May 07, 2021

To:

Jim Delaney
Director, Uranium and Radioactive Waste Division
Electricity Resources Branch
Natural Resources Canada
Email: jim.delaney@canada.ca;
nrcan.radwastereview-examendechetsradioactifs.rncan@canada.ca

Re: Canada's Radioactive Waste Policy Framework Modernization - Small Modular Reactor Deployment

Dear Mr. Delaney,

The members of the CANDU Owners Group (COG) Small Modular Reactor Vendor Participant Program (SMR VPP) include 10 SMR vendors that are interested in deploying SMR technology in Canada. The program participants include (listed alphabetically): ARC Clean Energy Canada Inc., GE Hitachi, Holtec International, [redacted] NuScale Power, Terrestrial Energy Inc., U-Battery, Ultra Safe Nuclear Corporation, Westinghouse, and X-energy.

The members of the COG SMR VPP appreciate the opportunity to provide input to Natural Resources Canada (NRCan), for consideration during NRCan's process of engagement with Canadians to Modernize Canada's Radioactive Waste Policy Framework.

Attachment 1 to this letter is a submission regarding the waste policy framework that was prepared in collaboration by the members of the SMR VPP.

SIGNED: [redacted] DATED: 07-MAY-2021

NORMAN SAWYER
CHAIR OF COG SMR VENDOR PARTICIPANT PROGRAM, &
PRESIDENT AND CEO, ARC CLEAN ENERGY CANADA INC.

Attachment 1:

Small Modular Reactor Vendor Participant Program (SMR VPP) Response to Natural Resources Canada: Modernizing Canada's Radioactive Waste Policy Framework

Authorization and endorsement of this document has been provided by the COG SMR Vendor Participant Program Members represented by:

ARC Clean Energy Canada Inc.: Norman Sawyer

GE Hitachi: Douglas MacDonald

Holtec International: Rick Trotta

[redacted]

NuScale Power: Dominick Claudio

Terrestrial Energy Inc.: Bill Smith

U-Battery: Steve Bubb

Ultra Safe Nuclear Corporation: Ken Darlington

Westinghouse: John Barrett

X-energy Canada: Katherine Moshonas Cole

Coordinated by:

CANDU Owners Group Inc.
"Excellence Through Collaboration"

Introduction

Canada's radioactive waste policy framework is founded upon principles, values, and roles and responsibilities for managing radioactive waste in Canada. To continue to manage radioactive waste in a responsible, safe, and environmentally friendly way, Natural Resources Canada (NRCan) has launched an engagement process with Indigenous peoples, the general public, stakeholders, experts, and any other interested parties to review and modernize Canada's Radioactive Waste Policy for future generations.

The members of the CANDU Owners Group (COG) Small Modular Reactor Vendor Participant Program (SMR VPP) appreciate the opportunity to provide input to NRCan, and have collaborated on this collective response, for consideration in *Modernizing of Canada's Radioactive Waste Policy Framework*.

This collective response conveys the perspectives of SMR technology developers who are bringing forth exciting innovations to the nuclear industry and, in doing so, contribute valuable viewpoints of the needs and opportunities that lie ahead for clean power in Canada. The SMR technology development companies are the experts in the SMR designs being proposed, possess knowledge of future technical aspects of the life-cycle of the reactors, and are working to characterize the end-of-reactor-life stage. With this important knowledge, the SMR VPP members have reviewed Canada's Radioactive Waste Policy Framework and the associated NRCan discussion papers and provide here consolidated comments for consideration in the policy review.

Input to the policy review in this submission begins with brief general comments, followed by specific input organized according to the topics of the NRCan discussion papers released online at https://www.rncanengagenrcan.ca/en/content/discussion-papers.

General

Canada has over 60 years of nuclear energy science, technology innovation, operating expertise, and research and development experience. Canada's outstanding performance and success in the nuclear industry presents an immense opportunity for SMR deployment. As SMR technologies continue to develop and evolve, the innovative thinking extends beyond the bounds of the reactor designs and into the opportunity for new and very different partnerships and operating models to address the vast spectrum of applications where heat and power from nuclear technology can be utilized. As a result of this, the future of nuclear in Canada, and around the world, may look very different than what it is today, with smaller reactors deployed in a larger number of localized regions. Correspondingly, it is important to consider that the traditional model for ownership, management, and liability of nuclear by-products may need to be transformed to appropriately support the future deployment of SMRs, and that national policies need to enable this with versatility.

In conjunction with the modernization of the policy framework, the members of the SMR VPP propose that the policy acknowledge that radioactive waste in Canada is generated for the purpose of clean electrical power generation (zero- or low-carbon), medical isotope production, and other important applications such as sterilization of medical equipment and food safety. These critical applications of nuclear technology have been, and will continue to be, of immense benefit to Canadians.

Waste Minimization

The SMR VPP members agree with the principles of the waste hierarchy in Canada as a logical and necessary guide to ensure the lowest possible impact of nuclear waste on the environment. Minimizing, reusing, and recycling of radioactive waste is a critical aspect of design, operational and decommissioning activities, to reduce volumes and activity to the extent practicable, and should be objectives that are pursued by waste owners before disposal. It is important for waste minimization policy objectives to be aligned with the context of the 'As Low as Reasonably Achievable' (ALARA) principle, rather than a requirement for minimization above all else. It is incumbent on all industry partners to reduce the volume of radioactive waste and therefore, waste owners should have the flexibility to implement both existing waste management technologies and new evolving ones, to the extent practicable with full evaluation of safety performance, operability, security, and economic factors.

The role of Government and regulator is appropriate and should continue to review the programs and policies to ensure radioactive waste practices are in place to minimize waste. Modern policies surrounding minimizing radioactive waste in Canada need to be flexible to not preclude the use of current and future innovative concepts that reduce the volume or activity of radioactive waste. High-level, intermediate-level and low-level waste streams may have different strategies for minimization in order to bring best practices in each of these areas to the forefront. Innovative approaches and technological advances to minimize waste will benefit all Canadians and therefore federal policy, support and funding mechanisms should be in place so that waste owners, in cooperation with industry partners, can fully investigate, research, develop, and implement new waste minimization technologies and processes that result in waste shifting lower down the waste hierarchy scheme.

Additionally, there is significant opportunity for benchmarking of countries which have established categorizations and associated strategies for waste minimization. In some countries, a very low level waste category is used, and Canada should evaluate application of this. Benchmarking of global best practices from the perspective of regulation, utility/operation, and private industry should be a prominent focus to ensure an eventual outcome supportive of national objectives and that the final process is effective, flexible, and accommodates potentially novel strategies.

Waste Storage

The current method for radioactive waste storage in Canada is appropriate and interim storage is a safe and judicious solution for radioactive waste, with sufficient control measures in place to limit the exposure to workers through individual and area monitoring. Canada does not have an operational waste disposal facility and therefore, Canada's interim storage practices have ensured the due diligence for the safety of the public and environmentally sound management of radioactive waste by the industry. Interim storage has allowed time for consideration on the best possible course of action as innovations have evolved all over the world over the course of the last six decades of nuclear energy generation in Canada. Whether it be implementing technology or processes for minimization, or evaluation of potential reuse or recycling, careful evaluation of all wastes ahead of permanent disposal ensures the lowest possible impact on the environment.

It was noted in the review of the waste storage discussion paper that the paper describes what is currently being done without any consideration of new technology or fuels that may have eventual use in Canada. Specifically, in the "Storage of High-Level Waste (used nuclear fuel)" it describes only the CANDU fuel storage

process. Looking to the future of nuclear technology in Canada, there must be consideration in the modernization of the policy framework that there will be new fuel forms from SMRs, such as enriched UO_2 fuels, metal fuels, and other types of advanced fuels that require storage, and the policy must be flexible to allow waste owners the liberty to make optimized decisions for waste storage. For example, the nuclear fuel waste of new reactor technologies may not be stored in water when initially discharged and it may be placed immediately in a dry storage facility. Canada's policy should account for this. Policy considerations should recognize the evolution of innovation and technology in the future and should not dictate particular storage strategies, containers, and timelines.

Canada has an opportunity to take advantage of the vast body of global expertise in addressing storage of enriched UO_2 fuels. There will be a substantial benefit to deployment timelines gained by employing existing techniques and regulatory frameworks.

With new reactor technologies coming to Canada, with various business and operational models, Canada's policy for waste storage should support waste owners in exploring consolidated waste storage facilities, or a means for title transfer. It must also be recognized that each fuel system or other waste streams have potentially unique challenges. In fact, some may be more readily consolidated than others to singular facilities. Further, Canada must address transportation logistics and regulations to allow transportation of radioactive wastes to such facilities in the event they can be consolidated. Examples from other countries indicate challenges would be expected with transportation across provincial borders unless regulated to address the need.

The Government and regulator should continue to review the programs and policies in place, verify that radioactive waste storage facilities are compliant with domestic and international policies, to ensure that human health and the environment are protected today and into the future.

Waste Disposal

Canada's policy on radioactive waste disposal includes appropriate federal oversight to ensure radioactive waste disposal is carried out in a safe, environmentally sound, comprehensive, cost-effective, and integrated manner. It also includes suitable federal regulation and oversight of producers and owners to ensure compliance with legal requirements and ensure the ability to meet their funding and operational responsibilities in accordance with approved waste disposal plans. Public engagement, as well as engagement with indigenous communities, Rights holders, and other stakeholders should continue to be mandated as part of the process in site selection activities.

The site selection process for a radioactive waste disposal facility has, and will continue to be, an immense undertaking in Canada. In consideration of this, Canada's waste policy needs to be sufficiently flexible to enable the number of disposal facilities to be optimized and support collaboration of waste owners on disposal facilities. It should also recognize that there are a number of approaches to permanent disposal solutions that are appropriate depending on the volume and activity of the waste and also, that for similar classes of wastes, there may be more than one solution that is safe and appropriate. Through the site selection process of a disposal facility, the VPP members agree that the waste disposal policy should continue to ensure that construction of waste disposal facilities be in willing host communities, which have been fully informed of the risks and benefits associated with all life-cycle aspects of the facilities.

The Nuclear Waste Management Organization (NWMO) is an appropriate group to design and implement Canada's plan for the disposal of high-level waste, however, the Nuclear Fuel Waste Act (NFWA) does not consider operators that only generate process heat to be within the definition of a 'nuclear energy corporation' as to meet the definition one must generate electricity from a commercial nuclear reactor. This would preclude a process heat only operator from being a shareholder in the NWMO. Policy needs to ensure that small waste producers have a route to disposal facilities. Additionally, the definition of nuclear fuel waste in the NFWA needs to be extended as it currently only applies to bundles, applicable to only certain current technologies.

Similar to the NWMO oversight of high-level waste, Canada would benefit from dedicated oversight of the disposal of intermediate-level and low-level waste for multiple waste owners. The implementation of waste disposal facilities, including those intended for high, intermediate and low-level waste, should maintain acceptance criteria based on the facility safety case and that do not preclude waste forms by definition. The waste owners must work with the groups managing waste disposal facilities early on to ensure new (and future) waste streams, which will be generated as new reactor technologies come online, will have a route to disposal. As with storage, transportation legislation and navigating the complexities of inter-provincial transport should be a federal concern, and modernized policies should support transportation for consolidation of wastes for disposal.

Many used fuel forms (including CANDU) still have potential energy that could, in the future, have the ability to be recycled into useable fuel forms making retrieval desirable. Therefore implementation of a disposal facility should also consider the ability to retrieve material. For some emerging SMR technologies, the burn-up through the reactor is high and there is relatively no energy left to extract from the used fuel. In this scenario, retrieval after disposal would not be beneficial. The storage and disposal facilities should consider these various aspects to accommodate all types of fuel.

Decommissioning

SMRs will bring power and/or heat to a wide range of versatile applications. They are smaller than conventional nuclear power plants and bring new possibilities to the approach to fabrication, transportation, construction, operation and decommissioning. As a result of the variety of technologies and applications, end-states may vary. New first of a kind reactors will present new challenges and opportunities and new technical considerations for dismantling, decontamination, possible re-use, etc. It is suggested that a specific end-state not be mandated in federal policy such that certain technologies are not prohibited. The policy should maintain flexibility on decommissioning strategy so that licensees are not restricted and can develop new approaches to optimize safety and stewardship.

The policy should allow for a broad range of end-state objectives and site-redevelopment plans that will be informed by public engagement, evaluation on impacts for indigenous and/or treaty rights, environmental impacts, evaluation of revenues, costs and funding models, the availability of waste management facilities and disposal capacity as well as any other social and economic impacts. Canada's policy on decommissioning should also include preserving the necessary information (records).

The modernized policy framework in Canada needs to be flexible to allow for a fleet of fueled reactor modules for some technologies to be removed from the operating site for final disassembly, de-fueling and waste storage as some technologies are factory decommissioned by design.

Canada's modernized policy framework should be flexible such that the licensee can approach decommissioning with either a prompt or deferred/delayed (or combination) strategy.

A critical enabler for the timing of decommissioning activities for all reactors, not just SMRs, is the availability of disposal facilities. Decommissioning reactors without disposal facilities could have the potential to create more waste because of the storage containers needed for decommissioned reactor structures and components.

The approach to decommissioning funding calculations for SMRs should ensure that the resultant funds are right sized for each individual nuclear installation.

Conclusion

The modernized radioactive waste policy framework in Canada needs to be flexible and non-prescriptive to allow new innovation and approaches to all aspects of waste management in Canada. It should enable the use of evolving technologies for waste minimization, as well as new methods, strategies and future collaboration on waste storage and disposal. Canada's waste policy framework should also account for decommissioning diverse reactor technologies, including reactor modules that are factory decommissioned by design. With a flexible approach to policy, waste owners will be able to create optimal minimization, storage, disposal, and decommissioning plans and strategies that ensure waste management is carried out in a safe, environmentally sound, comprehensive, cost-effective, and integrated manner.