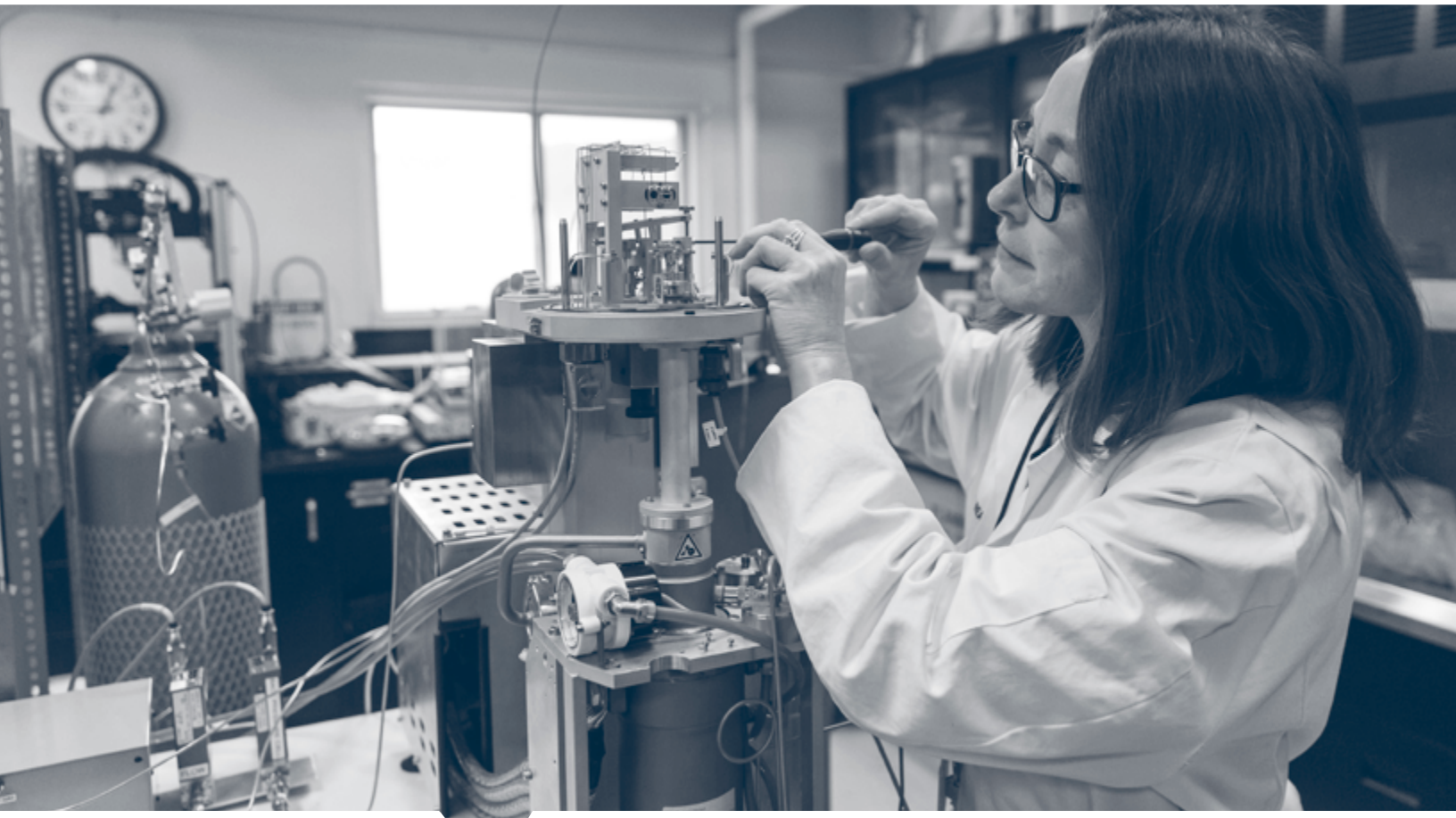
Atomic Energy
of Canada Limited



2021-22 to 2025-26 Corporate Plan Summary

Driving Nuclear Opportunity for Canada

AECL
EACL

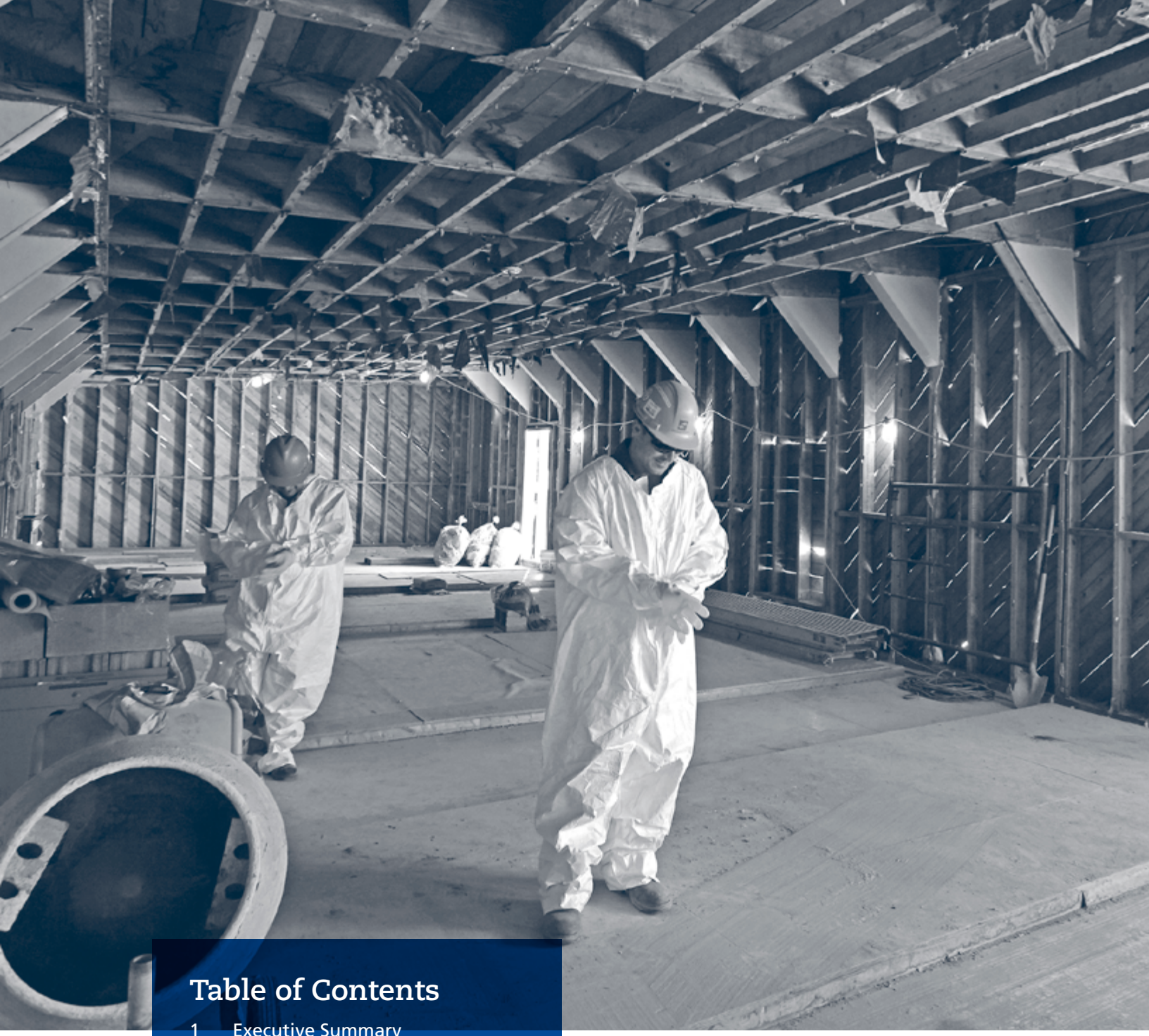


Table of Contents

AECL acknowledges with gratitude that we operate on territories that have, since time immemorial, been the traditional lands of Indigenous peoples in Canada.

Executive Summary

As a federal Crown corporation, Atomic Energy of Canada Limited (AECL) advances 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 treatments for cancer** and other diseases, and **accelerating Canada's environmental remediation projects**.

Since 2015, AECL has been delivering its mandate through a Government-owned, Contractor-operated model, whereby a private-sector organization, Canadian Nuclear Laboratories (CNL), is responsible for managing and operating AECL's sites.

Mission

Realize value for Canadians by driving nuclear innovation, creating a state-of-the-art nuclear campus, and cleaning up legacy wastes.

Vision

Driving nuclear opportunity for Canada.

This change in delivery model has brought about significant transformation in the short amount of time it has been in place. Since the implementation of the Government-owned, Contractor-operated model, CNL has made major progress in revitalizing the Chalk River site, where they have demolished close to 100 buildings and structures, upgraded a substantial portion of the site's supporting infrastructure and built two new important science facilities. The goal 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. To this end, an Advanced Nuclear Materials Research Centre is being planned to enable nuclear scientific activities for decades to come.

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 the private sector to advance the demonstration of small modular reactors (SMRs) and working to demonstrate production of hydrogen without greenhouse gas emissions.

To advance AECL's environmental stewardship responsibilities, CNL continues to work with technical experts, Indigenous communities, local municipalities, other stakeholders and the public to revise and finalize three separate regulatory submissions to the Canadian Nuclear Safety Commission. These Environmental Assessments include the proposal by CNL to build a near surface disposal facility at the Chalk River site for the long-term management of AECL's low-level radioactive waste. Furthermore, AECL is responsible for the Port Hope Area Initiative, which represents the Government of Canada's commitment to clean up and safely manage historic low-level radioactive waste currently located in the municipalities of Port Hope and Clarington, in Ontario.

Both AECL and CNL remain committed to working with Indigenous communities and organizations and other stakeholders in an open, respectful and cooperative manner to foster mutual understanding, build long-term relationships, advance reconciliation and achieve our overall objective of protecting the environment.

The COVID-19 pandemic has presented unprecedented challenges for organizations worldwide. AECL and CNL immediately implemented protocols to keep employees and contractors safe and to protect neighbouring communities. In accordance with regional health guidelines, most employees transitioned to work-from-home during required periods of reduced site operations, and projects continue to be reassessed to adapt to evolving circumstances and work realities.

While COVID-19 has affected how we work and engage others, CNL has mitigated schedule impacts, where possible, by pivoting to key planning and design activities for decommissioning and environmental remediation projects. However, supply chain issues, work interruptions, and additional measures put in place to protect workers have led to project and construction delays, as well as increased operating costs. Scientific and research activities slowed down, and fewer business development opportunities have decreased commercial revenues.

That said, the resilience and ingenuity of CNL employees also precipitated unique collaborations and achievements, showcasing the agility of our laboratories and the importance of maintaining world-class expertise and capabilities. Notably, CNL, together with TRIUMF and SNOLAB, joined an international effort to develop a ventilator that can be easily produced around the world using accessible, off-the-shelf parts. The resulting model was authorized by Health Canada in September 2020 and the Government of Canada has since purchased 10,000 units for use domestically and abroad. In addition, CNL and AECL continued to support Global First Power as it advances its SMR project through environmental assessment and regulatory processes. As the only such project launched in Canada to date, it is helping to maintain Canadian leadership in off-grid technology.

More generally, nuclear science and technology activities performed at the Chalk River Laboratories continue to benefit both the Government of Canada and the broader nuclear industry. Through the Federal Nuclear Science and Technology Work Plan, AECL oversees research and scientific activities that serve the needs of 14 federal departments and agencies in the areas of health, energy and climate change, the environment, and safety and security. CNL has been leveraging the capabilities and expertise at the laboratories to grow commercial revenues, positioning itself as a key player in nuclear science and technology in Canada and internationally.

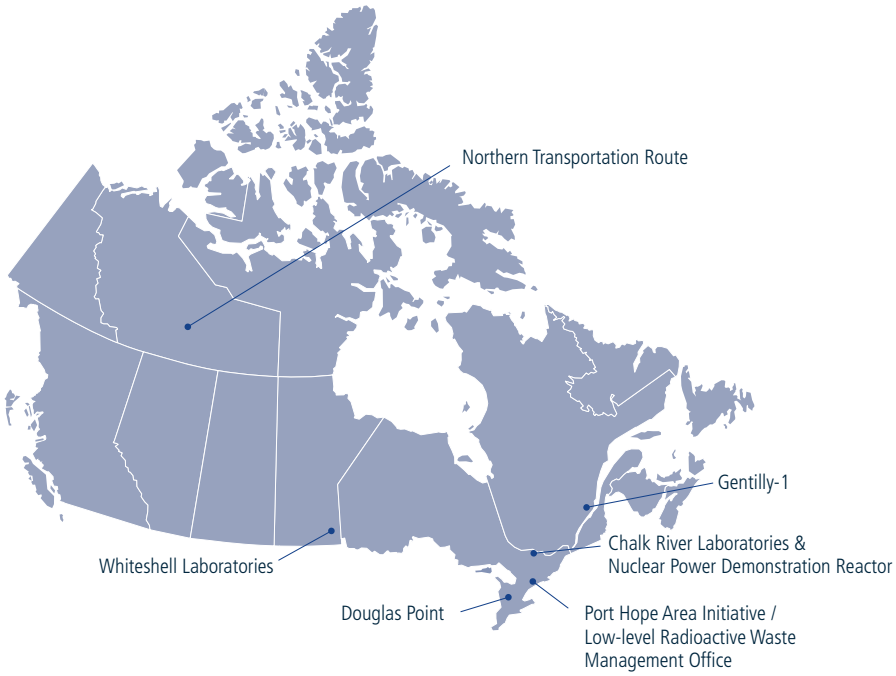
This 2021-22 Corporate Plan Summary outlines AECL's activities, objectives and plans in two main areas: nuclear science and technology and environmental stewardship. This includes work to build a world-class nuclear laboratory at Chalk River through infrastructure investments of $1.2 billion over ten years, starting in 2016.

The pages below present AECL's vision for continued transformation to meet these objectives, informed by long-term plans prepared by CNL and accepted by AECL, and considers the known impacts of COVID-19 at the time the document was prepared.

Overview

AECL is a federal Crown corporation that has a mandate to enable nuclear science and technology and to protect the environment by fulfilling the Government of Canada's radioactive waste and decommissioning responsibilities. This work, funded by the Government of Canada, is undertaken at several sites across Canada, with headquarters in Chalk River, Ontario. AECL's operating model allows it to leverage the expertise and experience of the private sector to advance work and drive priorities in two main areas: nuclear laboratories and environmental stewardship.

AECL Sites



Nuclear Laboratories

The Chalk River Laboratories are Canada's largest science and technology complex and host to nearly 2,800 employees, including a large number of engineers, scientists and technical staff. 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 site is currently undergoing an important renewal that is transforming the site into a modern, world-class nuclear science and technology campus, thanks to an investment of $1.2 billion over ten years by the federal government, beginning in 2016.

Environmental Stewardship

The objective is to safely and responsibly address the environmental responsibilities and liabilities that have resulted from legacy activities at AECL sites. This requires 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. Responsible decommissioning and radioactive waste management is necessary to clean up AECL's sites, protect the environment, and make way for new buildings that support the ongoing nuclear science and technology mission at the Chalk River site.

AECL receives funding from the Government of Canada and earns commercial revenues to deliver its mandate. As a federal Crown corporation, AECL reports to Parliament through the Minister of Natural Resources. AECL's most recent Annual Report (2021) can be found at www.aecl.ca.

Reconciliation

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 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 advancing reconciliation. As an organization, AECL is working hard to build new relationships and strengthen existing ones, recognizing that meaningful, respectful engagement takes time.

Corporate Profile

A significant restructuring of AECL was completed in 2015 that saw the management and operation of AECL's sites move to a Government-owned, Contractor-operated model. While AECL remains the owner of the facilities, assets, intellectual property and liabilities, a private-sector company – Canadian Nuclear Laboratories (CNL) – is now responsible for day-to-day management and operations.

Through the restructuring, the Government of Canada confirmed AECL's mandate, namely, to enable nuclear science and technology and to protect the environment by fulfilling the Government of Canada's radioactive waste and decommissioning responsibilities. AECL was also given a mandate to leverage the assets and capabilities at the Chalk River Laboratories to support industry on a commercial basis.

AECL's environmental stewardship activities are in line with the Government of Canada's goals to protect the environment. AECL-funded nuclear science and technology activities contribute to science and innovation goals, which benefit Canada's economy through the development of a highly skilled workforce, support for industry, and technology development.

Furthermore, AECL is supporting efforts to meet national climate change goals by funding work to help Canada's utilities operate power reactors safely and for longer periods of time, and through our efforts to advance SMRs. Nuclear power is an important part of Canada's low-carbon energy production – more than 60% of Ontario's electricity and 30% in New Brunswick comes from nuclear power. Similarly, SMR technologies offer a promising opportunity to bring low-carbon energy to the existing grid and to remote locations and communities.

The Government-owned, Contractor-operated Model

The Government-owned, Contractor-operated model allows AECL to leverage the expertise and experience of the private sector to accelerate our decommissioning and radioactive waste management program and build a world-class nuclear laboratory at the Chalk River site that fulfills Government requirements while reducing costs and risks to Canada. 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.

A key element of AECL's role under the Government-owned, Contractor-operated model is to set priorities for CNL and oversee and assess its performance to provide value for Canada. In other words, AECL sets out "what" needs to be achieved and CNL decides "how" it is best executed.

On an annual basis, AECL provides strategic guidance to CNL for the development of its annual plans, which in turn are supported by, and aligned with, longer-term plans that are accepted by AECL. CNL's performance is tracked based on the activities set out in these plans, including specific project milestones and deliverables.

AECL's Oversight Activities

AECL oversees all CNL activities:

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

To systematically monitor and assess contractor performance, a performance plan is issued by AECL annually. The 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 CNL's performance, 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).

For more information on the Government-owned, Contractor-operated model visit our website 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. Amongst key internal challenges and strategic issues 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 inability of the contractor to consistently execute and perform based on agreed-upon plans. To mitigate this risk, the contract with CNL is carefully structured to include several mechanisms for AECL to track CNL's performance, as noted above. On an annual basis, AECL sets priorities supported by achievable stretch targets to drive value for money for Canada. Ongoing evaluation provides AECL the opportunity to highlight strengths and weaknesses and the contractor the opportunity to correct course where needed.

Costs to operate the Chalk River Laboratories. The shutdown of the National Research Universal (NRU) reactor in March 2018 is creating cost pressures. The combination of lost revenue from the activities of the reactor (including isotope sales) and diminishing funding for the NRU, together with site costs that have not proportionally decreased, contribute to these pressures. As this was anticipated at the time of AECL's restructuring, the Government-owned, Contractor-operated contract includes requirements for CNL to look at all options for lowering costs, increasing revenues and managing the cost pressures to mitigate this risk. This is actively being pursued and implemented to enable a sustainable and science-focused organization in the long-term, while continuing to protect workers, the public, and the environment.

Human resources. AECL is a small organization that relies on a complement of national and international experts who bring a range of experience in the management of similar Government-owned, Contractor-operated arrangements, both from a government and contractor perspective. AECL has approximately 45 employees; it is expected that employee levels will remain within this range over the planning period. AECL's goal is to maintain the necessary expertise and capabilities to oversee the Government-owned, Contractor-operated contract and bring value for money for Canada.

AECL is committed to supporting diversity and inclusion, from identifying discrimination, harassment or lack of opportunities, to recognizing the different perspectives that employees bring to the workplace. Women make up 47% of AECL's workforce and minorities 7%.

AECL has in place a diversity and inclusion strategy anchored on 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.

Given AECL's size, an ongoing challenge is to adapt to fluctuating resourcing requirements across different areas of the organization and backfill those on short-term leave, where appropriate. To manage this, AECL strives to be flexible, deploying a handful of third-party service contracts to bolster resourcing when and where required and cross-training employees when the opportunity arises. A succession plan has also been developed and is reviewed on an annual basis at a minimum. Furthermore, AECL regularly reviews its total compensation package to remain competitive amongst similar employers nationally and internationally.

External Environment

External factors such as the dynamic nature of the COVID-19 pandemic have shifted the environment in which AECL and its contractor operate. In alignment with recommended actions by the Government of Canada and public health authorities, CNL reduced operations at all sites in March 2020 to mitigate risk to personnel and surrounding communities. Only safety-essential activities were maintained, along with a skeleton science and technology crew to continue limited operation of certain facilities, support the safety-critical requirements of customers (particularly the nuclear facility operators), contribute to COVID-19 response, and support emergency capabilities at our sites.

As of the writing of this report in early 2021, public health restrictions were still in place that affected the transition back to work. To date, beyond delays in physical work, there have been significant disruptions to the supply chain, sales/revenue and certain regulatory processes. Moreover, the COVID-19 countermeasures and adapted work processes that remain in effect, including physical distancing and use of personal protective equipment, have reduced the efficiency of some work. This is expected to have a cumulative effect beyond the current fiscal year. The full consequences of these disruptions are not yet known. Overall, the impact of these disruptions has been reflected to the extent possible in this document.

Environmental remediation projects. 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 Ontario.
- In-situ decommissioning of the WR-1 research reactor at the Whiteshell Laboratories in Pinawa, Manitoba.
- In-situ decommissioning of the Nuclear Power Demonstration reactor 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 Canadian Nuclear Safety Commission; and to adjust aspects of the project, where possible, based on public, Indigenous, government and regulatory feedback. While planning activities could continue, the COVID-19 pandemic has affected CNL's ability to engage stakeholders and Indigenous communities.

Small modular reactors. CNL is pursuing opportunities related to SMRs, which are nuclear reactors designed to be built at a smaller size but in larger numbers than most of the world's current nuclear fleet. As part of its long-term vision, CNL seeks to become an incubator for SMR 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 by 2026. The objective is to advance SMR technologies in Canada to contribute to Canada's broader economic growth, competitiveness, science, innovation, sovereignty, and climate change objectives.

In Canada, SMRs have the potential for three major areas of application:

- On-grid power generation, especially in provinces phasing out coal. Utilities are looking to replace end-of-life coal plants with non-emitting baseload 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 medium-term options for bulk heat and power that would be more reliable and cleaner than current energy sources.
- 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 catalyze development in the North, contributing to national sovereignty, energy security and the economy.

The opportunity related to SMRs is noteworthy given Canada's expertise in nuclear technology, including its existing supply chain and potential markets. Economic benefits for Canada derived from SMR development and deployment include an estimated 6,000 new jobs (direct and indirect) supporting a highly skilled labour force and an estimated $10 billion in direct impacts and $9 billion in annual indirect impacts between 2030 and 2040[1]. 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[2].

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

[2] Ibid

These activities are responsive to Canada's SMR Roadmap, which specifically recommended that "Governments, utilities, industry, and the national laboratory support demonstration of SMR 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 SMR research and development, continuing the invitation process and collaborating with international partners.

New area of cancer research. 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 and has used this in pre-clinical trials to demonstrate the efficacy of the proposed therapy. Based on promising results, CNL is exploring opportunities to partner with others in the production of actinium-225 on a scale that could support clinical trials and more widespread use in treatment across Canada and internationally.

Funding Requirements

Federal funding for the next five years is required to achieve the objectives presented in this Corporate Plan Summary. The following sections of the Corporate Plan Summary provide more information on work planned for environmental stewardship and the nuclear laboratories.

Total AECL Five-Year Projection of Federal Funding Requirements

				Plan					
(millions of Canadian dollars)	**Notes**	**Actual 2019-20**	**Budget 2020-21**	**2021-22**	**2022-23**	**2023-24**	**2024-25**	**2025-26**	**5 Year Total**
Funding Requirements									
Environmental Stewardship		590	660	808	819	355	384	193	2,559
Nuclear Laboratories – Operating		167	236	229	203	182	249	100	963
Nuclear Laboratories – Capital		110	113	152	195	123	40	23	532
Federal Funding Requirement AECL	1	**867**	**1,009**	**1,189**	**1,216**	**660**	**673**	**316**	**4,053**

[1] The current Government-owned, Contractor-operated contract ends September 2025 and current approved funding only extends up until this point.

AECL's detailed financial performance information and annual report can be found on our website https://www.aecl.ca/reports-resources/.

Objectives and Plans – 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, used today at 19 reactors in Canada and 30 (CANDU or CANDU-derivatives) internationally. It 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 scientific achievements – including two researchers who went on to win Nobel Prizes.

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 scientific legacy. AECL's mandate has been clearly defined by the Government to leverage the capabilities at the Chalk River Laboratories to support federal needs and responsibilities in nuclear science and technology, as well as to provide services to third-parties on a commercial basis. This has been further enabled by an investment of $1.2 billion between 2016 and 2026 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 its responsibilities in the areas of health, nuclear safety and security, energy and the environment.

AECL's planned results in this area include supporting 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 is focused on increasing collaboration and partnership with other nuclear industry members, academia and other national laboratories. As well, the advancement of nuclear technologies for the benefit of Canadians and the growth of commercial business opportunities remain a top priority.

Conceptual image: Third Way

CNL has developed a 10-year plan outlining its 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, the external environment and market opportunities, CNL has identified eight strategic initiatives to focus on during the planning period that help the federal government and third-party customers tap into new and expanded markets.

- **Small modular reactors:** With the release of Canada's SMR Action Plan in December 2020, the Government of Canada has recognized the potential for small reactors to help Canada achieve net zero by 2050. SMRs could provide vital, new clean energy options for replacing coal, greening resource extraction and improving energy security for remote communities. To keep Canada at the forefront of the SMR industry, CNL is aiming to site a demonstration reactor at one of AECL's sites by 2026. One project – by Global First Power – is the most advanced in Canada, having launched a licensing and Environmental Assessment process in 2019 to build an SMR at AECL's Chalk River Laboratories.
- **Advanced fuel fabrication:** This initiative involves the 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 for SMRs.
- **Decarbonizing the transportation sector:** 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 play a leading role in the demonstration of hydrogen-based bulk transport. This goal remains unchanged despite COVID-19, but risks remain and progress is being monitored closely. As hydrogen technologies have matured, costs have dropped to the point that hydrogen solutions are financially competitive with similar energy conversion technologies. 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 is working to establish a centre 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 borders by developing essential tools to detect contraband special nuclear materials.

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 radiation directly to cancerous cells by chemically binding appropriate radionuclides with targeting biomolecules. This is more effective in killing cancer cells and 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 going forward.

- **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 centre 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's goal is to develop and complete early demonstration of a suite of targeted alpha therapy compounds by 2022. This remains on schedule despite COVID-19.
- **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 market worldwide. 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 key priority. CNL has already commissioned a nuclear cyber security test facility located in New Brunswick, and is now working to develop, commercialize and deploy a nuclear industrial control cyber intrusion detection and mitigation system by 2022. This remains on track despite COVID-19, with work ongoing to involve industrial partners.
- **Reactor sustainability:** This initiative includes 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 in the process of 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 behaviour 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 of Funding Requirements

(millions of Canadian dollars)	Notes	Actual 2019-20	Budget 2020-21	Plan 2021-22	2022-23	2023-24	2024-25	2025-26	5 Year Total
Nuclear Laboratories									
Nuclear Laboratories – Operating		237	287	293	271	258	330	181	1,331
Revenue		70	51	64	68	76	80	81	369
Capital		110	113	152	195	123	40	23	532
Federal Funding Requirement	1	**277**	**349**	**380**	**397**	**305**	**289**	**123**	**1,494**

[1] The current Government-owned, Contractor-operated contract ends September 2025 and current approved funding only extends up until this point.

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 14 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 focuses on four research themes:

1) **Supporting the development of biological applications and understanding the implications of radiation on living things.** This includes:
   - 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.
   - Quantifying radiation health risks.

2) **Enhancing national and global security, nuclear preparedness and emergency response.** This includes:
   - Developing exercises and response for cyber security industrial control systems.
   - Developing novel techniques and methodologies for nuclear forensics to support federal agencies in their effort to establish and advance the national nuclear forensics capability.
   - Ensuring that Canada is ready to respond in an event of a radiological, nuclear and mix-threats emergency, in Canada or abroad.

3) **Supporting safe, secure and responsible use and development of nuclear technologies.** This includes:
   - Implementing the Pan-Canadian Framework and help achieve Canada's climate change goals and greenhouse gas emissions reduction targets by enabling technologies that reduce the environmental impacts of energy production, bring clean electricity onto the grid, reduce industrial emissions, and reduce diesel use in remote communities.
   - Increasing competitiveness and promoting the use of clean technology – including in Canada's natural resource sectors – through research, development, and demonstration of innovative nuclear energy technologies.
   - Supporting the Government of Canada's SMR initiatives.
   - 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.
   - Informing potential programs, regulations, and policies for new nuclear energy technologies.

4) **Supporting environmental stewardship and radioactive waste management.** This includes:
   - Supporting Canada's national and international leadership to reduce the environmental impact of nuclear energy.
   - Enabling Canada's environmental stewardship by supporting the development of nuclear energy within a robust framework that addresses environmental and waste management concerns.
   - Developing and demonstrating innovative technologies to reduce environmental impacts, increase competitiveness, and promote the use of clean technology, including in Canada's natural resource sectors.

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. National Research Council of Canada
12. Natural Resources Canada
13. Public Safety Canada
14. Royal Canadian Mounted Police

Status: In 2020-21, the federal interdepartmental committees, representing fourteen departments and agencies, continued to work with CNL on developing a program of work that addresses 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:

- demonstrate the production of hydrogen without greenhouse gas emissions using a copper-chlorine (Cu-Cl) thermochemical cycle (this work contributes to the Generation IV International Forum and CNL's work on hydrogen to decarbonize the transportation sector);
- advance SMR technologies and deployment for Canada in order 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;
- support regulatory and licensing decisions for projects to understand the behaviour of materials in advanced reactors, SMRs and the current fleet in extreme environments and the effects of aging, corrosion and degradation of in-core materials such as concrete and cables;
- examine the potential for SMRs to meet the needs of a near-zero carbon remote mining operation;
- develop improved bio dosimetry techniques for rapid triage in emergency response which can reduce dose triage estimations from up to three days to one day;
- develop a thorium generator to produce research quantities of actinium-225 in support of new medical applications for cancer treatments;
- understand the effects of gamma radiation and its effects on cancer;
- advance technologies for the detection of special nuclear materials at the border;
- reduce uncertainties in low-dose risk assessment to address challenges in regulatory policy, health assessment and public communication;
- improve the understanding of environmental impacts and waste of SMR operations in support of Canada's SMR Roadmap activities;
- host exercises to test cyber security resilience for nuclear power plants in a full-scale cyber physical simulation of the control and safety systems; and,
- support Canada's interests, commitments and arrangements in non-proliferation, counter-terrorism and disarmament priorities such as the International Partnership for Nuclear Disarmament Verification and the Comprehensive Nuclear-Test-Ban Treaty Organization though international engagements and technology demonstrations at the Chalk River site.

Work in 2021-22 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 to reach its climate change goals in 2030 and 2050. On the international front, priorities 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, the Fissile Material Cut-off Treaty, the Comprehensive Nuclear Test Ban Treaty, and the International Partnership for Nuclear Disarmament Verification.

As in previous years, the measures of success are related to meeting federal priorities by delivering on milestones and targets set out in CNL's annual plan.

To minimize the impact of reduced operations due to COVID-19, CNL has shifted and prioritized work that could be carried out remotely while most laboratory (experiment and field) work was suspended. This reprioritization of work allowed CNL to respond to immediate government needs for COVID-19, including activities to support vaccine development, ventilator design, risk-based modelling, scenario planning, and technology development such as material sterilization equipment.

Planning for new projects starting in the 2021-22 fiscal year continued as scheduled with all interdepartmental committee meetings held virtually. Leveraging the governance of the Federal Nuclear Science and Technology Work Plan, CNL continues to actively engage 14 departments and agencies to look for opportunities where CNL capabilities and expertise could be used to help government respond to COVID-19 and future pandemics.

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.	Support Canada's position as a global player in areas of security, health, energy and nuclear regulation. Develop highly qualified personnel for the next generation of nuclear workers and scientists. Advance unique technical knowledge and understanding to support nuclear policy and regulation, and maintain Canada's ability to actively and effectively participate in international fora and meet international obligations with respect to energy technology, safety, security and nonproliferation.

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 2020-21, CNL continued to work with various Government departments and agencies on nuclear research in safety and security.

In 2021-22, CNL will complete the re-fuel of the SLOWPOKE reactor at the Royal Military College of Canada in Kingston, Ontario. CNL will also continue a number of projects with federal departments and agencies including: 1) a project with Transport Canada to develop an assessment tool to examine clean technologies that could reduce greenhouse gas emissions and other pollutants from marine vessels; 2) a feasibility study with the Department of National Defence to assess the potential of providing Garrison Petawawa with energy generated from a demonstration SMR at the Chalk River Laboratories; and 3) a feasibility study with the Canadian Coast Guard to examine reducing greenhouse gas emissions in the Canadian maritime industry.

Furthermore, CNL will continue to participate in the Defence Research and Development Canada's Canadian Safety and Security Program to: 1) assess the epigenetic basis of radiation health effects; and 2) enhance and expand Canada's current suite of scientific and technical capabilities for the forensic analysis of noble gas emissions. CNL will also initiate a new project under this program to develop a deployable, non-destructive technique to support more secure and efficient package screening.

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 nuclear science and technology to increase collaboration in support of federal roles and needs for the benefit of Canadians.

New Technology Initiative 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 for future or emerging opportunities. Consistent with similar programs at national laboratories around the world, this fund supports work that may be at very early stages, peripheral to current research priorities, high risk, or exploratory. The New Technology Initiatives Fund is expected to promote innovative thinking, reward initiative, balance near-term priorities with long-term vision, and improve employee engagement.

Status: Projects underway in 2020-21 to support CNL's strategic initiatives in its four program areas are expected to continue into 2021-22:

- Continuing the characterization of boron nanotube composite materials for radiation protection in space.
- Under the Federal Nuclear Science and Technology Work Plan, CNL demonstrated and developed a thorium generator for the production of actinium-225. Work continues to improve actinium-225 production from a thorium generator under the New Technology Initiative Fund.
- Continuing with the Strategic, Enabling, Engaging, Development Crowd Sourcing Initiative that was launched in 2018-19. In 2020-21, 94 proposals were received, and 26 projects were initiated to improve products, processes, facilities and advance CNL's strategic initiatives. In 2021-22, CNL will launch the third round of the initiative.
- Completing the implementation of new test equipment such as the Focused Ion Beam to improve material science capabilities and the Charpy Impact Testing Equipment to enhance capabilities in the Centre for Reactor Sustainability.

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 continues to provide commercial services to third parties and to build a strong, vibrant and sustainable nuclear science and technology mission.

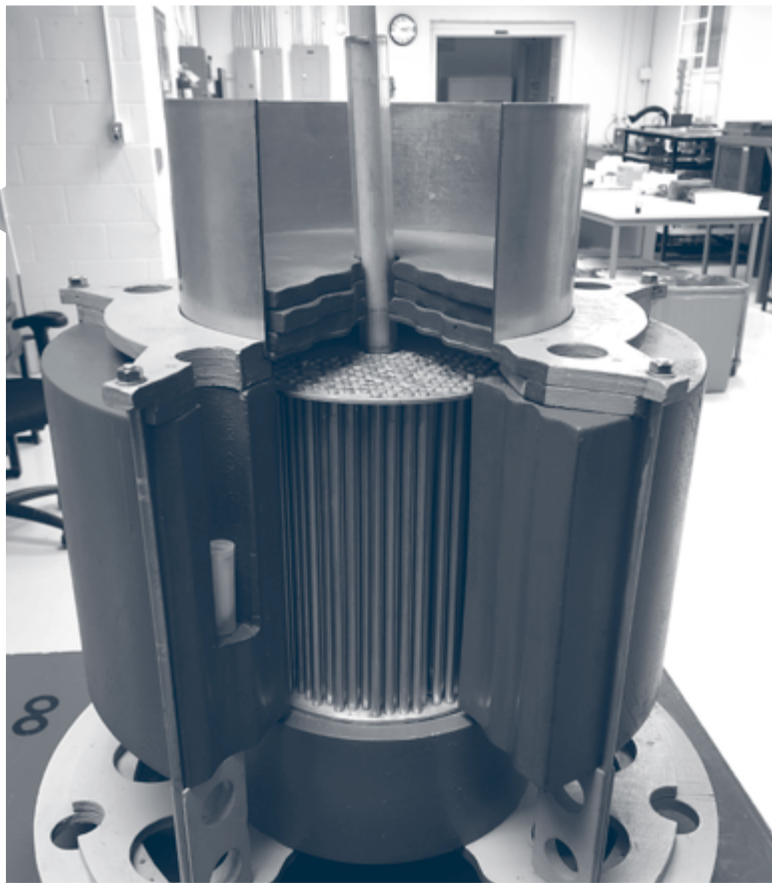
Status: Building on previous years' efforts, CNL continued to engage with and respond to existing customer requests and explore new markets, to the extent possible given COVID-19 restrictions. Going forward, CNL will continue to expand commercial opportunities based on identified strategic directions and opportunities, with growth expected in the areas of light-water reactors and SMRs.

Commercial opportunities in science and technology for industry customers continue to be pursued in the areas of health, safety and security, energy, and environment – with energy being the single largest area of current work and the largest growth area. Work for industry customers included energy-related services to the CANDU Owners Group and major utility companies, as well as new work in the light-water reactor market.

Anticipated work for 2021-22 includes:

- Materials, chemistry, and corrosion testing on irradiated and unirradiated materials for CANDU facilities.
- Post irradiation examination of light-water reactor fuel, including innovative destructive examination of fuel cladding that will provide valuable insight into corrosion rates and material integrity. Once the study is complete, it is anticipated that other American utilities will be interested in similar examinations for their units.
- Support for domestic SLOWPOKE reactors, including refueling activities and decommissioning.
- Production and supply of radionuclides for targeted alpha therapy in the battle against cancer and other diseases. CNL can apply existing expertise in isotope separation and the scaling up of processing and handling radionuclides.
- Commercial opportunities related to environmental remediation. CNL has significant and unique expertise in this area and can take advantage of growing opportunities.
- Early commercial opportunities related to SMRs. In particular, CNL has pursued opportunities in areas such as fuel development, thermophysical properties of molten salts and materials corrosion, where CNL has existing expertise and competitive advantage to participate in the emerging global market.

SLOWPOKE reactors were designed by AECL as a low-energy and cost-efficient option to provide a source of neutrons for scientific research. They are used today primarily as a tool for professional development and teaching nuclear science and technology. In addition, research applications include neutron radiography, material characterization for science and technology, including nuclear forensics, and the production of radioactive tracers for chemical and environmental research.



Calvin411, CC BY-SA 4.0, via Wikimedia Commons

National Research Universal Reactor

After 60 years of operation, the National Research Universal reactor was shut down in March 2018. Designed in the early 1950's, the research reactor enabled great advances across a variety of global industrial sectors. The National Research Universal 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 shutdown of the National Research Universal reactor has left a gap in research capabilities at the Chalk River Laboratories. AECL and CNL are currently exploring potential needs, interests and options around a future research reactor.

The COVID-19 pandemic has affected clients and services across the board in this area, with the exception of select essential work which was carried out as planned. Going forward, COVID-19 is anticipated to continue to affect new business lines due to limitations on in-person meetings, conferences and other relationship-building opportunities.

TARGETS		
Short-term 1-2 years	Medium-term 3-4 years	Long-term 5+ years
Generate more than $60.0M in revenue.*	3%-5% growth year-over-year.	2%-3% growth year-over-year.

* Revenue target adjusted for COVID-19 impact

Revitalization of the Chalk River Laboratories

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 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.

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 Canadian Nuclear Safety Commission, which as a regulator ensures that all nuclear activities in Canada are delivered safely, AECL expects high levels of performance from CNL in the areas of health, safety, security and environmental protection.

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 in order for AECL to meet its greenhouse gas 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 new non-nuclear facilities.	Commence construction on 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 the Chalk River Laboratories and all AECL sites.	

Other Areas of Focus

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. CNL is also examining how to treat inventories of heavy water that have small amounts of tritium and other contaminants, such that it could also be sold.

In 2021-22 and onwards, CNL will continue its work to optimize the management and sales of heavy water. Revenues from heavy water are retained by AECL to fund historic liabilities and business priorities in science and technology and related capital expenditures.

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

These activities pertain 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.

Objectives and Plans – 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, intermediate-level waste and low-level waste. Several sites and/or buildings have also 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 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 leading international practices. Specifically, AECL has asked CNL to propose long-term radioactive waste disposal solutions and to advance other decommissioning activities to reduce environmental liabilities.

This work is well underway, with significant progress made at the Chalk River Laboratories where close to 100 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 under Environmental Stewardship 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 of Funding Requirements

(millions of Canadian dollars)	Notes	Actual 2019-20	Budget 2020-21	Plan 2021-22	2022-23	2023-24	2024-25	2025-26	5 Year Total
Environmental Stewardship									
Total Environmental Stewardship		591	662	810	821	358	387	196	2,572
Revenue	1	2	2	2	2	3	3	3	13
Federal Funding Requirement	2	**590**	**660**	**808**	**819**	**355**	**384**	**193**	**2,559**

[1] Assumed Third Party Waste Costs and offsetting Revenue of $2-3 million are equal each year.

[2] The current Government-owned, Contractor-operated contract ends September 2025 and current approved funding only extends up until this point.

Waste Management and Disposal at the Chalk River Site

Overview: Existing radioactive waste is safely stored at the Chalk River site. However, long-term management and 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 AECL's low-level radioactive waste, as well as small amounts of waste from other Canadian producers such as hospitals and universities. The facility would allow for the disposal of the vast majority of AECL wastes currently in interim storage, as well as waste generated as a result of contaminated land remediation activities, decommissioning activities and continued operations of the nuclear laboratories. This project is critical to advancing 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 that 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 the proposed repository that is currently being explored by the Nuclear Waste Management Organization. Projects to manage used fuel are discussed in more detail in the section below on *Management of used fuel and repatriation of highly-enriched uranium*.

CNL also manages AECL's inventory of highly radioactive stored liquid waste which is a byproduct of medical isotope production. A project is in place to safely remove and process the legacy radioactive liquid wastes 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: CNL has been working with the regulator, the Canadian Nuclear Safety Commission, and meeting with stakeholders, Indigenous communities and local municipalities to discuss the proposed near surface disposal facility since 2016. In 2017, CNL submitted a draft Environmental Impact Statement and subsequently responded to comments from both federal and provincial regulators and organizations.

CNL is currently preparing to submit the final Environmental Impact Statement to the Canadian Nuclear Safety Commission in spring/summer 2021. Public hearings are expected in 2022. Outreach, engagement and collaboration with Indigenous communities, municipalities, stakeholders and the public will continue throughout the regulatory process.

The COVID-19 pandemic has led to some delays in projects, including in stakeholder and Indigenous engagement. With respect to the management of stored liquid wastes, field work was halted due to reduced operations.

TARGETS		
Short-term 1-2 years	Medium-term 3-4 years	Long-term 5+ years
Develop a program for radioactive waste that does not currently have a disposition route (where there are no plans for disposal). This will be aligned 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.	Complete construction of facility for interim storage of intermediate-level waste. Determine the disposal path for all waste that does not currently have a project in place, including intermediate-level waste.	
Receive low-level radioactive waste from the Whiteshell Laboratories site for storage and/or disposal.		
Receive regulatory approval to begin construction on the near surface disposal facility.	First waste emplacement at 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 near surface disposal facility.

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, 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 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 then, 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
Complete characterization and remediation plans for various waste management areas at the Chalk River site.	Remediate waste management areas once the near surface disposal facility is available.	Complete waste management areas and site remediation activities.

Decommissioning at the Chalk River Site

Overview: The Chalk River site includes multiple redundant buildings which require decontamination, decommissioning and demolition. The site has been in existence since the 1940s, 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 (e.g., machine shops, garages, etc.). Most of these facilities and buildings are outdated, no longer needed to meet operational needs, and contribute to high site costs through energy consumption and ongoing maintenance for safety and security purposes. Buildings also need to be removed to make way for new facilities as part of the Chalk River site revitalization.

Status: Since 2015, there has been significant acceleration of decommissioning work at the Chalk River site; close to 100 buildings and structures having been decontaminated, decommissioned and demolished.

While COVID-19 required all active decommissioning field work to be paused for a number of months, and will lengthen overall project timelines, CNL is adjusting plans to recover schedules to the extent possible. It should be noted that delays related to the proposed near surface disposal facility have required development of expanded interim waste storage capacity so that building decontamination and demolition can continue without interruption.

TARGETS		
Short-term 1-2 years	Medium-term 3-4 years	Long-term 5+ years
Demolish 10 buildings and structures.	Develop and implement a program of work to reduce the liability associated with the inventory of waste and assets in the NRU rod bays.	Reduce long-term liabilities through the safe and 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 Materials Management and Minimization project (formerly the Global Threat Reduction Initiative) – an initiative that aims to reduce 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 this material to the United States for conversion and reuse. This initiative provides a safe, secure, timely and permanent solution to Canada's long-term management of this material.

CNL is also advancing efforts to consolidate AECL's inventory of used fuel. This entails transferring used fuel, currently stored in various locations across Canada, to the Chalk River Laboratories. Consolidating used fuel in a single location will increase safety and security and reduce costs while a permanent disposal solution is being developed by the Nuclear Waste Management Organization.

Status: The fuel repatriation program continues to be very successful, with shipments of highly-enriched uranium fuel rods and target residue material (liquid highly-enriched uranium) completed in 2020 (despite challenges related to COVID-19). CNL is also advancing efforts to consolidate AECL's inventory of used fuel at the Chalk River site.

TARGETS		
Short-term 1-2 years	Medium-term 3-4 years	Long-term 5+ years
Continue to investigate and pursue the disposition or repatriation of fresh and irradiated fuel material to further reduce liabilities for Canada.		
Prepare plans and begin stakeholder and Indigenous engagement activities for the shipments of AECL used fuel to the Chalk River site.	New fuel storage capacity is ready to accommodate AECL used fuel.	Complete AECL fuel consolidation.

Closure of the Nuclear Power Demonstration Reactor Site

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 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 stakeholder and Indigenous community concerns. CNL submitted a draft Environmental Impact Statement in 2020. While the project is more than two years delayed against the original schedule, this has allowed for additional engagement with stakeholders and Indigenous communities to gather input and adjust the proposed approach, as necessary. Activities have included meetings, site tours and extensive Indigenous outreach, including providing funding for capacity-building and Traditional Knowledge studies, and to enable Indigenous communities to engage technical experts to comment on the draft Environmental Impact Statement.

In the meantime, CNL continues its work to characterize radioactivity and contamination, decommission and decontaminate other hazards, and maintain the facilities. CNL is also working to update the Environmental Impact Statement; public hearing dates have yet to be scheduled. Outreach, engagement and collaboration with Indigenous communities, municipalities, stakeholders and the public will continue throughout the regulatory process.

TARGETS		
Short-term 1-2 years	Medium-term 3-4 years	Long-term 5+ years
Submit the final Environmental Impact Statement for the proposed in-situ decommissioning of the Nuclear Power Demonstration reactor.	Remediate reactor site contamination, with long-term monitoring and surveillance in place. Canadian Nuclear Safety Commission accepts as complete all active decommissioning and waste management activities, with only long-term monitoring and surveillance activities remaining.	Ongoing long-term monitoring and surveillance.

Port Hope Area Initiative

Overview: The Port Hope Area Initiative represents Canada's commitment to clean up and manage historic low-level radioactive waste situated in the municipalities of Port Hope and Clarington, in Ontario. The objective is to safely relocate and manage roughly 2.4 million tonnes of historic low-level radioactive waste and contaminated soils. Two near surface long-term waste management facilities have been constructed (one in each municipality) and have been receiving waste from existing waste management facilities, as well as other locations in the local area.

Status: Significant progress is being made in advancing this complex remediation project, however, there continues to be challenges related to the number of properties requiring remediation and the timelines associated with this. With respect to the Port Granby Project, the total estimated waste volume increased by more than 50% from the original estimates due to the wider spread of contamination. That said, remediation was completed in the fall of 2020 and the facility will subsequently be capped and closed in 2021-22. The site will then transition to a long-term monitoring and maintenance phase. AECL is also currently exploring options regarding land surrounding the long-term waste management facilities, including potentially establishing a nature reserve in collaboration with local stakeholders, municipalities and Indigenous communities.

As part of the Port Hope Project, activities continued for the construction of the long-term waste management facility, however construction completion was delayed due to COVID-19. The clay base liner for the final cell was completed in 2020-21 and final construction activities are to be completed in the 2021 field season.

The largest challenge associated with the Port Hope project relates to the scope and execution of the remediation of residential properties. As characterization activities advance, the number of individual properties requiring remediation work has increased. Port Hope property owners and residents have expressed dissatisfaction about the length of time it takes to complete the remediation of their properties and CNL has identified that a significant number of property cleanups are driven by the generic, conservative cleanup criteria for arsenic and uranium in soil. As such, CNL is recommending changes to the cleanup criteria for arsenic and uranium to minimize unintended negative environmental impacts and disruption to the community.

CNL submitted an application to the Canadian Nuclear Safety Commission and is currently in the process of engaging federal and provincial regulators, the municipality, local Indigenous communities, and the public to move this application forward. A public hearing is not expected until spring 2022.

In March 2020, all physical work at the Port Hope Area Initiative was paused due to COVID-19. Some limited essential operations continued, for example, to ensure the safety and security of the long-term waste management facilities and associated groundwater collection systems and wastewater treatment plants. That said, a portion of planning activities were maintained, including work with regulators and stakeholders to revise the cleanup criteria for the remediation of residential properties. Should adjustments to the cleanup criteria be accepted, this would have positive impacts on the project, including reducing current timelines and risks associated with increases to the number of residential properties requiring remediation.

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

Closure of the Whiteshell Laboratories

Overview: The Whiteshell Laboratories, located in Pinawa, Manitoba, is the second largest AECL site 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. The site includes a radioactive waste management area that provides interim storage of radioactive waste created as a result of the operations of the research reactor and nuclear laboratories.

In 1998, the Government 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 increased emphasis on tackling environmental and decommissioning responsibilities, AECL 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, approximately 30 years ahead of the previous schedule. This includes a proposal by CNL to decommission the WR-1 reactor in situ which is currently undergoing an Environmental Assessment.

Status: CNL has been progressing the decommissioning of the site, with several buildings being decontaminated and demolished. 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 ground, that contain intermediate-level waste and potentially fissile nuclear material that cannot be fully characterized before retrieval begins. Given the level of risk involved with remediation, CNL has had to adjust its approach which is based on remote tooling and robotics (and as a result, more complex and costly) to protect workers and the environment.

CNL also continued activities to engage the public and Indigenous communities on its proposal to decommission the WR-1 reactor in situ. These included extensive engagement with Indigenous and local communities; providing funding for Traditional Knowledge studies, other capacity building activities and liaison positions; and hosting site tours and open houses. AECL has 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 schedule 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). It is expected that CNL will be submitting a revised and final Environmental Impact Statement in 2021; public hearings have not yet been scheduled.

Looking to site closure and mindful of the impact on the local community, AECL will continue to work with local and Indigenous communities to discuss the future of AECL's lands, with a view to finding acceptable solutions to support economic development, which could include consideration for siting an SMR at the Whiteshell site.

As with other AECL sites, decommissioning activities were paused at the Whiteshell site in March 2020. While working remotely, CNL attempted to mitigate schedule impacts by pivoting to necessary planning and design activities related to the standpipe remediation and other projects. While delayed physical works impacted the planned schedule, CNL is making every effort to achieve closure in 2027.

TARGETS		
Short-term 1-2 years	Medium-term 3-4 years	Long-term 5+ years
Decommission the majority of buildings on the main campus by 2022. Prepare the retrieval system for the standpipes and bunkers to start operations. Submit the final Environmental Impact Statement for the proposed in situ decommissioning of the WR-1 reactor.	Remove and transport all high-level radioactive waste and used fuel to the Chalk River Laboratories.	Complete waste retrieval for all the standpipes in the waste management area. Complete Whiteshell site contamination remediation, as well as a long-term surveillance plan. The Canadian Nuclear Safety Commission accepts as complete all active decommissioning and waste management activities, with only long-term monitoring and surveillance activities remaining.

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 and stakeholder and Indigenous engagement continue to enable the remediation of sites along the Northern Transportation Route. Due to COVID-19, none of the field work planned for 2020 was executed and was pushed to 2021, including the removal of material in 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 cleanup activities that will closely follow remediation of the temporary storage sites continue to be progressed. This will allow site remediation along the Northern Transportation Route to commence several years sooner than previously anticipated.

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 the Northern Transportation Route.	Continue to engage local stakeholders and Indigenous communities. Commence remediation for sites in the Sahtu region along the Northern Transportation Route.	Complete remediation for all sites along the Northern Transportation Route.

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: The decommissioning of these prototype reactors was not originally 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 scope. To move forward with the decommissioning of certain non-nuclear buildings at the Douglas Point site, CNL requested an amendment to its operating licence. Associated public and Indigenous engagement, including a public hearing held by the Canadian Nuclear Safety Commission, took place in late 2020. The Commission approved the request in March 2021. At Gentilly-1, asbestos and bulk waste removal will continue in 2021-22.

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.

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. Budgets have been included for completeness.

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 mission budgets (e.g., science and technology, environmental stewardship and capital) include both direct and indirect costs.

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. CNL manages and operates AECL's sites and undertakes 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. Revenue is generated from work to support the nuclear energy industry, the sale or lease of heavy water, and research and development services provided to third parties.

Statement of Financial Position

(millions of Canadian dollars)	Actual 2019-20	Budget 2020-21	Plan 2021-22	2022-23	2023-24	2024-25	2025-26
Financial Assets							
Cash	80	80	80	80	80	80	80
Long-term disposal of waste fund	43	49	54	59	64	69	75
Investments held in trust	56	58	60	62	64	66	68
Trade and other receivables	94	45	45	45	45	45	45
Appropriations receivable	100	120	140	145	110	115	80
Inventories held for resale	151	135	119	102	86	69	52
	524	486	497	493	449	445	400
Liabilities							
Accounts payable and accrued liabilities	35	32	31	31	34	34	33
Employee future benefits	18	16	14	12	10	8	6
Due to Canadian Nuclear Laboratories	164	140	160	165	125	130	95
Decommissioning and waste management provision	7,185	6,958	6,629	6,262	6,148	5,999	6,034
Contaminated sites liability	877	736	535	345	348	355	362
	8,280	7,881	7,369	6,815	6,666	6,526	6,531
Net Debt	(7,756)	(7,395)	(6,872)	(6,322)	(6,217)	(6,082)	(6,131)
Non-Financial Assets							
Tangible capital assets	716	781	888	1,037	1,118	1,108	1,082
Prepaid expenses	1	1	1	1	1	1	1
	717	782	889	1,038	1,119	1,109	1,083
Accumulated Deficit	**(7,040)**	**(6,613)**	**(5,983)**	**(5,284)**	**(5,098)**	**(4,973)**	**(5,048)**
Accumulated deficit is comprised of:							
Accumulated operating deficit	(7,041)	(6,613)	(5,983)	(5,284)	(5,098)	(4,973)	(5,048)
Accumulated remeasurement gains	2	–	–	–	–	–	–
	(7,040)	**(6,613)**	**(5,983)**	**(5,284)**	**(5,098)**	**(4,973)**	**(5,048)**

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.

Changes to the liability may occur in future years 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. This is particularly a known risk for the contaminated sites liability as CNL works to re-estimate costs for residential property remediation.

The decommissioning and contaminated sites liability is made up of a collection of estimates that provide a projected value of the cost of undertaking decommissioning, remediation or waste management projects, some far into the future. As projects near, they are examined in more detail to plan for execution, which can lead to increases in estimates. This is due to the fact that these projects are related to legacy sites, which brings a high level of uncertainty around waste and contamination levels. As work is planned for and undertaken, risks may materialize that lead to increased costs. This is typical of legacy nuclear research sites, and consistent with what is experienced in similar sites in the United States and the United Kingdom.

However, as decommissioning work ramps up in the coming years, the liability will decrease commensurate with the liabilities 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 funding provided for revitalizing the Chalk River Laboratories in the coming years.

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 2019-20	Budget 2020-21	Plan 2021-22	Plan 2022-23	Plan 2023-24	Plan 2024-25	Plan 2025-26	5 Year Total
Revenues									
Parliamentary appropriations		868	1,009	1,189	1,216	660	673	316	4,053
Commercial revenue		112	78	91	96	104	109	110	509
Interest income		6	4	4	4	4	4	4	20
Other proceeds		50	–	–	–	–	–	–	–
		1,036	1,090	1,284	1,316	767	785	429	4,582
Expenses									
Cost of sales		77	54	64	67	72	76	77	356
Operating expenses	1	83	66	64	64	59	68	64	319
Contractual expenses	2	241	252	249	224	207	276	130	1,086
Decommissioning, waste management and contaminated sites expenses	3	955	289	278	261	244	239	234	1,256
		1,355	662	654	616	582	659	505	3,017
(Deficit) surplus for the year	4	(319)	428	630	700	185	126	(75)	1,565
Accumulated operating deficit, beginning of year		**(6,722)**	**(7,041)**	**(6,613)**	**(5,983)**	**(5,284)**	**(5,098)**	**(4,973)**	
Accumulated operating deficit, end of year		**(7,041)**	**(6,613)**	**(5,983)**	**(5,284)**	**(5,098)**	**(4,973)**	**(5,048)**	

1 These amounts represent AECL's operating expenses.

2 Contractual expenses include payments to CNL (less payments for decommissioning and waste management, cost of sales and capital) and contractor fees.

3 Decommissioning, waste management and contaminated sites expenses represent the accretion expense on the decommissioning and waste management provision and contaminated sites liability.

4 Large surpluses are a result of capital and decommissioning and waste management funding received for which there are smaller corresponding accrual expenses. Capital funding received is partially offset by amortization expense, and decommissioning and waste management funding is partially offset by accretion expense.

Operating expenses are comprised of AECL oversight operations and amortization of tangible capital assets.

Reported contractual expenditures are expected to decrease over the planning period as a result of decreased spending for the National Research Universal reactor, as the reactor is now shut down.

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)	Actual 2019-20	Budget 2020-21	Plan 2021-22	2022-23	2023-24	2024-25	2025-26	5 Year Total
Operating transactions								
Cash receipts from Parliamentary appropriations	837	1,029	1,209	1,221	625	678	281	4,013
Cash receipts from customers	111	78	91	96	104	109	110	509
Cash paid to suppliers	(250)	(317)	(323)	(286)	(233)	(346)	(157)	(1,345)
Cash paid to employees	(12)	(13)	(14)	(14)	(14)	(14)	(14)	(70)
Cash paid for decommissioning, waste management and contaminated sites activities	(562)	(660)	(808)	(819)	(355)	(384)	(193)	(2,559)
Cash invested for future waste management and disposal activities	(12)	(8)	(7)	(7)	(7)	(7)	(8)	(36)
Interest received	4	4	4	4	4	4	4	20
Cash provided by operating transactions	116	113	152	195	123	40	23	532
Capital transactions								
Acquisition of tangible capital assets	(98)	(113)	(152)	(195)	(123)	(40)	(23)	(532)
Cash applied to capital transactions	(98)	(113)	(152)	(195)	(123)	(40)	(23)	(532)
Increase in cash	**18**	**–**	**–**	**–**	**–**	**–**	**–**	
Cash at beginning of year	**62**	**80**	**80**	**80**	**80**	**80**	**80**	
Cash at end of year	**80**	**80**	**80**	**80**	**80**	**80**	**80**	

Operating Budget And Notes

Approved Government of Canada Funding – Operating

(millions of Canadian dollars)	Notes	Actual 2019-20	Budget 2020-21	Plan 2021-22	2022-23	2023-24	2024-25	2025-26	5 Year Total
AECL									
Environmental stewardship		590	660	808	819	355	384	193	2,559
Nuclear laboratories – Operating		167	236	229	203	182	249	100	963
Total Government Funding – Operating	1	**757**	**896**	**1,037**	**1,022**	**537**	**633**	**293**	**3,521**

1 The current Government-owned, Contractor-operated contract ends September 2025 and current approved funding only extends up until this point.

Decommissioning and waste management funding has increased due to a ramp up of activities at the Port Hope Area Initiative and accelerated decommissioning and waste management at the Chalk River Laboratories, in particular the planned construction of the near surface disposal facility. Nuclear laboratories funding is expected to decline as a result of the shutdown of the National Research Universal reactor which occurred in March 2018.

Capital Budget And Notes

Approved Government of Canada Funding – Capital

(millions of Canadian dollars)	Notes	Actual 2019-20	Budget 2020-21	Plan 2021-22	2022-23	2023-24	2024-25	2025-26	5 Year Total
AECL									
Capital		110	113	152	195	123	40	23	532
Total Government Funding – Capital	1	**110**	**113**	**152**	**195**	**123**	**40**	**23**	**532**

1 The current Government-owned, Contractor-operated contract ends September 2025 and current approved funding only extends up until this point.

More details on the capital plan are provided in Annex 2.

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 support 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 commercial customers.

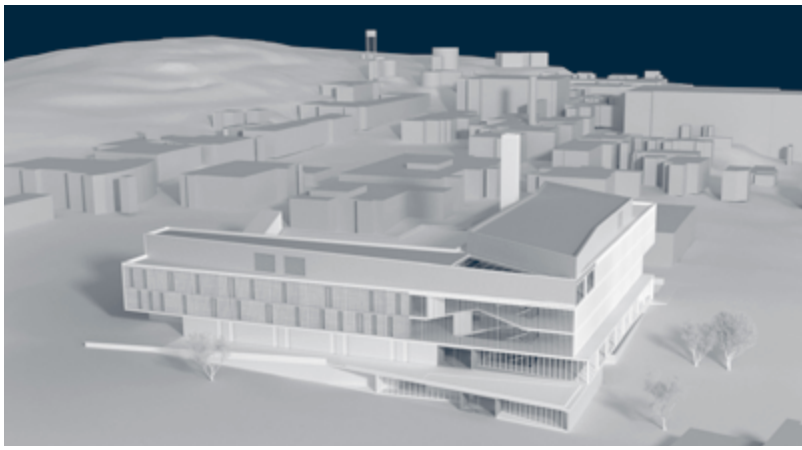
Revitalization activities address two main areas:

- **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 and 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, low-carbon, world-class science facilities and infrastructure to enable delivery of CNL's commitments set out in its long-term plan. The projects to be undertaken are aligned with the strategy to revitalize the Chalk River site and include the Advanced Nuclear Materials Research Centre and three conventional (or non-nuclear) new builds.



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 in targeted alpha therapy research, SMRs, advanced fuels fabrication, nuclear forensics and response, as well as ongoing work in support of utilities and their reactor life extension and reliability.

Status: The project is being delivered through an Integrated Project Delivery approach, whereby the design and construction teams collaborate at all stages of the project. Planning and design activities are underway.

Conventional New Builds

Overview: Conventional or non-nuclear new builds are under construction at the Chalk River Laboratories to enable the revitalization of the site by consolidating work and enabling the demolition of outdated buildings.

Photo courtesy of CNL IPD NB Poly Party Team © 2020 Kevin Belanger

Status: Two of the three facilities, a logistics/warehouse building and a support/maintenance facility, have been constructed and are now operational. The logistics/warehouse building is facilitating shipping and receiving at the site, enhancing security at the entrance and reducing the need for non-CNL staff to be on site. Similarly, the support/maintenance facility consolidates maintenance resources and equipment into a single, centralized location at the Chalk River site, allowing CNL to achieve efficiencies and provide safer, more cost-effective support to the programs on site. A third building, the business hub, is under construction to consolidate office space as other outdated buildings on site are being decommissioned.

With respect to COVID-19, construction activities were put on hold in the spring of 2020 and are slowly resuming in accordance with COVID-19 safety protocols.

Revitalization

Overview: Numerous facilities at the Chalk River site require revitalization to enable long-term reliability and continued compliance with regulatory and licensing requirements. Over the past few years, efforts were focused on the refurbishment of the Chemistry and Radio Analytical Lab (exterior work), Biological Research Facility, Nuclear Fuel Fabrication Facility and Waste Treatment Center, while seeing that fume hoods across the site remain compliant with applicable safety and environmental requirements.

Status: During 2021-22, it is expected that revitalization work will continue in the Biological Research Centre, particularly on its mechanical systems, to obtain the Good Laboratory Practice designation for the facility. This work is forecasted to be complete in 2022-23. Revitalization projects are focused on eliminating known safety hazards, improving working conditions and enabling the ongoing availability of facilities.

Site Support Infrastructure

Part of the revitalization of the Chalk River site includes the implementation of new utilities and services to enable the site's transformation. These are necessary to respond to regulatory requirements, address risks and hazards and reduce overall site operating costs. Projects include:

Information Technology (IT) Investment Projects

Overview: Investments in IT infrastructure include upgrades, replacements and implementation of hardware, software, applications, networks, and communications technologies throughout the CNL organization. The multiple improvements being implemented are broken down as follows:

- Base infrastructure – to upgrade current hardware and software company-wide.
- Business enablement – mostly focused on business intelligence solutions to provide dynamic reporting capability in the areas of finance, procurement and human resources.
- Collaboration – mostly focused on providing collaborative IT workspace through the implementation of solutions such as SharePoint.
- Security – the outcome of a comprehensive cyber program assessment, this project is focused on delivering a strong cyber security framework.

Status: In 2020-21, 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. Looking ahead, work is planned to upgrade to fiber optic service and increase cyber security through the selection and use of a managed security service provider.

Site Utilities Revitalization

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

Status: Recent activities have been focused on utility distribution systems for the newly constructed facilities and upgrades to existing distribution networks. Remaining work during this planning period includes storm water system work and installation of the sanitary sewer line for the Advanced Nuclear Materials Research Centre.

www.aecl.ca