

**Written Submission for the Pre-Budget Consultations in
Advance of the Upcoming Federal Budget**

Submitted by

Canadian Nuclear Laboratories (CNL)

7 August 2020

RECOMMENDATIONS

Recommendation 1:

Leverage private sector funding and assets already owned by Atomic Energy of Canada Limited (AECL) to ensure Canada's leadership role in the development of small modular reactors for export, support economic growth and provide a domestic response to the need of northern and remote communities and industries to eliminate the use of diesel¹

¹ This reflects a previous recommendation made by the Committee in their 2019 report [“Cultivating Competitiveness: Helping Canadians Succeed”](#) page 142

Introduction

Canadian Nuclear Laboratories (CNL) is a world leader in science and technology offering unique capabilities and solutions across a wide range of industries. Our 3,200 staff and over 500 leading scientists, engineers, and technicians are actively involved with industry-driven research and development in clean energy, radiopharmaceuticals, and environmental protection. At CNL, we provide solutions to some of Canada's largest engineering, scientific, and technical challenges. Our ability to meet these challenges are strengthened by the successful site revitalization taking place at our Chalk River facilities which are critical to retaining its world class scientific reputation.

Some of our active projects include research and development in **small modular reactors** and **hydrogen** to provide clean reliable energy for remote communities, the production and application of key **radioisotopes** such as actinium-225 in our collective battle against cancer, and modern waste management approaches such as the Near Surface Disposal Facility for low-level waste within our **environmental remediation** program. You may also be aware of our rich past as Atomic Energy of Canada Limited (AECL), a federal Crown corporation and the inventors of the CANDU reactor now providing over 60 percent of Ontario's clean energy, or as producers of life-saving medical isotopes from the storied National Research Universal reactor, that by some estimates has provided radioisotopes to a billion patients world-wide.

Today, CNL manages and operates several federal government-owned assets, and liabilities, in a performance-based contract through a Government-owned, Contractor-operated (GoCo) model overseen by AECL.

CNL's response to COVID

As your national nuclear laboratory, operating Canada's largest scientific installation, we are committed to doing everything possible to leverage our unique facilities and the scientific and technical skills of our 3,200 staff to provide solutions to these and other national challenges, both nuclear and non-nuclear.

In addition, CNL is committed to Canada's national recovery efforts post COVID-19 and will do everything possible to ensure we regain our economic and social leadership positions, domestically and internationally. We are working with all levels of government, research organizations and industries and are prepared to fast-track projects designed to address COVID-19, to get people back to work, and to create jobs. At CNL, we understand that this is a top priority.

We should also note that when the pandemic started back in mid-March, AECL, without reservation or hesitation, instructed CNL to do whatever possible to leverage our scientific and engineering capabilities in the global fight. And this leadership has enabled our participation in the Milano Ventilatore Meccanico (MVM) Ventilator project and so many other COVID-related solutions led by CNL.

CNL marshalled an immediate response to the COVID-19 virus by leveraging all aspects of its scientific and technical capabilities developed and nurtured over decades for nuclear applications. These are outlined as follows:

- CNL's proven expertise in engineering design, procurement, and prototype capabilities were used in collaboration with TRIUMF, SNOLAB, Canadian manufacturers and an international consortium of physicists, led in Canada by Dr. Art McDonald, to rapidly advance the design and

prototype demonstration, towards the eventual licencing and production of the Canadian version of an international “open-source” ventilator that uses readily available components to enable rapid production (weeks vs months) to help address an expected national and international shortfall in ventilators.

- CNL technical experts in radiological containment and decontamination have designed and demonstrated portable protective ventilation systems that can be applied to individual hospital rooms, enabling frontline hospitals to quickly and safely turn regular rooms into “isolation wards” as necessary.
- CNL staff have deployed the Laboratory’s 3D printing capabilities to help produce the Prusa RC-2 face shield for the protection of front-line healthcare workers.
- CNL has a Biological Research Facility and world-class expertise in medical radioisotope development and testing. CNL biotech experts are exploring opportunities to work with Health Canada and the National Microbiology Laboratory to assess the means of applying recently developed serological test protocols – which can detect COVID-19 antibodies – here in Canada.
- CNL experts have developed methods for sterilizing personal protective equipment (PPE) supplies using Ultra-Violet light and autoclaving for the decontamination and reuse of PPE – gloves, masks, face shields, etc. - used by frontline healthcare workers. Safe reuse can mitigate the national shortfall of PPE supplies.
- Throughout all of this, CNL continues to provide the essential technical and testing support to utilities in Ontario and New Brunswick that is required to meet regulatory requirements for continued safe operation of Canada’s nuclear power generation stations.

Stimulus Opportunities: CNL Goes Beyond Nuclear Applications to Address National Needs

The CNL capabilities being used in these examples were developed through a long-term investment in broad-based scientific capabilities at the laboratories. This science base can have an important role in the follow-up scientific and technical work that will be needed over the coming years to understand the ongoing fight against COVID-19 and to prepare for future pandemics. Examples of important science and technology (S&T) work that could be undertaken at the Chalk River Laboratories include:

- **Biological Research** - CNL’s capabilities in this area includes world-class expertise in radiobiology, microbiology and genetics, and Gammacells together with our unique Biological Research Facility for testing of treatments and methods in animal models. These capabilities can be used to address needs in DNA test development, serological test development and demonstrations and other similar areas. More generally, CNL has a long history of supplying medical radioisotopes and continues to be a world leader in research in this area. The COVID-19 pandemic broadly illustrates the critical importance of maintaining an array of innovative research and development that supports medical research and scalable deployment of treatments for diseases of all types. Among other initiatives in this area, CNL is actively pursuing the acquisition of an accelerator to address increasing national needs for radioisotope production. Work is ongoing at CNL on Targeted Alpha Therapy – the next generation of cancer therapy. This work remains a high priority and has the added advantage of maintaining the expertise and facilities needed to address future biological challenges.
- **Small Modular Reactors (SMR)** – The COVID-19 pandemic has demonstrated the importance of highly reliable and readily available power grids that can support an economy that is rapidly

increasing its dependence on interconnected communication and commerce. CNL is actively collaborating with commercial SMR developers to deliver demonstrations that can enable licensing and deployment. Experience has demonstrated that these type of projects can build a broad based Canadian science and technology capability which is critical to our nation's future.

- **Hydrogen** – CNL has world class facilities and expertise developing hydrogen production, storage, utilization, and safety which can support Canada meeting its clean energy targets, including net zero by 2050. CNL is developing a hydrogen production process using clean electricity and heat to produce hydrogen at industrial scale with no greenhouse gas emissions. Opportunities exist to attract partners for large scale production and advance hydrogen safety and licencing related to generation of hydrogen with small modular reactors.
- **Cybersecurity** - The dramatic and rapid increase in remote work, file-sharing and video/teleconferencing and a general increase in dependence on digital tools is bringing heightened cybersecurity concerns. CNL's leading cybersecurity capabilities – which includes a new cybersecurity research facility in New Brunswick - represent a national resource that can help address the spectrum of cybersecurity needs, including vulnerability assessments, threat analysis, control system security, protection of critical infrastructure, and development and testing of hardware and software.
- **Systems Engineering** – CNL has a strong and integrated engineering team with expertise in mechanical and control systems, design, rapid prototyping and additive manufacturing. Coupled with CNL's extensive collaborations with Canadian industry and rapid procurement/logistics expertise, CNL is able to quickly develop, build and demonstrate integrated solutions and then work with industry to address almost any emergent needs. These capabilities are contributing to the international ventilator project already underway and would be available for other similar rapid prototyping projects going forward.
- **Sensor Development** – CNL has world-class capabilities in the development and deployment of specialized sensors and analytical tools in challenging environments. These capabilities can be deployed to address critical measurements and analyses in a post-COVID world, including the development of thermal screening devices.
- **Systems Modeling** - CNL maintains significant capabilities in mathematical modelling and simulation, typically used to model complex nuclear systems, as well as the dispersion of radionuclides in the environment. This expertise is directly applicable to modeling needs related to COVID-19, including modelling of aerosol dispersion based on air flow and people traffic, which could be used to support both regional facilities and those at larger urban centres. Reducing potential community spread could be achieved through conventional and big data-based methods for tracking people-based pathways of infection. Contributions could be made to help to understand aerosolization of virus and impact of virus on the human respiratory system through computational fluid dynamics (CFD) simulations of various lung morphologies.

National Labs: Essential to Canada's prosperity, security, and innovation

The COVID-19 pandemic has demonstrated the vital role that our national research institutions play in Canada, and the value these institutions offer to all Canadians, especially when we join forces.

When the threat of COVID-19 became clear, Canada's multidisciplinary "big science" institutions quickly mobilized to contribute our expertise and capabilities to the response. In a far-reaching collaboration, TRIUMF, SNOLAB, the MacDonald Institute, and CNL joined forces to become lead partners in an

international project that developed a novel, low-cost, ventilator in less than 3 months. The expertise of Canada's scientists was critically important to this initiative, as was our partnership with the federal government. The Government of Canada has ordered 10,000 of these ventilators to be produced by Canadian manufacturers.

Canadian multi-disciplinary research institutions can, and are, helping to create better ventilators, develop vaccines, produce medical isotopes, and discover effective therapeutics, all in an effort to help our country better respond to COVID-19. But this is simply the start of what Canadian scientists and Canadian science facilities can contribute to Canada.

When needed — and most importantly, when working together — the depth and breadth of scientific and engineering excellence within Canada's network of national research facilities can be redeployed to solve some of the most demanding and urgent of problems facing our country and the world. Our laboratories stand ready to be of service to the nation especially when borders are closed, international supply chains are limited, and the country needs to employ its own ingenuity and know-how to weather a storm.

Conclusion

CNL's staff and technical capabilities are a world-class resource for Canada. They are the result of decades of investment by the Government of Canada. We stand ready to respond to the COVID-19 challenges today and into the future.

Several of the items above could also play an important role in stimulating recovery in the coming months and years, especially work on Targeted Alpha Therapy, SMRs and vaccines, which could all help grow domestic industries and strengthen Canadian knowledge-based businesses going forward. Similarly, investment in accelerated environmental remediation work could be considered from a stimulus perspective as it gets people working quickly while demonstrating environmental leadership.

Meanwhile, we remain committed to delivering on AECL's missions in a way that is consistent with the overall direction of the Government of Canada; delivering nuclear science that supports evidence-based decision-making within government and industry; and driving environmental remediation to protect the environment while reducing radioactive waste liabilities — all of which is directly responsive to the overall objectives of the Government.

As Canada's national nuclear laboratory, we are committed to serving Canada in these trying times, and we remain steadfast in our resolve to leverage our scientific, engineering, and technical capabilities to be of service to the nation. We would be pleased to discuss any aspect of how we may help in the short and long terms on COVID-19, and how we could be part of the Government's stimulus plans.