INTEGRATED WASTE PLAN FOR CHALK RIVER LABORATORIES

P. McClelland, I. Bainbridge
Atomic Energy of Canada Limited
Chalk River, Ontario, Canada

ABSTRACT

The core missions for Chalk River Laboratories (CRL) will involve a complex suite of activities for decades to come, many of these activities resulting in production of some amount of wastes. In order to support the business of the Nuclear Laboratories there is a requirement to responsibly manage the wastes arising from these activities. Capability to develop waste stream pathway scenarios and be able to make informed strategic decisions regarding the various options for waste processing, storage and long-term management (i.e. "enabling facilities") is necessary to discharge this responsibility in the most cost effective and sustainable manner. A holistic waste management plan integrated with the decommissioning, environmental remediation and operations programs is the desired result such that:

- Waste inputs and timings are identified;
- Timing of key decisions regarding enabling facilities is clearly identified; and
- A defensible decision-making framework for enabling facilities is established, thereby ensuring value for Canadians.

The quantities of wastes that require managing as part of the Nuclear Legacy Liabilities Program and AECL operations activities is in the range of 200,000 to 300,000 m^3, with a yearly increase of several thousand m^3. This volume can be classified into over thirty distinct waste streams having differing life cycle waste management pathways from generation to disposition. The time phasing of the waste management activities required for these wastes spans several decades and involves a complex array of processes and facilities. Several factors typical of wastes from the development of nuclear technology further complicate the situation. For example, there is considerable variation in the level of detail and format of waste records generated over several decades. Also, wastes were put into storage over several decades without knowledge or consideration of what the final disposition path will be.

Prior to proceeding with any major new-build project of waste management facilities, options assessment and feasibility studies are required to demonstrate a defensible justification of selected options. Recent experience with this "pre-project" process when applied to waste management is mixed. The reason for this is that the map of waste stream pathways from generation to disposition is not yet clear, and the time-phased inventories of wastes driving the business need for each facility have a high level of uncertainty. Recognizing there are gaps in this foundation information, pre-project options analysis has, at times, been difficult and of limited benefit.

Examples of difficult waste management decisions faced at CRL include:

- What waste processing infrastructure makes sense at CRL (e.g. radioactive waste incinerator, other thermal treatment options);
- Whether or not to build a Very Low Level Waste facility; and
- How to make best use of existing interim storage capability and how this impacts planning for additional future capabilities.

Other complex nuclear programs have had similar challenges worldwide and AECL is benefitting from experience and lessons learned at various decommissioning sites to improve Waste Management business planning for CRL. The process developed by the United Kingdom Nuclear Decommissioning Authority (NDA) for Integrated Waste Strategy is particularly relevant to the challenges faced with respect to planning for waste management infrastructure at CRL. This paper describes the application of the UK-NDA process at CRL and preliminary results obtained to date.

1. INTRODUCTION

AECL required an effective approach to developing a fully integrated waste plan for CRL. As existing internal processes were found to be lacking integration, a search for external experience was undertaken. Significant experience worldwide regarding the benefits of integrated waste strategies was discovered in the non-nuclear forum; however, specific experience in the nuclear realm and in particular nuclear decommissioning, was more difficult to find. Following extensive searching, the most relevant experience identified was from the United Kingdom Nuclear Decommissioning Authority (UK-NDA) and United States Department of Energy (USDOE) nuclear decommissioning programs. Of particular note, the International Framework for Nuclear Energy Cooperation (formerly known as Global Nuclear Energy Partnership or GNEP) initiative recognizes the importance of integrated waste management strategy.

The process to achieve integrated waste plans at UK-NDA sites is publicly available on their website www.nda.gov.uk[1], [2]. This is of particular value as there are several similarities between the UK nuclear decommissioning program and that in Canada. These include similarities between the regulatory regimes and the general lack of available facilities for long-term management of radioactive wastes. It is also noteworthy that the process evolved for application in the United Kingdom civil nuclear decommissioning programs had its origins from experience obtained at United States Department of Energy decommissioning sites.

A business case assessment supported the decision to trial the UK-NDA process for integrated waste planning at AECL's Chalk River Laboratories (CRL) site to gain experience in its application prior to rolling it out further at other AECL sites. In order to best achieve this, consultants from Babcock International (ex UKAEA) familiar with developing integrated waste plans for UK decommissioning sites were employed to assist AECL staff prepare the first Integrated Waste Plan (IWP) for CRL. Transfer of knowledge was a key deliverable in the agreement so that AECL would end up with both a published IWP document and an experienced team capable of producing future iterations of the IWP.

2. IMPLEMENTATION PLAN

Production of the first IWP for Chalk River was a substantial task. In order to best position for success, this endeavour was managed as an independent small project, with a project charter, execution plan and oversight. A project charter was established that defined:

- the scope of the project;
- the roles and accountabilities of involved organizations; and
- the project schedule and milestones.

A cross-functional team was developed with representation from each of the major internal stakeholders. Team members were selected with two objectives: obtaining the required skills and experience for the task, and building the buy-in by the organizations that were required to be intimately involved in production and ongoing implementation of program strategy and planning. A big challenge for this endeavour was obtaining overall alignment in strategic decision making. With a past history of in-depth technical work, there was often diversity of opinion on what direction needed to be taken that was heavily influenced by the lens through which the problem was being examined. Getting a diverse team representing all the important organizations engaged in a process that would develop consensus proved absolutely vital to developing an end product that would be viewed by all as a credible AECL position.

Given the scale of the task, it was clear that the plan itself could not be completed in one iteration. This was not the intent. The first iteration would gather in one place what the currently understood plan is, at its current state of development. There will be gaps and uncertainties that require resolution leading to an ever improving plan. This poses the challenge of determining where to draw the line on this first iteration, recognizing that to a certain degree, the plan will be out-of-date by the time it is actually published. The decision was taken to gather as much reference data as possible by a set "data freeze" date, and then exercise discipline in producing the first iteration of the IWP based on this data while acknowledging that new information can be captured in the next iteration of the published work.

A project schedule was established. This schedule identified the primary tasks, including those involving the consultant organization, as well as all tasks necessary to produce the end product. A risk register was also established. In addition to regular team meetings that mostly involved team technical review and progress review, regular oversight meetings that looked at the progress from a project management perspective proved essential to delivering the project on schedule. At the oversight meeting, schedule progress and risk register review were very important.

3. PROCESS OVERVIEW

The process employed by UK-NDA sites is to gather specified information against a specified checklist, which in essence defines the table of contents for a published Integrated Waste Plan (See Figure 1). An iterative phased approach is necessary:

1. Using the template in Figure 1, gather all currently available information into a comprehensive report with attachments. Result – an Interim IWP document.
2. Review the Interim IWP and note identified gaps.

3. Review gaps taking into account prioritization and undertake strategic studies to address gaps. Include where appropriate options studies and decision-making process.
4. Repeat steps 1 through 3 until all gaps have been addressed and the plan has been optimized (with appropriate stakeholder involvement including public consultation). Result – a completed IWP.
5. Continue to maintain IWP in custodian mode taking into account any significant changes in the program or environment.

Note that the above process recognizes that the level of detail in each waste stream pathway will vary until all flow paths have been refined to an acceptable level of detail. Examples of differing levels of refinement include:

- Waste stream is just barely known and the disposition route largely not yet known;
- Some of pathway known, major gaps in the detail of pathway (e.g. pathway taken to interim storage only and final disposition not yet determined);
- Enabling facilities for the waste stream identified, not yet specified in detail;
- Enabling facilities in design phase; and
- Enabling facilities in operation.

The IWP remains an Interim IWP until all gaps have been resolved and all pathways are at an acceptable level of detail (i.e. major decisions made and execution phase initiated). Full completion will involve a number of iterations, typically annually for up to six years (based on experience in the UK). The end result of completing this process is a comprehensive document and supporting information that includes:

- An Integrated Waste Plan document summarizing the entire waste management picture in one place;
- Details of all the wastes required to be managed, including volume and timings by waste stream (contents of an interactive database with links to the Master Schedule);
- Detailed waste stream pathway maps for the whole life-cycle for each waste stream to be managed from pre-generation planning through to final disposition;
- Critical decision points, i.e. decisions that need to be made and timings by when they need to be made;
- From the above, a list of necessary and optimized enabling facilities and timings; and
- Costed contingency plans for strategies containing a high degree of risk.

4. RESULTS

This first iteration of the IWP has been completed at CRL. There are several tangible results from application of this process at CRL. The first iteration of this process has provided a

detailed baseline plan at the current level of refinement. Waste flow maps for all identified waste streams, for the full waste life-cycle complete to disposition have been constructed. Subsets of these are illustrated in Figure 2 and Figure 3. The maps have been colour coded to identify areas requiring further development, and these diagrams provide a very quick visual reference to the overall level of development of the plan. These flow diagrams also show the complexities and inter-relationships between waste streams. Knowledge of these inter-dependencies is necessary in order to perform effective options studies for enabling facilities that may be necessary for multiple related waste streams.

A waste inventory has been constructed that serves as the master reference inventory of all waste that has been or is committed to be managed at CRL. In the past, only the waste that is in storage has been effectively captured, and future predictions of wastes requiring to be managed were not available in one place. This resulted in inefficiency and conflict when it came to making decisions regarding the need for enabling facilities, often with questions pertaining to the reliability and accuracy of the data set. Adopting the IWP approach has led to this new way of managing inventory information, ensuring that all options studies are using this single most up to date source of information as input, and all future refinements of inventory estimates are available to all.

A list of gaps and uncertainties has been identified. From this, a prioritized action plan has been constructed, based on the impact of the gap and the urgency that it must be addressed. Examples of high priority actions include:

- Continue development of a disposition facility for Very Low Level Waste (similar to those is France and Spain), given the very high volume and relatively low hazard of this waste stream resulting from decommissioning activities;
- Development of Strategic Waste Acceptance Criteria (WAC) for disposition for proposed long-term management facilities (in accordance with IAEA draft guidelines);
- Continue to refine the data set, especially with regard to estimates of waste volumes arising from decommissioning activities; and
- Development of characterization methodologies to comply with WAC for long-term management facilities.

Technical work and optioneering in areas of gap or uncertainty will lead to improvements of the plan in successive iterations. The results obtained thus far provide a clearer picture of the overall waste management picture as well as clues as to how to perform more effective options studies thereby leading to more robust decisions on enabling facilities going forward.

5. LESSONS LEARNED

The process developed in the UK is effective and well suited for the CRL site. It can be concluded that approaching the problem in this way was indeed very effective, and it is the intention of AECL to continue to use this process at CRL. There may be benefits to broader application at AECL and this is being studied.

The holistic view of all waste streams in one place facilitates completion of strategic options studies. Identified gaps and uncertainties that require future action will be addressed, with improved clarity of the required timelines for their resolution.

A number of long-term management facilities are needed for AECL radioactive wastes, including near surface and geological waste management facilities. In particular, a Very Low Level Waste long-term management facility provides significant advantages for the decommissioning program.

Many layers of complexity will continue to exist at CRL from overlapping work programs of decommissioning, environmental restoration, isotope production, and research and development. The IWP process has provided an excellent vehicle for consensus building cutting across all of the sources of complexity and resulting in a waste management plan that all areas of the Nuclear Laboratories buy into.

Approaching this complex task using project management principles and approach was key to delivering a high quality product on schedule. This exercise was not without its challenges. These were all overcome due to close attention to risk identification and mitigation, management oversight and action allowing the team to react and still achieve the high level milestone on schedule.

6. ACKNOWLEDGEMENT

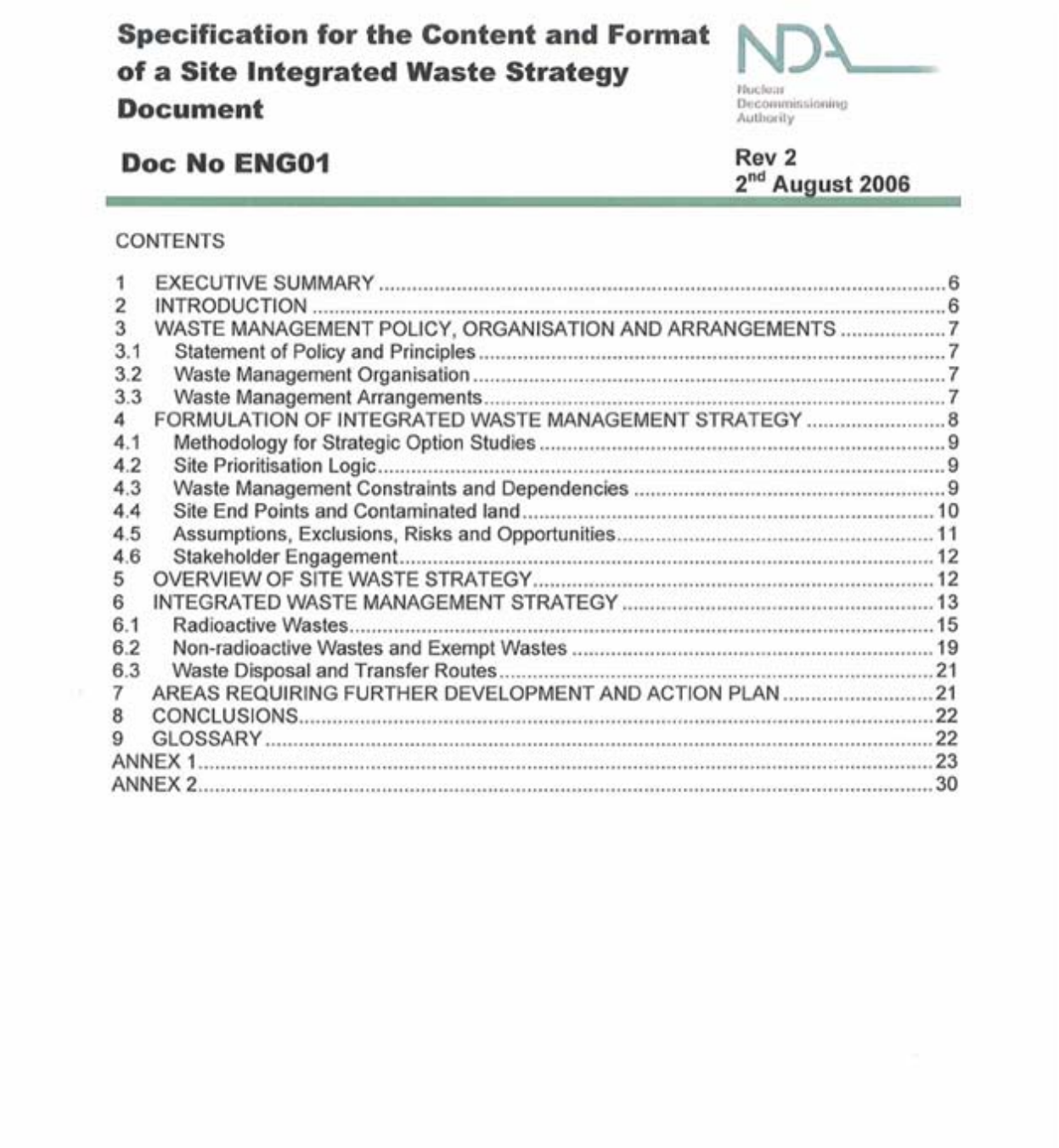
This work is funded by Natural Resources Canada through the Nuclear Legacy Liabilities Program.

7. REFERENCES

[1] Nuclear Decommissioning Authority, ENG01, Specification for the Content and Format of a Site Integrated Waste Strategy Document, Rev 2, 2006 August

[2] Nuclear Decommissioning Authority, ENG02, Companion Document to Integrated Waste Strategy Specification, Rev 2, 2006 August

Figure 1 Template for Integrated Waste Plan Document [1], [2]



Specification for the Content and Format of a Site Integrated Waste Strategy Document

Nuclear Decommissioning Authority

Doc No ENG01

Rev 2
2nd August 2006

CONTENTS

Figure 2 Waste Flow Maps for Solid Radioactive Waste Streams at CRL

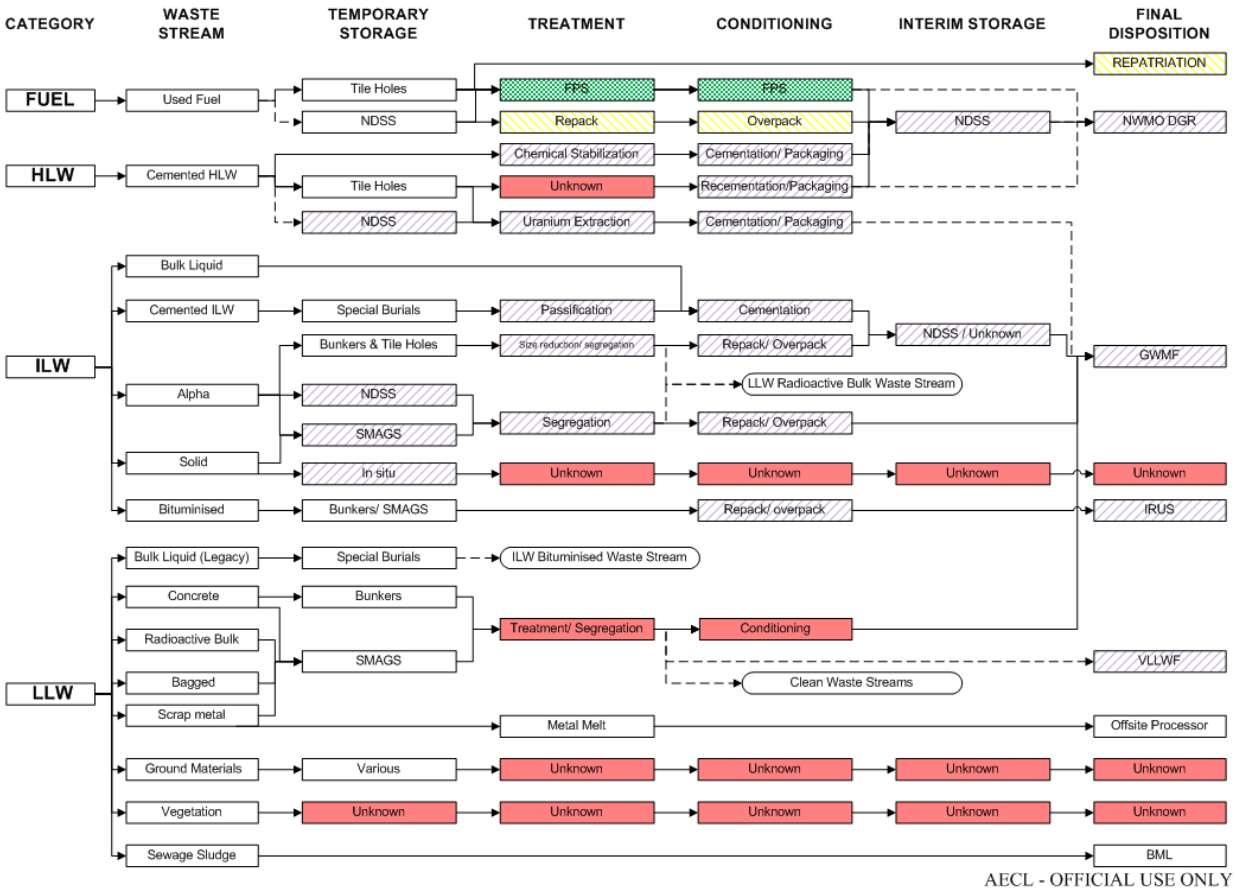


Figure 3 Waste Flow Maps for Mixed, Hazardous, Clean and Likely Clean Waste Streams at CRL