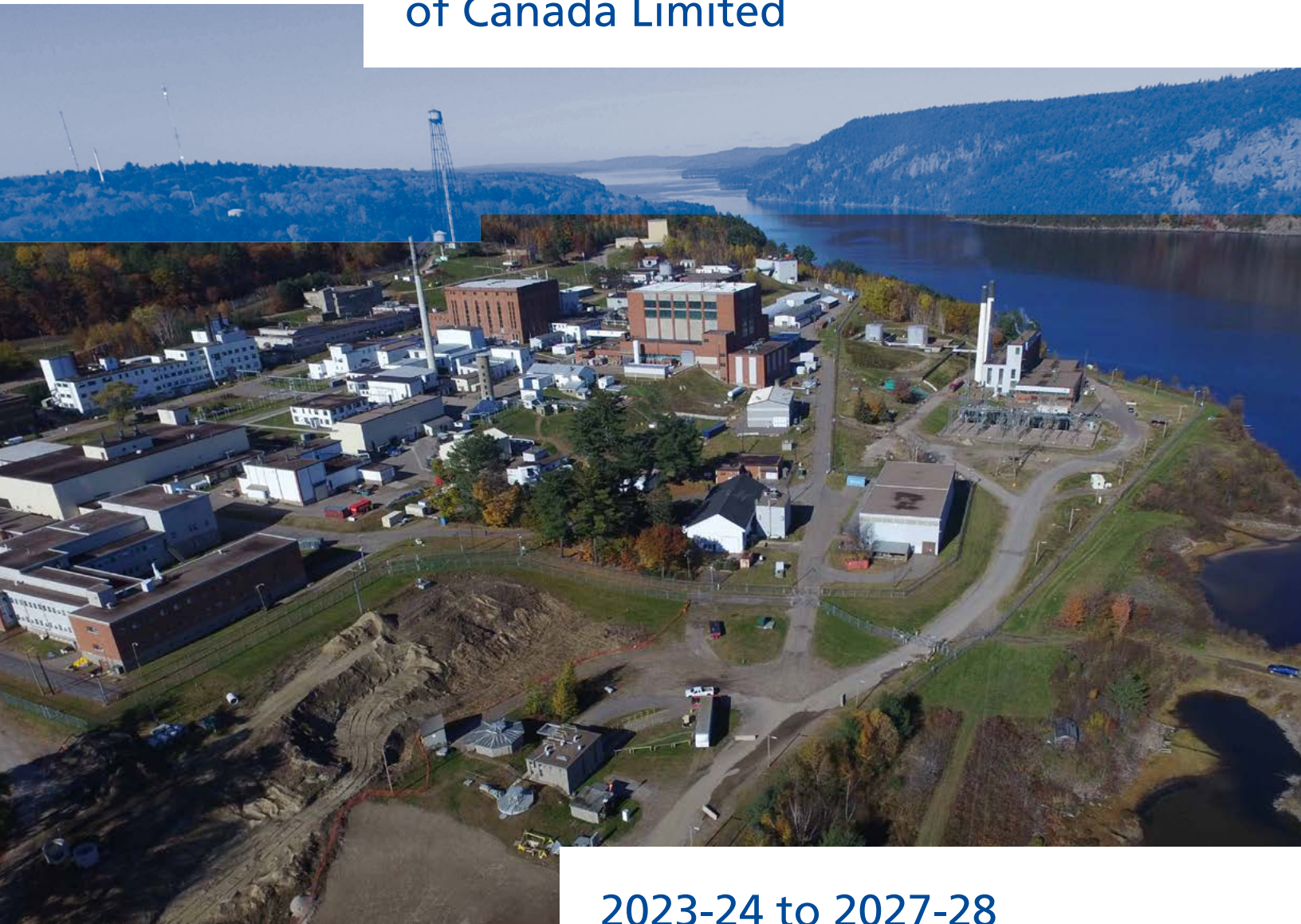


# Atomic Energy of Canada Limited



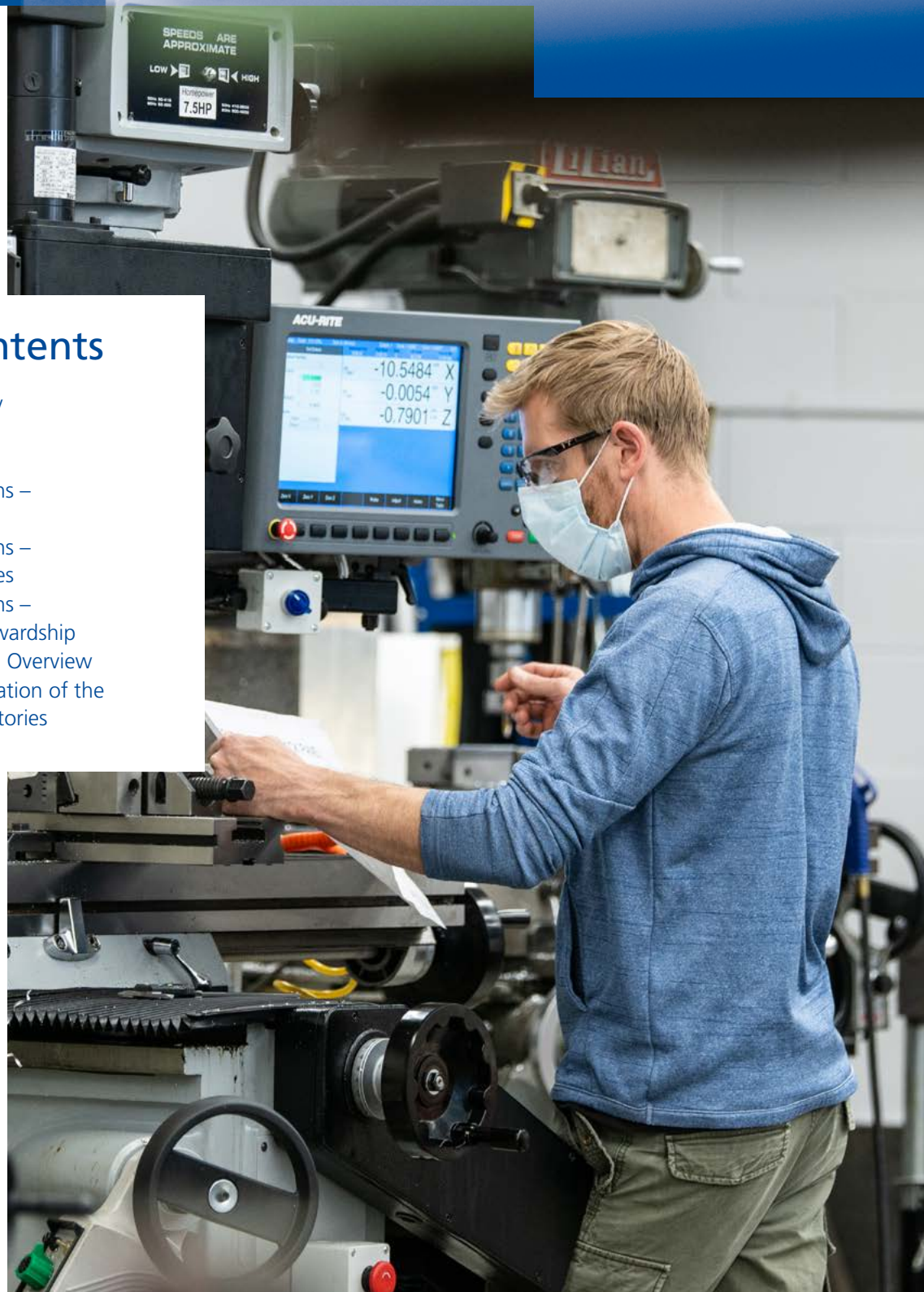
## 2023-24 to 2027-28 Corporate Plan Summary

Leveraging the full potential of Canada's expertise  
in nuclear science and technology



## Table of Contents

- 1 Executive Summary
- 3 Overview
- 5 Corporate Profile
- 10 Objectives and plans – Reconciliation
- 11 Objectives and plans – Nuclear Laboratories
- 23 Objectives and plans – Environmental Stewardship
- 34 Annex 1 - Financial Overview
- 41 Annex 2 - Revitalization of the Chalk River Laboratories



With gratitude, AECL acknowledges that it operates on the territories that have, since time immemorial, been the traditional lands of Indigenous peoples in Canada.



# Executive Summary

Atomic Energy of Canada Limited (AECL), a federal Crown corporation, works to advance Canada's interests through leading edge nuclear science and technology and environmental protection initiatives. This includes combating climate change through clean energy growth and decarbonization strategies, pioneering new treatment methods for cancer and other diseases, and accelerating Canada's environmental remediation projects.

## Mission

Driving nuclear innovation to deliver clean energy technologies and improve the quality of life of Canadians while caring for the land.

## Vision

Leveraging the full potential of Canada's expertise in nuclear technology to achieve a better future for Canada and the world.

Since 2015, AECL has been delivering its mandate through a Government-owned, Contractor-operated model, whereby a private-sector organization, Canadian Nuclear Laboratories (CNL), operates AECL's sites. This change in delivery model has brought about significant transformation. CNL has made major progress in revitalizing the Chalk River site, where it has demolished more than 116 buildings and structures, upgraded a substantial portion of the site's supporting infrastructure, and built two important science facilities. The goal of this revitalization is to build a modern, state-of-the-art nuclear science and technology campus that attracts the next generation of scientists who will drive nuclear opportunity for Canada.

With AECL oversight, CNL has also worked to place itself at the forefront of global efforts in exciting and valuable nuclear science and technology advancements, demonstrating production capabilities of an extremely rare isotope used in cancer therapy, partnering with other companies to advance the demonstration of small modular reactors, and demonstrating production of hydrogen without greenhouse gas emissions. This is in addition to projects studying advanced nuclear fuels, environmental sciences, cyber security, radiopharmaceutical development, and many other areas of research.

At the Chalk River Laboratories, nuclear science and technology activities continue to benefit both the Government of Canada and the broader nuclear industry. Through the Federal Nuclear Science and Technology Work Plan, research and scientific activities are undertaken to serve the needs of fourteen federal departments and agencies in the areas of energy, health, safety and security, and the environment. CNL leverages the capabilities and expertise at the laboratories to grow and diversify commercial revenues, thereby positioning itself as a key player in nuclear science and technology in Canada and internationally.

For over 70 years, AECL has been Canada’s engine for advancing nuclear science and technology by attracting the best minds from Canada and around the world to develop cutting edge nuclear technologies. These innovations have been deployed worldwide, saving millions of lives through medical isotopes, displacing megatons of greenhouse gases through the deployment of the CANDU nuclear reactor technology, and advancing the application of nuclear science in different fields – earning Canada two Nobel prizes.

Our past has made us what we are today: a Tier 1 nuclear nation with our own nuclear technology, fleet, and supply chain. AECL plays a key role in bringing together the Canadian nuclear community to achieve climate and innovation objectives, and to drive nuclear innovation for Canada. Notably, this role includes ensuring that AECL’s intellectual property for the CANDU reactor technology is exploited to its fullest in the pursuit of climate and innovation objectives as well as energy security and jobs for Canadians.

This 2023-24 Corporate Plan Summary outlines AECL’s activities, objectives and plans to advance nuclear innovation, address environmental liabilities, and deliver on its capital plan. This includes building a world-class nuclear laboratory at Chalk River and AECL’s ongoing work to build long-term, meaningful relationships with Indigenous communities in alignment with the government’s reconciliation agenda. The plan also notes AECL’s upcoming activities to undertake a competitive procurement process to renew the contract for the management of CNL under the Government-owned, Contractor-operated model.

### **CANDU Reactor Technology**

The CANDU reactor technology, developed by AECL at the Chalk River Laboratories, is one of Canada’s greatest engineering achievements.

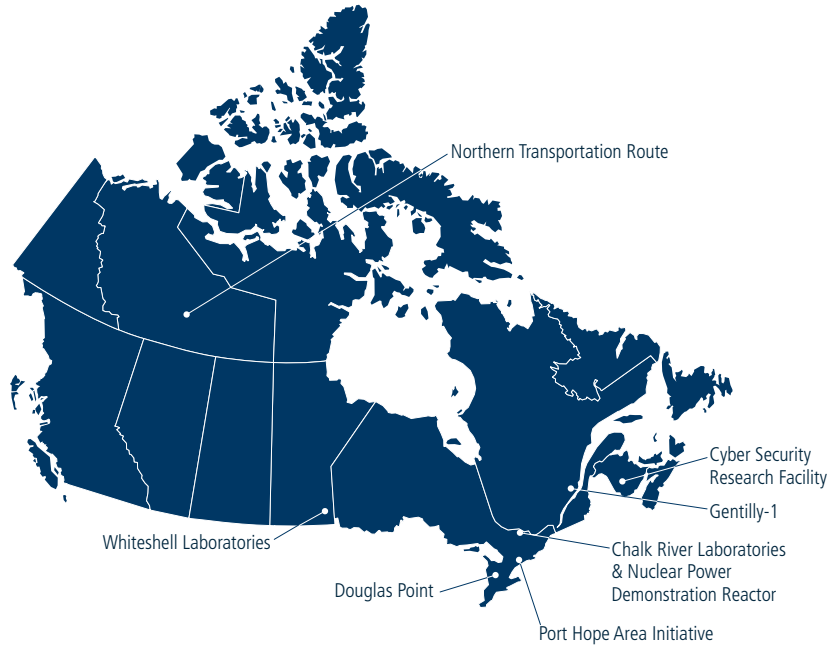
Nineteen CANDU reactors currently used in Canada provide 15% of the country’s non-emitting electricity. Another ~30 reactors (CANDU or CANDU-derivatives) are used internationally. Approximately 10% of all power reactors operated around the world are CANDU or CANDU-derivatives.

AECL is working with federal and provincial governments, together with industry, to identify and assess opportunities for “large nuclear” technologies, including the potential refresh of CANDU design to meet the energy needs of tomorrow.

Making the CANDU technology part of Canada’s net zero 2050 solution leverages decades of investment in CANDU technology and intellectual property, creates additional economic and energy security benefits for Canada through a nearly fully Canadian supply-chain, positions the innovative next generation CANDU for export, and cements Canada’s leadership in an area that is critical to our future prosperity.

# Overview

AECL is a federal Crown corporation mandated to enable nuclear science and technology, derive optimal value for Canada from AECL's CANDU intellectual property, and to protect the environment by fulfilling the Government of Canada's radioactive waste and decommissioning responsibilities. AECL undertakes this work at several sites across Canada, with headquarters in Chalk River, Ontario. AECL's operating model allows it to leverage private sector expertise and experience to advance work and drive priorities.



## Nuclear Innovation (Nuclear Laboratories)

AECL is focused on leveraging the successes of its past as well as future nuclear innovation to benefit Canada and Canadians. Working with industry, AECL is enabling the development of new technologies to advance Canada's climate change goals, including small modular reactors, clean hydrogen, and fusion. Advancements in nuclear medicine are also being pursued in an effort to further revolutionize the diagnosis and treatment of diseases. This includes supporting the research and development of new and promising nuclear health technologies, including new and emerging areas for cancer treatment such as targeted alpha therapy.

Work in these areas is enabled by the vast and unique capabilities that reside at CNL and the Chalk River Laboratories, Canada's largest science and technology complex and host to nearly 3,000 employees. The work undertaken at the laboratories supports Canada's federal roles, responsibilities, and priorities in the areas of health, energy and climate change, the environment, and safety and security. Services are also provided to industry and other third parties on a commercial basis. The Chalk River Laboratories are currently undergoing an important renewal that will transform the site into a modern, world-class nuclear science and technology campus, thanks to a 10-year, \$1.3 billion government investment that began in 2016.

## Environmental Stewardship (Decommissioning and Waste Management)

AECL's objective is to safely and responsibly address the environmental responsibilities and liabilities which have resulted from legacy activities at AECL sites. These legacy liabilities are the result of decades of significant contributions and advancements in nuclear science which have benefitted Canadians and the world, including the development of the CANDU technology and the production of medical isotopes used in the diagnostic and treatment of cancer and other diseases. AECL is focused on the decontamination and decommissioning of redundant structures and buildings, the remediation of contaminated lands and the management and disposal of radioactive waste at AECL sites, primarily at the Chalk River Laboratories in Ontario and the Whiteshell Laboratories in Manitoba.

AECL is also responsible for the remediation and long-term management of sites contaminated with historic, low-level radioactive waste where the Government of Canada has accepted responsibility, most notably as part of the Port Hope Area Initiative.

AECL receives funding from the Government of Canada and earns commercial revenues to deliver on its mandate. As a federal Crown corporation, AECL reports to Parliament through the Minister of Natural Resources.



### Reconciliation

As stewards of the environment, AECL recognizes that our nuclear science and research activities have created radioactive materials and waste, and we are committed to addressing this responsibly. We are dedicated to working in partnership with Indigenous communities to recognize and incorporate traditional knowledge, ceremony, and various cultural and stewardship practices. We have much to learn from each other as we work towards our common objective of environmental protection.

AECL is committed to collaborating with Indigenous groups in the spirit of reconciliation and is working hard to build new relationships and strengthen existing ones, while recognizing that meaningful engagement takes time.

# Corporate Profile

## Operating Model: The Government-owned, Contractor-operated Model

Under the Government-owned, Contractor-operated model, AECL owns the sites, facilities, assets, intellectual property and responsibility for environmental remediation and radioactive waste management. CNL is responsible for the day-to-day operations of AECL's sites, is the employer of the CNL workforce, and is responsible for all licenses and permits.

The Government-owned, Contractor-operated model allows AECL to leverage private-sector expertise and experience to accelerate the decommissioning and radioactive-waste management program, build a world-class nuclear laboratory at Chalk River to fulfill government requirements, and reduce costs and risks to Canada over the long term. As the government's agent, AECL brings value to Canada by overseeing the Government-owned, Contractor-operated arrangement and supporting the government's development of nuclear policy. Under this model, AECL can advance its priorities efficiently and effectively while ensuring that CNL meets and exceeds rigorous safety, security, and environmental requirements.



### AECL oversees all CNL activities:

- We set priorities for CNL.
- We approve their long-term plan.
- We provide guidance for and approve their annual plan and budgets.
- We use internationally recognized tools to track performance based on activities set out in the plans.
- We review their performance and perform audits.
- We can reduce fee if performance is not adequate.

AECL sets priorities for CNL and assesses its performance. In other words, AECL sets out “what” needs to be achieved with CNL deciding “how” it is best executed.

AECL provides strategic guidance annually to CNL for the development of its plans which, in turn, are supported by, and align with, longer term plans which are accepted by AECL. CNL's performance is tracked based on its planned activities, including project milestones and deliverables.

To systematically monitor and assess contractor performance, AECL issues a performance plan annually. The performance plan is based on, and developed in parallel with, the annual plan. It outlines AECL's priorities for CNL and sets out areas where the contractor stands to earn fee for the management and operation of AECL's sites, as per contractual arrangements. Two specific projects, the closure of the Whiteshell Laboratories and the Nuclear Power Demonstration reactor site, are managed separately under target-cost contracts.

AECL leverages other project management and performance measurement tools to track the performance of CNL, including an Earned Value Management System (an internationally recognized tool that allows for the simultaneous tracking of work scope, schedule, and cost) and a Contractor Assurance System (a comprehensive and integrated performance assurance regime that allows for the capture of performance metrics across a wide array of work areas).

The current Government-owned, Contractor-operated contract is set to expire in September 2025. AECL has launched a competitive procurement process to renew the contract for the management of CNL.

For more information on the Government-owned, Contractor-operated model visit our website [www.aecl.ca](http://www.aecl.ca).

## Internal Environment

AECL oversees an important portfolio of work. Sound management underpinned by a comprehensive contract management approach is at the core of the organization's strategy to deliver results for Canada in the most effective and efficient manner. Amongst key internal challenges and strategic issues being managed by AECL, three are notable and presented below.

**Contractor performance.** As AECL relies on a private-sector contractor to execute scope related to its mandate, an inherent internal risk is the possibility of the contractor being unable to consistently execute and perform based on agreed-upon plans. To mitigate this risk and drive the appropriate behavior, the contract with CNL is carefully structured to include several mechanisms for AECL to track CNL's performance, as discussed in the Operating Model section above. Key amongst these is a performance measurement plan, which is used by AECL to set priorities supported by achievable stretch targets to drive value for money for Canada. Ongoing evaluation of the contractor against the plan throughout the year provides AECL the opportunity to highlight strengths and weaknesses and the contractor the opportunity to correct course where needed.

**Costs to operate Chalk River Laboratories.** The shutdown of the National Research Universal (NRU) reactor in 2018 has created cost and funding pressures. This is due to the combination of lost revenue from the activities of the reactor (including isotope sales), diminishing funding for NRU, and site costs that have not proportionally decreased. Key mitigation measures include working with CNL to look at all options for lowering costs and increasing revenues. This is actively being pursued and implemented to enable a sustainable and science-focused organization in the long-term, while protecting workers, the public, and the environment.

**Human resources.** AECL is a small organization that relies on a complement of national and international experts, many of whom bring experience in the management of Government-owned, Contractor-operated arrangements from both a government and contractor perspective. In 2023-24, the number of AECL employees is expected to increase to 50-55, which is due to the activities related to the competitive procurement process to renew the contract for the management of CNL. AECL's goal is to maintain the necessary expertise and capabilities to oversee the Government-Owned, Contractor-Operated model and bring value for money for Canada.

AECL is also committed to supporting diversity, equity, and inclusion, from identifying discrimination, harassment, or lack of opportunities, to recognizing the different perspectives that employees bring to the workplace. Women make up 50% of AECL's workforce, visible minorities 9%, and Indigenous Peoples 2%. AECL has in place a Diversity, Equity, and Inclusion Plan with three over-arching goals:

- Workplace Inclusion: Promote a culture that encourages collaboration, flexibility, and fairness to enable individuals to contribute to their highest potential.
- Workplace Diversity: Attract, retain, and develop a talented and diverse workforce; and,
- Employee Capability: Enable employees' knowledge and understanding of what is meant by diversity and inclusion.

In 2023-24, AECL will further advance this through the implementation its Accessibility Plan in support of the Accessible Canada Regulations, by conducting a cultural competency assessment, and by continuing to implement strategies and plans to support mental health initiatives.



### **The Commissioner of the Environment and Sustainable Development's Audit on the Management of Low and Intermediate Level Radioactive Waste**

In 2022, the Commissioner of the Environment and Sustainable Development (part of the Office of the Auditor General of Canada) concluded an audit on the Management of Low and Intermediate Level Radioactive Waste which looked at AECL, Natural Resources Canada and the Canadian Nuclear Safety Commission's practices. It concluded that:

"Overall, [Natural Resources Canada, the Canadian Nuclear Safety Commission and AECL] did a good job of managing the low and intermediate level radioactive waste that makes up 99.5% of Canada's radioactive waste output. The entities' management of this waste aligns with key international standards that seek to protect the environment and the safety of current and future generations."

With respect to AECL, it noted that, "Atomic Energy of Canada Limited was improving its inventory information, but public reporting could be enhanced." Specifically, it noted that "Atomic Energy of Canada Limited should ensure that its public reporting clearly aligns its plans and activities with how it is addressing historic and legacy waste. For increased transparency, these reports should include monitoring activities and timelines." AECL has developed an action plan to respond to these recommendations, most of which has already been implemented. The remainder of the action plan is expected to be completed in 2023.

With operations in remote locations, attracting and retaining highly qualified personnel is a key focus. Efforts in this area include focusing on talent management, career advancement opportunities, succession planning, and regular total reward reviews for AECL to remain competitive amongst similar employers nationally and internationally.

## **External Environment**

External factors continue to play a significant role in the delivery of AECL's activities, including the activities of CNL under AECL's oversight. Amongst key external challenges and strategic opportunities being managed by AECL, three are notable and presented below.

**COVID-19 Pandemic:** While federal and provincial restrictions have been lifted, the pandemic continues to influence AECL's sites and CNL's activities. As is the case in other areas of the economy, AECL and CNL are affected by inflation, as well as supply chain issues which impact delivery, schedule, and cost to varying degrees.

**Environmental Stewardship:** As part of AECL's environmental stewardship responsibilities, three projects are currently undergoing Environmental Assessments through the Canadian Nuclear Safety Commission:

- Construction of a near surface disposal facility at the Chalk River Laboratories.
- In-situ decommissioning of the WR-1 research reactor at the Whiteshell site.
- In-situ decommissioning of the Nuclear Power Demonstration facility in Rolphton, Ontario.

AECL and CNL are dedicated to engaging stakeholders, the public, and Indigenous communities early and often, and throughout the regulatory process. Project timelines have been extended to consider all comments and concerns received, to accommodate additional scientific and technical studies requested by the CNSC, and to adjust aspects of the project, where possible, based on public, Indigenous, government and regulatory feedback.

**Next Generation Cancer Treatment:** CNL is leveraging its world-class expertise in medical isotope production to advance the development of targeted alpha therapy – a next-generation cancer treatment. To date, CNL has developed a generator to produce actinium-225 from its available nuclear materials, which has been used in pre-clinical and clinical trials to demonstrate the efficacy of the proposed therapy. Based on the promising results, CNL has explored opportunities to partner with others in the production of actinium-225 on a scale to support clinical trials more broadly (there are now more than 100 active clinical trials on this therapy) and more widespread use in treatment across Canada and internationally.

**Small Modular Reactors:** CNL is pursuing opportunities related to small modular reactors, designed to be built at a smaller size but in greater numbers than most of the world’s current nuclear fleet. As part of its long-term vision, CNL seeks to become an incubator for small modular reactor demonstration by the private sector and for supporting associated research and development. To that end, CNL’s goal is to have a demonstration unit built by third parties at an AECL site before 2030. The objective is to advance small modular reactor technologies in Canada to contribute to Canada’s broader economic growth, competitiveness, science, innovation, sovereignty, and climate change objectives.

In Canada, small modular reactors have the potential for three major areas of application:

- On-grid power generation, especially in provinces phasing out coal. Utilities want to replace end-of-life coal plants with non-emitting base-load nuclear plants of similar size.
- On- and off-grid combined heat and power for heavy industry. Oil sands producers and remote mines have expressed interest in options for bulk heat and power that would be more reliable and cleaner than current energy sources, and small modular reactors represent a potential opportunity in this regard.
- Off-grid power, district heating, and desalination in remote communities. These currently rely almost exclusively on diesel fuel, which has various limitations (e.g., cost, emissions). Renewables and batteries can mitigate these limitations to some extent for residential power, but may not supply building heat, nor are they likely to offer reliable bulk energy to support economic development. Very small modular reactors have potential to be a game changer regarding development in the North, contributing to national sovereignty, energy security and the economy.

The opportunity related to small modular reactors is noteworthy given Canada’s extensive capabilities in nuclear technology, including academia, research, engineering, manufacturing, and existing supply chain. Economic benefits for Canada derived from small modular reactor development and deployment include an estimated 6,000 new jobs (direct and indirect) supporting a highly skilled labor force and an estimated \$10 billion in direct impacts and \$9 billion in annual indirect impacts between 2030 and 2040.<sup>1</sup> There is also significant export potential for technology and services related to this industry should Canada be at the forefront, including an estimated total global export potential of approximately \$150 billion per year between 2030 and 2040.<sup>2</sup>

These activities are responsive to the small modular reactor roadmap, which specifically recommended that, “Governments, utilities, industry, and the national laboratory support demonstration of small modular reactor technologies, preferably more than one, at appropriate sites in Canada.” Also, AECL and CNL are responding to all four recommendations specific to AECL and CNL, including doing preliminary site identification work, undertaking small modular reactor research and development, continuing the invitation process, and collaborating with international partners on small modular reactors.

<sup>1</sup> A Call to Action: A Canadian Roadmap for Small Modular Reactors. Small modular reactor roadmap steering committee, November 2018. Available online at [smrroadmap.ca](http://smrroadmap.ca).

<sup>2</sup> Ibid.

## Funding Requirements

The Government of Canada approved a ten-year funding profile in 2015 for AECL to enable it to leverage its contract with CNL to deliver its mandate. The funding profile carries AECL to September 2025, the end of the current contract. That date falls within the five-year period addressed by this Corporate Plan Summary. There is therefore a need to forecast funding requirements outside of existing funding parameters.

The two tables below differ in that the first includes approved funding only and the second table includes funding requirements beyond the current contract end date in September 2025. These are early and preliminary values and ultimately will be subject to further planning and funding approval.

### Total Funding Projections Based on Approved Federal Funding

<i>(millions of Canadian dollars)</i>	Notes	Actual 2021-22	Budget 2022-23	Plan					5 Year Total
				2023-24	2024-25	2025-26	2026-27	2027-28	
<b>Funding Requirements</b>									
Environmental Stewardship		714	945	1,141	968	451	80	10	2,649
Nuclear Laboratories - Operating		182	199	230	286	105	17	17	655
Nuclear Laboratories - Capital		113	147	171	159	81	–	–	411
<b>Federal Funding Requirements AECL</b>									
	1	<b>1,009</b>	<b>1,291</b>	<b>1,542</b>	<b>1,413</b>	<b>637</b>	<b>97</b>	<b>27</b>	<b>3,716</b>

<sup>1</sup> AECL currently has approved funding for the majority of its activities until mid-2025. Please refer to the next table for details on funding requirements beyond this date.

### Total Five-Year Projection of Federal Funding Requirements Including Unapproved Funding

<i>(millions of Canadian dollars)</i>	Notes	Actual 2021-22	Budget 2022-23	Plan					5 Year Total
				2023-24	2024-25	2025-26	2026-27	2027-28	
<b>Funding Requirements</b>									
Environmental Stewardship		714	945	1,141	968	901	900	807	4,717
Nuclear Laboratories - Operating		182	199	230	286	189	201	219	1,125
Nuclear Laboratories - Capital		113	147	171	159	145	150	155	780
<b>Federal Funding Requirements AECL</b>									
	1	<b>1,009</b>	<b>1,291</b>	<b>1,542</b>	<b>1,413</b>	<b>1,235</b>	<b>1,251</b>	<b>1,181</b>	<b>6,621</b>

<sup>1</sup> The table above includes, in addition to approved funding, preliminary AECL projections of anticipated funding requirements that have not yet been subject to the federal cycle for approval of expenditures by the government and Parliament. These estimates are subject to further planning, and neither their preliminary status nor the numbers should be interpreted as an indication of the future funding level for AECL.

# Objectives and Plans – Reconciliation

AECL's sites and operations are situated on the traditional land and territories of Indigenous Peoples in Canada. Both AECL and CNL are committed to building meaningful and collaborative relationships with Indigenous Peoples based on the recognition of rights, respect, truth, cooperation, trust, and partnership.

AECL's commitments are:

- Listen, understand, learn, and take meaningful actions to advance reconciliation and healing.
- Learn about and understand the culture, traditions, and worldviews of the Indigenous Peoples on whose territories we operate.
- Consider and seek to integrate Indigenous knowledge and values in our activities.
- Empower and enable opportunities for Indigenous Peoples to participate in our projects for mutual benefit.

During the procurement process, AECL will continue to build meaningful relationships with Indigenous communities, recognizing that this takes time. Various agreements have either been put in place or are at different stages of development. AECL will continue to pursue these agreements, including identifying work and activities that will demonstrate commitment to Indigenous communities beyond these agreements.

A reconciliation action plan will also be co-developed with Indigenous communities to further identify collaboration and partnerships.





# Nuclear Laboratories

AECL has been leading nuclear science and technology for over seven decades. The organization was the birthplace of Canada's nuclear industry, having hosted the first sustained criticality (controlled nuclear chain reaction) outside of the United States. More importantly, the Chalk River Laboratories were the birthplace of the CANDU reactor technology, a technology that is currently used at 19 reactors in Canada, providing 15% of Canada's electricity, and 30 (CANDU or CANDU-derivatives) internationally. CANDU reactor technology also provided the research and facilities for breakthroughs in the life saving application of medical isotopes, including cobalt-60. Work undertaken at the Chalk River Laboratories has led to numerous and important scientific achievements – including two Nobel Prize winners.

Over the years, AECL has played an important role in supporting public policy and in delivering programs for the Government of Canada. This includes the production of medical isotopes and the provision of nuclear science and technology in the areas of energy, non-proliferation, emergency preparedness, counterterrorism, health, and security. AECL's unique facilities have made it an attractive research destination for scientists across Canada and the world, leading to home-grown innovation and the development and retention of highly qualified nuclear workers and scientists.

The restructuring of AECL and the implementation of the Government-owned, Contractor-operated model have brought new opportunities for building on this important scientific legacy. AECL's mandate has been clearly defined by Government to leverage the capabilities at the Chalk River Laboratories to support the federal government's needs and responsibilities in nuclear science and technology (through the Federal Nuclear Science and Technology Work Plan and work for federal departments and agencies as a federal lab), as well as to provide services to third-parties on a commercial basis. This has been further enabled by an investment of \$1.3 billion over 10 years starting in 2016 for new and renewed science and site support infrastructure at the Chalk River Laboratories, with the objective of building a world-class, state-of-the-art nuclear science and technology campus.

Nuclear science and technology activities at the Chalk River Laboratories support AECL's Federal Nuclear Science and Technology Work Plan, which helps the Government of Canada deliver on its responsibilities in the areas of health, nuclear safety and security, energy, and the environment.

AECL's planned results in this area include servicing the nuclear science and technology needs of federal departments and agencies and advancing nuclear knowledge, innovation, job creation, and the use of clean technologies. AECL and CNL are focused on increasing collaboration and partnership with other nuclear industry members, academia, and national laboratories. The advancement of nuclear technologies for the benefit of Canadians and the growth of commercial business opportunities also remains a priority.

CNL has developed a strategic approach to delivering an integrated, effective, project-based, and customer-focused science and technology mission that serves the needs of the federal government as well as those of external customers. Based on an assessment of existing capabilities, external environment, and market opportunities, CNL has identified eight strategic initiatives that it will focus on during the planning period which support the needs of the federal government and third-party customers to tap into new and expanded markets.

**Small modular reactors:** With the release of Canada's Small Modular Reactors Action Plan in December 2020, the Government of Canada has recognized the potential of small modular reactors to help achieve Canada's goal of net zero by 2050. CNL's goal is to demonstrate the commercial viability of the small modular reactor before 2030 with a view to positioning Canada to take a leadership role in this emerging nuclear technology. The objective is for Canada and CNL to provide low-carbon, reliable, load-following, scalable and cost-effective energy options to remote communities, mining and oil and gas applications, and to fill other energy gaps and needs.



### Small Modular Reactors

Small Modular Reactors are small reactors aimed at new markets, tackling a critical and time sensitive global need for safe, clean, economic energy. In Canada, this could mean vital, new clean energy options for replacing coal, greening resource extraction, and improving energy security for remote communities.

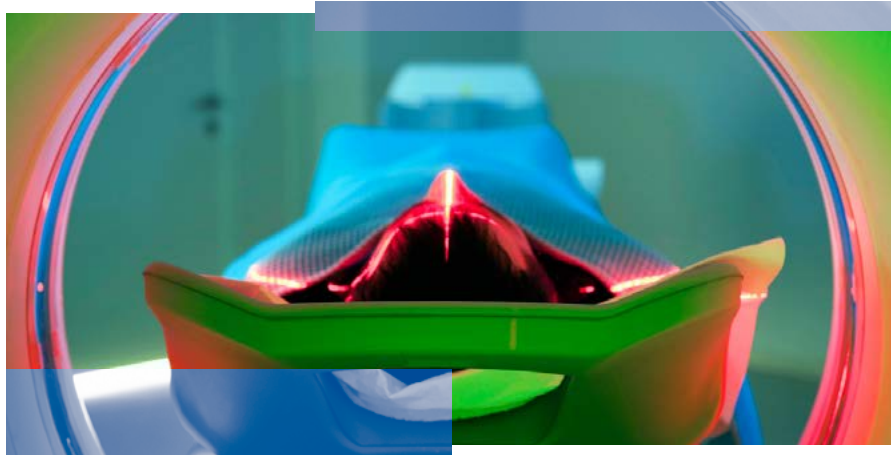
Canada is at the forefront of the small modular reactor industry thanks to the release of a roadmap convened by the Government and to CNL's work to site a demonstration reactor at an AECL site before 2030. This small modular reactor program is attracting significant attention worldwide as evidenced by the strong response to CNL's process to invite applications. Currently, three respondents have successfully completed the pre-qualification stage, and one has further progressed in the process, including applying for a license to prepare a site, which would make it Canada's first small modular reactor. CNL is supporting the vendors on commercial terms.

**Advanced fuel fabrication:** Development of advanced nuclear fuel concepts to support the long-term reliability of existing reactors and the development of advanced reactors. These advanced fuels offer higher performance, improved failure tolerance, increased safety, proliferation resistance and accident tolerance, and are recycled or recyclable. As new methods are required to fabricate these fuels, CNL is reviewing the go forward strategy on advanced fuels to align with emerging markets in small modular reactors.

**Hydrogen and Tritium Sciences and Applications:** CNL is building on capabilities developed to support hydrogen safety and heavy water and tritium management in CANDU reactors and leveraging recent capital investment in modern hydrogen laboratories. CNL's goal is to explore hydrogen, hydrogen safety and catalysts for clean energy systems and to advance work with tritium in detritiation, fusion and low power sources. Hydrogen technology offers low-carbon options for the energy and transportation sectors, which supports Canada's international commitments for carbon reduction and national objective of achieving net zero by 2050.

**Nuclear forensics, detection and response:** The need for science and technology activities in nuclear security continues to grow in Canada, as evidenced by the Government's renewed commitments to nuclear threat reduction, both domestically and abroad. There is a growing demand from government departments and agencies for nuclear science and technology expertise to inform their response to emergent national and international issues concerning nuclear safeguards, safety, and security. CNL has established a center for government agencies and commercial partners to develop, test, calibrate and validate nuclear forensics, non-proliferation, security and response technologies and materials. Furthermore, CNL is supporting work to improve safeguards and security at the borders by developing essential tools to detect contraband special nuclear materials.

**Targeted alpha therapy research:** Targeted alpha therapy is a new area of research in the battle against cancer and other diseases. The benefit of this therapy is that the radiation is targeted at just the cancer cell, unlike existing treatments that often involve radiation of all cells in the vicinity of a tumor, healthy and cancerous. CNL aims to become the center of international research efforts and a key supplier for these alpha-emitting isotopes by applying its expertise in isotope separation and scaling up of processing and handling radionuclides. CNL has developed and completed a demonstration of a first suite of targeted alpha therapy compounds under the Federal Nuclear Science and Technology Work Plan.



### Targeted Alpha Therapies

While current forms of radiation treatments affect many cells in the body, both healthy and cancerous, targeted alpha therapy is significantly more focused and delivers the radiation directly to the cancerous cells by chemically binding appropriate radionuclides with targeting biomolecules. This is both more effective in killing cancer cells as well as protecting healthy cells. A radionuclide with significant potential in this therapy is Actinium-225, but it is extremely rare and difficult to produce. CNL first demonstrated research quantity production of Actinium-225 through the Federal Nuclear Science and Technology Work Plan. Subsequently, and in partnership with TRIUMF (Canada's particle accelerator centre), the first production run of Actinium-225 has recently been completed. The objective is to demonstrate commercial viability in order to support this important and exciting healthcare research and treatment.

**Nuclear cyber security:** Cyber security of industrial control systems is a growing concern in all industries, and particularly in the nuclear industry where it represents a multibillion-dollar worldwide market. While a large commercial industry caters to the cyber security of information technology systems, most solution providers are focused on conventional hacking and data theft. The cyber security of industrial control systems used in nuclear power plants and other critical energy infrastructure, as well as non-nuclear process plants, is a priority in the new era of modernization. CNL has expanded its cyber security facilities located in New Brunswick, which will enable them to offer secure services to, and collaborate on, level-2 secure technology needs with federal partners, including the Department of National Defence. CNL also has a deployable nuclear industrial control cyber intrusion detection and mitigation system and has developed a simulator of a reactor control system as a test bed for developing intrusion-resistant systems, intrusion detection and remediation.

**Reactor sustainability:** Support for Canada's fleet of existing reactors through work on life extension and long-term reliability of the existing fleet of CANDU reactors domestically and internationally, and expansion to include support for other reactor designs. CNL is transforming from a historical CANDU focus to a broader "CANDU and more" perspective and building on capabilities in advanced nuclear materials and fuels research and nuclear chemistry applications.

**Science and technology for advanced environmental sustainability:** CNL is working to expand the understanding of the behavior of contaminant radionuclides, and further develop safe, economical nuclear waste management technologies. The environmental technology capability will also continue to support the Government in monitoring for the presence and spread of low levels of contamination.

#### Nuclear Laboratories Five-Year Projection for Use of Approved Federal Funding

<i>(millions of Canadian dollars)</i>	Notes	Actual 2021-22	Budget 2022-23	Plan					5 Year Total
				2023-24	2024-25	2025-26	2026-27	2027-28	
<b>Nuclear Laboratories</b>									
Nuclear Laboratories – Operating		253	268	302	363	183	95	100	1,042
Revenue		70	68	72	76	78	78	83	387
Capital (Revitalization of the Chalk River Laboratories)		113	147	171	159	81	–	–	411
<b>Federal Funding Requirement</b>	<b>1</b>	<b>295</b>	<b>346</b>	<b>401</b>	<b>445</b>	<b>186</b>	<b>17</b>	<b>17</b>	<b>1,066</b>

<sup>1</sup> AECL currently only has approved funding for the majority of its activities until mid-2025. Please refer to the next table for details on funding requirements beyond this date.

#### Nuclear Laboratories Five-Year Projection of Federal Funding Requirements Including Unapproved Funding

<i>(millions of Canadian dollars)</i>	Notes	Plan					5 Year Total	
		2023-24	2024-25	2025-26	2026-27	2027-28		
<b>Nuclear Laboratories</b>								
Total Nuclear Laboratories			401	445	334	351	374	1,905
<b>Difference Between Approved Government of Canada Funding and Federal Funding Requirements Including Unapproved Funding</b>								
	<b>1</b>		<b>–</b>	<b>–</b>	<b>(148)</b>	<b>(334)</b>	<b>(357)</b>	<b>(838)</b>

<sup>1</sup> The table above includes, in addition to approved funding, preliminary AECL projections of anticipated funding requirements that have not yet been subject to the federal cycle for approval of expenditures by the government and Parliament. These estimates are subject to further planning, and neither their preliminary status nor the numbers should be interpreted as an indication of the future funding level for AECL.



# Federal Nuclear Science and Technology Work Plan

**Overview:** AECL oversees the delivery of the Federal Nuclear Science and Technology Work Plan for nuclear research and development to support the Government's priorities and core responsibilities in the areas of health, nuclear safety and security, energy, and the environment. The Federal Nuclear Science and Technology Work Plan serves to build, maintain and maximize those capabilities that are unique to CNL. AECL engages with fourteen federal departments and agencies to develop a program of work that meets broad federal needs and priorities and fosters innovation through the development of technologies and applications, while supporting Canada's international partnerships, commitments, and obligations.



## AECL's Federal Nuclear Science and Technology Work Plan includes the participation of:

1. Canada Border Services Agency
2. Canadian Nuclear Safety Commission
3. Canadian Space Agency
4. Communications Security Establishment
5. Defense Research and Development Canada
6. Department of National Defence
7. Environment and Climate Change Canada
8. Global Affairs Canada
9. Health Canada
10. Innovation, Science and Economic Development
11. Natural Resources Canada
12. National Research Council of Canada
13. Public Safety Canada
14. Royal Canadian Mounted Police

AECL's Federal Nuclear Science and Technology Work Plan focuses on four research themes:

### 1) Supporting the development of biological applications and understanding the implications of radiation on living things. This includes:

- Supporting the health and wellness of Canadians by developing better methods for diagnosis and treatment using biological applications of nuclear research.
- Improving the understanding of radiological health risks caused by exposure to radiation at levels found in occupational and public environments.
- Contributing to the body of evidence that informs the international radiation protection framework (e.g., United Nations Scientific Committee on the Effects of Atomic Radiation, International Commission on Radiological Protection, International Atomic Energy Agency).
- Collecting or generating evidence to inform the application of international recommendations in Canada and incorporation into Canadian regulations and national guidance.
- Increasing knowledge of the uncertainties in low-dose risk assessment to address challenges in regulatory policy, health assessment and public communication.
- Integrating sex and gender-based analyses, as well as diversity analysis, to ensure research accounts for diversity factors.
- Improving regulatory oversight of relevant sectors.
- Improving communication to the public and stakeholders.
- Supporting science as an essential pillar in the strategy to create sustainable economic growth, including an appropriate balance between fundamental research to support new discoveries and the commercialization of ideas; and
- Supporting Canada's response to future pandemics.

- 2) Supporting environmental stewardship and radioactive waste management.** This includes:
- Maintaining Canada's national and international leadership related to demonstrating strong, science-based and risk-informed regulation with respect to historical, current and future applications of nuclear technologies.
  - Supporting Canada's environmental stewardship by ensuring that nuclear energy technologies are developed within a robust framework that addresses environmental and waste management concerns.
  - Supporting the implementation of Canada's Pan-Canadian Framework on Clean Growth and Climate Change and related initiatives such as the SMR Roadmap and the Canadian Critical Minerals Strategy through research to support transparent, science- and risk-based decision making related to the environmental behaviour of naturally occurring and anthropogenic radionuclides.
  - Developing and demonstrating innovative technologies to reduce environmental impacts, increase Canadian competitiveness, and promote responsible use of clean technologies.
- 3) Enhancing national and global security, nuclear preparedness, and emergency response.** This includes:
- Developing and advancing science and technology to detect, monitor, track and characterize chemical, biological, and radioactive and nuclear materials, including special nuclear materials, and other threats (explosives).
  - Improving Canadian global leadership in S&T development to support nuclear non-proliferation, safeguards, and trade to export control objectives and part of Canada's broader aim to advance its security interests around the world.
  - Supporting Canada's international commitments on the peaceful use of nuclear energy and its interests in the Comprehensive Nuclear-Test-Ban Treaty, Fissile Material Cut-off Treaty and the International Partnership for Nuclear Disarmament.
  - Improving cyber security and protecting our nuclear critical infrastructure from cyber-threats.
  - Ensuring that Canada is ready to respond in an event of a radiological or nuclear emergency, in Canada or abroad through science and technology to inform decision-making and solutions in emergency situations.
  - Building and improving domestic pandemic resilience and long-term preparedness.
- 4) Supporting safe, secure, and responsible use and development of nuclear technologies.** This includes:
- Implementing the Pan-Canadian Framework for Clean Growth and Climate Change and helping achieve Canada's international greenhouse gas targets by reducing the environmental impacts of energy production, bringing clean energy onto the grid, reducing industrial emissions, and reducing diesel use in remote areas.
  - Increasing competitiveness and promoting the use of clean technology through research, development, and demonstration of innovative nuclear energy technologies.
  - Supporting the Government of Canada's SMR initiatives including recommendations linked to the SMR roadmap and SMR Action Plan.
  - Delivering on Canada's commitment under Mission Innovation to advance clean energy research, development, and demonstration while encouraging private sector investment and increasing domestic and international partnerships.
  - Giving effect to Canada's bilateral partnerships on nuclear science and technology with countries such as United States, and United Kingdom, as well as multilateral partnerships including the Nuclear Energy Agency, Clean Energy Ministerial, and the Government's extension of the Generation IV International Forum (GIF) Framework Agreement and participation in GIF System Arrangements.
  - Informing potential programs, regulations, and policies of nuclear energy technologies; and
  - Providing risk-informed, science-based evidence for regulatory decision making.



**Status:** In 2022-23, the federal interdepartmental committees, representing fourteen departments and agencies, continued to work with CNL on developing a program of work that addresses the medium and long-term Government priorities in the areas of climate change and a clean environment, innovation for economic growth and prosperity, and the health, safety, and security of Canadians. This includes work to:

- Advancing small modular reactor technologies and deployment for Canada to inform regulatory guidance, assessments, and policies such as experimental validation of predictive models in support of safety analysis and licensing and the development of sensor monitoring of remote and underground structures.
- Examining the safety and efficacy of Actinium-225 in support of new medical applications and developing proof-of-concept production of high-quality radioisotopes for cancer treatments.
- Supporting regulatory and licensing decisions for projects to understand the behavior of materials in advanced reactors, small modular reactors and the current fleet in extreme environments.
- Examining the effects of aging, corrosion and degradation of in-core materials for new and current reactor types as well as develop state of the art online monitoring networks.
- Examining the potential for small modular reactors to meet the needs of a near-zero carbon remote mining operation.
- Contributing to Canada's emergency response capability by developing improved bio dosimetry techniques for rapid triage in emergency response; improvement of techniques for rapid measurement of radionuclides and development of decorporation and decontamination techniques.
- Improving the understanding of the basis of biological effectiveness of different radiations at low doses and dose rate.
- Advancing technologies for the detection of special nuclear materials at the border.
- Studying nuclear security and emergency response considerations for deployment of small modular reactors in remote sites.
- Reducing uncertainties in low-dose risk assessment to address challenges in regulatory policy, health assessment and public communication through in vivo mice studies.
- Improving the understanding of environmental impacts and waste of small modular reactor operations in support of the Small Modular Reactor Action Plan.
- Hosting exercises to test cyber security resilience for nuclear power plants in a full-scale cyber physical simulation of the control and safety systems; and,
- Supporting Canada's interests, commitments and arrangements in non-proliferation, counter- terrorism and disarmament priorities such as the International Partnership for Nuclear Disarmament Verification.

Work in 2023-24 and over the planning period is consistent with and responsive to AECL's priorities and those of the Government of Canada, including supporting the Government of Canada to reach its climate change targets in 2030 and 2050. On the international front, priorities continue to include strengthening Canada's bilateral partnerships on nuclear science and technology with countries such as the United States and the United Kingdom, as well as multilateral partnerships including the Nuclear Energy Agency, the International Atomic Energy Agency, the Generation IV International Forum, and the International Partnership for Nuclear Disarmament Verification.

As in previous years, the measures of success are related to meeting federal priorities through delivering on milestones and targets set out in CNL's Annual Program of Work and Budget.

TARGETS		
Short-term 1-2 years	Medium-term 3-4 years	Long-term 5+ years
Deliver quality research projects on time, as set out in the Federal Nuclear Science and Technology Work Plan and detailed in CNL's annual plan.	Meet identified project objectives and disseminate the results with uptake from stakeholders.	<p>Support Canada's position as a global player in areas of security, health, energy, and nuclear regulation.</p> <p>Develop highly qualified personnel for the next generation of nuclear workers and scientists.</p> <p>Advance unique technical knowledge and understanding to support nuclear policy and regulation.</p> <p>Maintain Canada's ability to actively participate in international obligations with respect to energy technology, safety, security, and non-proliferation.</p>

### CNL as a Federal Laboratory

**Overview:** In addition to work for federal departments and agencies under the Federal Nuclear Science and Technology Work Plan, CNL provides services and access to its unique expertise and facilities on a commercial basis. These capabilities are also made available to international agencies such as the International Atomic Energy Agency and the Nuclear Energy Agency.

**Status:** In 2022-23, CNL continued to work with various Government departments and agencies, including Defense Research and Development Canada through its Canadian Safety and Security Program, the Canadian Nuclear Safety Commission, Transport Canada, Department of National Defense, Canadian Coast Guards, and Natural Resources Canada.

Under the Canadian Safety and Security Program, CNL will complete the examination of the epigenetic basis of radiation and its health effects, continue the development of a deployable technique that will support more secure and efficient screening of packages and travelers, start new projects to explore active interrogation techniques for nuclear disarmament verification, and start the development of low burden shielding material with melanocytes as a possible means of shielding and protection against radiation.

CNL will also continue to expand work with federal departments in small modular reactors and hydrogen including further work with the Department of National Defense to explore the feasibility of energy offtakes of a small modular reactor on the Chalk River site, underground hydrogen storage with Natural Resources Canada and work with the Canadian Coast Guard to examine low-carbon fuels for their vessels.



TARGETS		
Short-term 1-2 years	Medium-term 3-4 years	Long-term 5+ years
Propose and develop between 3 and 5 collaborative agreements, memoranda of understanding, or other agreements with organizations.	Sign between 3 and 5 collaborative agreements, memoranda of understanding or other agreements with organizations.	Leverage the knowledge and capabilities developed under the Federal Nuclear Science and Technology Work Plan to increase collaboration and work in support of federal roles and needs for the benefit of Canadians.

### New Technology Initiatives Fund

**Overview:** The New Technology Initiatives Fund allows CNL to undertake science and technology activities to build expertise and capability at the Chalk River Laboratories, with a long-term view to attracting and retaining world-class expertise and building skills and knowledge that are anticipated to be needed for future or emerging opportunities. Consistent with similar programs at national laboratories around the world, providing funding to support work and projects that may be at very early stages, peripheral to current research priorities, high risk, or exploratory, is expected to promote innovative thinking, reward initiative, balance near-term priorities with long-term vision, and improve employee engagement.

**Status:** Planned work in 2023-24 includes:

- Continuing with the sixth iteration of the Strategic, Enabling, Engaging, Development (SEED) Crowd Sourcing Initiative that was launched in 2018-19. This program draws inspiration from the startup model and crowd sources employee ideas for new projects, investing in those selected for the research pipeline. Continue work in new or emerging areas, such as:
  - Characterization of boron nanotube composite materials for radiation protection in space;
  - Developing advanced modelling techniques to model nuclear graphite structures;
  - Integrating hydrogen production with nuclear and renewable energy systems;
  - Developing a novel prototype neutron detector, initiated following a successful SEED project from 2018, as an alternative neutron detectors to He-3; and,
  - Advance research on targeted alpha therapy using intracellular nanobodies to support the development of various applications of this promising new cancer treatment.

TARGETS		
Short-term 1-2 years	Medium-term 3-4 years	Long-term 5+ years
Maintain and enhance expertise and capabilities.	Maintain and develop expertise and capabilities.	Develop world-class expertise, new capabilities, and build skills and knowledge for future or emerging opportunities.

## Commercial Science and Technology

**Overview:** CNL will continue to provide commercial services to third parties and to build a strong, vibrant, and sustainable nuclear science and technology mission.

**Status:** Building on previous years' efforts, CNL continued to engage with and respond to existing customers' requests and explore new markets, to the extent possible as COVID-19 restrictions were lifted. Going forward, CNL will continue to expand commercial opportunities based on identified strategic directions and opportunities, with growth expected in the areas of light water reactors, advanced reactors, decommissioning and waste management, and radiopharmaceuticals.

Commercial opportunities in science and technology for industry customers continue to be pursued in the areas of fleet support, hydrogen and tritium, isotopes, radiobiology, and environment, safety and security, and advanced reactors – with fleet support being the single largest area of current work and one of the largest growth areas. Work for industry customers included energy-related services to the CANDU Owners Group, major utility companies, marine propulsion companies, and new work in the light-water reactor market.

Areas of work for 2023-24 will continue from previous years and include:

- Fuel, materials, chemistry, and corrosion testing on irradiated and unirradiated materials for CANDU facilities.
- Participation in international fuel channel inspections.
- Tool development and technical support to CANDU utilities to reduce outage time and worker dose rates during refurbishment and major component replacement projects.
- Post irradiation examination of light-water reactor fuel, including innovative destructive examination (burst testing).
- Spent nuclear fuel studies to support the safe, long-term storage of dry stored CANDU fuel.
- Characterization, tooling, and related support for CANDU decommissioning and waste management planning.
- Commercial work relating to small modular reactors. CNL expects to achieve further growth in multiple services categories including fuel prototyping and qualification, novel test facility design and operation, feasibility studies for end users, materials testing, and safety analysis. In particular, services to the OPG Darlington New Nuclear Project will be a crucial component of CNL's growth in this market sector in the future.
- Technology development and the provision of techno-economic feasibility assessments and front-end engineering and design projects for hydrogen production and hydrogen-derived clean fuels (e.g., syngas, synthetic diesel, methanol, etc.).
- Tritium process engineering support for fusion energy developers and for CNL's heavy water detritiation project.
- Pre-clinical and contract research organization services for radiopharmaceutical organizations.
- Production and supply of radionuclides for purposes of targeted alpha therapy in the battle against cancer and other diseases. This is in alignment with efforts to become an internationally recognized centre of excellence in this domain. CNL can apply existing expertise in isotope separation, scaling up of processing and handling of radionuclides. Strategic commercial partnerships are being pursued, including progress of arrangements with private sector industry, to grow revenues in the pharmaceutical market.

TARGETS		
Short-term 1-2 years	Medium-term 3-4 years	Long-term 5+ years
Generate more than \$69 M in revenue	3-5% growth year-over-year.	2-3% growth year-over-year.



### **National Research Universal (NRU) Reactor**

After 60 years of operation, the NRU was shut down in 2018. Designed in the early 1950's, the low-temperature, low pressure, research reactor enabled great advances across a wide variety of globally important industrial sectors. The NRU reactor was used to prove out many concepts which later appeared in the CANDU reactor. It spawned a global medical radioisotope industry and provided the neutron source to conduct research across a wide spectrum of sciences, both applied and basic.

The reactor shutdown reactor has left a significant gap in research capabilities at the Chalk River Laboratories. AECL and CNL are currently exploring options around a future research reactor.

### **Heavy water**

AECL currently owns heavy water assets which can be used either in a CANDU reactor or for non-nuclear purposes. Activities associated with this are limited to managing and selling the existing inventory. Through the Government-Owned, Contractor-Operated model, CNL acts as an agent for AECL for the marketing, sale and distribution of AECL's heavy water inventory. CNL also manages AECL's inventory of heavy water at AECL's facility in Laprade, Quebec.

AECL will be looking to CNL to continue its work to optimize the management and sales of heavy water. Revenues from heavy water are retained by AECL to fund historic liabilities, business priorities in science and technology, capital expenditures and other organizational priorities.

### **Revitalization of the Chalk River Laboratories (Capital Plan)**

As part of AECL's role in overseeing CNL's activities for the management and operations of our sites, a clear focus is placed on the ongoing, safe operations of the nuclear laboratories and decommissioning sites. Above and beyond the role of the CNSC which, as a regulator, ensures that all nuclear activities in Canada are delivered safely, AECL expects high levels of performance from CNL in health, safety, security, and environmental protection.

CNL's long-term plans for targeted and strategic capital investments will allow the laboratories to grow the unique complement of science and technology capabilities, while remaining flexible to quickly adapt to the evolutionary opportunities of nuclear and energy-related, leading-edge innovation. These investments will contribute to an efficient and cost-effective campus, replacing aged facilities and infrastructure that are costly to operate and maintain.

AECL has also asked CNL to transform its operations to increase value for money and reduce costs and risks to Canada. The overall objective is to have in place a cost-effective, modern campus-like site with new and refurbished facilities to support the future growth of CNL. Any capital investments at AECL sites will take into consideration best practices with respect to sustainability and green building standards for AECL to meet its GHG emission reduction targets. Details on capital plans are provided in Annex 2.

TARGETS		
Short-term 1-2 years	Medium-term 3-4 years	Long-term 5+ years
Complete and commission the Science Collaboration Center.  Start construction of the Advanced Nuclear Materials Research Centre.	Continue construction of the new Advanced Nuclear Materials Research Centre.	Complete construction and commissioning of the Advanced Nuclear Materials Research Centre.
Ensure stability in health, safety, security, and environmental industry standard metrics against industry standard benchmarks.	Continue improving health, safety, security, and environmental metrics.	
Implement actions to achieve CNL's objectives to manage operating costs while maintaining safety and the protection of the environment, with a view to ensuring a sustainable and science-focused organization in the long term.	Continue achieving industry best practices for the management of all AECL's sites.	

# Environmental Stewardship

AECL's objective is to protect the environment by advancing key decommissioning, remediation, and waste management projects to address risks and hazards.

AECL has been conducting nuclear science and technology activities for decades. While these activities have had important benefits for Canada and Canadians – for example the production of medical isotopes used in the detection and treatment of cancer – they also produced radioactive waste. AECL has various types of radioactive waste at its sites, including high-level waste (used fuel), intermediate-level waste and low-level waste. Several sites, buildings and structures have been contaminated as a result of nuclear science and technology activities and past waste management practices; these now need to be decontaminated and demolished, sites cleaned up and remediated, and the radioactive waste managed properly and safely.

AECL is also responsible for fulfilling Canada's responsibilities with respect to historic low-level waste at sites where the original owner no longer exists, or another party cannot be held liable and for which the Government has accepted responsibility. This includes the cleanup and safe long-term management of historic, low-level radioactive waste in the municipalities of Port Hope and Clarington, in Ontario pursuant to an agreement between Canada and the municipalities. This project is one of the largest and most complex environmental projects in Canada.

With the implementation of the Government-owned, Contractor-operated model, AECL was given a mandate to accelerate these activities to reduce risks and costs for Canada in a safe manner, consistent with international leading practices. Specifically, AECL has asked CNL to propose long-term radioactive waste disposal solutions and to advance other decommissioning activities to reduce its environmental liabilities.

This work is well underway, with significant progress having been made at the Chalk River Laboratories where over 116 old and outdated buildings and facilities have been demolished. This not only reduces AECL's environmental liabilities and overall site maintenance costs, but it also paves the way for new facilities to be constructed as part of the site's revitalization.

AECL's planned results in this area include working safely to reduce environmental risks and hazards in the short-term, working towards environmental remediation and closure of four nuclear sites, and ultimately protecting Canadians and the environment through decommissioning and waste management activities.

## Environmental Stewardship Five-Year Projection for Use of Approved Federal Funding

<i>(millions of Canadian dollars)</i>	Notes	Actual 2021-22	Budget 2022-23	Plan					5 Year Total
				2023-24	2024-25	2025-26	2026-27	2027-28	
<b>Environmental Stewardship</b>									
Total Environmental Stewardship		716	948	1,144	971	454	83	13	2,664
Revenue	1	2	3	3	3	3	3	3	15
<b>Federal Funding Requirement</b>		<b>714</b>	<b>945</b>	<b>1,141</b>	<b>968</b>	<b>451</b>	<b>80</b>	<b>10</b>	<b>2,649</b>

<sup>1</sup> AECL currently only has approved funding for the majority of its activities until mid-2025. Please refer to the next table for details on funding requirements beyond this date.



## Environmental Stewardship Five-Year Projection of Federal Funding Requirements

(millions of Canadian dollars)	Notes	Plan					5 Year Total
		2023-24	2024-25	2025-26	2026-27	2027-28	
<b>Environmental Stewardship</b>							
Total Environmental Stewardship		1,141	968	901	900	807	4,717
<b>Difference Between Approved Government of Canada Funding and Federal Funding Requirements Including Unapproved Funding</b>							
	1	–	–	(450)	(820)	(797)	(2,067)

<sup>1</sup> The table above includes, in addition to approved funding, preliminary AECL projections of anticipated funding requirements that have not yet been subject to the federal cycle for approval of expenditures by the government and Parliament. These estimates are subject to further planning, and neither their preliminary status nor the numbers should be interpreted as an indication of the future funding level for AECL.

## Remediation, Decommissioning and Radioactive Waste Management at the Chalk River Laboratories

Activities in this area include all waste and decommissioning activities to address AECL's environmental, decommissioning and waste management responsibilities at its Chalk River Laboratories. A key project in this area is the proposed Near Surface Disposal Facility, which is necessary to enable large-scale environmental remediation and risk reduction. The project is currently undergoing an Environmental Assessment, as detailed below.

### Waste Management and Disposal at the Chalk River Site

**Overview:** Radioactive waste is safely stored at the Chalk River site. However, final disposal solutions must be developed for various types of wastes to allow for the remediation of contaminated buildings, lands, and soils and to move away from continuous temporary storage. As such, CNL has proposed to build a near surface disposal facility for the permanent disposal of AECL's low-level radioactive waste, as well as small amounts of waste from other Canadian producers such as hospitals and universities. Near surface disposal is an internationally proven method of disposing of such wastes. The facility would allow for the permanent disposal of the vast majority of AECL wastes currently in interim storage, as well as waste which will be generated as a result of contaminated land remediation activities, decommissioning activities and continued operations of the nuclear laboratories. As noted above, this project is critical to advance decommissioning and remediation activities at AECL sites, and to further protect the environment.

With respect to AECL's intermediate-level waste, CNL will continue to explore options over the planning period and will align with the work that the Nuclear Waste Management Organization is doing, as requested by the Minister of Natural Resources, to develop an Integrated Radioactive Waste Strategy for Canada. Of note, AECL's high-level waste (used fuel) is destined to be disposed of in Nuclear Waste Management Organization's proposed repository. Projects to manage used fuel are discussed in more detail in the section on *Management of used fuel and repatriation of highly enriched uranium* below.

CNL also manages AECL's inventory of highly radioactive stored liquid waste which is a byproduct of nuclear science and technology and medical isotope production. A project is in place to safely remove and process the legacy radioactive liquid wastes (240 cubic meters) from existing tanks at the Chalk River site and to decommission the tanks and associated structures.

Until disposal solutions are approved and available, CNL will continue to manage existing radioactive waste inventories at dedicated waste management facilities at the Chalk River site in a manner that is safe and minimizes the impacts on the environment.



**Status:** Since 2016, CNL has been working with the regulator, the Canadian Nuclear Safety Commission, and meeting with stakeholders and Indigenous communities to discuss the proposed Near Surface Disposal Facility.

CNL submitted its final Environmental Impact Statement to the Canadian Nuclear Safety Commission in December 2020 and a two-part public hearing to consider CNL’s application was held during the first half of 2022. The Commission withheld a decision until 2023 and directed staff from the Canadian Nuclear Safety Commission, AECL and CNL to continue to engage and consult with Kebaowek First Nation and Kitigan Zibi First Nation, with further evidence to be submitted and an additional public hearing to take place in 2023. In the meantime, interim waste storage has continued to expand to accommodate waste which is produced as a result of continued building decontamination and decommissioning at the Chalk River site, as well as ongoing nuclear science and technology operations.

TARGETS		
Short-term 1-2 years	Medium-term 3-4 years	Long-term 5+ years
Receive regulatory approval to begin construction on the Near Surface Disposal Facility.	Should regulatory approval be received, construct the Near Surface Disposal Facility.	Safely operate the Near Surface Disposal Facility and routinely emplace low-level waste from decommissioning, remediation and ongoing nuclear science and technology activities.  Retrieve low-level waste from legacy storage, characterize and process for disposal, and emplace in the Near Surface Disposal Facility.
Radioactive waste from other AECL sites is received at the Chalk River Laboratories (low-level radioactive waste received for disposal and intermediate-level waste for storage).	Radioactive waste from other AECL sites is received at the Chalk River Laboratories (low-level radioactive waste received for disposal and intermediate-level waste for storage).	Complete consolidation of low and intermediate level radioactive waste from other AECL sites at the Chalk River Laboratories (low-level radioactive waste for disposal and intermediate-level waste for storage).

TARGETS		
Short-term 1-2 years	Medium-term 3-4 years	Long-term 5+ years
<p>Develop a program for radioactive waste where there are no plans for disposal. This will be aligned with the work of the Nuclear Waste Management Organization, as requested by the Minister of Natural Resources, to develop an Integrated Waste Strategy for Canada.</p> <p>Complete the construction of a facility for the interim storage of intermediate-level radioactive waste at the Chalk River Laboratories.</p>	<p>Determine the disposal path for all waste that does not currently have a project in place, including intermediate-level radioactive waste.</p>	

### Environmental Restoration at the Chalk River Site

**Overview:** For more than 60 years, nuclear science and technology activities at the Chalk River site have led to the production of a variety of radioactive and other hazardous wastes. These wastes are carefully managed in dedicated areas, otherwise known as waste management areas. While the majority of the Chalk River site remains undisturbed, certain areas, including the waste management areas, have contaminated soil and waste requiring retrieval and processing to allow for final disposal. As there remains a significant amount of buried waste, soil contamination and associated plumes, remedial actions are required to further protect the environment. Until such a time, legacy waste is being safely managed and closely monitored.

**Status:** The remediation of the waste management areas cannot progress until the Near Surface Disposal Facility is available. The intent is to align the completion of the characterization and remediation planning of the waste management areas with the availability of the disposal facility.

TARGETS		
Short-term 1-2 years	Medium-term 3-4 years	Long-term 5+ years
<p>Complete characterization and remediation plans for various waste management areas at the Chalk River site.</p>		<p>Remediate the waste management areas once the Near Surface Disposal Facility is available.</p>

### Decommissioning of Buildings at the Chalk River Site

**Overview:** The Chalk River site includes multiple redundant and outdated buildings, which require decontamination, decommissioning and demolition. The site has operated since 1944, and some buildings still standing today date back to that era. Some facilities were used as nuclear science and technology facilities (and therefore may have some level of radioactive contamination), while others were used as support buildings (for example machine shops, garages, etc.). Most of these facilities and buildings are outdated, no longer required to meet operational needs, and contribute to high site costs through ongoing maintenance for safety and security purposes, energy consumption, etc. Buildings also need to be removed to make way for the Chalk River site revitalization.



**Status:** Since 2015, there has been significant acceleration of decommissioning work at the Chalk River site: more than 116 buildings and structures have been decontaminated, decommissioned, and demolished. CNL is now tackling the decommissioning of a large multi-purpose laboratory which houses a former Tritium Facility, Hot Cells, and an Active Liquid Storage Tank. Three other large buildings, which represent the highest risks at the Chalk River site, are also being decommissioned. These include buildings used for laboratories and nuclear materials storage and handling for fuel from the NRX reactor, a former thorium fuel reprocessing facility, a former plutonium plant, and a former fuel rod storage and handling bay.

Despite COVID-19 requiring all active decommissioning field work to be paused for several months over the last few years, CNL has cleared space for many new buildings and decommissioned buildings decades ahead of what was planned before the implementation of the Government-owned, Contractor-operated model. It should be noted that delays in the approval for the Near Surface Disposal Facility have required expanded interim waste storage so the demolition of buildings can continue to progress.

TARGETS		
Short-term 1-2 years	Medium-term 3-4 years	Long-term 5+ years
Complete the decommissioning of 19 buildings and structures.	Complete the decommissioning of highest risk buildings and the MAPLE reactors.  Advance the non-radioactive decommissioning activities for the NRX and NRU reactors.	Reduce long-term liabilities through the safe environmentally responsible removal of redundant facilities and structures.

### Management of Used Fuel and Repatriation of Highly Enriched Uranium

**Overview:** Highly enriched uranium originating in the United States was used at the Chalk River site as reactor fuel and in the production of medical isotopes. This material requires high levels of security as well as costly and complicated storage. As part of the Global Threat Reduction Initiative (an initiative which aims at reducing proliferation risks by consolidating highly enriched uranium inventories in fewer locations around the world), AECL is working with the United States Department of Energy and CNL to return (repatriate) this material to the United States for conversion and reuse. This initiative provides for a safe, secure, timely and permanent solution to Canada's long-term management of this material.

CNL also manages AECL's used fuel inventory, which is destined to a national deep geological repository currently being advanced by the Nuclear Waste Management Organization. CNL is working with the Nuclear Waste Management Organization to ensure that AECL's used fuel inventory meets the waste acceptance criteria for disposal. Current estimated timelines for transporting the used fuel to the yet-to-be-determined disposal site is between 2055 and 2065. While these timelines remain decades away, work is ongoing to identify the requirements and capabilities needed to execute this complex project. This includes having plans and capabilities in place to retrieve legacy materials from existing storage (including decades-old in-ground concrete silos), characterize the materials, condition it and, if needed, convert it to stabilized, storage-ready and/or disposal-ready configurations, package it and store it in modern interim storage until the deep geological repository is available.

**Status:** The fuel repatriation program for highly enriched uranium continues to focus on the repatriation of nuclear fuel and fuel material, thereby removing this risk and liability from Canada, and contributing to our non-proliferation and nuclear security objectives. Over the coming years, CNL will be consolidating AECL's used fuel from the Whiteshell Laboratories and Gently-1 sites. Preliminary planning activities are also underway to identify the necessary capabilities and infrastructure needed to prepare AECL's used fuel for long-term management in the Nuclear Waste Management Organization's deep geological repository.

TARGETS		
Short-term 1-2 years	Medium-term 3-4 years	Long-term 5+ years
Planning activities, including stakeholder and Indigenous engagement, for used fuel retrieval, characterization, packaging and storage.	Planning activities continued.	
Continue to investigate and pursue the disposition or repatriation of fresh and irradiated fuel material to further reduce liabilities for Canada.	Continue to investigate and pursue the disposition or repatriation of fresh and irradiated fuel material to further reduce liabilities for Canada.	
Advance plans and engagement for the shipment of AECL used fuel to the Chalk River site.	Used fuel is shipped from the Whiteshell Laboratories and other sites to the Chalk River Laboratories.	Complete AECL fuel consolidation at the Chalk River Laboratories for interim storage.

## Decommissioning and Closure of the Whiteshell Laboratories

**Overview:** The Whiteshell Laboratories, located in Pinawa, Manitoba, is the second largest of AECL's sites operated by CNL. It was established in 1963 as a research laboratory, with a focus on the largest organically cooled, heavy water moderated nuclear reactor in the world, the WR-1. Facilities also included a SLOWPOKE reactor as well as shielded hot cell facilities and other nuclear research laboratories. There is also a radioactive waste management area which serves to provide interim storage of radioactive waste for which was created through operations of the Whiteshell Laboratories site.

In 1998, the Government of Canada announced the closure of the Whiteshell Laboratories, and decommissioning activities have been underway since then. With the implementation of the Government-owned, Contractor-operated model and the increased emphasis placed on tackling its environmental and decommissioning responsibilities, AECL has asked CNL to accelerate and complete the decommissioning and closure of the site. As a result, CNL is proposing to decommission and close the site by 2027, which is approximately 30 years ahead of the previous schedule. The acceleration of the decommissioning of the site includes a proposal to decommission the WR-1 reactor in situ. That specific project is currently undergoing an Environmental Assessment.



**Status:** CNL has been progressing the decommissioning of the site with the decontamination and demolition of several buildings. However, significant challenges have emerged with respect to the complexity and level of hazard related to the retrieval, processing and transport of radioactive waste currently being stored in a radioactive waste management area known as the ‘standpipes and bunkers’. These are concrete structures, mostly below grade, which contain intermediate-level waste and potentially fissile nuclear material that cannot be fully characterized before retrieval begins. Given the level of risk involved with their remediation, CNL has had to adjust its approach, which is now more complex and costly (as it is based on remote tooling and robotics), to protect workers and the environment. This approach will also provide insight on best practices to deal with significantly more challenging retrievals and conditioning at the Chalk River Laboratories.

Regarding CNL’s proposal to decommission the WR-1 reactor in situ, activities to engage the public and Indigenous communities have continued. CNL has provided funding for Traditional Knowledge studies, offered other capacity building activities, hosted site tours and open houses, and more. AECL has also been participating in many of these engagement activities, with a view to building relationships over the long-term. That said, and as noted in the previous sections, higher-than-anticipated public and Indigenous engagement, as well as requests from the Canadian Nuclear Safety Commission to provide additional technical studies have led to delays in the project of almost three years. While these have had a financial impact on the project, they are allowing for more public and Indigenous engagement, and the development of additional studies in support of the project’s safety case (which are also facilitating public and Indigenous engagement). CNL submitted a revised draft Environmental Impact Statement in 2022, which was accepted as a complete submission by the regulator and is currently under review by federal, provincial and other reviewers.

Looking to the final site closure and being mindful of the impact on the local community, AECL will continue to work with the local communities and Indigenous communities to discuss the future of AECL’s lands, with a view to finding acceptable solutions which support the local and Indigenous community in advancing plans related to economic development, which could include consideration for siting a small modular reactor at the Whiteshell site. Engagements on future land use have begun and are expected to continue through 2023-24.

TARGETS		
Short-term 1-2 years	Medium-term 3-4 years	Long-term 5+ years
Decommission most buildings on the main campus by 2023.	Remove and transport all high-level radioactive waste and used fuel to the Chalk River Laboratories.	Complete Whiteshell site contamination remediation, as well as a long-term surveillance plan.
Prepare the retrieval system for the standpipes and bunkers to start operations.		Complete waste retrieval for all the standpipes in the waste management area.
Submit the final Environmental Impact Statement for the proposed in-situ decommissioning of the WR-1 reactor.		The Canadian Nuclear Safety Commission accepts as complete all active decommissioning and waste management activities, with only long-term monitoring and surveillance activities remaining.

## Port Hope Area Initiative

**Overview:** The Port Hope Area Initiative represents Canada’s commitment to clean up and safely manage historic low-level radioactive waste situated in the Ontario municipalities of Port Hope and Clarington. The objective is to safely relocate and manage roughly 2.1 million cubic meters of historic low-level radioactive waste and contaminated soils. To achieve this, two projects are being undertaken: the Port Granby Project and the Port Hope Project. Both involve the remediation of contaminated material and the construction of a near surface long-term waste management facility (one in each municipality). Whereas the Port Granby Project is nearly complete, the Port Hope Project is significantly more complex and will remain ongoing for the coming years.

**Status:** The Port Hope Area Initiative has faced challenges associated with scope increase as remediation work has progressed, with higher-than-anticipated volumes of waste needing to be remediated. At the Port Granby site, the total estimated waste volume increased by more than 30% from the original estimates (550,000 m<sup>3</sup> to 750,000 m<sup>3</sup>) due to the wider spread of contamination. That said, remediation was completed in the fall of 2020 and the facility is now capped and closed while the site is being transitioned into a long-term monitoring and maintenance phase.

As part of the Port Hope Project, completion of the last cell of the Long-term Waste Management Facility (cell 2B) was delayed due to COVID-19 but was completed in 2022-23. The remediation of the Port Hope harbour has also progressed, and remediation of all four temporary storage sites, Pine Street consolidation site, Strachan Street site, waterworks east site and the Mill Street site is now complete. The remediation of the lands directly under and surrounding the railway viaducts is underway and expected to be complete before the end of 2022-23.

The remaining large scale remediation site is the Highland Drive project. Remediation of this site has begun with the removal of the consolidation site which is adjacent to the Highland Drive landfill. Remediation of the landfill is expected to begin in late 2022-23 and will conclude in 2023-24. It is expected that all the large scale remediations will be completed by fall 2025.

The largest challenge in this project relates to the scope and execution of the remediation of residential properties. As characterization activities have advanced, the number of properties requiring remediation work has increased. Port Hope property owners and residents have expressed dissatisfaction about the time it will take to remediate their properties. CNL's experience in the field has identified the fact that a significant number of property cleanups are being driven by the generic, conservative cleanup criteria for arsenic in soil. As such, CNL is recommending changes to the Port Hope Area Initiative cleanup criteria for arsenic to minimize unintended negative environmental impacts and disruption to the community.

CNL has made an application to the CNSC to amend the cleanup criteria and is engaging federal and provincial regulators, the municipality, local Indigenous communities, and the public to move its application forward. This would minimize unintended negative environmental impacts and the disruption caused by the project in the community while still being protective of human health and the environment. Importantly, it would continue to meet the intent of the Government of Canada's commitment in the original Legal Agreement with the Municipalities to leave properties such that they can be used for "all current and foreseeable unrestricted uses". Should the revised cleanup criteria be accepted by CNSC, this would have the effect of reducing the scope of the cleanup and the overall number of properties requiring remediation.

TARGETS		
Short-term 1-2 years	Medium-term 3-4 years	Long-term 5+ years
The Port Granby site is placed into long-term surveillance.	Port Hope Project: Complete remediation of large-scale and industrial sites.	Complete the remediation of low-level radioactive waste for residential properties in Port Hope.  The Port Hope long-term waste management facility is closed and capped and placed into long-term surveillance.
Engage local Indigenous Nations and communities to explore options and gather feedback on potential changes to the cleanup criteria for the Port Hope Project.		



## Closure of the Nuclear Power Demonstration Reactor

**Overview:** The Nuclear Power Demonstration reactor, located in Rolphton, Ontario, was the first Canadian nuclear power reactor and the prototype for the CANDU reactor design. For 25 years, the reactor produced low-carbon energy and operated as a training centre for nuclear operators and engineers from Canada and around the world. Operations at the Nuclear Power Demonstration reactor ended in 1987, after which the first stages of decommissioning were completed, including the removal of all fuel from the site and the draining of the systems. The site has been in a safe shutdown state for the last 30 years.

As part of its objectives to protect the environment and address its environmental and decommissioning responsibilities, AECL has asked CNL to propose plans to safely decommission and close the Nuclear Power Demonstration reactor site. As a result, CNL is proposing to decommission the reactor in situ, meaning that it would be immobilized in place by grouting (i.e., cementing) the reactor which is located below the surface. The project is currently undergoing an Environmental Assessment.

**Status:** Since the launch of the Environmental Assessment process in 2016, CNL has been developing its safety case and preparing scientific studies with a view to providing all necessary documentation and responding to stakeholders and Indigenous communities' concerns. In the meantime, work on site continues and includes routine safety inspections and general building management.

While the project is more than three years delayed against the original schedule, it has allowed for additional engagement of stakeholders and Indigenous communities on the project in order to gather input and adjust the proposed approach as necessary. Activities have included multiple meetings, site tours and outreach to Indigenous communities, including providing funding for capacity building and Traditional Knowledge studies, and to enable Indigenous communities to engage technical experts to comment on the Environmental Impact Statement. The final draft Environmental Impact Statement is expected to be submitted to the Canadian Nuclear Safety Commission in 2023.

TARGETS		
Short-term 1-2 years	Medium-term 3-4 years	Long-term 5+ years
Submit the final Environmental Impact Statement for the proposed <i>in-situ</i> decommissioning of the Nuclear Power Demonstration reactor.	Should approval be granted by the Canadian Nuclear Safety Commission, complete the decommissioning of the Nuclear Power Demonstration reactor.  CNSC accepts as complete all active decommissioning and waste management activities, with only long-term monitoring and surveillance activities remaining.	

## Decommissioning of Prototype Reactors

**Overview:** Gentilly-1 and Douglas Point are shutdown prototype nuclear reactors owned by AECL and located in Bécancour, Quebec and Kincardine, Ontario, respectively. The reactors operated in the late 1960's through the mid 1980's to advance the understanding of boiling light waterpower reactors (Gentilly-1) and steam condenser power reactors (Douglas Point). Both reactors are now shutdown and in a safe shutdown state prior to being fully decommissioned.

**Status:** Originally the decommissioning of these prototype reactors was not planned to occur for many decades. However, to reduce costs associated with storage and surveillance of this aging infrastructure, decommissioning plans are being prepared to advance this work. In order to move forward with the decommissioning of certain non-nuclear buildings at the Douglas Point site, CNL requested an amendment to its operating license. Permission to begin removing these facilities was granted in in 2021. At Gentilly-1, asbestos and bulk dry active waste removal continued in 2022-23.

TARGETS		
Short-term 1-2 years	Medium-term 3-4 years	Long-term 5+ years
Demolish supporting and/or redundant facilities at the Douglas Point reactor.  Review options for Douglas Point and Gentilly-1 for transport of fuel to the Chalk River Laboratories.	Continue to advance planning and Indigenous and community engagement for the decommissioning of the Douglas Point and Gentilly-1 reactors.	Decommission and remove all plant, equipment, and fuel from both the Douglas Point and Gentilly-1 facilities.

## Low-level Radioactive Waste Management Office

**Overview:** The Government of Canada, through AECL, has assumed responsibility for historic, low-level radioactive waste where the original owner no longer exists, and the current owner cannot reasonably be held responsible. Through CNL, AECL is managing these responsibilities which include the cleanup of historic low-level radioactive waste at various sites across Canada (excluding the Port Hope Area Initiative, discussed above). This includes ongoing interim waste management and remediation projects mostly in Ontario, Alberta and the Northwest Territories.

**Status:** Planning, stakeholder and Indigenous engagement continues to enable the remediation of sites along the Northern Transportation Route. The field work planned for 2020 that was pushed to 2021 due to COVID-19 was successfully completed. This includes the removal for disposal of the material stored in the temporary storage sites at the Fort Smith landfill in the Northwest Territories and at Fort Fitzgerald, in Northern Alberta. Planning and design activities for the next phase of clean-up activities continue to be progressed, including engagement with Indigenous communities and capacity building through contribution agreements.

TARGETS		
Short-term 1-2 years	Medium-term 3-4 years	Long-term 5+ years
Engage local stakeholders and Indigenous communities to agree on cleanup plans for sites along the Northern Transportation Route located in the southeastern Northwest Territories and northern Alberta.	<p>Continue to engage local stakeholders and Indigenous communities.</p> <p>Complete remediation activities for sites along the Northern Transportation Route locations in the southeastern Northwest Territories and northern Alberta.</p> <p>Commence remediation for sites in the Sahtu region along the Northern Transportation Route.</p>	<p>Complete remediation for all sites along the Northern Transportation Route.</p> <p>Complete remediation of Greater Toronto Area sites where the Government of Canada has accepted the liability.</p>

### Third-party waste

AECL's sites and waste management capabilities are unique in Canada. Historically, AECL has accepted small amounts of radioactive waste from Canadian facilities, most notably hospitals and universities. CNL continues to provide these services to third parties for the handling, storage and disposal of radioactive waste. These activities are delivered on a full cost-recovery basis and do not require government funding.

## Other Areas of Focus

### Competitive Procurement Process to Renew the Contract for the Management of CNL

AECL has launched a competitive procurement process to continue the management and operation of CNL beyond the current contract, which expires in September 2025. CNL has been managed since September of 2015 by Canadian National Energy Alliance, a consortium made up of three partner companies – SNC-Lavalin, Jacobs Engineering and Fluor Federal Services.

The competitive procurement process will include a pre-qualification stage in which interested parties will be invited to submit a response that will be evaluated to confirm that mandatory technical criteria, financial capability requirements, national security requirements, and certifications are met. Following qualifications, qualified participants will be invited to participate in detailed consultations that will cover the draft request for proposal and form of contract.

A final request for proposal is expected to be issued in 2024, with contract award in 2025.

### Wrap-Up Office (retained liabilities from former CANDU Reactor Division)

These activities relate to legal matters related to AECL's former CANDU Reactor Division, the assets of which were sold to Candu Energy Inc. in 2011. The few remaining claims and litigations that comprise the business of the Wrap-up Office are being managed by AECL's legal team, supported by external counsel. This includes the commercial and legal work required to defend, assert, and settle outstanding claims.

AECL continues to advance its interests related to its intellectual property and the CANDU reactor technology. AECL's objective is to ensure that nuclear energy, derived from nuclear technology developed in Canada, remains a viable and readily available option in Canada's fight against climate change. AECL is looking for CANDU designs to remain in a state of readiness (including from a supply chain perspective) to address future potential electricity supply shortfalls, build on the economic growth provided by ongoing CANDU refurbishments and enhance Canada's energy security generally by leveraging AECL/Canadian developed & owned CANDU technology supported by a uniquely Canadian supply chain.



# Annex 1 – Financial Overview

## Financial statements and notes

This section presents AECL's financial statements reflective of AECL's role under the Government-owned, Contractor-operated model, which include payments to CNL and its parent company, Canadian National Energy Alliance. The CNL-related mission budgets (e.g., science and technology, decommissioning and waste management and capital) include both direct and indirect costs. These statements exclude Wrap-Up Office activities.

Under the Government-owned, Contractor-operated model, AECL receives funding from the Government of Canada to deliver on commitments, priorities and objectives related to the nuclear laboratories (including nuclear science and technology and the revitalization of the Chalk River site), as well as environmental stewardship (decommissioning and waste management). CNL manages and operates AECL's sites and undertakes the necessary activities to respond to AECL priorities as per its contractual arrangement with AECL. Revenue from third-party work performed by CNL using AECL sites, facilities and assets is recognized by AECL. These revenues come from work conducted in support of the nuclear energy industry, the sale or lease of heavy water, and research and development services provided to third parties. AECL also earns interest income on cash, short-term investments from appropriations and investments held in trust.

AECL's financial statements are prepared under Public Sector Accounting Standards. Changes to Public Sector Accounting Standards adopted during the year did not result in any changes to the financial statements while changes proposed have yet to be incorporated in the financial statements.

The statements below have been updated to reflect AECL's current projection of approved and required funding. This includes projections for all areas, currently unfunded, for the second half of 2025-26 and all of 2026-27 and 2027-28.

## Statement of Financial Position

(millions of Canadian dollars)	Actual 2021-22	Budget 2022-23	Plan				
			2023-24	2024-25	2025-26	2026-27	2027-28
<b>Financial Assets</b>							
Cash	262	262	262	262	262	262	262
Short-term investments	72	117	163	210	258	258	258
Long-term disposal of waste fund	30	35	40	46	51	57	63
Investments held in trust	74	76	78	80	82	84	86
Trade and other receivables	65	45	45	45	45	45	45
Inventories held for resale	94	71	48	24	–	–	–
	597	606	636	667	698	706	713
<b>Liabilities</b>							
Accounts payable and accrued liabilities	38	36	35	34	38	36	35
Employee future benefits	15	13	12	10	9	7	6
Due to Canadian Nuclear Laboratories	190	170	170	170	165	165	165
Decommissioning and waste management provision	7,343	6,920	6,338	5,857	5,393	4,869	4,395
Contaminated sites liability	1,531	1,322	1,056	833	636	480	344
	9,117	8,461	7,610	6,904	6,241	5,557	4,944
<b>Net Debt</b>	(8,520)	(7,855)	(6,974)	(6,237)	(5,543)	(4,852)	(4,231)
<b>Non-Financial Assets</b>							
Tangible capital assets	849	949	1,076	1,193	1,297	1,409	1,519
Prepaid expenses	–	1	1	1	1	1	1
	849	950	1,077	1,194	1,298	1,410	1,520
<b>Accumulated Deficit</b>	<b>(7,671)</b>	<b>(6,905)</b>	<b>(5,897)</b>	<b>(5,043)</b>	<b>(4,245)</b>	<b>(3,442)</b>	<b>(2,711)</b>
Accumulated deficit is comprised of:							
Accumulated operating deficit	(7,669)	(6,905)	(5,897)	(5,043)	(4,245)	(3,442)	(2,711)
Accumulated remeasurement losses	(3)	–	–	–	–	–	–
	<b>(7,671)</b>	<b>(6,905)</b>	<b>(5,897)</b>	<b>(5,043)</b>	<b>(4,245)</b>	<b>(3,442)</b>	<b>(2,711)</b>

The long-term disposal of waste fund will increase as AECL sets aside funding to account for future waste disposal activities arising from the ongoing operation of the site which create radioactive waste and/or decommissioning liabilities.

The Decommissioning and waste management provision and Contaminated sites liability represent the future obligation to address waste management and decommissioning liabilities. The liability is expressed in terms of the net present value of future expenditures required to discharge the obligation. AECL's decommissioning and waste management provision and contaminated sites liability are adjusted annually to reflect progress to date, new estimates as they become available and new waste liabilities arising from ongoing CNL operations.

The year-over-year change in these accounts represents the increase in the net present value with the passage of time (accretion) offset by the reduction in the liability from the spending incurred each year. Other changes to the liability may occur as CNL advances decommissioning activities. The assessment and planning of projects, which are understood in more detail as projects are undertaken, could result in adjustments to expected cost estimates, which would impact the value of the liability.

However, as decommissioning work continues in the coming years, the liability will be decreasing commensurate with the liabilities being settled. As the decommissioning and waste management provision and contaminated sites liability decrease, so will AECL's overall negative Accumulated Deficit. The above projections do not attempt to capture the impact of potential future changes in the interest rate used to derive the net present value changes of the reported liability.

Tangible capital assets are expected to increase in line with increased investment in infrastructure at the Chalk River site, as reflected by the important funding provided for the revitalization of the Chalk River Laboratories.

Accumulated deficit changes are largely reflective of changes in surplus for the period.

## Statement of Operations and Accumulated Deficit

(millions of Canadian dollars)	Notes	Actual 2021-22	Budget 2022-23	Plan					5 Year Total
				2023-24	2024-25	2025-26	2026-27	2027-28	
<b>Revenues</b>									
Parliamentary appropriations	1	1,009	1,291	1,542	1,413	1,235	1,251	1,181	6,621
Commercial revenue		137	110	115	120	123	75	80	513
Interest income		3	4	4	4	4	4	4	20
Other proceeds		20	–	–	–	–	–	–	–
		1,169	1,405	1,661	1,538	1,362	1,330	1,264	7,154
<b>Expenses</b>									
Cost of sales		89	77	81	84	86	53	56	359
Operating expenses	2	100	69	65	64	66	65	72	332
Contractual expenses	3	240	184	216	273	172	193	210	1,064
Decommissioning, waste management and contaminated sites expenses	4	1,375	311	291	263	240	218	195	1,206
		1,804	641	652	684	563	528	533	2,960
<b>Surplus for the year</b>	5	(634)	764	1,008	854	798	802	731	4,194
<b>Accumulated operating deficit, beginning of year</b>		<b>(7,035)</b>	<b>(7,669)</b>	<b>(6,905)</b>	<b>(5,897)</b>	<b>(5,043)</b>	<b>(4,245)</b>	<b>(3,442)</b>	
<b>Accumulated operating deficit, end of year</b>		<b>(7,669)</b>	<b>(6,905)</b>	<b>(5,897)</b>	<b>(5,043)</b>	<b>(4,245)</b>	<b>(3,442)</b>	<b>(2,711)</b>	

- 1 Parliamentary appropriations have been updated to reflect AECL's current projection of spend and required funding.
- 2 These amounts represent AECL's operating expenses associated with its oversight activities and amortization.
- 3 Contractual expenses include payments to CNL (less payments for decommissioning and waste management, cost of sales and capital) and contractor fees.
- 4 Decommissioning, waste management and contaminated sites expenses represent the accretion expense on the decommissioning and waste management provision and Contaminated sites liability, as well as any revisions in estimate and timing of expenditures.
- 5 Large early surpluses are a result of Capital and DWM funding received for which there are smaller corresponding accrual expenses. Capital funding received is partially offset by amortization expense, and decommissioning, waste management funding is partially offset by accretion expense.

Operating expenses are comprised of AECL operations associated with its oversight activities. Decommissioning, waste management and contaminated sites expenses include the increase in the net present value (accretion of discount) of the decommissioning and waste management provision and contaminated sites liability. As these obligations decrease, the decommissioning, waste management and contaminated sites expenses will decrease as well.

## Statement of Cash Flows

(millions of Canadian dollars)	Notes	Actual 2021-22	Budget 2022-23	Plan					5 Year Total
				2023-24	2024-25	2025-26	2026-27	2027-28	
<b>Operating transactions</b>									
Cash receipts from Parliamentary appropriations	1	1,131	1,291	1,542	1,413	1,235	1,251	1,181	6,621
Cash receipts from customers and other sources		139	110	115	120	123	75	80	513
Cash paid to suppliers		(317)	(249)	(282)	(342)	(246)	(258)	(281)	(1,409)
Cash paid to employees		(12)	(13)	(14)	(14)	(14)	(14)	(14)	(70)
Cash paid for decommissioning, waste management and contaminated sites activities		(653)	(945)	(1,141)	(968)	(901)	(900)	(807)	(4,717)
Cash designated for future waste management and disposal activities		(3)	(7)	(7)	(7)	(8)	(8)	(8)	(38)
Interest received		1	4	4	4	4	4	4	20
<b>Cash provided by operating transactions</b>		<b>286</b>	<b>192</b>	<b>217</b>	<b>206</b>	<b>193</b>	<b>150</b>	<b>155</b>	<b>921</b>
<b>Capital transactions</b>									
Acquisition of tangible capital assets		(112)	(147)	(171)	(159)	(145)	(150)	(155)	(780)
<b>Cash applied to capital transactions</b>		<b>(112)</b>	<b>(147)</b>	<b>(171)</b>	<b>(159)</b>	<b>(145)</b>	<b>(150)</b>	<b>(155)</b>	<b>(780)</b>
<b>Investing transactions</b>									
Cash invested in short-term investments		(57)	(45)	(46)	(47)	(48)	–	–	(141)
<b>Cash applied to capital transactions</b>		<b>(57)</b>	<b>(45)</b>	<b>(46)</b>	<b>(47)</b>	<b>(48)</b>	<b>–</b>	<b>–</b>	<b>(141)</b>
<b>Increase in cash</b>		<b>117</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	
<b>Cash at beginning of year</b>		<b>145</b>	<b>262</b>	<b>262</b>	<b>262</b>	<b>262</b>	<b>262</b>	<b>262</b>	
<b>Cash at end of year</b>		<b>262</b>	<b>262</b>	<b>262</b>	<b>262</b>	<b>262</b>	<b>262</b>	<b>262</b>	

1 Parliamentary appropriations have been updated to reflect AECL's current projection of spend and required funding.



## Capital Budget and Notes (Revitalization of the Chalk River Laboratories)

### Federal Funding Requirements Including Unapproved Funding – Capital

<i>(millions of Canadian dollars)</i>	Actual 2021-22	Budget 2022-23	Plan					5 Year Total
			2023-24	2024-25	2025-26	2026-27	2027-28	
<b>AECL</b>								
Capital (Revitalization of the Chalk River Laboratories)	113	147	171	159	145	150	155	780
<b>Total Government Funding – Capital</b>	<b>113</b>	<b>147</b>	<b>171</b>	<b>159</b>	<b>145</b>	<b>150</b>	<b>155</b>	<b>780</b>

Note that the above table includes currently approved funding and estimates for expected requirements beyond the current contract period.

### Approved Federal Funding – Capital

<i>(millions of Canadian dollars)</i>	Notes	Actual 2021-22	Budget 2022-23	Plan					5 Year Total
				2023-24	2024-25	2025-26	2026-27	2027-28	
<b>AECL</b>									
Capital (Revitalization of the Chalk River Laboratories)		113	147	171	159	81	–	–	411
<b>Total Government Funding – Capital</b>	<b>1</b>	<b>113</b>	<b>147</b>	<b>171</b>	<b>159</b>	<b>81</b>	<b>–</b>	<b>–</b>	<b>411</b>

1 The current contract for the Government-Owned, Contractor-Operated model ends September 2025 and current approved funding only extends up until this point.

## Operating Budget And Notes

### Federal Funding Requirements Including Unapproved Funding

<i>(millions of Canadian dollars)</i>	Actual 2021-22	Budget 2022-23	Plan					5 Year Total
			2023-24	2024-25	2025-26	2026-27	2027-28	
<b>AECL</b>								
Environmental stewardship	714	945	1,141	968	901	900	807	4,717
Nuclear Laboratories – Operating	182	199	230	286	189	201	219	1,125
<b>Total Government Funding – Operating</b>	<b>896</b>	<b>1,144</b>	<b>1,371</b>	<b>1,254</b>	<b>1,090</b>	<b>1,101</b>	<b>1,026</b>	<b>5,841</b>

Note that the above table is a projection of funding requirements as used for the financial statements above and includes approved funding as well as assumptions on required funding for those periods outside the current approved funding envelope (latter half of 2025-26 and all of 2026-27).

### Approved Federal Funding - Operating

<i>(millions of Canadian dollars)</i>	Actual 2021-22	Budget 2022-23	Plan					5 Year Total
			2023-24	2024-25	2025-26	2026-27	2027-28	
<b>AECL</b>								
Environmental Stewardship	714	945	1,141	968	451	80	10	2,649
Nuclear Laboratories – Operating	182	199	230	286	105	17	17	655
<b>Total Government Funding – Operating</b>	<b>896</b>	<b>1,144</b>	<b>1,371</b>	<b>1,254</b>	<b>556</b>	<b>97</b>	<b>27</b>	<b>3,305</b>

# Annex 2 – Revitalization of the Chalk River Laboratories

AECL's plan to revitalize the Chalk River Laboratories is based on CNL's ongoing assessments of infrastructure needs, including consideration for health, safety, security and environmental risks, current facility conditions, regulatory requirements, and ongoing business needs. All investments are in support of the renewal and revitalization of the Chalk River site, to create a world-class nuclear science and technology campus that serves the needs of the Government of Canada and of commercial customers.

Revitalization activities are meant to address two main areas:

- **New and Renewed Science Infrastructure** – These investments are part of a longer-term plan to revitalize the Chalk River site and construct new and renewed science facilities to build a modern, world-class nuclear science and technology campus that serves the needs of government and industry.
- **Site Support Infrastructure** – Immediate investments are required to renew existing and aging infrastructure systems and facilities at the Chalk River site such as potable water, storm sewer, sewage treatment, electrical system, and other utilities. These investments are necessary to respond to regulatory, health, safety, security, and environmental requirements, as well as to maintain a cost efficient and reliable site.

Further details on specific projects for the planning period are presented below.

## New and Renewed Science Infrastructure

Projects in this category include modern, world-class science facilities and infrastructure to enable delivery of AECL's objectives over the long term. The projects to be undertaken are aligned with the strategy to revitalize the Chalk River site.

### Advanced Nuclear Materials Research Centre

**Overview:** This represents the most significant capital investment at the Chalk River Laboratories and a critical facility to enable nuclear science and technology activities for the coming decades. The objective is to combine the capabilities of existing but outdated facilities into a modern shielded facility and laboratory research complex. This new facility will allow further advancements in the nuclear science and technology program, including targeted alpha therapy research, small modular reactors, advanced fuels fabrication, nuclear forensics, and response, as well as ongoing work in support of utilities and their reactor life extension and reliability.

**Status:** Construction work started in 2022-23 with mass excavation of the project site. In 2023-24, the detailed design will be completed, and construction of the building envelope will begin. Construction will continue over several years, with commissioning expected in 2028.

## Science Collaboration Centre

**Overview:** This office building is currently under construction at the Chalk River Laboratories to enable CNL to consolidate office space from across the site and several other locations. The building will offer a professional office complex and serve as a key venue to effectively engage with both government and third-party stakeholders in advancing the future program of work for science and technology. With a number of older buildings currently housing staff which are slated for decommissioning, and the overall dependence on trailer systems for office space, the Science Collaboration Centre will fill the space gap for the long-term. The office building is also expected to house the information technology data center.

**Status:** Construction proceeded as expected in 2022-23 with the installation of the mass timber frame (from Canadian wood), building systems (HVAC, mechanical), and all exterior glazing. The building is now weathertight, interior finishing has begun, and it is expected to be commissioned in 2023-24.

## Site Support Infrastructure

### Information Technology (IT) Investments

**Overview:** Investments in IT infrastructure include upgrades, replacements and implementation of hardware, software, applications, networks, and communications technologies throughout CNL. Improvements include base infrastructure (upgrading current hardware and software), the implementation of business intelligence solutions to provide dynamic reporting capability in the areas of finance, procurement and human resources, the adoption of collaborative IT workspace such as SharePoint, and the delivery of an enhanced cyber security framework.

**Status:** In 2022-23, activities continued to modernize and integrate IT applications and systems, automate business system processes, and improve reporting capabilities. A new business intelligence system was launched, a number of services were moved to the Cloud and voice service upgrades were made across site. Work in 2023-24 include upgrading to fiber optic service and increasing cyber security protections through the selection and use of a managed security service provider.

### Site Utilities Bridging

**Overview:** The objective is to further enable reliable electrical power and other essential utility services and to continue the upgrades to aging infrastructure at the Chalk River site.

**Status:** Activities in 2022-23 have focused on utilities distribution systems for the newly constructed facilities on the Chalk River site, as well as upgrades to existing distribution networks. Work has been completed on relocating the buried services and utilities in and around the footprint of the Advanced Nuclear Materials Research Centre project site. In 2023-24, planning activities will also take place for the larger investment required to upgrade aging infrastructure beyond the current contract and funding profile.

