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An Integrated Approach to Environmental Assessment (EA): A Case Study of the Port Hope Area Initiative EA Program

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ABSTRACT

In 2002, the Low-Level Radioactive Waste Management Office (LLRWMO) was mandated to complete screenings of the Port Hope Area Initiative (PHAI) Projects, Port Hope and Port Granby, in accordance with the *Canadian Environmental Assessment Act* (CEAA), but to the level of comprehensive studies. The LLRWMO therefore developed an Environmental Assessment (EA) approach that would: (i) assemble a multi-disciplinary team of experts from among Canadian engineering and environmental consulting firms; and (ii) complete each of the two EAs in an integrated manner and to an equal level of rigour. Nine separate consulting firms, providing expertise in a variety of disciplines, were contracted for the EA Team lead by the LLRWMO. To achieve the necessary level of integration within and consistency between the two EAs, a series of tools, including methodologies and templates developed by top EA practitioners, were adapted and introduced at critical milestones.

1.0 INTRODUCTION

The Port Hope Area Initiative (PHAI) is a community-based program directed at the development and implementation of a safe, long-term management solution for low-level radioactive waste (LLRW) that has existed in the Port Hope area for over seven decades. It is the result of a legal agreement between the Government of Canada and the affected municipalities for the management of the contaminated material within the communities in aboveground facilities designed to last several hundred years. The PHAI includes two primary physical undertakings: i) the Port Hope Long-Term Low-Level Radioactive Waste Management Project (the Port Hope Project); and, ii) the Port Granby Long-Term Low-Level Radioactive Waste Management Project (the Port Granby Project).

In November 2001, the Low-Level Radioactive Waste Management Office (LLRWMO), in its role as proponent for the projects on behalf of the federal government, submitted separate Project Descriptions for the Port Hope Project and the Port Granby Project to Natural Resources Canada (NRCan) and the Canadian Nuclear Safety Commission (CNSC) (Low-Level Radioactive Waste Management Office, 2001a and 2001b). Based on the information contained in the Project Descriptions, NRCan and the CNSC determined that environmental assessments (EAs) pursuant to the requirements of the *Canadian Environmental Assessment Act* (CEAA) were required before the projects could be implemented and that the EAs were to be conducted as screenings.

Conduct of the EA studies and the preparation of two EA Study Reports (EASRs) were delegated to the LLRWMO.

This paper will describe how the generic concept of an environmental screening has been re-configured and is being applied to two separate and unique, yet companion projects involving the remediation of contaminated properties and the consolidation and long-term management of some 1.5 million cubic metres of LLRW in separate southern-Ontario communities of mixed urban and rural land uses. Specifically, it will focus on the planning and implementation framework for the EAs, recognizing the uniqueness and the commonalities of the projects as well as the regulatory and multi-stakeholder interests within which the assessments must be conducted.

The Port Hope and Port Granby Projects are each complex, large-scale undertakings that have their own set of particular environmental and engineering issues and public concerns. Together, they represent probably the most significant environmental remediation and commitment to long-term management of contaminated wastes ever undertaken in Canada. Notwithstanding that they are framed within CEAA parlance as "Screenings", the EAs must consider the range of project complexities and the comprehensive nature of potential environmental issues in both the biophysical and human environments. Because the projects have been defined as separate, albeit companion undertakings, it is necessary that the EAs be conducted individually for each. As such, it is necessary that the EAs reflect an appropriate level of consistency, but also the uniqueness of each project and the environments and issues individually associated with them.

2.0 SCOPING REQUIREMENTS

As is the standard practice for EA studies conducted under the *CEAA* and delegated to others, the Responsible Authorities (NRCan, the CNSC and the Department of Fisheries and Oceans) prepared a *Scope of Assessment* for each of the Port Hope Project and Port Granby Project EAs (Natural Resources Canada, 2002a and 2002b). While the projects are separate undertakings, they are companion projects under the PHAI. Accordingly, the *Scopes of Assessment* express the similarities to the extent possible while also considering the unique aspects of each project. Given that both EAs were delegated to a single proponent, are the responsibility of the same RAs and address projects with similar elements and issues including geographic proximity there was every expectation that the studies and associated EASRs would be based on a common approach and structure.

The *Scope of Assessment* for any EA describes the basis for its conduct and focuses the EA on relevant issues and concerns. Since it is typically the basis for the subsequent Screening Report prepared by the RAs, a *Scope of Assessment* often provides direction on the content and structure of the technical documentation (i.e., the EASR). Because the *Scope of Assessment* effectively defines the EA, arguably its most fundamental elements are:

i) the determination of the scope of the project (i.e., what activities are included [and alternatively, not included] in the project); and

ii) the factors to be considered in the assessment of environmental effects.

For both the Port Hope Project and the Port Granby Project EAs, the *Scopes of Assessment* made clear that the scopes of the projects being assessed were to include the physical activities associated with site preparation, construction and operation (including monitoring) of local long-term low-level radioactive waste management facilities, and the associated physical

infrastructure required for construction and operation of the facilities. The individual *Scopes of Assessment* also included elements unique to each Project; the Port Granby Project *Scope* included bluff stabilization and groundwater diversion structures as they may be needed and the Port Hope Project *Scope* included remediation of contaminated sites in the community including the Port Hope Harbour and the closed municipal landfill.

Notable in both *Scopes of Assessment* was that the projects as defined for EA purposes did not include the future decommissioning of the long-term waste management facilities (LTWMFs). As "management" rather than "disposal" facilities, it was implicit that the LTWMFs would ultimately be subject to some form of decommissioning in the future, however it was recognized that decommissioning would be the subject of separate EA and licensing programs when the intentions in that regard were established.

The factors to be considered in the EAs for both projects were also generally similar and included the requirements to: i) identify the likely effects of the projects (including as they may accumulate with effects of other projects); ii) identify measures to mitigate adverse effects; iii) determine the significance of effects that remain after mitigation; and iv) consider comments received from the public. While under the requirements of the *CEAA*, the assessments were to be conducted as screenings, the *Scopes of Assessment* emphasized that the EAs were to be robust and thorough; essentially conducted to a level commensurate with comprehensive studies. This enhanced level of rigour was exemplified by the inclusion of the following as additional factors to be addressed in the EAs:

- the need for the projects;
- the purpose of the projects;
- consideration of alternative means of implementing the projects;
- the need for and requirements of an EA follow-up program; and
- the effects of the projects on the capacity of renewable resources.

3.0 LLRWMO ENVIRONMENTAL ASSESSMENT APPROACH

As stipulated in the *Scopes of Assessment*, the LLRWMO was to describe the projects for EA purposes, characterize the baseline environment, both biophysical and human, and determine the likely effects of the projects on the environment, as is typically required for a screening level EA. However, the LLRWMO was also required to describe the need for and purpose of the projects, assess alternative means of implementing the projects, and apply an assessment methodology that considered effects on renewable resources, all of which are more typical of a comprehensive study. To fully meet the requirements of the *Scopes of Assessment* and in recognition of the commonalities in the EAs, a prescriptive planning and implementation framework was developed within which to carry out the technical studies and prepare the EA documentation.

From its inception in 1982 to the initiation of the PHAI in 2001, the role of the LLRWMO has primarily, although not exclusively, included the management (monitoring and maintenance) of known inventories of historic LLRW in Canada and conducting environmental restoration work projects where applicable. The LLRWMO has established core expertise and staff capability in areas consistent with its mandate and the scale of its operations and it routinely retains consultants for specific assignments. At the outset of the PHAI and the EAs as its initial major elements, the LLRWMO committed to a program of selective recruitment and creation of an

operational structure that would facilitate internal management of the EAs, both administratively and technically.

The LLRWMO considered alternative implementation models for the planning and management of the EAs and the associated technical studies. An obvious and often-used approach that was considered was the appointment of one or two large consulting firms to oversee and manage the conduct of all of the technical studies (i.e., to retain an EA consultant, either one to carry out both EAs or two separate EA consultants, one for each project). As both an "informed client" and the proponent of the EAs, the LLRWMO was of the opinion that its responsibilities included the project management control and overall strategic direction of the EAs. Also, the LLRWMO believed that by retaining individual firms to focus on the respective environmental components, a greater level of technical rigour and professional "ownership" could be achieved than if a single EA consultant had been engaged to carry out the entire EA.

With management control of the EAs confirmed internally, the LLRWMO formed two coordinated project teams to focus on four primary aspects of the EA Program:

- Engineering and Design (Including Alternative Means evaluation and Site Characterization);
- EA Study Report Compilation;
- Baseline Characterization and Assessment of Environmental Effects; and
- Stakeholder Consultation and Communication.

The framework that was eventually adopted involved the assembly of a multi-disciplinary team of experts for each project, which included representation from several top Canadian engineering and environmental consulting firms. Each team, comprised of several individual consulting firms with relevant CEAA experience, was tasked with conducting the necessary technical studies, authoring the technical study reports and the two EASRs. It was recognized that the EAs could not be conducted on the basis of available information concerning the existing environment, as is often the case for screenings of lesser scope and the Technical Study Authors (TSAs) immediately set about developing work plans to characterize the baseline environment in support of the assessment of environmental effects.

Engineering support elements were also added (separately for each project) to advance the level of design for the initial project concepts and evaluate the alternative means of their implementation. The community information program, already well established within the LLRWMO, was augmented and tailored to provide the vehicle for community and stakeholder outreach and consultation specifically as it related to the EAs. Lastly, the municipalities of Port Hope and Clarington retained consulting teams to review the work of the EA teams and provide technical advice to the respective Councils, because of their roles as principal stakeholders in the PHAI. With endorsement from the subject municipalities, the engineering teams further evolved the project descriptions to a level of design commensurate with the needs of the EA process.

Each EA team therefore consisted of the LLRWMO as overall project managers, LLRWMO staff specialists, consultant specialists with expertise in the engineering, design and description of similar undertakings, and environmental consultants with appropriate expertise in the characterization of the baseline environment and the assessment of likely effects of the projects. The team structure is illustrated conceptually in Figure 1.

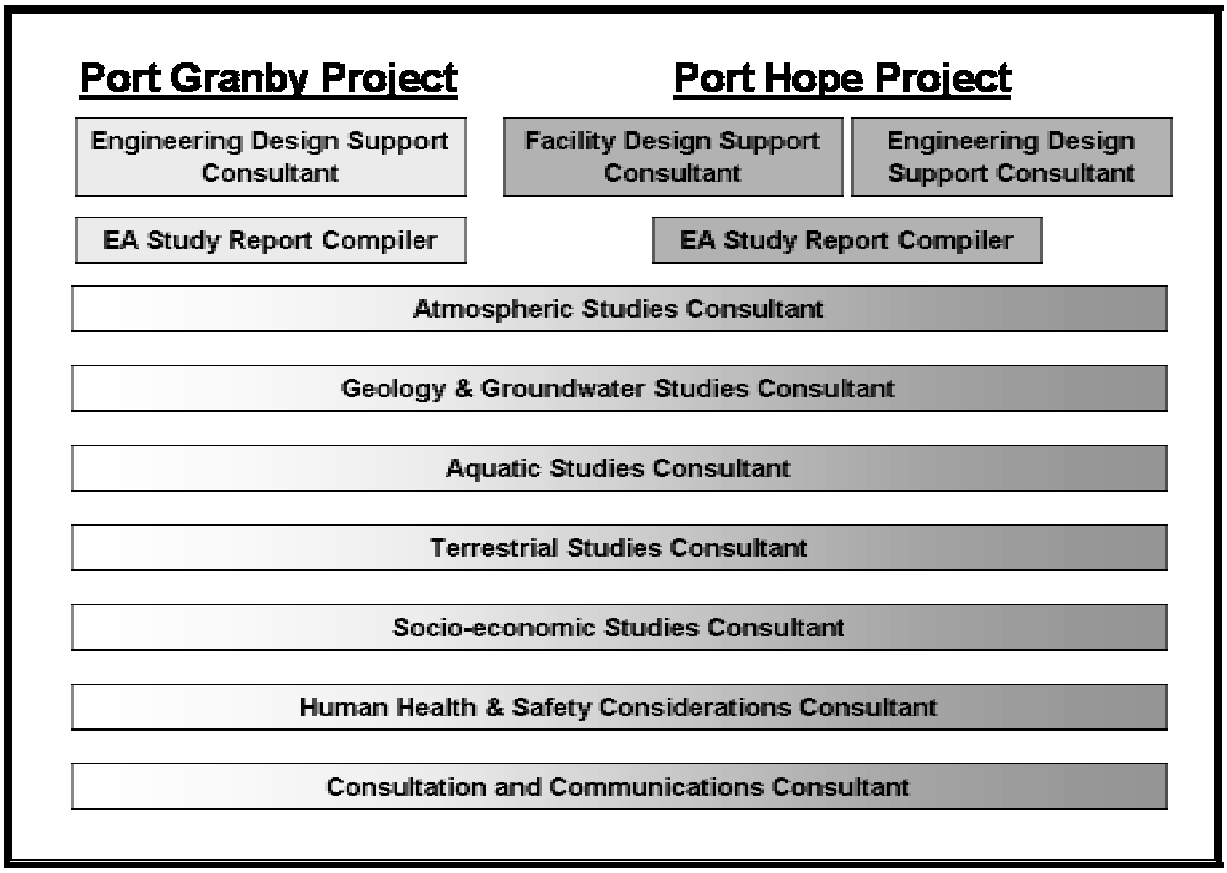

Figure 1 LLRWMO EA Planning and Implementation Framework

Separate engineering support consultants (ESCs) were assigned to complete the description of each of the Port Hope and Port Granby Projects and to provide engineering input as the effects assessment phase proceeded. Separate consultants were also retained to compile the EASRs for the two EAs. TSAs were appointed to characterize and assess the effects of the projects on the components of the biophysical environment, comprising the atmospheric, geology and groundwater, aquatic and terrestrial environments, and the human environment, comprising the socio-economic and human health and safety considerations. Each TSA was given the task of completing the baseline characterization and effects assessment work for both projects, which ensured that at the most detailed level of study there was consistency of methodology and expertise applied to each project. A single Communications and Consultation consultant was engaged to assist with carrying out the stakeholder consultation and communications aspects concurrently for both projects. Some of the consulting firms carried out multiple (never more than two) roles on the respective teams as indicated below.

Marshall Macklin Monaghan Limited (MMM) and Conestoga-Rovers and Associates (CRA) were ESCs for the Port Hope Project; MMM was the ESC for the contaminated sites remedial action planning work and CRA was the ESC for the LTWMF design component. MMM also functioned as the compiler for the Port Hope Project EASR. Golder served as both the Compiler and the ESC for the Port Granby Project. SENES Consultants Limited (Atmospheric studies), CRA (Geology and Groundwater studies), EcoMetrix Incorporated (Aquatic studies), AMEC Earth and Environmental (Terrestrial studies), Gartner Lee Limited (Socio-economic studies) and Golder Associates Limited (Human Health and Safety Considerations) were the TSAs responsible for completing the baseline characterization and the assessment of effects for both

projects. Haussmann Consulting and Bancroft-Wilson Associates jointly provided expertise in stakeholder consultation, the later providing consultation expertise as it related to Aboriginal interests.

LLRWMO project managers and project specialists were assigned coordination and oversight roles that generally paralleled the consulting assignments (i.e., the description of the projects for EA purposes, the conduct of the EA studies for each of the environmental components, the compilation of the EASRs and stakeholder consultation). LLRWMO staff assumed primarily a managerial role, providing technical assistance where appropriate. However, LLRWMO management efforts were supported with the strategic advice of the EASR Compilers for each of the Port Hope and the Port Granby Projects. LLRWMO staff also coordinated all internal and external review of the technical documentation produced in support of the two EASRs.

4.0 ENVIRONMENTAL ASSESSMENT TOOLS AND TEMPLATES

In order to achieve a consistent quality, focus and utility of reports from each of the EA studies and to facilitate their incorporation into the EA process and the EASRs, the EA team developed a series of standardized methodologies, procedures and document templates for use by the TSAs and others as applicable (e.g., ESCs). These "tools" included methodologies for the evaluation of alternative means, selection of valued ecosystem components (VECs), assessment of effects of the projects, assessment of cumulative effects, as well as outlines and structural templates for all key reports required for the EAs.

Alternative Means Evaluation Methodology

The *Scope of Assessment* clarified "alternative means" as being the various ways that the project(s) could be implemented that were technically and economically feasible and functionally similar to the community-developed concepts. "Alternatives to" the projects were not to be considered. A single methodology for considering alternative means was developed for both the Port Hope and Port Granby Project EAs and the responsibility for its implementation assigned to the respective ESCs. Each project and each major element of the projects (e.g., LTWMF; site remediation; and transportation routes) was considered individually.

The alternative means evaluation was conducted as a series of steps, each culminating at a decision point where the subject of consideration was either dropped from the evaluation or advanced for further consideration. The steps involved progressively:

- Developing the list of *Approaches* (an Approach was an overall direction or general idea for implementing the project through all of its stages);
- Filtering the Approaches to advance only those that met the basic project criteria as defined by the *Scope of Assessment*;
- Identifying the individual *Components* comprising each Approach (a Component was a specific technique or feature intended to achieve an objective or function);
- Identifying the various ways that each Component could be implemented (the various ways of Component implementation were defined as *Alternative Means);*
- Filtering each Alternative Means to confirm its technical and economic feasibility;

- Assembly of individual Alternative Means into *Feasible Concepts*. (A Feasible Concept was a complete, integrated solution for implementing the project); and
- Comparing Feasible Concepts to determine which was most appropriate for implementation as the project.

The evaluation criteria applied throughout the alternative means process were derived through consultation with the public and other stakeholders. Their development was initiated at a public workshop held for that purpose and they were subsequently finalized through collaboration of the engineering and EA teams.

Valued Ecosystem Components Selection Methodology

The characterization of the baseline environment included the identification of appropriate VECs for each environmental component. VECs are features of the environment chosen to be a focus of the EA because of their ecological, scientific, cultural, economic, health or aesthetic importance and their potential vulnerability to the effects caused by a project. They are used as the measurement end-points of predicted effects. Because the baseline characterization was carried out as it related to individual environmental components and by six separate consultants, it was necessary to ensure they applied a consistent methodology for the selection of VECs. Accordingly, a template approach was developed and applied by all TSAs. Although VECs were selected uniquely for each project and for each environmental component, the process of their selection was appropriately similar.

VEC selection began early in the baseline characterization studies with the compilation of preliminary lists of VECs that considered the likely interactions between the projects and the individual environmental components. VEC selection workshops were held involving public and technical stakeholders during which the preliminary selections were presented and discussed. As the baseline studies progressed and with consideration for the stakeholder input, the preliminary VEC selections were refined and finalized with the completion of the baseline characterization studies.

Methodology for Assessment of Effects of the Project

To ensure a consistent and robust consideration of environmental effects (of the projects), the following process was prescribed for each of the TSAs:

- **Identify project-environment interactions** – each of the Port Hope and Port Granby Projects was defined within its specific works and activities (45 separate works and activities were identified for the Port Hope Project; 38 for the Port Granby Project) and the plausibility of interaction between each work and activity and the individual components of the environment was considered by each TSA;
- **Determine environmental change** – each plausible project-environment interaction was evaluated to determine if it would be likely to result in a measurable change to the environment;
- **Assess likely environmental effect (of change)** – each interaction likely to result in a measurable change was to be considered within a context of criteria and professional judgement to determine if it would be likely to result in an effect on a VEC, either adverse or beneficial;

- **Consider mitigation measures and identify residual effects** – consider technically and economically feasible means to mitigate adverse effects and re-evaluate to determine residual effects (i.e., those that would remain assuming mitigation was applied); and
- **Determine the significance of residual adverse effects** – evaluate the significance considering magnitude, extent, duration, frequency and permanence of the residual effects.

Effects of the projects on the environment were considered in terms of a "source-pathway-receptor" model wherein each project-environment interaction (source) was evaluated to consider the likely associated change to the environment (pathway) that would result in an effect on a VEC (receptor).

Similar methodologies were also developed and prescribed for other aspects of the effects assessment; specifically, effects on renewable resources, and effects of the environment on the projects.

Methodology for Assessment of Cumulative Effects

A cumulative environmental effect is an effect of the subject project in combination with effects of other projects or activities that have been or will be carried out and that will overlap in space and time with those of the project. The fundamental methodology for considering cumulative effects is accepted among EA practitioners to include the following steps:

- Determine if the subject project is likely to result in residual environmental effects, either adverse or beneficial;
- Determine if the residual effects of the subject project are likely to coincide (in space and time) with similar effects of other projects or activities, either existing or future;
- Consider if the coincidental effects are likely to result in cumulative effects on the environment (as represented by the selected VECs) now or in the future;
- Consider additional mitigation measures to further ameliorate adverse cumulative effects and determine the cumulative effects likely to remain after mitigation (i.e., residual adverse cumulative effects); and
- Evaluate the significance of residual adverse cumulative effects.

To ensure a consistent application of the fundamental methodology, however, the EA team developed a prescriptive Technical Brief on Cumulative Effects that not only provided further clarity on the approach to be applied, but also identified and described the specific "other" projects and activities that were to be considered. Specifically, 25 other projects and activities throughout the Regional Study Area were described for consideration in the cumulative effects assessment.

Document Outlines and Templates

Prescribed formats, tables of content and electronic templates were prepared by the EA team for use by all authors of technical studies and related documents. These served the dual purpose of providing a common appearance and identity for all EA-related materials and more importantly, facilitating the development of the EASRs, which were prepared at the conclusion of the technical studies. The EASRs served as summaries and their contents were derived directly from the materials contained in the precursor technical studies and reports.

A range of other tools and devices were also used throughout the EA process to promote a unified approach and maximize synergies between the two projects. These included:

- An interactive web site for secure communications, exchange of electronic files, and an electronic library and repository for reports and other documents;
- A common reference list for both EA projects maintained as a database on the web site; and
- Map layers and figure templates developed and maintained in GIS format, also on the web site.

5.0 IMPLEMENTATION

The inter-relationships inherent in the environment (i.e., the environmental components) and required of the EA process (Figure 2) created an enhanced need for effective integration of EA work elements and the team responsible for the elements. This proved to be challenging given the number of EA-related projects, project managers and specialists, consultant specialists and participating companies involved in the EAs. EA study results were, however, successfully integrated through a structured and disciplined approach to communication, thoughtful sequencing of the EA studies and the systematic review of the resulting reports.

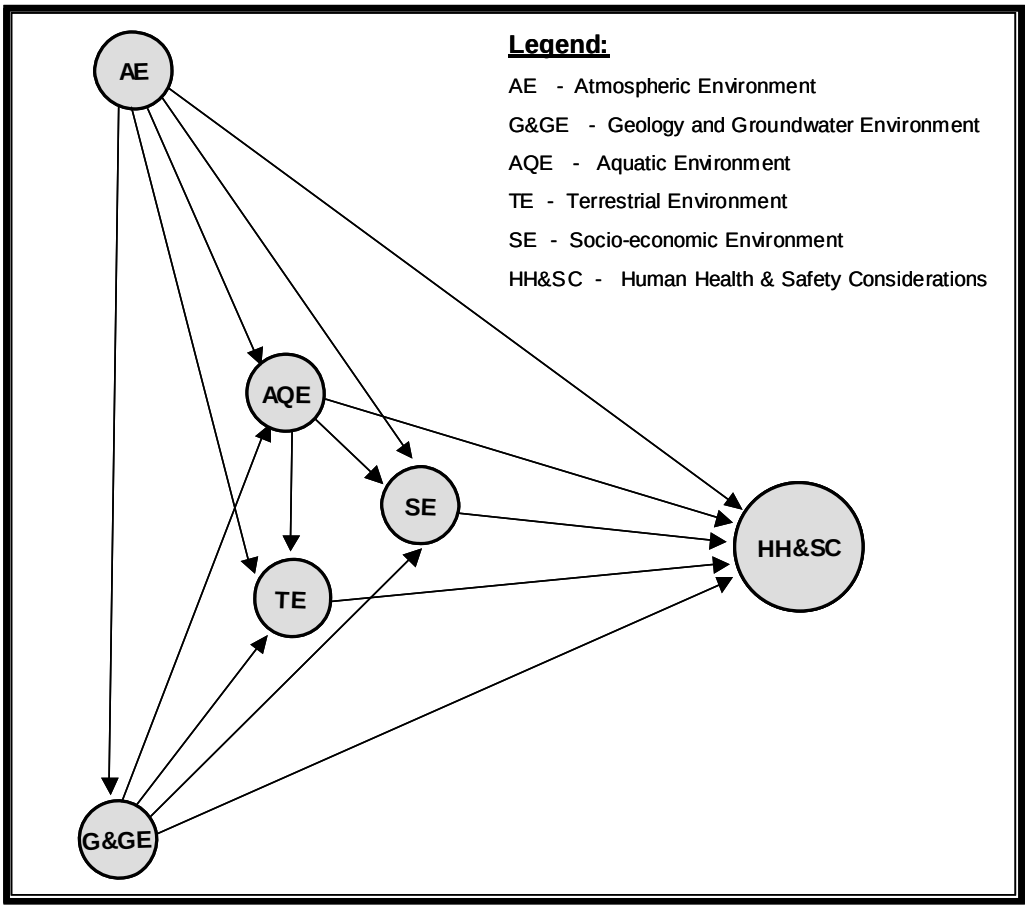

Figure 2 Relationships between Environment Components and Considerations.

Communications within the EA team were facilitated by a nested series of LLRWMO team meetings, EA planning and strategy sessions and technical working sessions (approximately every six weeks, or as required), all of which served to provide updates on progress, coordinate the production of reports and ensure the consistent application of the methodologies, tools and templates. These meetings, strategy sessions and working sessions were vital in ensuring that the EAs were carried out in a consistent, integrated manner, but also to an equal level of rigour. For example, it was the purpose of the technical workings sessions to provide clarification, and in some cases improvements, on methodologies (e.g., the alternative means evaluation methodology and the methodology for the assessment of cumulative effects), document outlines and templates. These meetings also contributed to an elevated sense of accountability and responsibility among the EA team members.

The sequencing of the studies, information dissemination and report production also reflected the interrelated nature of the environmental components and the need for integration of the output of the studies. While the baseline characterization studies (the first phase of the EA) were carried out generally in parallel, the progressive integration of the effects assessment studies required a more definitive sequencing that would provide for the results of one study to be advanced as input for the support of subsequent studies. For example, the results of the assessment of atmospheric deposition were required to complete the assessment of effects on surficial soils. Figure 2 illustrates the inter-relationships of the environmental components and generally reflects the sequencing of effects assessment (from left to right) required to ensure the timely delivery and integration of the reports.

A systematic review process was also applied to ensure that the studies were conducted in a consistent manner and to an equal level of rigour. The process involved several layers of review representing varying degrees of independence from the projects. The LLRWMO were the primary reviewers of all reports. The EASR compilers also served in the role of technical and process reviewers on each of the TSA reports. AECL experts with no prior involvement in the projects were also engaged to provide an independent technical review of the TSA reports. Finally, the Municipal Peer Review Team (MPRT) provided a fully independent review of the reports that comprised the EA submission.

6.0 CONCLUSIONS

To date, comprehensive Baseline Characterization Study (BCS) Reports have been assembled for each component of the environment, for each of the two EAs. These were reviewed and have been endorsed by the MPRT (with their comments incorporated) and integrated into the evolving draft EASRs. The ESC teams have concluded their evaluation of alternative means of implementing the projects. Their recommendations (also reviewed by the MPRT) have been endorsed by the municipalities and advanced as the description of the projects for EA purposes. These descriptions have also been incorporated into the EASRs.

With baseline characterization studies completed and the description of the project(s) developed, the effects assessment studies were undertaken. Draft Environmental Effects Assessment (EEA) Reports have been submitted to the MPRT and their contents integrated into the EASRs. As of this writing, the EEA reports are being finalized and the draft EASRs have been provided for comment to the MPRT. The EAs are currently on schedule for completion and submission of the EASRs to the RAs by March 31, 2005.

The stakeholder consultation program has been and continues to be especially active. It has evolved as an effective means of not only providing information to, and soliciting input from the communities, but also of maintaining on-going dialogue with regulatory stakeholders, including the RAs. It is appreciated that dialogue up to this point has significantly benefited the quality of the EAs and it will ease the subsequent review phase.

The process has not been without its challenges however, virtually all of which have been successfully overcome and have contributed positively to important "lessons learned". Particular among the challenges and lessons were:

- The importance of establishing early in the process, the objectives and expectations in terms of levels of commonality and consistency between the related aspects of the projects; and even more importantly, the means and tools for achieving the objectives. It is unavoidable that these expectations would evolve and change throughout each of the projects however, with benefit of hindsight, the need to fully define and articulate these goals at the outset is paramount;

- The need to develop a comprehensive work plan and schedule that considers to the maximum degree possible, the inter-related needs and dependencies of the various related technical studies. During the Port Hope Project and Port Granby Project EAs, the requirement for well-planned sequencing of the work and synthesis of data became a routine watchword;

- The benefits of fostering and maintaining a mutually supportive relationship among the individual consultants on the team. While seemingly self-evident, this is not necessarily so easily accomplished since the firms are normally competitors and independent practitioners and not always accustomed to collaborations of the scale required of these EAs; and

- The importance of establishing a sense for common objectives and achievement among all stakeholders. This was exemplified particularly on these EAs by the relationship between the EA team and the MPRT, which become one of professional regard and respect, recognizing that there was a shared interest in developing sound projects and high quality EAs.

Despite the challenges, the EA approach was successfully implemented as is evidenced by the following milestones:

- November 2001 - Port Hope and Port Granby Project descriptions issued for Environmental Assessment (EA) purposes;
- 2001-2004 - 24 month alternative means process completed in tandem with baseline characterization of the environment;
- September 2004 - Alternative means process for the Port Hope Project results in recommendation for a single consolidation site and Port Hope Council provides concurrence on the preferred option;
- September 2004 - Alternative means process for the Port Granby Project results in recommendation for a single consolidation site;
- January 31, 2005 - delivery of draft EASRs to the MPRT;
- February 7, 2005 – Draft EASR delivered to Municipality of Clarington;
- February 15, 2005 – Draft EASR delivered to Municipality of Port Hope;

- February 21, 22 and 24, 2005 - Draft EASRs presented to public; and
- On target to deliver the EASRs to the Responsible Authorities March 31, 2005.

The LLRWMO is confident that as a result of the selected methodology, superior EASRs will have been produced for the Port Hope and Port Granby Projects. The coordinated approach among the various team members, including as represented by the individual TSAs and the ESCs, the extensive report review process, and the development (customization) of tools and templates for the two projects all contributed to enhancing the quality and thoroughness of the EA studies.

7.0 REFERENCES

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