Training for Effective Environmental Protection in the Nuclear Industry

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Abstract

This paper examines the role of environmental training in the delivery of effective environmental protection programs for construction projects in the nuclear industry. The paper uses a case study approach, based on Point Lepreau Generating Station's Refurbishment Project, to demonstrate how the underpinning principles of "training, awareness and competence" can be delivered within a structured environmental management framework, to achieve sustained excellence in environmental management and performance. Key issues addressed by the paper include the early identification of different target audiences, making effective use of communication themes, and the importance of reinforcement and follow-up in support of training goals.

1. Introduction

In 2005, the Government of New Brunswick approved the plan to refurbish New Brunswick Power's (NB Power) Point Lepreau Generating Station (PLGS) to allow the station to produce nuclear energy for the province for an additional 25 to 30 years.

The central activity of the refurbishment project is the replacement of all 380 fuel channels and the full length of the connecting feeder pipes (the "retube" portion of the project). NB Power is also taking advantage of this outage to perform other "refurbishment" activities. Since the retubing and continued operation of the PLGS will generate solid radioactive waste, additional storage facilities at PLGS's Solid Radioactive Waste Management Facility (SRWMF) are required. NB Power has appointed Atomic Energy of Canada Limited (AECL) to be the Contractor for the Refurbishment Project.

PLGS had been granted an operating licence for the SRWMF; however, because of the proposed modifications to the SRWMF, that operating licence required an amendment. This amendment constituted a trigger under the Canadian Environmental Assessment Act, which required Canada's nuclear regulator, the Canadian Nuclear Safety Commission, to carry out an environmental assessment of the project, before authorizing the new structures to be constructed at the SRWMF. In response, the CNSC delegated to PLGS the preparation of an environmental assessment study report [1]. To mitigate the potential adverse effects of the construction effort at the SRWMF, PLGS developed a Construction Environmental Protection Program. To ensure the provisions of the Protection Program were successfully implemented a training program was developed for both the contractors carrying out the construction and for those responsible for managing the effort. This paper describes that Environmental Protection training program.

2. Setting the Training in Context – NB Power Requirements

The Environmental Management System (EMS) at Point Lepreau is an important part of the station processes which form the foundation of the Station's licences to operate. The EMS is registered to the ISO 14001 standard that requires, amongst other things, that people be aware of

the environmental implications of their activities. In addition, there is a requirement that individuals receive job-specific or task-specific training.

Within PLGS, the requirement that people be aware of the environmental implications of their activities is reflected in a requirement that employees or contractors that will be spending time on site to either be accompanied by trained individuals, or that they receive "general employee training" (GET). The GET training provides training on a number of issues, including:

- The station's environmental management system;
- Workplace Hazardous Material Information System (WHMIS); and
- Radiation protection.

In the case of the modifications to the SRWMF, it was realised that neither the GET training nor the job-specific training for work on site was adequate to address the construction activities that would be involved as the construction involved a "green field" site, which had not previously been disturbed. As such, AECL undertook to develop a training program that would complement (not replace) the GET, and would provide detailed information directly related to the construction activities and the associated environmental aspects. This program was tailored to reflect two levels of job responsibilities – the hands-on worker and the management workers. The following sections describe how this program was planned and delivered, consistent with the Station and EMS requirements.

3. Planning and Delivery of Training

As discussed above, the Construction Environmental Protection Plan (CEPP) training was required to complement existing training programs already in place at PLGS – and to demonstrably communicate the knowledge, principles and procedures entrained within the CEPP to:

- those responsible for construction of the SRWMF; and
- those responsible for managing that effort.

As one of the initial steps on the critical path to the overall PLGS refurbishment there was also an underpinning requirement for construction to be achieved in line with a schedule – whilst also demonstrating excellence in environmental stewardship and protection – creating the potential for conflicting pressures and goals.

Managing that potential in a pro-active and effective fashion was recognized as the **key training challenge.** Meeting that challenge meant ensuring:

- an informed workforce;
- working within a structured framework of environmental protection measures and procedures.

In order to achieve this, the development of the training program was undertaken in a structured fashion that:

- was consistent with the underpinning training, awareness and competence requirements of ISO 14001; and
- provided for continued input and review from stakeholders, enabling the ongoing refinement of the "training messages" and the mechanisms by which these were to be delivered.

In broad terms, the development of the training program can be divided into the following key stages:

- development of the training model, including Summary Training Objectives;

- development of the "draft" training program and materials;
- "the pilot delivery session" attended by representatives from stakeholder organizations, providing a critical review of content and delivery mechanisms;
- the updating of materials followed by commencement of the training program; and
- ongoing delivery, course administration and reinforcement (linked to site inspection).

3.1 Developing the Training Model

The first step in developing the training program was the translation of the underpinning **key training challenge** into clearly definable training objectives – set out in the form of the **training model.** The training model developed for the program is shown in Figure 1 below.

AECL Training Program Outline:

Management Level Training

Summary Training Objectives:

The key training objectives of the Management Level Course are to ensure that attendees develop a clear understanding of:

- The concepts of EMS, the CEPP and the associated environmental protection plans (EPP), and how and why they apply to SRWMF;
- Their own and others roles and responsibilities with regard to the project environmental protection;
- The management structure that has been developed to facilitate the conduct of those roles and responsibilities;
- The communications processes that have been established;
- Their own and others accountability under the CEPP (including the legislative framework); and
- The consequences (individually and corporately) of failing to comply with the requirements of the EPP.

All site management and environmental staff will attend a one day training course on environmental management, regulatory requirements, NB Power's corporate environmental polices and the Environmental Management System (EMS), construction environmental concerns, the CEPP environmental protection plans and procedures (eg soil erosion, waste management, and hazardous materials management), environmental monitoring, visual observations, and contingency /emergency plans.

Contractor Crew Training

The key training objectives of the Contractor Crew Level Course are:

- Awareness of the overall context in which the EPP has been developed (in other words why they are in the training room);
- Knowledge transfer with regard to the specific requirements of the EPP; and
- Understanding of the potential consequences of failing to follow the EPP.

Awareness will be at the general level, with just sufficient detail to allow attendees to put the rest of their training in context within 2 to 3 hours.

The training will focus on construction activities that may lead to environmental concerns. Emphasis will be on environmental protection measures under the CEPP implementation programs, spill prevention control and countermeasures approach.

Figure 1: The Training Model

This training model clearly defined at an early stage the need for two levels of formal environmental protection training for the construction of the SRWMF:

- The first level (Management Level) was aimed at those responsible for the management of construction – and required the transfer of knowledge on factors underpinning environmental protection for the SRWMF. The training was therefore required to be able to effectively communicate conceptual and legislative issues, as well as those associated with practical environmental protection measures; while
- The second level (Contractor Crew Level) was aimed at those responsible for actual construction, and was required to convey both the **importance** of environmental protection within the SRWMF construction program and **how that protection was to be achieved.**

A key part of both programs was the clear conveyance of the consequences (both individually and corporately) of failing to comply with the environmental protection measures of the CEPP.

Only once this training model had been reviewed and agreed by all stakeholders did the development of the program move onto the next stage – developing draft training materials. *The future success of the training programs can, at least in part, be traced back to the early establishment of this process of initial development, stakeholder review, and finalization. A process that was continued throughout all stages of the training program development.*

3.2 Draft Training Materials

The development of draft training materials for the Management and Contractor Crew level programs was conducted concurrently, ensuring that the two programs would eventually provide an integrated training suite – delivering a consistent and mutually reinforcing training message. Materials were developed in MS Power Point using a combination of text and graphics slides to optimize accessibility in terms of **knowledge transfer** and to develop an **environmental protection culture.** The attainment of both these goals was regarded as essential for the effective implementation of the CEPP for the SRWMF. Figure 2 shows an example knowledge transfer slide.

Figure 2: Example Knowledge Transfer Slide

Knowledge transfer slides were prepared using clear and simple lay-outs punctuated with animated "highlight boxes" summarizing key learning messages. These knowledge transfer slides were used to convey:

- Specific **roles and responsibilities** covered by the CEPP;
- Specific **activities** covered by the CEPP – and how they should be conducted; and
- Additional information (such as species at risk) necessary for the implementation of the CEPP.

By contrast, slides aimed at developing an environmental protection culture focused on:

- The clear projection of the importance of demonstrably following the CEPP, both in terms of the SRWMF construction project, and with respect to the overall refurbishment of the PLGS as a whole;
- What to do and what not to do under specific circumstances (such as accidents and incidents, unusual weather conditions); and
- The promotion of the importance of the **precautionary principle** – especially throughout the Contractor Crew Level training – expressed as "If you are unsure of anything STOP work and ask the Site Superintendent or the Senior Environmental Inspector"

These slides made use of strong clear graphic messages – creating simple icons that could be repeated throughout the training session to provide reinforcement and to assist in gaining buy-in and acceptance of the training message. Figure 3 below shows a typical example.

Figure 3: Example Environmental Protection Culture Slide

Developing **targeted** training materials for **different audiences** was one of the main keys to success for the training program. This was reflected both in the content of the courses and in the means of delivery. Content slides for the two courses are shown in Figures 4 to 6 below.

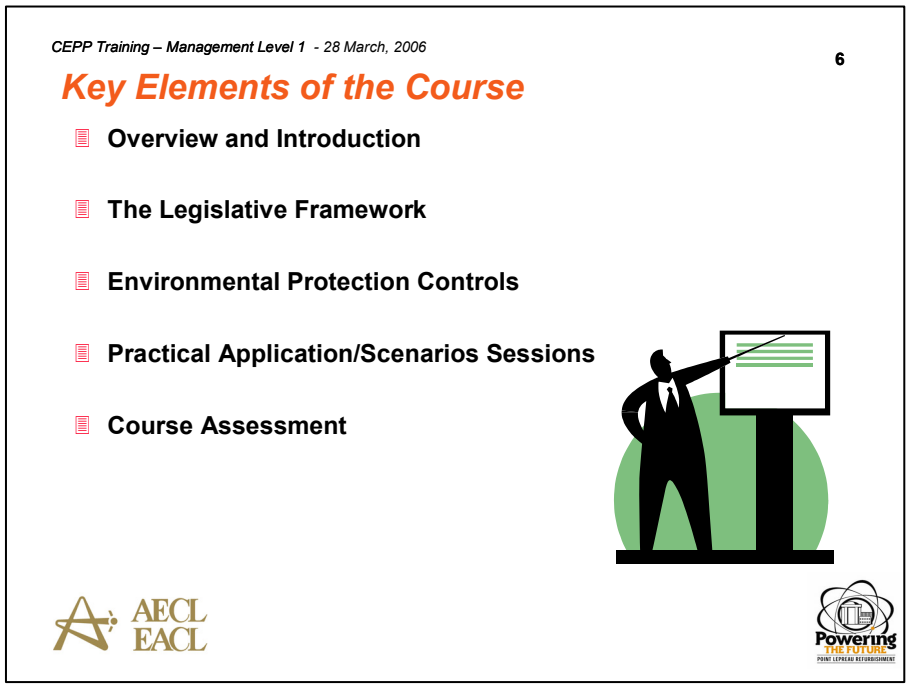

Figure 4: Management Level Course – Main Content Slide

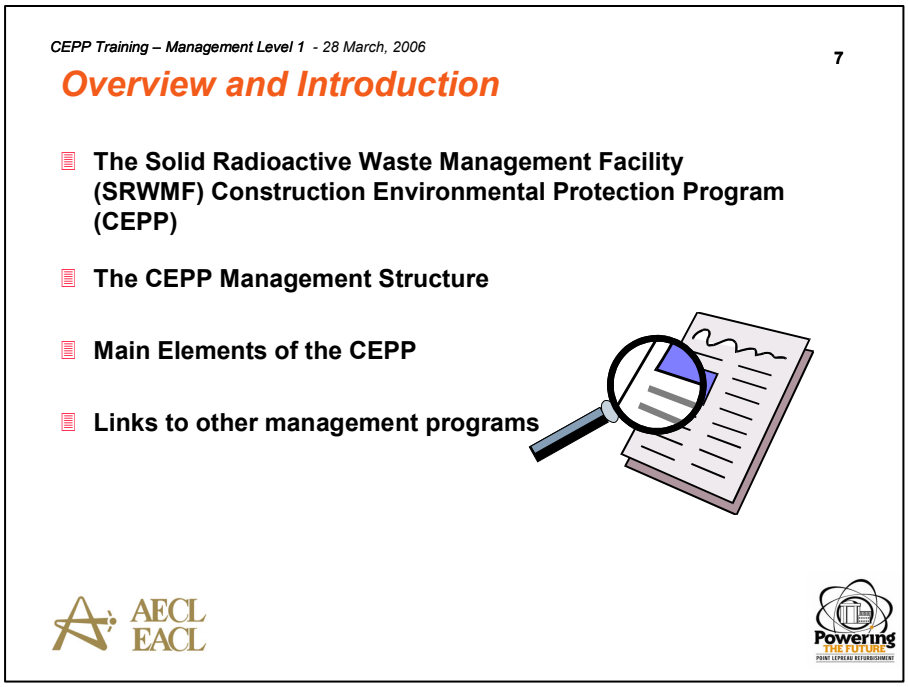

Figure 5: Management Course – Supplementary Content Slide

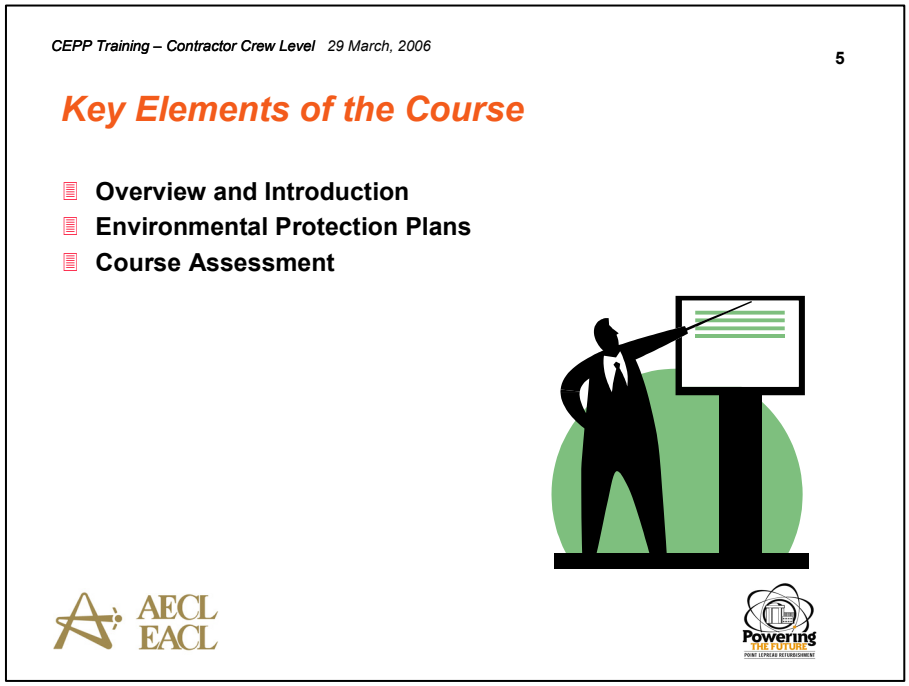

Figure 6: Contractor Crew Course - Main Content Slide

Key characteristics of the Management Level course were:

- An emphasis on ensuring understanding of the reasons for the CEPP, how it evolved, and an understanding of the key roles and responsibilities in its administration and its successful operation;
- A strong management systems component, including an introduction to management systems theory;
- An overview of relevant legislation, both Federal and Provincial;
- An introduction to environmental protection controls; and
- Scenario based exercises, requiring delegates to actively consider and engage in problem resolution and associated reporting techniques.

By contrast, the Contactor Crew Level course contained:

- An overview of roles and responsibilities, with a strong focus on those with direct operational roles; and
- Instruction to the key aspects of the ten Environmental Protection Plans contained in the CEPP.

Ensuring the relevance of training to the target audience was a fundamental goal of the training model developed in step 1 – and one of the key's to the program's ultimate success.

In order to ensure that the training was effective in attaining the prescribed learning goals assessment tests were also developed for both the Management Level and Contractor Crew training courses. These were based on multiple choice test sheets, with the degree of difficulty of the assessment for the Management level and the Contractor Crew level being set to appropriately reflect the nature of the courses.

The use of assessment tests was, however, only one of several means used throughout the program of assessing **competency** of staff with regard to their roles and responsibilities with

respect to environmental protection. This multi-layered approach to ensuring training awareness and competency is entirely consistent with the underpinning principles of ISO 14001, helping to ensure that the training program for this important project remained in keeping with established best environmental practices. Further details on competency reinforcement and assessment are provided in Section 3.5.

Following stakeholder review the training materials were finalized and the development of the training program moved on to step 3 - the pilot delivery session.

3.3 Pilot Delivery Session

This pilot session formed a key element in the quality assurance of the training program – providing an opportunity for the materials to be delivered by the lead trainer to a selected audience of stakeholders. This session provided for a final check on content (both in terms of accuracy and effectiveness in delivery of the identified training messages) and the opportunity to test and evaluate the materials in terms of visual effectiveness, timing, and overall suitability for the target training audiences.

The pilot session was also attended by the Senior Environmental Inspector (SEI) for the SRWMF construction – enabling the SEI to input to and to approve the materials. The SEI was responsible for the compilation of detailed notes on comments arising from the pilot delivery session – and assisted in the incorporation of changes to the materials to provide a final "approved" version of the both the Management and Contractor Crew level courses. These approved versions were subject to the quality management document control processes of AECL.

This pilot session enabled the fine tuning of the training program such that a high level of course quality, both in terms of content and delivery, could be established from the onset of the program – preventing a "learning curve" phenomenon with respect to early courses.

3.4 Ongoing Training Program

Once the final training materials had been approved, the training program for both Management and Contractor Crew levels was commenced. Management level training was held at the AECL offices, Saint John, New Brunswick while Contractor Crew training was held at PLGS facilities and was linked to the provision of the site-specific health and safety training session required for all new workers on site. Training was a mandatory requirement for all contractors and no contractor was allowed to work unaccompanied on site until the training had been successfully completed and the assessment test had been passed. To ensure this, training records were maintained on site by the SEI. These records were subject to audit by both internal and external auditors.

3.5 Maintaining Commitment and Excellence

As can be seen from the above sections, significant effort was directed at the development and eventual delivery of effective training programs in support of environmental protection for the SRWMF construction project. This effort was based on a clear understanding of the potentially critical nature of any failure to demonstrate due-diligence with regard to project stakeholders' environmental stewardship responsibilities, and the potential implications with regard to later stages of the project.

From the onset, however, it was recognised that in order to be successful, the training needed to be set against a clear framework of environmental protection measures (the CEPP) and continued mechanisms to reinforce and support the training provided through the Management Level and Contractor Crew level courses.

Key amongst these mechanisms was the appointment of an SEI with specific responsibility to monitor the implementation and effectiveness of the CEPP with regard to continued environmental protection. The SEI was in turn able to call on the support of additional resources, including an Environmental Monitoring Consultant (responsible for physical monitoring of environmental receptors, such as watercourses), and an archaeologist, to be present whenever there was an initial disturbance or clearance of ground.

To assist in maintaining the link between the training program (the classroom) and the site – the role of the SEI was strongly integrated with the training program through a number of mechanisms:

- The SEI was involved in the review and approval process for the training program, and participated as a delegate in the pilot delivery session;
- The SEI was responsible for coordinating training programs and ensuring that training was held as required to meet operational construction requirements;
- The SEI attended all training courses, and was identified to all delegates as being the main environmental authority on site, with the independent power to issue stop work orders;
- The SEI reviewed test assessment results and where necessary provided additional coaching to individuals to ensure that the environmental protection requirements of the CEPP were adequately understood; and
- The SEI administered all training records.

This strong integration of training and operational controls (the SEI role) is a cornerstone of good environmental management system practices, and was an ongoing contributor to the maintenance of excellence in environmental management practices and environmental protection at the site.

In addition to the above, the knowledge transfer and environmental protection culture developed through the training program was also supported by ongoing environmental inspections, reviews and audits by both internal and external stakeholders and organizations.

A final feature of maintaining commitment was the development of clear communication processes by which changes in site practices, identified through the environmental management protection system documentation, were incorporated into the training materials and/or training delivery. This approach ensured that training remained relevant, accurate and credible with regard to the continued delivery of excellence in environmental protection at the site.

4. Moving Forward

As the construction phase of the SRWMF reaches its conclusion and future phases of the PLGS refurbishment begin to gear up it can only be expected that the need for excellence in environmental protection will continue to grow. The project stakeholders recognise this and clearly understand that only through the structured development of training programs such as the one described here can this expectation be reasonably met.

5. Conclusions and Lessons Learned

This paper has presented the approach to environmental protection training developed for the SRWMF construction project at PLGS. It has shown how a structured approach to environmental protection training, conducted in line with the training, awareness and competency provisions of ISO 14001, can be a cornerstone of excellence in environmental protection. The paper examines the key steps in the development and delivery of the training program for the SRWMF construction project – and draws attention to critical elements that were essential to its success. These elements included:

- The early identification of target training audiences and the development of a training model that takes account of their differing expectations and requirements;
- The establishment, from the onset, of a clear process of stakeholder engagement with respect to both the content and delivery mechanisms for the training program;
- A focus on attaining both knowledge transfer and the development of an environmental protection culture;
- A clear acknowledgement of the need to develop and implement mechanisms for the assessment and monitoring of competency – both as part of the training process itself, and later, through the integration with operational controls; and
- The incorporation of a dynamic process of continual improvement, allowing content of training materials to be informed by actual site events, thereby ensuring the continued relevance – and therefore credibility – of ongoing training efforts.

This paper shows that through such an approach the potential conflicts arising from pressured construction schedules and environmental stewardship and protection requirements can be anticipated and pro-actively avoided to the benefit of both the environment and the project as a whole. For high-profile projects where environmental issues may be placed front and centre the overall advantages of this are clear.

6. References

[1] Jacques Whitford Environment Ltd., “Point Lepreau Solid Radioactive Waste Management Facility Modifications Environmental Assessment Study Report”, prepared for NB Power, Document No. 87RF-07020-7000-001-ENA-A-03, May 2003.