Application of the Canadian Environmental Assessment Act to Nuclear Research Projects: Lessons Learned at AECL

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Abstract

This paper explores AECL's experience with the application of the Canadian Environmental Assessment Act (CEAA) to its nuclear research projects carried out within AECL-owned or operated sites in Canada since 1995. Through a number of case studies, the paper illustrates how the Act applied to AECL's research projects and how our understanding of its requirements has evolved over the last three years.

Background

For over fifteen years, AECL has carried out environmental assessments for its significant domestic research projects. One of the first environmental assessment reports authored by AECL was for the Underground Research Laboratory (URL) in Manitoba[1]. It effectively preceded the Environmental Assessment and Review Process Guidelines Order (EARPGO), highlighting the Company's early commitment to assess the potential environmental effects of its research projects. This principle was eventually entrenched in the Corporate policy for the protection of the environment which was adopted in 1993 June.

Between the preparation of the environmental screening report for the URL and the proclamation of the CEAA in 1995 January, over forty domestic projects were reviewed internally for their potential environmental effects. Under the EARPGO regime, Crown Corporations were invited to participate in the federal environmental assessment (EA) process. AECL voluntarily participated and forwarded a number of assessment decisions to the Federal Environmental Assessment Review Office for projects as varied as a new radioisotope production reactor, new fuel fabrication facility and remediation activities. AECL continues to carry out environmental reviews of its projects and activities within sites in Canada owned or operated by AECL in compliance with its corporate policy.

Since the proclamation of the CEAA, a number of regulatory duties exercised by the AECB can trigger an environmental assessment. These duties are described in the Law List Regulations under the CEAA and comprise four provisions of the Atomic Energy Control Regulations:

1. subsection 7(1) pertaining to prescribed substances licences,
2. Section 10 related to the construction of a nuclear facility,
3. paragraph 25(1)(b) which regards the abandonment or disposal of prescribed substances, and,
4. subsection 27(1) dealing with amendments to site licences.

Thus, as shown on Figure 1, the EA has become intimately linked to the licensing process for new nuclear research facilities to be constructed within sites in Canada.

Since the proclamation of the Act, the majority of the environmental assessments carried out by AECL at the CRL and WL sites have been triggered by site licence amendments resulting from modifications to existing nuclear research facilities. Among the modifications that required an EA, were a number of decommissioning projects and upgrades to existing facilities.

Applicability

In the start-up phase of the environmental assessment, the applicability of the Act to the proposed project or activity has to be determined. In theory[2], this should be a simple exercise, however, the practice has revealed a few difficulties. Those difficulties seem to be related to the nature of the triggers which are associated with regulatory powers exercised by a federal agency.

For instance, there was, at times, a tendency to consider the regulatory trigger before establishing whether or not there was a project for the purpose of the Act. There was one instance where it was suggested that a change in a temperature trip setting in a loop test facility was an activity that would require an EA. Whereas such an action may be subjected to a regulatory approval, it may not necessarily require an environmental assessment. Hence, as suggested in the guide published by the Canadian Environmental Assessment Agency (the Agency), one has to address the following four questions, preferably in this order:

- is this a project for the purposes of the Act?
- is the project excluded?
- does it involve a federal department? and,
- does it involve an action that triggers the need for an EA?

Our experience has shown that it is reasonably easy to address the latter two questions but that the former two can cause difficulties, often because of the prescriptive nature of the regulations under the Act.

The definition of a project itself seems to be have been designed with the phases of the project in mind. The definition reads:

'project means ... in relation to a physical work, any proposed construction, operation, modification, decommissioning, abandonment or undertaking in relation to that physical work...'

Physical activities not related to a physical work which are listed in the Inclusion List Regulations also constitute projects.

The AECB's regulatory duty related to prescribed substances causes some confusion when trying to determine whether a project as defined in the CEAA exists. Licences issued by the AECB enable the possession of prescribed substances and/or the use of certain equipment and devices which are not physical activities and which may not constitute physical work.

As a result, there have been some inconsistencies with the interpretation of the definition of a project for regulatory decisions made pursuant to Section 7 of the Atomic Energy Control (AEC) Regulations.

This ambiguity has led to the demand for an environmental assessment for the renewal of the CRL[3] and Whiteshell Laboratories (WL) site licences in 1996 despite the fact that Section 9 of the AEC Regulations - operation of a nuclear facility- is not included in the Law List Regulations. However, since the CRL and WL site licences are issued under both Section 7 - prescribed substance licence - and Section 9 of the AEC Regulations, and that Section 7 is found on the Law List, an environmental assessment was requested.

In this case, the EA was certainly not carried out before any irrevocable decisions were made about the 'project' since most of the facilities authorized under Section 7 of the AEC Regulations were built several decades ago.

It appears that 'operation' of a physical work was added to the definition of a project to ensure that the re-start of an industrial facility, e.g., a pulp mill, enabled by way of financing by the federal government, would not lead to the adverse environmental effects for which the government would have been held liable.

It could be argued that the EA is, by far, a more effective tool when applied in the planning phase of a project. There is little doubt that the operation of a physical work has to be included in the scope of the assessment. However, the use of 'operation' as a trigger for an EA is of little value when the facility already exists.

Exclusion Clauses

Another area that proved challenging is the interpretation of some of the clauses of the Exclusion List. The addition of Section 7 of the AEC Regulations to the Law List required a number of exclusion clauses to ensure that EAs would only be required when significant facilities requiring an approval under Section 7 were proposed.

This resulted in certain inconstancies/discrepancies:

- the construction, installation, operation or modification of a small particle accelerator (less than 50 MeV for electron linac or cyclotron or less than 5 MV for an electrostatic accelerator) is excluded, but the decommissioning of such facilities is not. AECL has notified the Agency of the inconsistency and, as a result, an amendment to Section 26 of the Exclusion List has been proposed.

- the proposed construction, installation, operation, modification, decommissioning or abandonment of monitoring, safety or security equipment affixed or adjacent to an existing nuclear facility is excluded (Section 28 of the Exclusion List). Safety or security equipment is not defined in the Act or Regulations. However, a very narrow interpretation is used by the Agency. In effect, the interpretation of safety equipment is limited to fire extinguishers, showers and the like. Therefore, modification or upgrade to certain safety-related systems in a research reactor would not be exempt from the EA process on that basis.

- exclusions are seldom found for projects where expansion or modification of an existing nuclear facility are proposed. An environmental assessment will likely be triggered whenever a modification could result in impacts on health, safety or the environment that are different from those described in the applicable licensing documentation. Exclusion clauses only apply to trivial modifications to safety and security equipment (within the narrow definition mentioned earlier), to modifications for which an EA has been previously conducted or to modifications to fixed structures within a facility as long as there is little likelihood of water pollution. Exclusions do not exist for modifications undertaken to abate environmental impacts, e.g., improved wastewater treatment, as this legislation does not prejudge the potential benefits of projects.

- there exists a discrepancy between the exclusion criteria that apply to 'dismantling' of buildings in which activities licensed under Section 7 of the AEC Regulations previously took place and those applicable to the demolition of existing building. Although the physical works can be vastly different in nature and potential hazards, there is a difference of one order of magnitude in the exclusion criteria related to the floor area: 1000 m^2 for buildings and 100 m^2 for facilities approved under Section 7. Besides, proximity to another building is a criterion for ordinary buildings but not for facilities approved under Section 7.

- the definition for water body left some uncertainty vis-à-vis man-made waterworks. A question was raised when the replacement of the active drain system at CRL was proposed. Following consultations with the Agency staff, it was confirmed that the definition of water body did not extend to storm sewers. With regard to potential spills, it was noted that proponents or contractors were expected to deploy their spill contingency plan to mitigate the adverse effects. Hence, EA is not a substitute for sound environmental management practice, rather it forms a component of any well-established environmental management system.

EA Track

After it has been determined that the CEAA applies to the project or activity, the final step in the start-up phase of the process is the determination of EA track. This has been relatively straightforward for most projects but an inconsistency was revealed when upgrades to the Waste Treatment Centre (WTC) at CRL were proposed.

The Waste Treatment Centre currently treats two of the three low-level radioactive liquid waste streams at CRL: the Decontamination Centre and the Active Drain which collects low-level liquid wastes from sinks and drains in laboratories and radioisotope production facilities. The third waste stream whose principal sources are various drains in the NRU reactor is pumped into a dispersal pit. The proposed upgrades to the WTC will include modifications to improve the processing technology and increase the throughput capacity sufficiently so that all three waste streams can be treated reliably. The fundamental design concept is to process the waste streams using evaporation, to solidify the concentrates into bitumen and to discharge the purified effluent into the Ottawa River following verification monitoring.

The upgrades require relatively minor modifications to an existing facility consisting mainly of the replacement of obsolete equipment with new processing equipment. They do not involve any site preparation work since the footprint of the facility will remain essentially unchanged. Despite several obvious operational and environmental benefits, it was determined that the project would require a comprehensive study.

Even though the project would have been exempted from a comprehensive study by virtue of clauses specific to nuclear facilities in Part VI of the Comprehensive Study List (CSL) Regulations, it was determined that Part X of the same regulations also applied to the project.

Part X of the CSL Regulations applies to proposed construction, decommissioning or abandonment of a facility used exclusively for the treatment, incineration, disposal or recycling of hazardous waste. It was noted that the definition of hazardous waste in the Canadian environmental legislation (Canadian Environmental Protection Act and Transport of Dangerous Goods Regulations) includes radioactive materials with an activity greater than 74 kBq/kg. Part X also applies to expansion of such facilities where the increase in production capacity increases by more than 35%. Because the project involved the treatment of 'hazardous waste' and that the throughput of the WTC would be increased by a factor 4, Part X was deemed applicable.

Part X of the CSL Regulations is inconsistent with Part VI for projects involving the processing and disposal of radioactive wastes. This raises the prospect of 'routine' comprehensive studies for a class of waste management projects, not only at CRL, but elsewhere in the nuclear industry. This would impose unnecessarily stringent requirements for a number of waste management projects. This appears to contradict the Agency's goal to improve the efficiency of the federal EA process[4].

Scoping

At the onset of an environmental assessment, the EA practitioner has to establish the boundaries for the study so that time and resources are utilized in an efficient manner[5]. This step is known as the scoping and is defined as an activity aimed at identifying those components of the biophysical and social environment which may be impacted by the project and for which there may be a public and/or professional concern[6]. The outcome of the scoping exercise forms the foundation for carrying out the rest of the environmental assessment.

In the federal environmental assessment process, the scoping phase involves two main activities. The first is related to the definition of the scope of the project and the second, to the scope of the assessment, which is also affected by some legal considerations.

Scope of Project

To date, the determination of the scope of the project has not caused significant problems to AECL. One area requiring some careful consideration is that related to the question of the 'principal project/accessory test'. Whereas the principal project is easily defined in a majority of cases, a number of questions can arise with regard to physical works or physical activities accessory to the principal project. Any physical work or physical activities that are linked or interconnected to the principal project have to be considered in the environmental assessment.

An area where the scope of the project needs to be particularly well defined is that of decommissioning projects, especially when it is the intent to defer part of the decommissioning work. For example, some decommissioning work is currently underway at the NRX reactor at CRL. Decommissioning of the rod bays is proceeding even if decommissioning of the reactor itself has not begun. In effect, it was argued in that case that the decommissioning of the rod bays did not force the decommissioning of the reactor since storage capability still exists elsewhere on site (NRU bays). Conceivably, this approach could be employed for other decommissioning projects as long as the proposed activities could be undertaken without leading to the unavoidable decommissioning of the whole nuclear facility.

Scope of Assessment

Defining the scope of the assessment has created some difficulties in the first two years of application of the CEAA. An example of this is the 1996 site licence renewal for the CRL and WL sites. An environmental screening had to be prepared because the site licences make reference to Section 7 of the Atomic Energy Control Regulations which is on the Law List Regulations. To define the scope of the assessment, we had to consider carefully the definition of a nuclear facility and establish a list of all the nuclear facilities and buildings and equipment associated or connected to the nuclear facilities. This list established, from a legal point of view, what was excluded from the scope of the assessment.

Some of the difficulties resulted from the roles played by the principal players. Since AECL was acting as a proponent and the AECB was the responsible authority for AECL projects under the

Act, delays were experienced when the two parties could not readily agree on the scope of the assessments. However, a positive step was taken when the AECB started to issue terms of reference for the environmental assessments undertaken after 1996. Particularly relevant guidance was obtained for a number of waste management projects at the outset of the process. A relevant example is the terms of reference for a comprehensive study for the upgrade of a low-level liquid facility at CRL which not only proposed a table of contents for the report, but also identified specific areas that needed to be addressed in the study.

With the coming into force of the Federal Coordination Regulations in 1997 April, a federal authority is required to provide a project description to the other federal authorities in order to identify all federal authorities that will play a role in respect of a project. AECL has since been asked to submit a project description to assist in the determination of the scope of the assessment by the federal authorities every time the AECB is formally notified of a new project. The information to be provided includes:

- a summary description of the project,
- information indicating the location of the project and the areas potentially affected by the project, and,
- a summary description of the physical and biological environments within the areas potentially affected by the project.

AECL is now providing this information as an attachment to letters of notification. Although gathering the information requires a relatively significant effort at a very early stage of the project, it contributes in accelerating the preparation of the environmental assessment documentation later on.

Boundaries

Another important scoping consideration is the establishment of temporal and spatial boundaries for the assessment. Again, the principal goal to boundary setting is to allow the practitioner to focus his/her time on the most important issues and to limit the analysis to a manageable level.

One of the effective ways to establish the spatial boundaries requires the identification of the Valued Ecosystem Components (VECs) in the study area. Once the identification has been completed through field work and consultation, the practitioner can set the spatial boundaries on the basis of the geographical limits of the VECs. This approach is more sound than reliance on project or political boundaries.

Even if the impact prediction for AECL's projects has not been limited to VECs, some of the VECs have been considered in the establishment of spatial boundaries.

For example, the Ottawa River water quality has been identified as a VEC for projects to be carried out at the CRL site. This environmental component is valued because of recreational activities on the river, including sport fishing. The Ottawa River is also a source of drinking water for communities downstream of CRL (with the nearest community 11 km from CRL).

This requires that a number of pathways have to be considered in the assessment, including fish and water consumption.

Traditionally, such pathways are considered for the establishment of Derived Release Limits (DRLs) for normal operations at AECL sites[7]. Hence, the magnitude of predicted emissions can be compared with the DRLs to help determine the significance of the impact in conjunction with the predicted doses to members of the public.

Another approach for the establishment of spatial boundaries is to consider the time required for a VEC to recover from an impact. This, of course, is challenging as one often has to perform the analysis to establish the recovery period for a given component.

It often becomes more practical to consider the complete life-cycle of a project, from site investigation to the ultimate decommissioning of the facility. For a nuclear facility this period could easily span several decades.

Regulatory requirements can also impose temporal boundaries for the analysis. An example is the AECB Regulatory document R-104 on the long-term aspects of radioactive waste disposal. This document requires the assessment of individual risk over a maximum period of 10,000 years. That temporal boundary was used in the EA for the proposed Intrusion Resistant Underground Structure (IRUS) for the disposal of low-level radioactive waste at CRL. An assessment over such an extended period becomes fairly speculative owing to the uncertainties on future environmental conditions, but is necessary to secure regulatory approval.

Carrying Out the Assessment

Although most of the growing pains experienced in the first years of the application of the CEAA were in the start-up phase of the EA process, carrying out the actual assessment was not without challenges. On the other hand, a number of attributes can contribute to streamlining the assessment.

Attributes

As mentioned earlier, the scoping process can be challenging and lengthen the start-up phase of the assessment. There is a significant benefit from gathering as much information on the project and setting at the outset of the EA exercise. The data collection makes for a more timely establishment of the scope for the assessment and the associated boundaries. In our experience to date, projects for which the proponent has clearly defined the objectives and evaluated the alternatives have proved the easiest in terms of setting up the framework for the assessment.

One particularly relevant example of a well-defined project is that of the upgrades to the WTC at CRL and which was briefly described earlier. First, the client has assessed a number of options with the assistance of a consultant. The assessment of the options was carried out using a number of assessment criteria and weighting factors to assist with the ranking. The assessment was well documented in a separate report. Second, the client clearly established performance criteria for the final effluent based on compliance with existing regulations and guidelines. The

selection of the technology as a function of the performance criteria readily addressed the area that constituted the source of potentially the most significant environmental effect.

Another positive factor in that case was the operating experience that had been acquired in that facility. The operating experience was particularly relevant since it involved the operation of similar technologies over more than 15 years. Information on airborne and liquid emissions as well as exposure to personnel was, therefore, readily available. Such information is not available in all cases, but well-established monitoring programs pay dividends when facilities are to be expanded, modified or upgraded.

Another important factor is the presence of a well-defined EA process, well integrated within the environmental management system. As indicated in the introductory comments, AECL has adopted a corporate policy on the protection of the environment since 1993. The Environmental Protection Program Manual, which implements the policy for AECL owned or operated sites in Canada, incorporates the principle of prior assessment for projects and activities with potential environmental impacts. Further, clear guidance is available for the internal proponents in tiered documentation including a guideline which clearly establishes the EA process and the roles of the key participants. The availability of such guidelines helps the proponent to understand the process and the role of the EA in relation to environmental protection at AECL, and the licensing process that applies to the project.

Over the years, AECL has devoted a substantial effort to characterize its research sites at CRL and the Whiteshell Laboratories (WL). A very detailed site description has been documented for the CRL site for inclusion in recent environmental assessment reports. When new projects require the preparation of an EA report, the section of the report that describes the local environment is readily prepared by extracting the relevant bio-physical and socio-economic descriptions from the detailed site description. Then, the section is complemented with site-specific information where required. A great deal of effort can be saved in this manner. Maintaining a database on the environmental baseline and a detailed site description requires some effort that can only pay dividends when there is some assurance that a number of projects will be proposed at a given site.

A final asset worth mentioning is the value of a team approach for the preparation of environmental assessments. Because the environmental assessment is intimately linked to the licensing process for a majority of projects, a number of other documents prepared in support of the licence/approval application are also readily available. One that is particularly important to secure the approval is the safety analysis report. Since there exists a certain amount of overlap between the two reports, the safety and environmental analysts can often collaborate and share information. Key areas where information can be shared include project description, emissions, waste management and analysis of accidents and malfunctions. For many of AECL's projects, such collaboration has saved considerable effort and helped secure approvals in a timely fashion.

Challenges

In addition to the challenges encountered in the start-up phase of the assessment described earlier, there exist a few challenges leading to delays in the completion of the environmental assessment.

One of the challenges that still exists in some cases is that related to the timing of the environmental assessment. Meaningful EAs require that the assessments be carried out before any irrevocable decision is made. However, some project proponents come to the EA practitioners quite late in the project planning phase. This tends to occur when project proponents have had less exposure to the licensing process. However, the problem of early notification has largely been addressed through ongoing training of AECL managers.

Since the coming into force of the Federal Coordination Regulations, the role of various federal agencies in the EA process has been formalized. Unfortunately for the proponents, and despite the efforts of the responsible authority for AECL projects - the AECB, delays have been experienced both during the definition of the scope of the EA and in the review of the EA report. In the former case, instructions regarding the scoping are rarely obtained in less than a month. In the latter case, the review and approval of projects can be delayed considerably. As an example, the comprehensive study for the upgrades to the WTC was submitted in 1997 November and the approval was not obtained until 1998 August. Such a delay was experienced even though the environmental benefits of the project were recognized by the federal departments and no significant concerns were voiced by members of the public during the consultation.

Conclusions

With the experience acquired in recent years, it has become apparent that the environmental assessment is more than ever intimately part of the regulatory approval process of a nuclear facility as illustrated in Figure 1. To facilitate the preparation of environmental assessments for nuclear-related projects and minimize delays in the licensing process, a number of actions can be taken by the project team:

1. Early Notification and Involvement of EA Practitioner

This would initiate the dialog between the EA practitioner and the Responsible Authority for a rapid determination of the applicability of the CEAA and the selection of the appropriate EA track. Besides, this would ensure that the EA process is initiated at the right time, i.e., before the concept is finalized.

2. Definition of Project Scope and Identification of All Project Activities

Early in the EA process, the proponent should clearly identify the need for the project and its alternatives. A project description should be put together as early as possible with relevant information on all phases (site investigation to decommissioning) of the project. Alternatives should be identified and assessed in the EA context.

3. Establishment and Maintenance of an Environmental Baseline

Where a number of projects are likely to be proposed at a given site, efforts should be devoted to the preparation and maintenance of the environmental baseline. Information on liquid and airborne emissions and waste management should be updated periodically and whenever new facilities are commissioned.

4. Early Notification of RA (AECB) and Submission of Complete Background

An early notification of the responsible authority - the AECB, is key to the early definition of the scope of the EA. With the proposed harmonization agreement between the federal government and the Ontario government, it will become increasingly important to rapidly inform all the potential stakeholders to minimize any possible delays.

5. Identification of Assessment Tools and Factors to Assess the Significance of Residual Effects

Credible environmental assessments depend very much on the use of appropriate assessment tools. The proper documentation of the assessment process is critical in order to make the assessment traceable. A number of federal departments have already developed their own EA guidance documents complete with methods to assess the significance of environmental effects. Development of such tools and/or the establishment of a 'tool box' may be warranted depending on the number of anticipated projects.

6. Team Approach

The sharing of information among all team members will likely reduce the effort required to complete the licensing documentation. Not only will duplication be minimized but a consistent story will also be conveyed by the whole team.

7. Properly Documented Consultation Program

A transparent process calls for a well-documented consultation program including its results. In particular, a register of all contacts, questions and issues should be maintained along with the way concerns were addressed. The documentation of the process will play a significant role, particularly for projects for which a comprehensive study is required.

8. Proper Choice of Language for the EA Report and Reference Documentation

The use of appropriate language in the EA documentation is critical. Lay person terms should be used whenever possible. When the use of technical terms is unavoidable, those terms should be defined in a glossary. Since EAs tend to be fairly voluminous, the executive summary should be particularly well-written, provide as complete a picture as possible and should be accessible to a majority of readers. Since all EA reports are in the public domain, restricted documents should not be referenced in the reports.

These relatively simple guidelines should help carry out EAs more efficiently and minimize the period required for their endorsement.

References

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Figure 1
EA & Licensing Process for the
Construction of a New Nuclear Facility