



Nuclear Waste Burial in Canada? The Political Controversy over the Proposal to Construct a Deep Geologic Repository

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Rec date: Feb 14, 2016 Acc date: Apr 14, 2016 Pub date: Apr 19, 2016

Abstract

Canada's newly minted federal minister of the environment, Catherine McKenna, decided on February 18, 2016 to delay the federal government's decision on a proposal to construct a permanent repository for nuclear waste beneath the Bruce nuclear site, little more than a kilometre from Lake Huron. Officially called a 'deep geologic repository', or DGR, the facility is the brainchild of Ontario Power Generation. While it would not store fuel rods from nuclear plants, it would take in all other types of low- and intermediate-level radioactive wastes including concrete, equipment and protective gear from the continued operation and planned refurbishment of all Ontario's 20 nuclear power reactors. While most of the studies and consultations were done when the Conservative government was in power, Minister McKenna has now delayed the decision pending more information and will seek a further extension for the review from cabinet at a later date. A federal panel appointed by then minister of the environment, Peter Kent, and the Canadian Nuclear Safety Commission gave its overall seal of approval to the controversial proposal in May 2015. The panel's favourable view overcame a major regulatory hurdle in the construction of the DGR however since the panel released its decision after public hearings, political opposition to this plan has only grown and spread. Critics argue that low-level and intermediate-level waste from all Ontario's nuclear reactors should not be stored so close to the source of 20 percent of the world's surface fresh water. The proposal's scientific and technical merits and demerits are already well documented in various reports and hearings, but more controversy is expected now that the federal minister of the environment has announced another setback to the proposal. We can probably expect more political debate and long delays.

Keywords: Deep geologic repository; DGR; Nuclear power; Nuclear waste; Ontario power generation

Introduction

A proposal to construct a Deep Geologic Repository (DGR) under the world's largest operating nuclear power plant, approximately 1.2 kilometers away from one of the Great Lakes has met with vigorous local and international opposition. The DGR project put forward by Ontario Power Generation (OPG) proposes to design, construct and operate a deep geologic disposal facility on the Bruce nuclear site within the municipality of Kincardine in the Canadian province of

Ontario. The DGR would be designed to manage low and intermediate waste produced from the continued operation of OPG-owned nuclear power plants. Now that Katherine Wynne's provincial cabinet has committed Ontario to refurbish the Bruce, Darlington, and Pickering reactors - barring discovery of an alternative technology - Ontario needs to figure out what to do with its nuclear waste.

Many municipalities adjacent to Lake Huron have already received millions of dollars since 2005 - and will continue to do so until 2035 - so long as they support the nuclear waste disposal site. In May 2015 a federal environmental panel endorsed Ontario Power Generation's proposal. Then in November 2015 the newly-elected Canadian government promised to announce some sort of decision in March 2016 [1]. In a letter to interested parties in February 2016, Ms. McKenna delayed a decision on whether to approve the proposed deep DGR for low- and intermediate-level radioactive waste and set a short April 18 deadline for OPG to furnish a timeframe within which it could provide an updated list of commitments to mitigate potential damage from the site. Furthermore, she stated she will seek a further extension for the review from cabinet at a later date [2]. We can expect more long delays and more political controversy at the local-, national- and international levels. This paper explains the political controversy and the arguments different organizations and individuals have put forward for and against the proposed DGR. Not intended as a research article about the scientific and technical aspects surrounding the original proposal, this paper takes a qualitative political science approach to exploring the resulting political controversy that surrounds the proposal to bury nuclear waste in Canada.

Findings

In North America, First Nations, municipalities and hundreds of thousands of citizens are uniting in opposition to constructing large limestone caverns that would house nuclear waste so close to the Great Lakes water basin. They argue the proposal must be opposed and decision-making processes internationalized rather than decided upon at national or local levels.

The Minister of Environment and Climate Change, the Honourable Catherine McKenna is now requesting additional information and further studies on the environmental assessment for the proposed DGR in Kincardine, Ontario. On February 18, 2016 she requested OPG provide additional information on three aspects of the environmental assessment: alternate locations for the project, cumulative environmental effects of the project, and an updated list of mitigation commitments for each identified adverse effect under the Canadian Environmental Assessment Act, 2012. OPG has been asked to provide the Canadian Environmental Assessment Agency, by April 18, 2016, with a schedule for fulfilling the information request.

The Minister's request for information from OPG has paused the timeline for an environmental assessment decision to be issued, and at a later date, the Minister will seek a further timeline extension from the Canadian Cabinet. More political controversy is expected now that the federal minister of the environment has announced another setback to the proposal. We can probably expect more political debate and long delays.

A Federal Environmental Panel gave its Overall Seal of Approval in 2015

In May 2015, the federal panel appointed in 2012 by Canada's Minister of the Environment Peter Kent and the Canadian Nuclear Safety Commission (CNSC) gave its overall seal of approval to the controversial nuclear waste disposal site proposal [3]. The panel's favorable view of the project overcame a major regulatory hurdle in the construction of the DGR [4]. The panel recommended then-Minister of the Environment, Leona Aglukkaq approve the building of a subterranean crypt below the Bruce nuclear station near Kincardine, Ontario. Critics pointed out the unelected panel had been appointed by CNSC President Michael Binder and its three-year environmental assessment had ended after merely 4 weeks of hearings that were held only in northern Ontario's Kincardine area [5,6]. While the federal environmental panel strongly endorsed the proposal in the spring of 2015, the office of the Minister of the Environment asked for more time given the upcoming federal election that was scheduled to take place in October 19, 2015. That October the Minister lost her seat in the Liberal sweep that replaced the long-ruling Conservatives in office. She was replaced by Liberal Catherine McKenna, the Minister of the renamed Department of Environment and Climate Change on November 4, 2015. Minister McKenna's office quickly issued a statement extending the decision-making period yet again to March 1, 2016 but then her office delayed the decision once again on February 18, 2016.

A Hosting Agreement arranges for OPG to pay Municipalities Millions of Dollars

A little-known 21-page 2004 hosting agreement between OPG and the Kincardine municipality has already arranged for millions of dollars to be paid by OPG to Kincardine and the adjacent municipalities "so long as they provide their cooperation in support of the environmental approvals and licensing applications sought as well as any other approvals or licences required to construct or operate the DGR." If at any time OPG determines that they are not "in good faith, exercising best efforts to achieve any of the milestones, OPG may in its sole discretion, acting reasonably, decline to make further annual payments or any further one-time lump sum payments [7]."

According to the agreement's terms, Kincardine received two one-time payments of \$1.3 million (Cdn.) in 2005 and 2013, and annual payments each year of \$650,000 since 2005. The adjacent municipalities – Saugeen Shores, Huron Kinloss, Arran Elderslie and Brockton – also received millions of dollars. It is not known how these local councils have spent their windfall but critics argue millions of dollars can buy much more than hockey rinks, including acquiescence [8-11]. Now that alternative sites must be identified, it is unclear whether the payments could dry up or other municipalities could receive similar payouts.

International and National Opposition has Mounted

Outside the local Kincardine area, critics in the U.S. and Canada argue that burying nuclear waste merely 1.2 kilometers from the Lake Huron shoreline risks our lives and future generations [12]. Michigan's two U.S. senators and most of the members of the U.S. House of Representatives asked newly-elected Canadian Prime Minister Justin Trudeau to reject the approvals needed for the proposed waste facility on November 5, 2015. OPG's plans are to bury more than 200,000

cubic meters of low- and intermediate-level radioactive waste produced from the Bruce, Darlington and Pickering reactor operations in a series of underground caverns. "These wastes have to be isolated from the environment for hundreds of thousands of years; burying them in limestone right beside Lake Huron simply makes no sense," says Kevin Kamps, a radioactive waste specialist with a U.S.-based group Beyond Nuclear which closely follows the Canadian controversy [13].

During the hearings, a retired nuclear scientist, Dr. Frank Greening who had worked at OPG, raised serious doubts about OPG's estimates concerning the inventories it planned to bury in the DGR [14,15]. Opponents urged the panel to adjourn the hearings until OPG filed a complete plan, but the review panel rejected that request [14,15].

Worries are that if OPG expands the site by another 135,000 cubic meters, it may take decommissioned wastes – including radioactive reactor components and contaminated building materials and rubble – through a license amendment, after approval based on the initial proposal has been issued [16,17].

Some of these wastes – called 'low-level' radioactive wastes – do not require extra barriers to shield workers from radioactivity, although they are still hazardous. Other wastes, classified as 'intermediate' wastes are almost as highly radioactive as 'high level' waste and elements of these wastes will remain dangerously radioactive for hundreds of thousands of years.

U.S. Congressman Dan Kildee issued a statement expressing his disappointment in the environmental panel's 2015 report, which he said was fundamentally flawed in several ways. "Human error is always a possibility, and if an accident were to happen on the shores of the Great Lakes, a nuclear radiation release could endanger the freshwater supply for over 40 million people, both in the U.S. and Canada... Permanently storing nuclear waste less than a mile from the Great Lakes is an unnecessary risk and too much of a threat to the world's largest supply of freshwater, which would be forever changed if they were to become contaminated with nuclear waste."

Many more North Americans have united to speak out in opposition to the plan. Already 154 North American municipalities representing more than 21 million people have passed resolutions opposed to OPG's proposed waste depository. Detroit City Council passed a resolution against it on May 19, 2015 joining other big cities like Chicago and Toronto. The large and growing public opposition includes many elected representatives in the U.S. At least 20 members of the U.S. Congress—10 Democrats and 10 Republicans—are co-sponsoring a resolution seeking an alternative location [18,19]. On September 26, 2015, The Great Lakes Legislative Caucus, a nonpartisan group of state and provincial lawmakers from eight U.S. states and two Canadian provinces (Ontario and Quebec) passed a resolution opposing the repository [20].

U.S. Senators Carl Levin and Debbie Stabenow have also sent a letter to Secretary of State John Kerry asking him to stop the decision to store such large quantities of nuclear waste along the shores of an internationally-shared resource. They and others are asking the bi-national International Joint Commission (IJC) to thoroughly review and reconsider the decision. According to Michigan law, nuclear waste is not allowed within 10 miles of the Great Lakes so critics argue Canada's nuclear waste laws should be in line with the U.S [21].

"Nuclear waste is everybody's business. Decisions can no longer be left to the discretion of the nuclear establishment and its regulatory

bodies,” says Dr. Gordon Edwards of the Canadian Coalition for Nuclear Responsibility. “The Canadian Nuclear Safety Commission, appointed by the government, has little or no objectivity in dealing with nuclear waste issues...When Linda Keen was fired from her position as head of the CNSC in 2008 for trying to enforce regulatory requirements, I believe that any chance for the CNSC to play an independent role was scuppered,” said Edwards [22].

Recently the Mohawk Council of Kahnawake sent a supportive letter to Chief Vernon Roote of the Saugeen Ojibway Nation (SON) regarding “your fight to prevent the creation of a repository for nuclear waste on the Bruce power site on the banks of Lake Huron [23].” During the hearings held in Kincardine, SON Chief Randall Kahgee also testified the nuclear waste site could not go ahead without SON’s support. He saw this as a ‘forever’ project and the SON did not have a process or protocol for looking past seven generations [24].

Grand Council Chief Patrick Madahbee now says that the Anishinabek Nation stands behind the SON in opposing the panel’s recommendation to proceed with a plan to bury nuclear waste deep under Bruce County. Madahbee agrees with Chief Roote that First Nations should be concerned about a possible leak and the impact on future generations. “The uncertainties and risk are too great for the Anishinabek Nation and Ontario citizens to consider,” says Madahbee [25,26].

Deep-set Differences

Despite all sorts of protests, the federal government’s environmental panel asserted there would be “no significant adverse effects on Lake Huron or the other Great Lakes.” Any release of radiation, it stated, “would be extremely low relative to current radiation levels in Lake Huron and negligible relative to dose limits for the protection of the public.” The panel went on to dismiss various fears that were raised during the hearings, despite the fact the Canadian Environmental Law Association had testified about the negative hydrogeological and physical aspects, and raised questions about whether siting a gravel pit in Ontario would have received a more rigorous review.

During the hearings, some experts claimed this would be one of the most difficult scientific projects conceived in humanity’s history, while others viewed it as entirely feasible [14,15,27,28]. Critics pointed out the only example OPG offered of a similar DGR – the Waste Isolation Pilot Plant in New Mexico – was no longer operating, after an underground fire and loss of containment resulted in radioactive releases to the surface in 2014. Germany’s vaunted salt mine solution for low-level nuclear waste had also proven to be full of holes as thousands of litres of groundwater continue to leak into the Asse mine every day and mix with radioactive waste [14,15].

But the federal environmental panel maintained that the rock in which the DGR would be located is extremely stable, and fluids contained in the rock would travel so slowly in geological terms that any radioactivity that might escape would decay before reaching the lake. On the other hand, one widely-quoted geologist in the media compared controlling radioactivity from leaking into the water table to, fruitlessly, preventing dye from dissipating in a swimming pool [29].

The panel went on to assert the Bruce site was a good choice, and although OPG decided to construct the waste disposal facility there without thoroughly investigating alternative sites: “The relative environmental effects of constructing a DGR on an undeveloped site would be higher than on the already disturbed Bruce nuclear site.” As

the panel asserted, “There would be socio-economic challenges at an undeveloped site ... In addition, the Bruce nuclear site is highly secure; thus, the risk of malevolent acts is already managed and low”. Yet critics pointed out that burying the waste at the Bruce site meant it would be nigh impossible to ensure they could be monitored and retrievable in the event of an unforeseen nuclear accident, like what happened in 2011 at Fukushima in Japan.

As mentioned, the public hearings ended in October 2014 and the federal panel approved the project in May 2015. The then-federal Minister of the Environment explained that a final decision would be delayed pending more feedback on the panel’s report – as well the looming federal election in October would allow more debate and discussion. But other issues dominated in the Canadian federal election ranging from Senator Mike Duffy’s trial to the issue of what to do about thousands of Syrian refugees. It remains important to consider why some advocated burial while others are strongly opposed to building an underground nuclear shaft.

No Easy Answers: Why some choose Burial and others Advocated against it

It is proposed that spent fuels and other forms of nuclear waste will need to be transported to Lake Huron by truck or train. Transportation by helicopter has already been rejected due to environmental safety concerns. The panel reported that much of the Bruce reactor’s waste is already stored above ground at the Bruce station, but there will be tons of waste from Darlington and Pickering that will need to be moved once these reactors are refurbished or phased out [30]. The Katherine Wynne government announced in January 2016 plans to go ahead with refurbishing all these reactors so that they will continue to operate for 30 more years or longer [31] so the issue of what to do with hundreds of thousands of tons of ongoing nuclear waste will continue to be a problem.

If Ottawa does agree to host a large nuclear waste site at the Bruce site, the timing of the transport of nuclear waste on provincial highways would need to be kept secret due to the prospect of public opposition and possible terrorism. Some roads, like the major highways crossing through Toronto and southwestern Canada might have to be shut down entirely so that there was no chance of a terrorist strike against trucks carrying nuclear waste or public protest.

Certainly the nuclear waste would need to be stored in containers that would last tens of thousands of years, without leaking into the Great Lakes water system. No such containers have been invented. The long-term sustainability of the current containers manufactured in Japan cannot be precisely calculated. Improved containers might be invented hundreds of years from now, but this places an unfair burden on future generations to clean up this generation’s mess.

Alternatively vitrified glass logs could be used to store some waste so that it is less prone to leakage and stealing, but this process is expensive and not technically developed. For now, there is no solution to this problem so most nuclear waste is stored in liquid pools close to the nuclear power plants scattered all around North America.

Of course, the costs to transport all the waste to the Bruce nuclear site and store it cannot be accurately estimated. Previously Atomic Energy of Canada Limited estimated the cost of site construction somewhere in Canada would be more than \$13 billion, approximately the same as Canada’s entire annual defense budget [32]. Now that AECL was sold by the federal government, it is difficult to figure out

which corporations or government agencies would bear the cost of site construction. Which governments would bear the cost of overruns, commonly expected in all types of huge construction projects? Bruce Power announced in December 2015 it will spend \$13 billion to refurbish six nuclear reactors at the Bruce site and in January 2016 that it will assume all risks of cost overruns for its Darlington nuclear rebuild project, which will start in 2020 [31] but the temptation might be for future federal and provincial governments to agree to take other countries' waste in order to offset prohibitive long-term costs for electricity.

Ensuring the waste site's security –for more than tens of thousands of years – will be hugely expensive. Some jobs, created over many human generations, would help the local economy but only marginally. The monetary advantages for residents of creating a few local jobs would be offset by the many risks incurred, including possible leakage into underground water systems. The costs of increased insurance and emergency planning must also be properly factored into the decision-making process. Since the president of the Canadian Nuclear Safety Commission was fired by the federal government for being too strict in her enforcement of reactor safety regulations, the process of firing her raises further questions about accountability in the event of an emergency. Since then, the federal government's failure to establish a new arms-length agency to launch, guide, and determine any waste plan's acceptability means that the whole process of seeking democratic input has been heavily undermined, decreasing public acceptability further.

Indeed, Saskatchewan Premier Brad Wall was accused of subverting the nuclear hearings because he proposed that a research reactor be built within three years, at the same time as his provincial government was holding public hearings to gauge public sentiment on large-scale reactor construction combined with uranium enrichment. In the end, Saskatchewan seems to have decided against building a nuclear waste disposal site, leaving the problem up to Ontario to clean up.

Down in the Dumps due to Undemocratic Decision-making

Due to undemocratic decision-making at local levels, North Americans could end up with a liability for hundreds of thousands of years, long after nuclear power plants have fallen out of favour. Rather surprisingly, only four weeks of public hearings were held in Kincardine and Port Elgin, Ontario, although the DGR would be the only one of its kind in North America. It would handle low- and intermediate-level nuclear waste from OPG nuclear generators at Bruce, Pickering and Darlington but the hearings were held around the Bruce site only. It would be located within 1.2 kilometers of the Lake Huron shore in caverns dug in sedimentary rock, but nay-sayers living around the Great Lakes had to travel far north at their own expense to testify.

Because the intention to bury nuclear waste is precedent-setting and the repository is close to a valuable water resource, the proposal is subject to considerable federal and provincial input. But so far opposition from communities and organizations across North America has been met with delays and relative silence by the federal and provincial governments.

If it is ultimately approved by the federal government, the DGR would be designed to store a minimum of 200,000 cubic meters of radioactive waste permanently. It would not accept high-level waste – that is, irradiated nuclear fuel – but it would receive filters, equipment,

tools, workers' outfits, materials used to clean up radioactive spills, reactor core pipes and tubes removed during refurbishment, and steam generators.

All such waste would be shipped to Kincardine, packed in containers, and stored in limestone caverns. OPG seems confident the limestone would be sufficient to contain the waste as it is very thick and stable, and has lain undisturbed by environmental or geological changes for more than 450 million years. While OPG recognizes that limestone is water soluble, it claims that the rock is of such low permeability at the proposed depths that it is unlikely the waste will leak into the water table.

Opponents' predominant concern is that nuclear waste has never been successfully disposed of. As mentioned, the proposals to dispose nuclear waste at the Asse Mine in Germany and Yucca Mountain in the U.S. have been embarrassing and costly failures. Critics argue the human species has no experience to determine what might go wrong. There are many risks in transportation and storage plus questions about the limestone's stability if it is affected by construction of the caverns, or even targeted by terrorists.

Gradually more Michigan-based and Canadian organizations are uniting in their concern that the dump would be so close to a major body of freshwater. If nuclear waste were to leak, the consequences for the natural environment and humankind could be extremely problematic.

In its own documents, OPG asserts its current method of above-ground storage has been safe for more than 40 years, and could continue for several more decades. Some opponents of the site argue it would be more responsible to continue with this method than build a DGR [33].

OPG admits it will eventually discontinue monitoring the repository. Since some of the waste will be radioactive for tens of thousands to hundreds of thousands of years, critics point out the repository would be expected to last on its own without maintenance for a period of time that dwarfs the span of human history [34].

Selection of this site was based on local council acceptance, but the concept is slowly being met with considerable domestic and international opposition. OPG admits it did not look for alternative sites, which opponents argued was contrary to the Canadian Environmental Assessment Act. Now OPG is being asked to provide more information about alternative sites. OPG says there was little community resistance to the original project, but there is doubt whether the community was informed. OPG's own poll found most individuals in the region had not heard of the project [35]. Local citizens worried the risk of contamination would reduce property values. Accidents or terrorism aside, some argued any stigma surrounding the nuclear dump site could negatively affect property values.

The Precautionary Principle

The precautionary principle suggests OPG's proposal should be jettisoned. This principle is incorporated into environmental and international law to protect the public from exposure to harm when extensive scientific knowledge on a matter is lacking. It states a project should not be undertaken if it might have serious adverse ecological consequences, even if it is not possible to know that these consequences will materialize.

At the hearings, a lawyer Paula Lombardi argued the precautionary principle. A medical doctor commented on the possible ill-health effects. Many American and Canadian activists including a senator from Michigan travelled to northern Ontario to voice their economic, environmental and social arguments. Dozens of organizations, including the Bluewater Sportfishing Association, the Coalition for Nuclear Free Great Lakes, Inverhuron Committee, the Metis Nation of Ontario, and the Sierra Club of Michigan, presented oral and written statements. They had little or no financial backing to undergird long publicity campaigns. The press release issued by the Canadian Environmental Agency explained the long testimonial process as such: "Prior to the federal government's decision on the project, the Canadian Environmental Assessment Agency will invite Aboriginal groups and registered participants to comment on potential conditions relating to possible mitigation measures and follow-up requirements that could be necessary, if the project is authorized to proceed. These comments will be taken into account by the Minister of the Environment for the decision statement [36]."

Subject to the federal government's decision statement - which now could be delayed for months, if not years - the Joint Review Panel, as a panel of the Canadian Nuclear Safety Commission under the Nuclear Safety and Control Act, may also have to revisit its decision whether to issue a license to Ontario Power Generation to prepare a site and construct the deep geologic repository facility. We should expect more controversy and more delay.

Delayed Decision-making Processes

All the delay and controversy, including a federal election, meant that the Federal Minister gained much longer than 120 days to make any controversial decisions. Since a federal election was mandated for October 2015 the Conservative cabinet was able to delay its decision-making until the election results would be safely delivered. Then the Minister of the Environment under the new Liberal government delayed the decision and asked for more information from OPG. Eventually the "registered participants" and "interested parties" may be expected to prepare mountains of testimony once again.

Some people ask, "what more evidence would it take to persuade authorities that a DGR under the Bruce nuclear site would be needless or necessary?" Dr. Gordon Edwards and others have counseled it is sometimes better to wait for an idea to fizzle out - and be put on the shelf for future consideration. For instance, OPG's previous 'steam generator' proposal fizzled out and is never mentioned anymore [37]. In the long run, the DGR proposal may eventually be left to lie by the wayside. And now that OPG faces the prospect of considering alternative sites, there will be questions about whether other willing host sites should be able to sign lucrative hosting agreements as well. If OPG had been granted a construction license in the spring of 2016, OPG had forecast a shovel-ready date of 2018 and an in-service repository by 2025 [38]. Now another option is that, perhaps decades or centuries into the future, a widely-acceptable and feasible solution to nuclear waste disposal will be further developed, like glass vitrification. In the interim, many opponents agree, however that these wastes will continue to be a radioactive legacy that must be stored above ground, far away from the Great Lakes water basin, and not right underneath the world's largest operating nuclear facility.

Conclusions

Since the intention to bury nuclear waste is precedent-setting and the repository would be close to a valuable water resource, the proposal has been subjected to considerable local, provincial, state-level, federal, and international input. It is clear from the resulting controversy that the DGR proposal warrants considerably more input from all levels. Now that the newly minted federal government has requested more information from OPG including information about alternative sites, we can expect more political controversy and more delays.

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