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Development of an Integrated Waste Plan for Chalk River Laboratories – 13376

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ABSTRACT

To further its Strategic Planning, the Atomic Energy of Canada Limited (AECL) required an effective approach to developing a fully integrated waste plan for its Chalk River Laboratories (CRL) site. Production of the first Integrated Waste Plan (IWP) for Chalk River was a substantial task involving representatives from each of the major internal stakeholders. Since then, a second revision has been produced and a third is underway. The IWP remains an Interim IWP until all gaps have been resolved and all pathways are at an acceptable level of detail. Full completion will involve a number of iterations, typically annually for up to six years. 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;
- 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; and
- Critical decision points, i.e. decisions that need to be made and timings by when they need to be made.

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. The IWP has also 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. The maps identify areas requiring further development, and 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.

The next step is to engage external stakeholders in the optioneering work required to provide enhanced confidence that the path forward identified within future iterations of the IWP will be acceptable to all.

INTRODUCTION

AECL Chalk River Laboratories (CRL) has been producing a wide variety of both solid and liquid wastes, ranging from clean waste to high level radioactive waste since site began operating in 1944. Currently these wastes are stored at the CRL Waste Management Areas in various storage types and locations.

These wastes are primarily received from Research & Development, isotope production, or refurbishment work. A small amount of commercial waste is also received. These wastes continue to be produced, and will do so until the end of site operations.

In 2006, the Nuclear Legacy Liabilities Program (NLLP) was established to effectively manage all liabilities at AECL prior to 2006.

The NLLP includes decommissioning on and off site facilities (including those which are either currently operational or are yet to be decommissioned). The program also deals with the remediation of legacy wastes from the CRL site to ensure the site end state can be achieved.

Therefore both decommissioning wastes and site remediation wastes are also received for storage at current operational CRL waste management areas. It is anticipated that as the NLLP progresses, the volume of these waste types will increase.

It was felt that an integrated approach to managing all wastes at the CRL site, including operational, decommissioning and site remediation, was required. To do this, AECL required an effective approach to developing a fully integrated waste plan for CRL. Following extensive research, the United Kingdom Nuclear Decommissioning Authority (UK-NDA) process was used.

PROCESS OVERVIEW

As per the UK-NDA process, an iterative phased approach is being used to produce the IWP, involving the following steps:

1. Gather all currently available information into a comprehensive report with attachments. Result – an Interim IWP document.
2. Review the Interim IWP and identify 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 (Figure 1 & 2) have been refined to an acceptable level of detail.

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
- Cost- based contingency plans for strategies containing a high degree of risk.

Technical work and optioneering in areas of gap or uncertainty will lead to improvements of the plan in successive iterations.

RESULTS

Previous Iterations

The first two iterations of the IWP have been completed at CRL. The first iteration provided a detailed baseline plan at the current level of refinement. The first iteration gathered in one place what the currently understood plan was, at its current state of development. It was accepted that there would be gaps and uncertainties that require resolution leading to an ever improving plan.

The second iteration of the plan reviewed the waste volumes, the anticipated waste estimates, and the assumptions made when determining these estimates.

Work acknowledged as filling some of the gaps in the latest revision of the IWP includes:

- Production of a Strategic Waste Acceptance Criteria for the proposed Geologic Waste Management Facility,
- Production of Strategic Waste Acceptance Criteria for the proposed Very Low Level Waste Facility,
- Ongoing work to assess the feasibility of a Very Low Level Waste facility, and
- The full commissioning and routine operation of cement pulverizing equipment to allow reuse of clean concrete on site.

Current Status

The next iteration of the IWP is working towards providing the information required to inform and engage both internal and external stakeholders on both the baseline waste strategies and any

contingency that is required. Once feedback has been obtained regarding the general consensus on the strategic issues, option studies will to be carried out to complete the IWP. Table I shows the current assumed treatment and disposition routes for the waste each waste category, along with the major assumptions made.

Table I – Waste categories

Waste Category	Treatment/ Interim Storage	Disposition	Assumptions
Clean	• Waste Analysis Facility	• Reuse • Recycling • On and off site landfill	• Optimize use of waste hierarchy • Disposition routes remain available
Hazardous/ Mixed	• On Site Storage Area	• Storage area on site • Off site disposition	• Disposition routes remain available
Very Low Level Waste (VLLW)	• Currently Stored as Low & Intermediate Level Waste (L&ILW) • Sewage Sludge straight to disposition	• VLLW Facility • Bulk Material Landfill (BML)	• VLLW Facility operational 2017 • BML available until 2100
Low & Intermediate Level Waste (L&ILW)	• Bunkers • Modular Above Ground Storage (MAGS) / Shielded Modular Above Ground Storage SMAGS • Tile Holes	• Deep Geologic Repository (Geologic Waste Management Facility- GWMF) at CRL	• Sufficient storage available until GWMF available (>2030) • Technical assessments, safety performance assessments and stakeholders support a GWMF at CRL
High Level Waste (HLW)/ Used Fuel	• Wet Storage – cooling ponds • Dry storage – Tile Holes • Fuel Packaging & Storage Facility	• National Repository (Adaptive Phased Management Deep Geologic Repository – APM DGR) • Repatriation for suitable material	• National Research Universal (NRU) Reactor operational until 2021 • Molybdenum isotope production ends 2016 • National repository available 2055

Liquid Low & Intermediate Level Waste (LL&ILW)	• Bituminization – Waste Treatment centre • Cementation – mobile cement plant	• Deep Geologic Repository (Geologic Waste Management Facility) at CRL	• Bituminized product unsuitable for long term management

To date, a review of waste volume estimates and waste projections from previous iterations of the IWP has been undertaken and previous baseline assumptions have been verified. Work is currently focused on reviewing the possible treatment, conditioning and final disposition methods which are currently available for Low and Intermediate Level waste.

This involves gathering worldwide data regarding treatments and disposition routes. Only those which are technically feasible and are proven technology will be discussed.

The work will include, identifying which treatment and disposition options are suitable for each waste stream and, where required, providing life cycle costs for options. Enabling facilities will also be identified, but this will ultimately be dependant on the final disposition route.

Suitable methods identified for the CRL site will be discussed as part of the IWP. This review is addressing an area with higher uncertainty on the waste pathways and, therefore, a higher degree of risk. This will enable some of the gaps identified in previous iterations of the IWP to be filled and allow contingency if the current baseline assumptions made regarding the strategies are proved to be invalid. At this stage, only the baseline strategy will be identified and no decisions will be made regarding the options until stakeholder engagement is obtained.

The data collected will be provided as an appendix to the IWP to provide information to both internal and external stakeholders. This information will provide the basis to begin the optioneering process for optimizing the pathways for the site wastes.

Other work underway which will assist in removing gaps and, therefore, uncertainty in the pathways identified within the IWP, includes:

- Production of a Very Low Level Waste facility conceptual design. Work is currently underway to determine the design requirements for such a facility at CRL,
- A third party review of the feasibility of a deep waste repository at CRL is being undertaken. The current baseline assumption is that this will be available. However, as there is some uncertainty with this baseline assumption, alternatives have been provided as part of the IWP process to provide contingency, and

- The suitability of specific waste management areas for in situ disposition is being assessed and reviewed. This could have a major impact on the volumes of waste requiring treatment, interim storage and final disposition at the CRL site.

CONCLUSIONS

The IWP process is proving effective in providing a platform to identify gaps and ensure that long term strategic issues are being addressed.

It has been identified that a number of waste enabling facilities and long-term management facilities are required for dealing with AECL radioactive wastes, and these are currently being reviewed as part of the IWP process. Discussions with all stakeholders are required to ensure that the strategic outcome is successfully bought into by all interested parties.

The IWP process has provided an excellent vehicle for sharing relevant strategic information with stakeholders and allowing us to be better positioned to engage with stakeholders regarding strategic decisions at CRL.

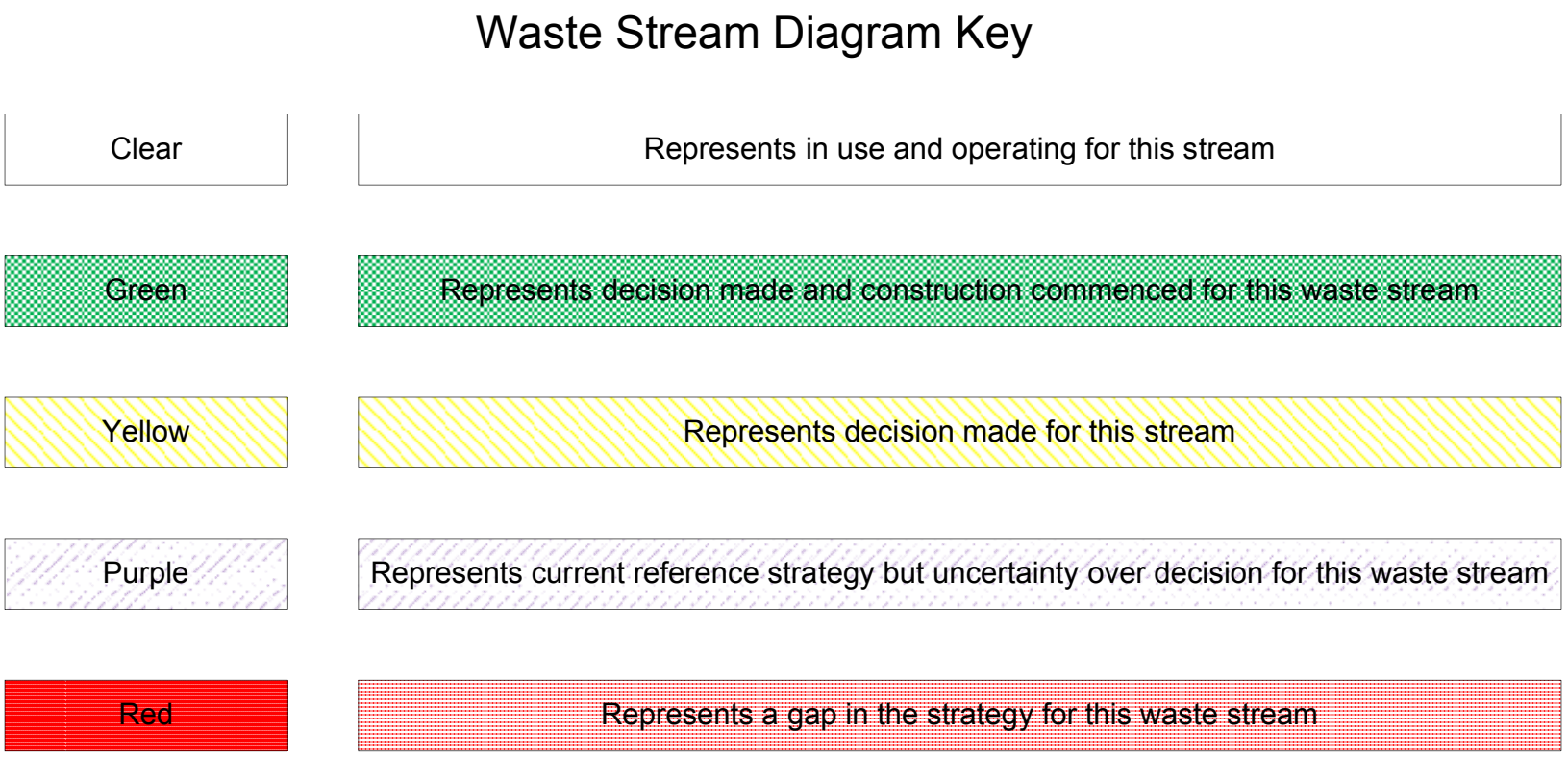

Figure 1. Waste Stream Diagram Key

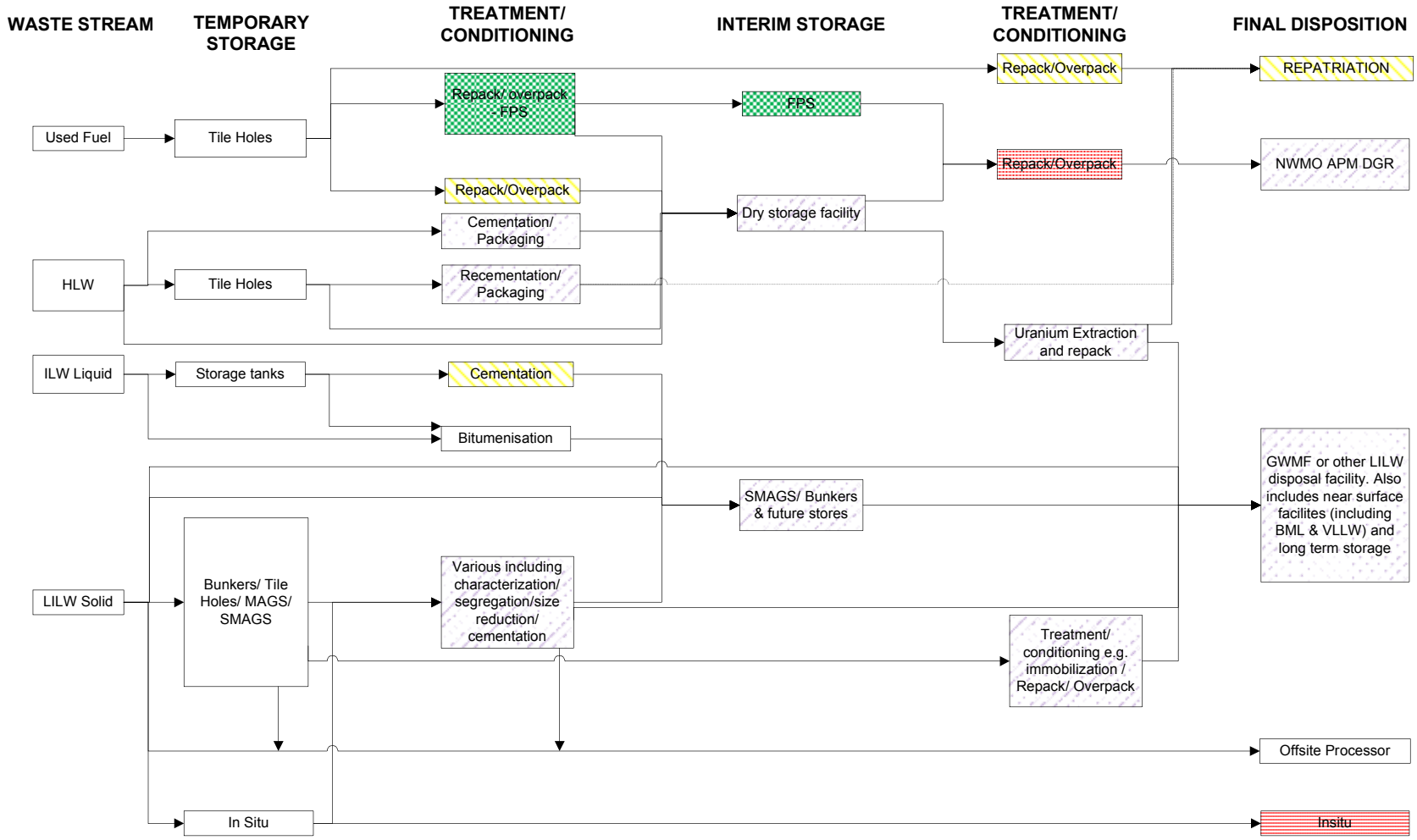

Figure. 2 Flow Diagram Example