communities have resulted in a well-informed public that understands the work to be done and is eager to see their concepts take shape and become reality. As Canada's largest environmental remediation and restoration undertaking, the PHAI is fulfilling its vision – working with the local communities to discharge Canada's commitment to the cleanup of historic waste in Port Hope and Port Granby that will leave an honourable legacy for future generations.



Figure 2 Conceptual Rendering of Completed Port Hope LTWMF



Figure 3 Conceptual Rendering of Completed Port Granby LTWMF