Chapter 11
Small Modular Reactors in Canada: Eroding Public Oversight and Canada's Transition to Sustainable Development

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Abstract The civil nuclear power industry has been moribund since prohibitive construction costs and the Chernobyl disaster effectively halted the construction of new reactors in the 1980s. With many of Canada's nuclear reactors now approaching the end of their operational lives, the survival of the civil nuclear industry is increasingly viewed as contingent upon the commercialization of so-called 'Small Modular Reactors' (SMR). SMRs are compact nuclear reactor

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designs, producing from 1 to 300 MW of electricity, with design features promised to overcome the challenges that have historically prevented the expansion of nuclear power. Canadian SMR proponents argue that due to their small size, SMRs are suitable for providing power for resource extractive and heavy industries, decentralized on-grid generation, and replacing diesel generation in remote communities. Proponents also portray SMRs as a needed component in a low-carbon society. Nevertheless, recent events indicate that the success of this technology is contingent upon the lessening of Canada's environmental and safety requirements, and government shouldering the risks accompanying their development and operation. This chapter will explore the alleged barriers to SMR development in the context of past failures to commercialize new innovative reactor designs. It will also consider how industry-based policy and law reform requests undermine public oversight of nuclear safety in Canada and impedes Canada's transition to sustainable development.

Keywords Environmental Protection · Sustainable Development · Nuclear Renaissance · Oversight · Nuclear Power · Nuclear Waste · Public Dialogue · Transparent Decision-Making · Nuclear Nonproliferation · Small Modular Reactor · Regulatory Capture · Polluter Pays Principle · Intergenerational Equity

11.1 Introduction

The once ambitious civil nuclear power industry has been moribund since prohibitive construction costs and the Chernobyl accident, one of the worst environmental catastrophes of the late twentieth century, effectively halted the sector's expansion.[1] With many reactors in Canada now approaching the end of their operational lives, the survival of the civil nuclear industry is increasingly viewed as being contingent upon the commercialization of so-called 'Small Modular Reactors' (SMRs).

While there is no one accepted definition of what constitutes an SMR, it generally refers to more compact nuclear reactor designs, producing between 1 and 300 MW of electricity and potentially heat. The term 'modular' refers to industry's hope that SMRs can be assembled from factory produced modules, rather than constructed on site like existing large reactor designs. Proponents allege that the modularity of the design will also reduce construction costs by allowing fleets of reactors to be produced in factories and being less capital intensive, more readily obtain financing.

In November 2018, the Canadian Nuclear Association (CNA) released its vision for SMRs in Canada title "A Call to Action: A Canadian Roadmap for Small

[1] Richardson 2017, 15.

Modular Reactors" ("SMR Roadmap").[2] With nearly half a million dollars (CAD) in funding from the Federal Government's Department of Natural Resources of Canada (NRCan),[3] the SMR Roadmap sets out a glowing future for SMR technology, describing them as 'a source of safe, clean, affordable energy, and opening opportunities for a resilient, low-carbon future and capturing benefits for Canada and Canadians'.[4] Due to their smaller size, the Roadmap champions the suitability of SMRs for providing off-grid heat and power generation for resource extraction and heavy industry, decentralized on-grid generation, and replacing diesel generation in remote communities.[5]

Among the main purposes of this report, authored by industry and subsequently promoted by the federal government, is the identification of regulatory barriers and challenges to SMR deployment. The Roadmap proposes over fifty recommendations categorized into four key areas for consideration by government, industry and nuclear stakeholders in order to 'capitalize on Canada's SMR opportunity'.[6] The majority of recommendations seek financial support or policy changes from federal, provincial, territorial governments and agencies, including Canada's nuclear regulator, the Canadian Nuclear Safety Commission (CNSC). Also primary among the recommendations, are requests to restrict the application of federal environmental impact assessment legislation, incorporate new waste streams into existing long-term radioactive waste management plans, and ensure liability protection for operators and suppliers in the event of an accident.

In light of the Roadmap's recommendations, this chapter analyzes the implications of SMR development and deployment on Canada's progress towards sustainable development. Sustainability, as referenced in this chapter, represents a goal in which biophysical, human and socio-economic systems coexist.[7] Sustainable development, conversely, is the process or program of action which allows for development which meets the needs of the present without compromising the ability of future generations to meet their own needs.[8] The philosophy of sustainable development, which often invokes the principles of pre-caution and polluter pays, behooves society to act for the long-term protection of the planet and future generations.[9] The precautionary principle defines how to respond to the challenges of sustainable development and denotes a duty to prevent harm,[10] while the polluter pays principle posits that the

[2] Canadian Small Modular Reactor Roadmap Steering Committee (2018) A Call to Action: A Canadian Roadmap for Small Modular Reactors. Ottawa, Canada, p. 9 [SMR Roadmap].

[3] Government of Canada (2019) Government Grants and Contributions. https://open.canada.ca/en/search/grants/reference/nrcan-rncan%7CGC-2018-Q4-06790 and https://open.canada.ca/en/search/grants/reference/nrcan-rncan%7CGC-2018-Q4-06759. Accessed 30 Jan 2019.

[4] SMR Roadmap, 9.

[5] SMR Roadmap, 2.

[6] SMR Roadmap, ii.

[7] Flint 2013.

[8] World Commission on Environment and Development 1987, 8.

[9] Richardson 2017, 122.

[10] Benevides and McClenaghan 2016.

party responsible for causing harm bears the cost of managing and preventing its adverse impacts on human and environmental health.[11] Both principles are means of encouraging progress towards sustainable development.

Proper consideration of sustainability requires applying a 'positive overall contribution to sustainability' test and thus in this chapter, we apply this prerequisite to the proposal for SMRs in Canada.[12] We thus consider the principles of precaution and polluter pays, in light of the potential harm to sustainable development, given the nuclear sector's previously failed attempts to commercialize so-called new and innovative reactor designs.

As some commentators, including Sovacool and Ramana (2015) have remarked, nuclear advocates are advancing rhetorical visions of SMRs 'imbued with elements of fantasy' to attract political support while purging past industry failures from public debate.[13] Underpinning these rhetorical visions are utopian hopes where SMRs produce plentiful, low-carbon, affordable energy without harmful environmental externalities, such as accidents or radioactive waste. Thus, we draw on Sovcacool and Ramana's research which has found that the promise of SMR technology has been subject to an erasure of past failures, or 'selective remembrance', which has allowed the problematic environmental and economic attributes of the technology to be erased, or downplayed.[14]

Overall, we argue that the government policy choices needed to realize the SMR vision and overcome the historic challenges faced by nuclear technology in Canada will have negative democratic, social and environmental implications for Canadians. We cite how past attempts to restart the Canadian nuclear industry have undermined public oversight of nuclear safety in Canada and identify how the adoption of industry-based policy and law reform requests impedes Canada's transition to sustainable development.

11.2 From Nuclear Renaissance to Nuclear Relapse

The Roadmap remarks that with SMR leadership, comes opportunities for capturing economic, social and environmental benefits.[15] It proposes that these benefits can be achieved through the deployment of SMRs in three Canadian-specific applications: first, for use in remote, off-grid communities to replace diesel reliance; second, to replace smaller on-grid fossil fuel based generation; and third, to power resource extraction projects, such as the proposed mines in Ontario's Ring of Fire.

[11] de Sadeleer 2002, 21.

[12] Gibson et al. 2008.

[13] Sovacool and Ramana 2015.

[14] Ibid.

[15] SMR Roadmap, 10.

The current story told by SMR proponents echoes the positive narrative which imbued proposals for new, innovative reactors designs in the early 2000s. At the time, the nuclear industry and supporting institutions built an expectation among the public and decision-makers of an imminent "nuclear renaissance" which would be driven by more affordable reactor designs and cost-effective means of lowering greenhouse gas emissions. Promising enhanced safety, greater efficiency and lower life-cycle costs, Atomic Energy of Canada Limited (AECL)—the former state-owned designer of CANDU reactors—declared in 2008 that 'the world has entered a "Nuclear Renaissance", as public opinion, environmental considerations and world energy supply realities have converged to bring nuclear energy back in favour'.[16]

Despite the positive rhetoric, the 'nuclear renaissance' forecasted by the nuclear industry never materialized.[17] Reactor developers were unable to develop designs capable of fulfilling promised cost targets and the 2011 Fukushima nuclear disaster served to remind the world of the dire social and environmental risks associated with nuclear reliance. Nuclear advocates now assert SMRs are a necessary component of a global, low-carbon economy and Canada can be a 'world-class hub for innovation'.[18] SMR proponents promise for lower capital investment is also reminiscent of AECL's past statements that its new reactor design (the Advanced CANDU Reactor or ACR) would 'modularize', thereby permitting parallel component fabrication and a reduction in construction costs by up to 40%.[19] AECL succeeded in leveraging the nuclear renaissance narrative into financial support from the federal government, receiving $433.5 million in subsidies received between 2002 and 2009 to support the development of the ACR.[20] But, AECL did not deliver on its promise of a lower cost ACR and in 2009, the Ontario government suspended its procurement of new reactors.[21] Not a single ACR has been built anywhere in the world.

During the nuclear renaissance, the Canadian nuclear industry also argued that reactor life-extension projects would be cost-effective, thus permitting the continued operation of all of Canada's reactors. However, in practice, industry was unable able to deliver on its cost targets, with refurbishment projects in both Ontario and New Brunswick incurring significant cost overruns. The inability of the Canadian nuclear industry to meet its cost estimates prompted decisions to close nuclear stations in Ontario and Quebec. For instance in 2005, Ontario Power Generation (OPG) announced it would close two reactors due to the 'costs and the risks' of

[16] Atomic Energy of Canada Limited (2008) Corporate Plan Summary: 2007–2008 to 2011–2012, 5.

[17] For the purposes of this paper, references to the 'nuclear renaissance' refer to the period between 2000 and March 2011 when the nuclear industry and Canada asserted that climate change and the prospect of new cheaper reactor designs would relaunch the construction of new reactors.

[18] SMR Roadmap, 2.

[19] Nuzzo et al. 2005.

[20] AECL (25 Sept 2009) 'Briefing Note', obtained through ATI request.

[21] Hamilton (14 July 2009).

keeping them operating and in 2010, abandoned plans to refurbish four reactors, also due to prohibitive costs.[22] Likewise in 2012, the Quebec government announced it would not proceed with the life-extension of its reactor, Gentilly-2, due to high costs.[23] Even though Ontario's government has approved the rebuilding and life-extension of reactors at its Darlington and Bruce nuclear stations, the future contribution of nuclear power in Ontario could decline further because of 'off-ramps' built into policy commitments.[24] Accordingly, should a project fail to adhere to approved costs or, a more economically viable alternative become available, the refurbishment would not proceed.

From our perspective, the definitive end to Canada's promised nuclear renaissance can be traced to 2011. This was not only the year in which the Fukushima nuclear accident in Japan occurred, but the year in which the federal government's reactor development division sold to SNC-Lavalin for $15 million.[25] This price, accordingly, was likely indicative of SNC-Lavalin's market valuation of potential reactor sales as they subsequently ended the development of the ACR.

The Canadian nuclear sector is now in decline because of industry's failure to deliver on its vision for a nuclear renaissance. Furthermore, by 2024, nine of Canada's twenty-two CANDU reactors will be permanently shut down because prohibitive operating costs. This phenomenon is not unique to Canada as globally, the age profile of the world's nuclear stations continues to increase with more than 60% of operating reactors being over thirty-years-old, and 18% over forty.[26] Without a sufficient number of new reactors under construction, aging reactors will not be replaced at the end of their operational lives. This trend is particularly accelerated in Canada where, due to the unique characteristics of the CANDU reactor, reactors require extensive repairs to operate beyond their approximate 25-year operating life.[27]

The similarity between the promised nuclear renaissance during the 2000s and the current promise of SMR is instructive: while nuclear industry advocates succeeded in erasing the past failures of the Canadian nuclear industry with a positive vision of how yet-to-be developed nuclear technology could meet society's expectations for affordable and climate-friendly energy, they were unable to realize their vision. The inability of the industry to build new reactors, despite significant government funding and policy support, should inform how we view industry's repackaged and hopeful vision for SMRs.

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[22] Ontario Power Generation (2006) Annual Report - 2005.

[23] Hydro-Quebec 2012, p. 2.

[24] Government of Ontario, Ontario's Long-Term Energy Plan 2017: Delivering Fairness and Choice, pp. 50–51.

[25] Spears and Ferguson (30 June 2011).

[26] Schneider et al. 2018, 17.

[27] These repairs, also referred to as refurbishments, involve the removal and replacement of the reactor core as well as the replacement of other life-limiting components.

11.3 Nuclear Industry Regulator or Enabler: The Canadian Nuclear Safety Commission

The 2011 Fukushima nuclear accident highlighted the unfortunate effect of policy decisions intended to encourage nuclear expansion. Investigations into the disaster found it was caused by a nuclear safety regulator whose focus had shifted from the protection of public safety to the enabling of financial interests for reactor operators. Among Canadian civil society organizations, the Fukushima accident exacerbated already existing concerns about the regulator's oversight of public safety.[28] As discussed in this section, trust in nuclear safety has been undermined by the extra-legislative actions of the federal government and the industry-centric messaging by Canada's nuclear regulator, the CNSC.

The need for regulatory independence has become more acute in light of the findings from the Japanese government's investigation into the Fukushima disaster.[29] The report of the Fukushima Nuclear Accident Independent Investigation Commission concluded that the accident had resulted from government-industry 'collusion' and it was clearly a 'manmade' accident due to an industry-friendly nuclear regulator.[30] The Commission noted the underlying cause of the Fukushima accident as 'the social structure that results in "regulatory capture", and the organizational, institutional, and legal framework that allows individuals to justify their own actions, hide them when inconvenient, and leave no records in order to avoid responsibility'.[31]

Other independent observers have referred to the Fukushima accident as a case of regulatory capture,[32] wherein the regulatory agency becomes beholden to the interests of the sector it is vested with regulating. As further defined by Carpenter and Moss (2014), regulatory capture is:

> [T]he result or process by which regulation, in law or application, is consistently or repeatedly directed away from the public interest and toward the interests of the regulated industry, by intent and action of the industry itself.[33]

In many ways, regulatory capture is reliant upon the mindset of regulators and the government authorities which oversee their actions. Determining whether these bodies have permitted the pecuniary interests of industry to be emphasized ahead of the public interest makes regulatory capture difficult to definitively diagnose. However, strengthening the independence of the regulator can mitigate the potential

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[28] Letter by the Canadian Environmental Law Association et al. to the Honourable Justin Trudeau (Office of the Prime Minister), 8 March 2016. http://www.cela.ca/sites/cela.ca/files/Trudeau-NuclearReview.pdf.

[29] Blaise et al. 2019.

[30] National Diet of Japan 2012, p. 16.

[31] Ibid., 21.

[32] Kurokawa and Ninomiya 2018.

[33] Carpenter and Moss 2014, p. 13.

for institutional bias. This was also recognized by the Commission in response to the Fukushima disaster, who recommended that the Japanese government strengthen the independence of its national nuclear regulator. Similarly, the International Atomic Energy Agency (IAEA) has increasingly emphasized the importance of regulatory independence in guidance to member states post Fukushima. For example, the IAEA's regulatory guidance states:

> The government shall ensure that the regulatory body is effectively independent in its safety-related decision making and that it has functional separation from entities having responsibilities or interests that could unduly influence its decision making […] The regulatory body shall be able to make independent regulatory judgments and decisions, free from any undue influences that might compromise safety, such as pressures associated with changing political circumstances or economic conditions, or pressures from government departments or from other organizations.[34]

Only after a regulatory breakdown results in a disaster, are the deep flaws of a regulatory regime truly exposed.[35] However, this section attempts to discern events in Canada which have contributed to the perception of Canada's nuclear regulator as being industry biased. For instance, in 2008 the federal government dismissed the first president of the CNSC, Linda Keen. The publicly-stated reason for her removal was her alleged mishandling of the shutdown of AECL's National Research Universal (NRU). The NRU shutdown created a shortage of radio-isotopes used in cancer treatment and was publicly controversial. However, the former President stated this was "an excuse" and instead, she was dismissed for a failure to grant industry's request to grandfather safety standards necessary to accelerate the approval of proposals to build new reactors in Ontario.[36] As the President chronicled for the media, SNC-Lavalin, a Canadian engineering company that has historically acted as a key contractor in construction of CANDU reactors, was 'furious' that she had refused to loosen regulatory requirements for new reactors in Canada and they subsequently hired a lobbying firm to advocate for her replacement.[37]

Although not publicly communicated as such, the federal government's decision to intervene in the CNSC's operations through the removal of its President was effectively a policy decision which lessened regulatory barriers, in an attempt to enable the construction of new reactors. The President's removal from the CNSC occurred only eight years after the legislation overseeing nuclear safety in Canada was modernized. The Nuclear Safety Control Act (NSCA) came into force in 2000 and gave the CNSC the mandate to regulate the development, production and use of

[34] IAEA Safety Standards, Government (2016), Requirement, p. 4.

[35] Campbell 2016.

[36] MacKenzie and MacLachlan 2009.

[37] Hamilton 2010.

nuclear energy.[38] However, the CNSC's predecessor founded in 1946, the Atomic Energy Control Board (AECB), had a dual mandate of promoting *and* regulating nuclear energy.[39] While this undesirable confluence of promotional objectives with that of regulation[40] has since been eliminated from the NSCA, in our view the President's removal is indicative of lingering institutional bias and policy tensions within the government, regarding the role of the regulator.

The CNSC's promotional tone has also been observed by an independent expert panel tasked by the federal government with reviewing Canada's environmental assessment process.[41] In the Expert Panel's report released in 2017, they observed that a 'frequently cited concern' among public submissions was the 'perceived lack of independence and neutrality because of the close relationship the NEB [National Energy Board] and CNSC have with the industries they regulate'.[42] The Expert Panel also commented that participants were concerned that the CNSC, 'promote[s] the projects they are tasked with regulating' and often used the term 'regulatory capture' in describing their perception.

Further indications that the CNSC was monitoring and responding to the intent of industry is illustrated by the regulator's proactive review of its readiness to review and approve the construction and operation of SMRs, prior to the issuance of the Roadmap in 2018. One of the Roadmap's key areas of concern is 'regulatory readiness' or, the CNSC's ability to approve the construction and operation of SMRs. The Roadmap states 'regulatory clarity and manageable regulatory timelines are key to promoting serious consideration of SMRs'.[43] Although the Roadmap states that '[e]xisting regulatory and legislative processes are ready for SMR deployment in Canada', it recommends a review of refinements to ensure 'enabling frameworks' are in place. Notably, the Roadmap suggests the CNSC has a role to play in advancing the industry's export markets by 'demonstrating regulatory excellence internationally and influencing the development and enhancement of international regulatory guidance on SMRs'.[44] Indeed, the CNSC has already engaged in pre-licensing reviews of ten SMR reactor designs.[45] As a briefing note to the CNSC's management committee in 2015 describes regarding their institutional interest in SMRs, 'even if no SMR project comes to fruition, the work done

[38] Nuclear Safety and Control Act, SC 1997, c 9.

[39] Atomic Energy Control Act, s 9(1)(a). See also Johannson and Thomas 1981.

[40] At the time of the Atomic Energy Control Board's founding, the President of Eldorado Nuclear Ltd—one of the companies whose activities were regulated by the AECB—sat as of one five members on the AECB; ibid.

[41] As the CNSC is a federal authority vested with powers to conduct environmental assessment, in addition to licensing and regulation Canada's nuclear industry, it was subject to review by the Expert Panel.

[42] Minister of Environment and Climate Change 2017.

[43] SMR Roadmap, p. 21.

[44] SMR Roadmap, p. 2.

[45] Canadian Nuclear Safety Commission 2019.

to date will further enhance our regulatory tools and contribute to Canada's leading influence in international discussions'.[46]

Cumulatively, the government's decision to dismiss the CNSC's first President, the Expert Panel's observations of the CNSC as industry-friendly, and the CNSC's subsequent involvement in the development of the Roadmap, have negatively implicated the public's trust in the oversight of nuclear safety in Canada. It is within this context that industry's current policy requests for the development of SMRs must be understood. At a minimum, these actions have led to the perception that the CNSC is behaving as a 'captured' regulator. At most, as demonstrated by the Commission's findings following the Fukushima disaster, these actions contributing to regulatory capture may in extreme cases create the conditions for major nuclear accidents.

11.4 Responding to the Legislative and Policy Barriers to SMR Development

11.4.1 Applying Sustainability-Based Criteria to SMRs

The Roadmap identifies environmental assessment (EA) law as an 'impediment' and 'risk to the future of SMR deployment in Canada'[47] and recommends that SMRs up to and including 300 MW(e) reactors be exempt from EA, or impact assessment processes (IA). Troublingly, in May 2019 the government proposed legislative amendments which, if enacted, would exempt SMRs under 200 MW of thermal generation from requiring an EA.[48] Should this amendment be enacted, there would be no legislative basis requiring SMRs' contribution to, promotion of, or harm to sustainability to be examined. Consequently, this section analyzes the impact of these proposed legislative and regulatory reforms on Canada's trajectory to sustainable development.

Environmental or impact assessments (IA) are a recognized means of achieving sustainable development and indeed, fostering sustainability is recognized as a statutory purpose of Canada's federal environmental law. Decisions to exempt SMRs from IA eliminates this mechanism, meant to assess a project's contribution or harm to sustainability, prior to development. Sustainability-based assessments recognize that ecological, social and economic objectives are interdependent and

[46] CNSC, Briefing Note for Management Committee (MC)—Small Modular Reactors (SMR): Readiness to Regulate, obtained through ATI, Request # A-2016-00010.

[47] SMR Roadmap, Regulatory Readiness Working Group—Final Report, ii [Regulatory Working Group Report].

[48] The Senate Standing Committee on Energy, the Environment and Natural Resources, *Report of the Committee,* 28 May, 2019. https://sencanada.ca/en/committees/report/74834/42-1; Canadian Environmental Assessment Agency, *Discussion Paper on the Project List,* May 2019. https://www.impactassessmentregulations.ca/consultation-on-the-proposed-Project-List?preview=true.

not accommodated through trade-offs, a balancing of considerations or compromise.[49] While IAs aim to lessen a project's impacts, avoid or mitigate harm, sustainability assessments are distinct by design because they seek to *improve* social and ecological conditions.[50] Incorporating sustainability within the IA process ensures that a range of interrelated socio-economic and biophysical implications of a project are explicitly addressed and considered from the outset of the decision-making process.[51] Both Canada's current federal environmental assessment statute, the Canadian Environmental Assessment Act, 2012 and its proposed successor, the Impact Assessment Act (IAA), allow for the 'positive contribution to sustainability' test to be applied to project reviews.[52]

The Roadmap cites a number of reasons, supporting its recommendation that SMRs up to and including 300 MW(e) reactors be exempt from IA. *First*, SMR proponents assert that the 'low safety and environmental risk' of the reactors merits their exclusion from IA review.[53] As SMRs are prototype, yet-to-be proven designs, the Roadmap fails to recognize potential variation in risk among designs. The environmental risk transferred to future generations because of the reactors' waste legacy is also absent from review. The Roadmap's framing of risk, which generalizes among all potential SMR designs is also incongruous with its other findings which highlight the distinctiveness of designs—such as there being 'no single design' which could meet the needs of all the three proposed applications (i.e. on-grid, heavy industry and remote communities).[54]

Secondly, the Roadmap indicates there are no technical barriers to SMR development and deployment, but for IA approvals which if required 'could take many years'.[55] The Roadmap asserts 'social acceptance will drive progress on assessments under this legislation', and thus 'advance consultations with northern communities, indigenous people and public interest groups and the Canadian public' would be needed in order to 'explain the environmental and community benefits of these low emitting technologies'.[56] Public participation is both a basic principle of effective governance for sustainable development[57] and a prerequisite to any IA decision.[58] However, the Roadmap has deemed this fundamental as incompatible with SMR development and deployment. The impact of exempting

[49] Gibson et al. 2016; Gibson 2006, p. 182.

[50] Gibson 2006, p. 178.

[51] Noble 2010, 5; World Commission on Environment and Development 1987, paras 59–60; Swaigen 1981, 246.

[52] In the context of CEAA 2012, see Markvart 2014; in the context of of the IAA, see section 22 (1)(h) which requires an assessment of a project's contribution to sustainability.

[53] Regulatory Working Group Report, 41.

[54] SMR Roadmap, 23 and 9.

[55] Regulatory Working Group Report, 34.

[56] Canadian Environmental Assessment Act 2012.

[57] UN Economic and Social Council 2018.

[58] Jociute 2012.

SMRs would not only remove the public's opportunity to weigh-in on the need for the project, its purpose, and potential alternatives, but exclude directly affected communities from a public, decision-making process which statutorily requires consideration of the project's social, economic and environmental effects.[59] By identifying 'social acceptance' as the driver of IA review, and thus a barrier to SMR development, the Roadmap has ignored the need for a social licence, or 'society's consent' in order to advance SMRs in Canada. Unlike a legal licence, which is granted through a formal procedure, a social licence is neither formally granted nor written down.[60] However as some commentators including Seth Hoedl have remarked, the concept of a social licence explains why some projects are built while others languish.[61] Accordingly, Hoedl found that nuclear projects which have achieved a social licence have also supported the following key principles: (i) engendering trust; (ii) transparency; (iii) meaningful public engagement; and (iv) protecting health, safety and the environment.[62] Not only do these principles align with the basic tenets of EA law, they emulate the principles of sustainability.

Third, nuclear proponents frame IAs as being duplicative and thus unnecessary on the basis that 'most nuclear sites have undergone full environmental assessments'.[63] This statement is misleading as the construction of Canada's nuclear generating stations predates our first environmental assessment laws. While various components of nuclear power plants have undergone EAs since the coming into force of EA laws in the 1990s, these assessments were neither site- nor station-wide. Additionally, whether EAs have occurred at existing nuclear sites has no bearing on SMRs, which are proposed for deployment in locations which are not currently used for nuclear purposes.

Fourth, the Roadmap contends that even if SMRs were excluded from IA review 'they would still be subject to a comprehensive environmental risk assessment under the CNSCs licensing process'.[64] This is an oversimplification which conflates risk assessment with sustainability assessment.[65] If nuclear projects like SMRs escape IA review, they would only undergo a licensing review pursuant to the NSCA. The NSCA is a regulatory statute which guides licensing, and unlike an IA review does not require consideration of a project's 'positive contribution to sustainability'. The CNSC's regulatory mandate does not include more broadly scoped environmental planning issues, and there is no equivalent purpose in the CNSC's enabling statute that requires projects foster sustainability, consider effects on

[59] CEAA, 2012, s 19; IAA, s 22.

[60] Hoedl 2019, p. 22.

[61] Ibid., 23.

[62] Ibid., 28.

[63] Canadian Nuclear Association (6 April 2018), Submission on Bill C-69 to the House of Commons Standing Committee on Environment and Sustainable Development. https://cna.ca/news/submission-on-bill-c-69-to-the-house-of-commons-standing-committee-on-environment-and-sustainable-development/.

[64] Regulatory Working Group Report, p. 37.

[65] See Canadian Environmental Law Association 2018; see also CELA 2018.

environment, health and socio-economic conditions, or consider alternatives to the undertaking.[66] While these considerations are mandatory under EA law, they are not requirements of this regulatory statute.

In addition to the Roadmap's recommendation that SMRs be exempt from IA, the CNSC has also advocated that SMRs be excluded from the forthcoming *IAA*. According to information obtained through federal Access to Information legislation, the CNSC was recommending the federal government exempt SMRs from IA before the Roadmap was publicly released in November 2018. As a briefing note produced for a meeting between the CNSC President and a nuclear licence holder from April 2018 states:

> The CNSC has indicated that the [project] list should not be expanded, particularly given the strong oversight of the CNSC under the NSCA. The CNSC is recommending that a threshold be established for power reactors so that small units are not subject to an impact assessment (IA). The number of nuclear project (sic) subject to an IA will likely be very limited in the foreseeable future.[67]

It appears the CNSC's advocacy to exempt SMRs from impact assessments is compelled by its wish to increase the nuclear industry's longevity. As a briefing note prepared for the CNSC's former President obtained through Access to Information notes:

> The future of the nuclear industry, especially for Canadian participants, is dependent on the success of SMRs. It will be very important to get the Project list right so that there is a reasonable threshold on what kind of projects need an IA.[68]

In our view, the CNSC's decision to advocate to exempt SMRs from IA is additional evidence that it behaves like a captured regulator. This has negative implications for the public's trust in the oversight of nuclear safety in Canada and the approval of SMR projects which also should have a social licence to operate. Currently, Canada's federal Environment Minister has ceded to the requests of industry and the CNSC, by exempting SMRs from IA review. Thus, if the *IAA* receives Royal Assent as currently proposed,[69] the only legal framework which would have required an assessment of SMRs' contribution to sustainability will be of no force and effect. Resultantly, without an assessment mechanism to gauge the benefit or harm of SMRs, their effect on sustainability will remain unassessed, and potential SMR host communities will be deprived of rights of access to information and public participation.

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[66] The CNSC has publicly recognized that they do not consider socioeconomic aspects in their review of projects, see Canadian Nuclear Safety Commission (2018) Transcript of Proceeding dated 28 June 2018.

[67] Eaton et al. (2018), Information Note for the President—Meeting with Cameco, 12 April 2018, obtained through ATI, EDOC# 5476531, A-2018- 00061, 5.

[68] Natural Resources Canada (2018), Scenario Note and Annotated—NRCAN Portfolio Heads Meeting, Agenda April 12, 2018, obtained through ATI, EDOC# 5504411, # A-2018-00061, 3.

[69] The Impact Assessment Act received Royal Assent on 21 June 2019, and SMRs remain exempt from its scope.

11.4.2 Consenting to Development: Consideration of Indigenous Interests and Rights

One of three potential SMR applications championed by nuclear proponents is their deployment in remote, off-grid communities in order to offset current diesel reliance. The Roadmap also targets 'indigenous engagement' as one of four priority areas requiring further action by governments and industry in order to 'capitalize on Canada's SMR opportunity'.[70] As remote communities in Canada are predominantly Indigenous,[71] it is likely that First Nation communities would host the majority of remotely deployed SMRs. While neither author of this chapter identifies as Indigenous, advancing reconciliation requires respect for Indigenous values and traditional knowledge, and their equal, effective, and fair participation in decision-making processes. Absent which, decisions can be made without meaningful consideration of Indigenous rights and interests. Therefore, this chapter reviews the participation of Indigenous communities in the development of the Roadmap and addresses the contribution of Indigenous peoples in fostering of sustainable development.

The publication of the *Our Common Future* report in 1987 popularized the notion of sustainable development and recognized the inclusion of the Indigenous voice as a means of contributing to sustainable development:

> Traditional rights must go hand in hand with measures to protect local institutions that enforce responsibility in resource use. And this recognition must also give local communities a decisive voice in the decisions about resource use in their area.[72]

Despite pronouncements in the Roadmap that 'indigenous people and communities should be engaged constructively from the outset of proposals that might affect them', neither indigenous people nor community representatives were members of the Roadmap's Steering Committee. The Roadmap's Indigenous and Public Working Group, was also void of any Indigenous representation and comprised solely of nuclear proponents and licence holders.[73] The inclusion of Indigenous peoples from any of Ontario's 40 remote, off-grid communities was also a notable omission from the Roadmap's workshops, which were limited to Nunavut, New Brunswick and Alberta.[74] Similarly, while multiple Ontario-based energy corporations were represented on the Steering Committee, no Indigenous communities nor their provincial territorial representatives were present.

The lack of Indigenous representation within the Roadmap's development is indicative of a broader, systemic inadequacy of considering Indigenous interests early in decision-making. As the United Nations Special Rapporteur for Indigenous

[70] SMR Roadmap, ii.

[71] Natural Resources Canada 2011, 20 [Status of Remove Communities].

[72] Borrows 2002, 32.

[73] CNSC 2018.

[74] Status of Remote Communities, 20.

peoples in Canada reported in their review of the Indigenous human rights in Canada, consultation processes are 'generally inadequate and 'usually take place at a stage when project proposals have already been developed'.[75]

The Roadmap is also silent on the Indigenous human rights principle of 'free prior and informed consent' (FPIC). As the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) states:

> States shall consult and cooperate in good faith with the indigenous peoples concerned through their own representative institutions in order to obtain their free, prior and informed consent before adopting and implementing legislative or administrative measures that may affect them.[76]

Given the Roadmap's already inadequate attempts at Indigenous engagement and consultation, it is less likely that the consent of First Nation communities will be sought prior to the siting and installing SMRs. *First*, that the term 'consent' does not appear anywhere in the Roadmap, nor its session or working group papers. *Secondly,* statements made in the Roadmap signal that the need for consultation and reconciliation may not be fully appreciated by nuclear proponents. For instance, in an attempt to encourage greater engagement with Indigenous communities the Roadmap notes 'any delay in engagement would risk decisions being made exclusively in the South *without consideration* of Northern priorities and needs' (emphasis added).[77]

The duty to consult must be satisfied prior to decisions being made which could affect First Nations' constitutionally protected traditional and treaty rights.[78] Therefore, making decisions to site and deploy SMRs in Northern and remote communities absent fulfilling the duty to consult would conflict with the Honour of Crown. While Canadian courts are yet to explicitly begin developing jurisprudence regarding consent,[79] legal commentators have suggested that a decision to do so would concurrently 'encourage the Crown to negotiate early'.[80]

In our view, advocacy by SMR proponents and the CNSC to exempt SMRs from IA (as further discussed in Sect. 4.1) is inconsistent with the Roadmap's alleged prioritization of Indigenous engagement. Critically, excluding SMRs from IA

[75] United Nations General Assembly 2014, para 71.

[76] United Nations Declaration on the Rights of Indigenous Peoples (2008), Article 19.

[77] SMR Roadmap, 19.

[78] As the Supreme Court of Canada recognized in *Haida Nation v British Columbia (Minister of Forests)*, 2004 SCC 73, 'The duty to consult and accommodate is part of a process of fair dealing and reconciliation that begins with the assertion of sovereignty and continues beyond formal claims resolution. The foundation of the duty in the Crown's honour and the goal of reconciliation suggest that the duty arises when the Crown has knowledge, real or constructive, of the potential existence of the Aboriginal right or title and contemplates conduct that might adversely affect it'.

[79] Imai, p. 46.

[80] Imai, p. 49.

review removes a means of participating in environmental decision-making which is cognizant of biophysical and sociological ecosystems. 'Mistrust of the CNSC' was already noted as a concern by Indigenous workshop attendees[81] and thus, should SMRs only undergo a licensing review by the CNSC, the public accountability and integrity of SMR development and deployment would be compromised.

11.4.3 Perspectives on Radioactive Waste: Considerations of Intergenerational Equity and Public Trust

The Roadmap concludes Canada's existing radioactive waste management to be 'sound'[82] and 'sufficiently flexible to accommodate'[83] However, the Roadmap does not consider the effect of expanded radioactive production created by SMRs alongside longer term considerations of sustainable development. In our view, it also overlooks decisions by the Nuclear Waste Management Organization (NWMO) regarding Canada's waste management approach for existing stockpiles of radioactive materials, and modifications which may be necessary to account for new waste streams generated by SMRs. In turn, this may undermine confidence in the authority vested with overseeing Canada's long-term management of radioactive waste and pose an obstacle to successfully obtaining the social licence needed to accompany new reactor construction in Canada.

A key goal of sustainability assessment is to discourage decisions which transfer the negative impacts of our activities today onto future generations.[84] For this reason, the expansion of nuclear power and its resulting production of long-lived radioactive wastes has been viewed critically by advocates of sustainable development. Canada's current generation of reactors were built without environmental assessments or meaningful consideration of the intergenerational impacts of radioactive waste production.

The need to review Canada's waste management framework in light of the Roadmap's vision for SMRs is another theme in common with the nuclear renaissance, when the federal government undertook legislative initiatives aimed at addressing ongoing obstacles to the expansion of nuclear power in Canada. It was recognized in the early 2000s that for a nuclear renaissance to come to fruition, Canada's nuclear industry required a plan for managing the stockpiles of high-level radioactive fuel waste generated by reactor operators since the 1960s. In response, the federal government passed the Nuclear Fuel Management Act (NFWA) in

[81] Canadian Small Modular Reactor Roadmap (12 June 2018) Workshop 3: Off-Grid Northern and Remote Communities, Iqaluit, May 10–11 2018, p. 11.

[82] SMR Roadmap, p. 27.

[83] Ibid.

[84] Gibson 2006.

2002.[85] The NFWA created the NWMO which was mandated to develop and implement a plan for managing Canada's nuclear fuel waste.[86]

In line with the polluter-pays principle—an economic rule of cost allocation, requiring that the entity which creates a pollutant be responsible for the external costs arising from its effects[87]—the federal government delegated the responsibility for developing and implementing a strategy for the long-term management of nuclear fuel waste to radioactive waste producers. The NFWA assigned responsibility for fuel waste to Canada's fuel waste producers: Ontario Power Generation (OPG), AECL, Hydro Quebec and New Brunswick Power.

The NFWM mandated the NWMO develop a plan for the management of nuclear fuel waste and, over a three-year period, review the following management options: (i) deep geological repository (DGR) in the Canadian Shield; (ii) storage at nuclear reactor sites, and (iii) either above or below ground centralized storage.[88] To ensure accountability and the consideration of the public interest, the NFWA required the NWMO to consider issues such as the ethics, environmental impacts and risks of different waste management approaches as well as input from Canadians. For each of these options, the NWMO was also required to carry out a comparison of 'benefits, risks and costs of that approach with those of the other approaches, taking into account the economic region in which that approach would be implemented, as well as ethical, social and economic considerations associated with that approach.[89]

As mandated by statute, the NWMO undertook public consultations with the general public, civil society and First Nation groups as well as industry on the risks and benefits of each of the proposed approaches from 2002 to 2005. The fundamental assumption used for comparing the risks and benefits of each approach was that 'the volume of used nuclear fuel which needs to be managed was *assumed to be limited* to the projected inventory from the existing fleet of reactors' (emphasis added).[90]

Considerations of intergenerational and intragenerational equity are key sustainability principles and as required under the NFWA, the NWMO's consultations considered the ethical implications of fuel waste manage management, including the transfer of risks and burdens to future generations. The NWMO's Roundtable on Ethics observed that achieving an ethical nuclear waste management approach was an intractable problem and producing additional wastes would be unethical:

[85] Nuclear Fuel Waste Act, SC 2002, c 23 [NWFA].

[86] Ibid.

[87] Sadeleer 2002, 21.

[88] NFWA, s. 2.

[89] NFWA, s. 4.

[90] Nuclear Waste Management Organization 2004.

> Given the large stockpile of high level nuclear waste that already exists in Canada and that will be hazardous for thousands of years, some solution to managing wastes as safely and effectively as possible must be found. Even if no ethically optimal solution exists, it would be ethically justified to adopt the least unacceptable option available. By contrast, to justify new nuclear power plants or even replacing the ones now in place when they reach the end of their serviceable life, one would have to have an ethically sound waste management method, not just a least-bad one.[91]

In its final report to government, the NWMO's Advisory Committee noted it would be critical of 'any management approach that makes provision for more nuclear fuel waste than the present generating plants are expected to create, unless it were linked to a clear statement about the need for broad public discussion of Canadian energy policy prior to a decision about future nuclear energy development'.[92] As acknowledged by the Advisory Council, NWMO's consultations and waste management risk assessment only considered the waste produced by Canada's existing fleet of CANDU reactors. Recognizing that non-CANDU waste, were not considered during their consultations with Canadians the Advisory Council stated:

> A nuclear expansion scenario would likely entail fuel enrichment and new reactor technology, with spent fuel possessing new characteristics. These could affect the performance of the disposal technology and introduce a change in the outlook on reprocessing. Such technical aspects were not considered by NWMO in its study, which focused on existing facilities using natural uranium fuel.[93]

Following the public consultation period, NWMO's recommended waste management approach was 'Adaptive Phased Management' (APM). APM recommends that the waste produced by Canada's existing reactors be moved from reactors sites to a centralized storage facility, and eventually relocated to a geological repository. While this approach may arguably reduce risk because it isolates the hazard posed by nuclear fuel waste to a centralized location, this management approach assumes a finite amount of waste. The federal government has since accepted NWMO's proposal and has directed they begin implementing APM.

Despite ethical, environmental and social risks factoring into the NWMO's APM recommendation, these elements do not appear to have been considered within the Roadmap's development. The Roadmap's Waste Working Group, for instance, does not attempt to analyze SMR waste in light of NWMO's final report to government and instead asserts, 'The NFWA, and the NWMO's development of APM, considered the potential for new wastes forms through new technologies or new-nuclear projects. As such, fuel waste from SMRs would be within NWMO mandate for long-term disposal'.[94] The Roadmap's assumption that the NWMO has

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[91] Nuclear Waste Management Organization (2004) Ethical and Social Framework, June 24 2004.

[92] Advisory Council to the NWMO (2005) Nuclear Waste Management Organization—Advisory Council Final Report, 22 September 2005 [NWMO Final Report].

[93] NWMO Final Report.

[94] Canadian SMR Roadmap (2018), Waste Working Group Report, July 2018, p. 3.

the mandate to accept additional and new types of nuclear fuel waste has not been publicly discussed with either federal government or Canadians. If the NWMO permits new SMR fuel wastes into the APM plan, it may arguably increase public distrust and skepticism of its proposals to find a willing community to host a DGR for nuclear fuel wastes.

While the Roadmap recommends the NWMO "offer early engagement with SMR proponents to ensure appropriate technical specifications for a safe disposal facility and compatible waste forms for SMRs that could be deployed in Canada,"[95] The proposed SMR designs all foresee operating on some form of enriched fuel. Enriched fuels typically create wastes that are more radioactive and longer-lived than used-CANDU fuel. According to an internal CNSC report of a Roadmap workshop, waste producers already plan to accept SMR fuel wastes into the proposed DGR. As New Brunswick Power's Deputy Chief Nuclear Officer told workshop attendees, utilities would set a 'fair price' for storing the fuel wastes produced by SMR projects.[96]

Although the NWMO does not perform regulatory functions like the CNSC, as an agency created by statute to which the government has delegated the implementation of government policy, it must be free of conflicts of interest. As both OPG and New Brunswick Power are members of the NWMO Board of Directors, and both companies have been publicly pursuing the development of SMR technology, there is a potential conflict of interest. This is further amplified by NWMO's direct participation in the development of the Roadmap. In our view, it is reasonable to question whether the NWMO's ostensible mandate to implement government policy in the public interest has been diverted 'by intent and action of the industry itself'.[97]

The NWMO's participation in the development of the Roadmap and its support for integrating SMR fuel waste into APM signifies its willingness to modify the waste management strategy to align with industry interests. Although the Roadmap found there were no fundamental barriers to the NWMO's management of used nuclear fuel, such actions implicate the NWMO's accountability and may eventually undermine the public's trust in their process to site and develop a DGR. In our view, should the federal government accept the Roadmap's finding that SMR-produced radioactive waste can be integrated into the NWMO's APM approach, without having publicly reviewed the accompanying ethical, social, economic and intergenerational risks, is ill-advised and contrary to the NWMO's founding purpose.

[95] SMR Roadmap, p. 66.

[96] Belyea and Rickard 2018.

[97] Carpenter and Moss 2014.

11.4.4 Contravening the Polluter-Pays Principle: Nuclear Liability Protection

In light of the Three Mile Island, Chernobyl and Fukushima accidents, the safety of nuclear power continues to be of public concern. The Roadmap attempts to dispel such concerns by repeatedly asserting SMRs' 'innovative "passive safety" features' allow it to 'naturally shut down during an emergency; also referred to as "inherent" safety'.[98] In spite of these claims of increased safety, an objective of the Roadmap is to maintain liability protection which shields reactor operators and suppliers from responsibility in the event of an accident. This scheme transfers much of risk associated with reactor operation to Canadian society, contrary to a key principle underpinning sustainable development, the polluter-pays principle. The polluter-pays principle is often invoked to incentive environmental protection and justify the adoption of strict liability, wherein an operator assumes responsibility for all consequences of operation, regardless of intent to cause harm, in order to ensure availability of compensation for losses.[99]

Among the Roadmap's priority recommendations is that the federal government review regulations under the Nuclear Liability and Compensation Act (NLCA) to 'ensure that nuclear liability limits for SMRs are aligned with the risks they pose, using a graded scale based on risk informed criteria'.[100] On its face, the Roadmap's prioritization of liability protection appears incongruous with proponents' reassurances that SMRs will attain higher levels of safety. Industry's adamant reliance on nuclear liability legislation, which protects reactor operators and suppliers from accident risk, suggests their private assessments of SMR risks may be quite different than public portrayals.

When the NLCA came into force in 2017, it increased the liability limit for nuclear operators from $75 million to $1 billion. The NLCA replaced the 1976-based Nuclear Liability Act which capped the liability of reactor operators at $75 million. As acknowledged by the federal government, the intent of liability protection under the Nuclear Liability Act was to 'to provide an environment for nuclear development'.[101] In effect however, by enabling the expansion of nuclear power, the NLCA and its predecessor effectively transfer the responsibility for compensating victims for the damage and clean-up of nuclear accidents from the nuclear industry to Canadians.

The principles of nuclear liability protection were developed in the United States in the 1950s, in response to a shift in nuclear power development from the public to

[98] SMR Roadmap, p. 25.

[99] Sadeleer 2002, p. 50.

[100] SMR Roadmap, p. ii.

[101] Minister of Natural Resources to Theresa McClenaghan (Canadian Environmental Law Association) and S-P Stensil (Greenpeace) Minister's Response to Petition 350, 9 September 2013, Response to Question 14.

private sector. Faced with untested and catastrophic risks posed by nuclear technology, reactor operators, suppliers and the insurance industry refused to assume outright responsibility for reactor risks. To make the nascent nuclear industry viable, the U.S. government exempted the nuclear industry from tortious actions, whereby a harmed individual could obtain a civil remedy for losses, and effectively 'invented' a new principle of liability shileding reactor vendors and suppliers from liability in the event of an accident.[102] A key principle of nuclear liability developed by the American government and also taken up in Canada's statutory approach to nuclear liability is referred to as 'legal channelling'. Accordingly, operators are exclusively liable for damages, even if the negligence of a supplier or designer contributed to causing an accident. Indeed, Vanden Borre (1999) has argued that shielding reactor suppliers was the primary reason to establish legal channelling, stating '[c]hannelling was therefore not introduced to protect the victims of nuclear accidents, nor to reduce the insurance costs, but to protect the American nuclear industry'.[103]

Legal commentators have questioned whether legal channelling is still appropriate, given the projected transition to passively safe reactor designs.[104] In light of claims put forward in the Roadmap that tout the increased passive safety of SMRs resulting from their pre-fabrication and the associated reduction in the role of operators in ensuring their safe operation, whether the continued channelling of limited liability to operators is reasonable must be reexamined. In our view, the shielding of reactor suppliers and the limited liability provided to reactor operators is a disincentive to risk reduction. The victims of the Fukushima accident who struggle for compensation demonstrates all too well the effect of a statutory limitation that shields suppliers and vendors from responsibility,[105] instead of apportioning liability jointly and severally.

Canada's nuclear industry continues to benefit from the accident liability protection afforded to it by the federal government. However, applying a sustainability lens demonstrates that transferring risk for reactor operation from operators and suppliers to Canadians is contrary to the polluter-pays principle. Expecting that this liability regime continue undermines the validity of industry's claims that SMRs can provide reliable, passively safe energy to Canadians. Moreover, the shift to purported passively safe designs and modular manufacturing should trigger a review of the existing liability scheme and whether exemptions for nuclear designers and suppliers is still appropriate.

[102] Pelzer 2000, p. 435.

[103] Vanden Borre 1999, 38.

[104] Ameye 2010.

[105] McClenaghan 2017, pp. 57.

11.4.5 Imposing Risk on Future Generations: Proliferation Concerns

Despite national and international efforts to secure nuclear safety and its peaceful uses, nuclear non-proliferation remains challenged by the continuing risk of nuclear and other radioactive materials being used by terrorists to threaten life and create fear.[106] As previous sustainability-based assessments of nuclear energy have identified, the use of nuclear power for power generation poses uniquely severe accident, security and weapons proliferation risks.[107] Applying an intergenerational equity lens to nuclear projects also reveals the proliferation risks imposed onto future generations due to nuclear power generation's waste legacy.[108] As the purported cost-competitiveness of SMRs with other low-cost forms of electricity production is contingent upon their mass fabrication, hundreds if not thousands of SMRs may need to be deployed in order to be economically viable.[109] Therefore, this section reviews the proliferation risks accompanying their use.

Academic commentators have remarked that SMRs will necessarily be subject to 'less stringent transport and siting requirements' in order to enable their installation in more diverse and remote regions.[110] After a period of approximately thirty years, it would be necessary to transport the spent fuel to a reprocessing facility. However, due to the potentially high number of deployed SMRs and their geographic range, it is likely that several reprocessing facilities across a similar spread would be needed in order to reduce transportation distances.[111] They note that proliferation risks increase because of difficulties in measuring amounts of plutonium in spent fuel, thus challenging the subsequent tracking of amounts which may have been diverted from a reprocessing facility.[112]

Other proliferation risks presented by SMR deployment result from the nature of their intended applications and are highlighted in the working group reports from the Roadmap. In remote locations, it was remarked that there could be limited accessibility for CNSC or IAEA inspections. The lack of linear infrastructure may present additional challenges for the transportation of preassembled and loaded nuclear cores.[113] If deployed at mining sites, the operating life of an SMR may potentially exceed that of energy need at the facility.[114] Ultimately, should SMRs

[106] Black-Branch and Fleck 2018, pp. 2 and 46.

[107] Gibson et al. 2008.

[108] *Id*, pp. 53, 66, and 85.

[109] Glaser et al. 2015.

[110] Glaser et al. 2013; Locatelli and Mancini 2011, p. 212.

[111] Frieß et al. 2015, p. 731. While not taking into account SMR designs proposed for Canada, a review of a generic sodium-cooled SMRs by Frieß et al. is instructive.

[112] Ibid.

[113] Regulatory Working Group Report pp. 27, 40.

[114] Ibid., 30.

be exempt from IAs, a sustainability assessment of proliferation risks imposed on future generations would be critically lacking, despite the potential for SMRs to produce significant quantities of plutonium attractive for weapon purposes.[115]

11.5 Conclusion

The hopeful narrative put forward in the SMR Roadmap resembles the promises put forward during the 2000s, when new reactor designs with environmental and economic benefits to Canadians were promoted by industry. Nuclear advocates are promoting visions of SMRs 'imbued with elements of fantasy' in order to attract political support while purging past industry failures from public debate.[116] In our view, this is the motivational intent of the Roadmap, confirmed by its paucity of discussion which reconciles the nuclear industry's past failures with the vision of SMRs it now touts.

Our analysis illustrates that should the law reform and policy requests contained within the Roadmap be implemented, Canada's progress towards sustainable development and its foundational principles of precaution, polluter-pays and intergenerational equity would be undermined. Of most concern is the industry's request, inappropriately supported by the safety regulator, to exempt SMRs from review under the proposed Impact Assessment Act (Sects. 11.4.1 and 11.4.2). This would deprive Canadians, indigenous people and communities, and government decision-makers of a key mechanism for gathering information on the social, environmental, and health risks of SMRs, and their impact on Canada's transition to sustainability. As the production of long-lived radioactive waste suggests a priori the transfer of risk to future generations (Sect. 11.4.3), it also furthers development contrary to sustainability and the principle of intergenerational equity. In the same vein, increased radioactive waste production transfers risks of proliferation and security to future generations (Sect. 11.4.5). Despite public assurances of safety, the Roadmap's request to maintain a liability regime which shields SMR operators and suppliers from liability in the event of an accident (Sect. 11.4.4) indicates that the success of SMRs is contingent upon contravening the polluter-pays principle.

Our analysis also highlights actions by the CNSC, indicative of a captured regulator and the long-term implications of the Roadmap's recommendations, specifically as it relates to the oversight of nuclear safety and management of radioactive waste. This chapter has also critiqued the participation of the NWMO in the development of the Roadmap, and whether its acceptance of additional and new types of fuel wastes without public or government consultation is contrary to its legislated mandate.

[115] Frieß et al. 2015, p. 730.

[116] Sovacool and Ramana 2015.

The success of SMRs is a destiny issue for what remains of Canada's nuclear industry. To achieve sustainability, the proposal to develop and deploy SMRs must be viewed in light of harms or contributions to sustainable development. Anything less, deprives Canadians and Indigenous people of participating in decisions whose effects implicate the environment, their community and future needs.

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