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Overview of Atomic Energy of Canada Limited's Waste Management Operations at the Chalk River Laboratories

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ABSTRACT

AECL is a global nuclear technology and engineering company, well known for the CANDU reactor as well as other nuclear products and services.

AECL's Chalk River Laboratories (CRL) site has been in operation since 1952, and operates a variety of nuclear facilities to benefit the nuclear industry.

In the production of products and services, waste is produced. All solid and liquid active and/or hazardous and routine waste are handled by Waste Management Operations.

This overview looks at the past, present and future of Waste Management facilities and services at Chalk River.

1 OVERVIEW OF AECL

Atomic Energy of Canada Limited (AECL) is a global nuclear technology and engineering company that designs and develops the CANDU nuclear power reactor as well as other advanced energy products and services. Approximately 3,500 highly-skilled people worldwide are employed at various AECL sites.

AECL's Chalk River Laboratories (CRL) site is located approximately 200 km northwest of Ottawa, Ontario on the shore of the beautiful and historic Ottawa River. The CRL site operates a variety of nuclear facilities (reactors, hot cells, analytical labs) to the benefit of the nuclear industry.

All these facilities and processes produce nuclear, hazardous, mixed and routine landfill waste that requires the services of Waste Management Operations (WMO). In addition to supplying the needs of Chalk River, WMO also receives solid commercial waste from hospitals, universities, and nuclear businesses across Canada other than the power utilities. WMO also offers a disposal service for mixed liquid wastes to all Canadian active waste producers (including the power utilities).

The overview of Chalk River provides a look at our facilities past, present and future and programs that can provide a service not only to CRL facilities, but also to the Canadian Nuclear Industry.

2 OVERVIEW OF WASTE MANAGEMENT OPERATIONS (WMO)

AECL's Waste Management Operations (WMO) is mandated to provide waste management services to our customers in a cost-effective, safe and environmentally responsible manner. WMO provides waste management services of solid and liquid radioactive wastes as well as conventional and hazardous wastes, required by CRL and non-AECL waste generators.

The operation focus is to prevent, reduce, and mitigate the impact of radioactive waste on the health and safety of employees and the public, and the environment by:

- reducing the quantity of radioactive and hazardous wastes;
- improving waste transfer practices;
- improving waste processing practices;
- improving waste storage practices;
- providing long-term storage until waste disposal facilities;
- enhancing performance monitoring;
- increasing the level of understanding about the nature and condition of ongoing and stored waste; and
- enhancing and formalizing initiatives to address conventional (non-radiological), hazardous wastes and mixed waste.

WMO is broken down into four main areas:

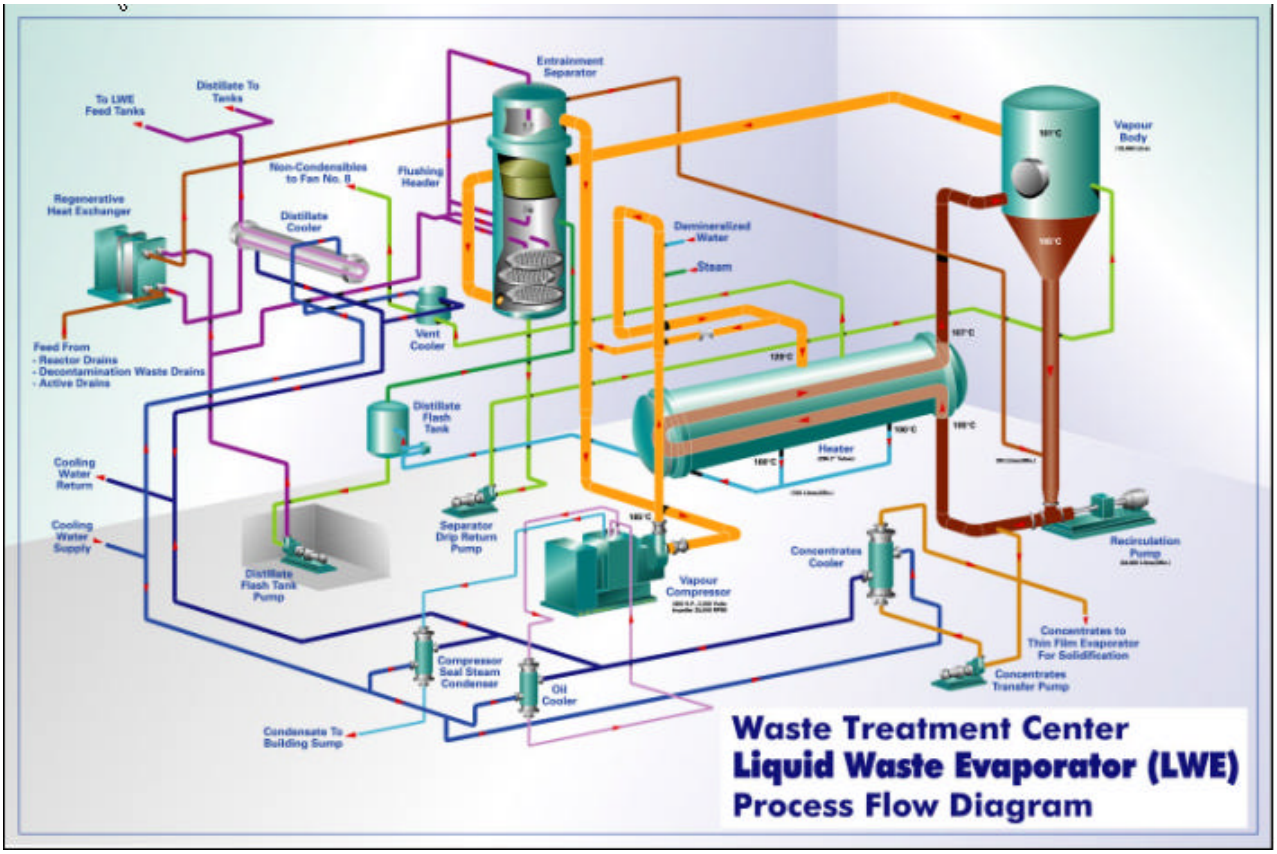
- Liquid Radioactive Waste Management Facility;
- Solid Radioactive Waste Management Facility;
- Waste Segregation and Hazardous Waste Programs; and
- Technical Unit.

3 WASTE MANAGEMENT OPERATIONS

3.1 Liquid Radioactive Waste Management

The Waste Treatment Centre (WTC) was built at Chalk River Laboratories (CRL) in 1980 to separate radionuclides from low-level liquid waste produced on-site. The original equipment commissioned at the WTC included an incinerator, ultrafiltration, reverse osmosis, thin-film evaporators and microfiltration.

The current equipment is a 100 l/min liquid waste evaporator (LWE) to concentrate the (volume) low level liquid waste produced by the reactors, research and test areas as well as the decontamination process. Thin-film evaporators further concentrate the LWE waste and solidify the concentrate in emulsified bitumen contained in galvanized steel drums.



The distillate water from the evaporators is sent to holding tanks where it is acceptance tested for release. If the distillate passes testing, the water is discharged to the process sewer, which discharges to the Ottawa River. The immobilized bitumen waste is transported to a waste management area for dry-storage management.

A number of projects have been initiated to provide new and/or improved operations for the WTC:

- Site active liquid wastes are collected via Active drain lines. These lines have recently been upgraded to a double wall containment lines with leak detection.
- A new tank facility is in operation providing double containment for storage of operational waste streams.
- The reverse osmosis/ micro filtration plant has been upgraded to provide back-up processing for prolonged outage of the LWE.
- Twenty-one legacy waste tanks will be transferred and consolidated into a new double containment holding facility.
- Improvements to resin bed removal systems for bulk and selective isotope removal are in progress.

3.2 Solid Radioactive Waste Management

The WMAs are licensed to operate, construct, monitor, and maintain storage space for historic and operational solid wastes. Approximately 1400 m^3 of waste (in final form) ranging from very slightly contaminated material to used reactor fuel must be stored, each year, in one of four different Waste Management Areas (WMA) Facility at the CRL site. Initiatives such as baling and high-force compaction are two techniques currently used to reduce the volume of solid wastes to minimize the use of storage space.

3.2.1 Sand Trench

Waste Management Area C (WMA C), an unlined sand trench facility used for storing Low-Level Radioactive Waste (LLRW) has been in operation since 1963 at Chalk River Laboratories (CRL). In the 1990s, it was recognized that this facility was approaching its capacity and the Modular Above-Ground Storage (MAGS) facility was built to provide improved new storage capacity for LLRW.

3.2.2 Modular Above Ground Storage (MAGS)

The MAGS system for processing and storing LLRW came into operation in November 2002. The MAGS system signifies a substantial change in the way low-level wastes are handled and stored at CRL. The LLRW waste generally contains items such as lightly contaminated clothing, paper towels, glassware, used equipment and building materials produced at CRL or received from Canadian hospitals, universities and other waste generators such as MDS Nordion. These materials, previously stored in unlined sand trenches, are now stored, in a dry, monitored and easily retrievable state in steel containers in MAGS storage buildings.

The principal environmental benefits derived by the MAGS project are reduction in overall volume of LLRW wastes being stored at CRL (due to compaction of loose wastes), and a significant reduction in the quantity of waste (up to 95%) stored in unlined sand trenches.

The MAGS storage buildings are prefabricated metal buildings with reinforced concrete floors containing drainage and ventilation systems. Each building has a capacity for two years' worth of low-level radioactive waste at CRL. Solid Wastes are packaged either in steel containers or in 45-gallon drums for storage.

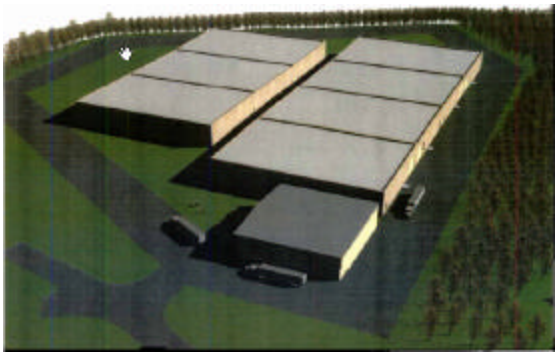
3.2.3 Bunkers

Bunkers are located in Waste Management Area "B". Waste Management area B was put into service in 1953. The early bunkers were of a rectangular design, which were in use between 1959 and 1978. The rectangular bunkers walls are 6 inches thick and the base is 8 inches thick. The rectangular design was replaced by a more robust less maintenance intensive cylindrical design which is still in use today. The entire structure is reinforced concrete. The floors and walls are 6 and 10 inches thick respectively. The floor is sloped to a center pump pit and a liquid detection tube runs from the sump pit to ground level to allow for detection of any in-leakage.

While in use, the bunkers are covered with a metal weather shield. On closure, the bunker is covered with a flat 6 inch reinforced concrete roof.

Bunkers are near surface low/intermediate level storage structures. Typical waste packages are soft materials (mop heads, tyveks), IX columns, filters and bitumen drums from the solidification process at the WTC.

3.2.4 Future Project: Shielded Modular Above Ground Storage (SMAGS)



The Shielded Modular Above Ground Storage (SMAGS) structures are based on the same principle as the MAGS, with the metal wall replaced by a 10-inch concrete wall. The SMAGS structures will house the MAGS type waste and some higher activity wastes from the bunkers. The SMAGS provides better use of available land. A project is currently underway to begin construction the first on these structures in 2006.

3.2.5 Tile Holes

Tile holes are concrete, steel-lined containers intended for high-level waste. Tile holes are 3.6 to 4.9 m deep and from 15 cm to 90 cm wide. The excavated tile hole construction area is backfilled with sand.

Tile holes are used to store radioactive materials that require more shielding and heat dissipation than materials stored in bunkers. All wastes transferred to tile holes is done through shielded flasks. Tile holes are continually monitored to ensure integrity and containment. Waste consists primarily of used reactor components and fuel.

3.2.6 CANISTERS

In 1988, 12 cylindrical canisters were built for the storage of fuel from NPD. Eleven are fuel and one is kept as a spare. The Canisters are:

- made of reinforced concrete with an internal liner of 34-inch carbon steel pipe,
- 6.2 m high and 2.6 m outside diameter,
- supported on reinforced concrete foundations placed directly on bedrock, and
- designed for deadweight, thermal, wind and seismic loads.

All canister transfers are performed with shielded flasks with an overhead crane.

Canister storage will be used for storage of calcined waste form isotope production and is being considered as an alternative for future high-level storage within one of our new storage projects.

3.3 Waste Segregation and Hazardous Waste Programs

3.3.1 Waste Segregation Program

The primary objective of this activity is to prevent non-radioactive waste from going into radioactive waste management areas, and ensuring that waste going off-site or to non-radioactive facilities at the CRL are not radioactively contaminated. Using the "3R" approach – reduce, reuse, recycle – WMO is ensuring the on-going availability of both CRL landfills and municipal landfills.

3.3.2 Hazardous Waste Chemical Program

The Hazardous Chemical Waste Program (HCWP) manages (segregates, collects, routes, tracks, stores, monitors and dispositions) all AECL CRL hazardous chemical waste and mixed waste (waste that has a chemical hazard and a radiological hazard). The key program principle, and one that is constantly emphasized, is that the foundation of good waste management is early segregation. To be most effective this must begin at the source - with the waste generator. The HCWP is constantly training and educating waste generators on the importance of waste segregation. A second and equally important program principle is that waste history is crucial in determining waste classifications and segregation requirements.

When waste is deemed to be non-radioactive (by history, segregation and field monitoring), it passes through an enhanced verification monitoring process to confirm a non-active status. If confirmed non-active, the waste is processed for off-site disposal by a Ministry of the Environment (MOE) certified hazardous waste disposal company. If the waste fails verification and deemed to be active, it is stored in one of the hazardous active storage facilities to be dispositioned at a later date.

Waste initially classified as active is analyzed to confirm its activity.
There are a couple of options for the disposition of liquid radioactive wastes (aqueous or organic). Aqueous wastes are processed through the CRL Waste Treatment Centre and organic liquids are transported to a company in the United States.

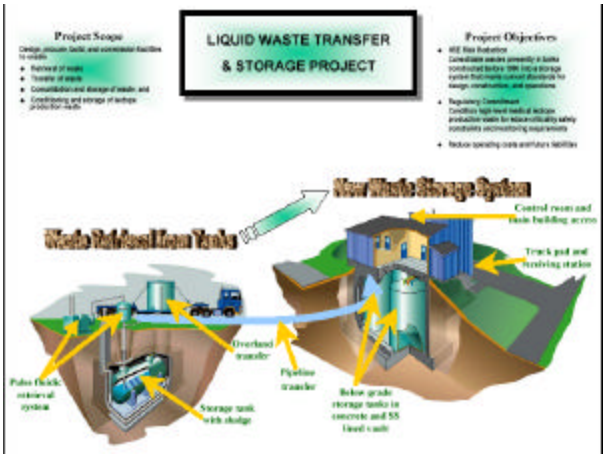
3.4 Technical Unit

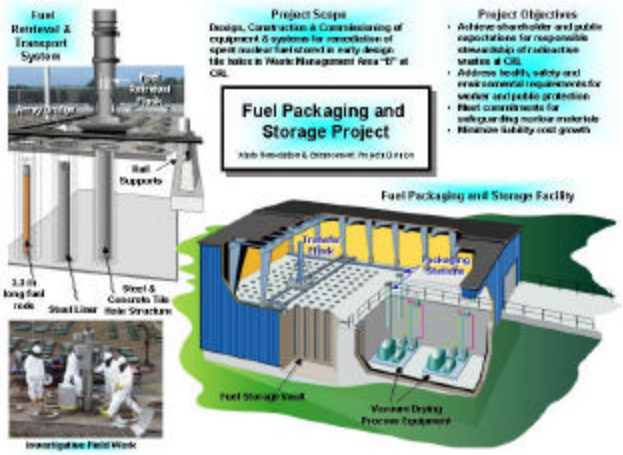
The Technical Unit is a highly experienced engineering team in facility operations. They allow the WMO facilities to remain focussed on the routine operation and maintenance by:

- providing technical solutions to non-routine problems;
- taking on significant projects; and
- acting as the client or operations representative with major-project teams who require a strong technical interface with the facility.

The Tech Unit provides a strong presence on major projects to ensure the operability and maintainability of the final deliverable and ease the commissioning and transition into operation.

The unit is built-up from experience gained in the routine operation of the supported facilities. The group affords experienced operating engineers the chance to grow by interacting more broadly with other AECL support groups such as project management, design, safety and licensing, environmental protection, maintenance and planning.





4 FUTURE OPERATIONS

Waste Management Operations is dedicated to continuous improvement. As such, we are investigating and moving away from existing "traditional" waste storage structures. A few of the projects currently underway are:

- Major Projects:
- Tile Hole Replacement,
- Stored Liquid wastes,
- WTC upgrades,
- Active Drains / Holding Tank Facility,
- Shielded Low Level Waste Storage,
- New high level waste storage,
- Security Improvements,

5 SUMMARY

CRL has been in the Waste Management business since 1946. This was a general overview of Chalk River waste programs and facilities, providing a glimpse at our past, present and future.

Waste Management Operations is committed to the continual improvement and enhancements of waste management practices. Interactions with customers help us ascertain future waste needs and ensure waste storage/program options are available when needed. We actively pursue opportunities that will reduce or eliminate nuclear liability. Our priority is the protection and safety of our employees, the public and the environment