

THE LAKE SUPERIOR BASIN - SITE OF THE WORLD'S LARGEST NUCLEAR WASTE REPOSITORY?

Overview by H. Whent - January 25, 2012

PREAMBLE

This document is prepared for the information of those who may be interested in the development of a Deep Geological Repository in Canada and how that may be connected to events in the United States and may affect Lake Superior. This document is a follow up summary to the awareness information provided the Lake Superior Binational Forum in the fall of 2011. It is not intended to demonstrate support for or opposition to the process, but simply for information which to the best of my knowledge is accurate and up to date.

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BACKGROUND

Canada passed the Nuclear Safety Control Act in 2000 which established the Nuclear Waste Management Organization (NWMO) in 2002 as an industry funded entity (with its Directors appointed by the industry) which also reports to the federal government. Its mandate is to find a site for the permanent storage of Canada's high level nuclear waste.

It is using the term 'Adaptive Phased Management' which in reality has as an end point a "Deep Geological Repository (DGR) which has been proposed for decades. One of the features is that it is to be 'retrievable'. There is no costing or techniques for retrieving the stored waste according to NWMO's own documents.

NWMO formally launched its 'siting process' in 2010 to find what it terms a 'willing and informed' host community. They have not 'imposed' that on anyone, but there certainly are a lot of resources being expended to support what they call the 'learning phase'.

INTERESTED COMMUNITIES

Within the Lake Superior basin there are four communities that have expressed interest: Wawa, Schreiber, Nipigon and Red Rock but Red Rock did not meet the criteria of the 'initial screening' so there are now 3.

In addition there is Hornepayne which is on the edge of the basin along with Ignace and Ear Falls to the west of Thunder Bay which are not within the basin. There are communities now in the Bruce peninsula expressing interest along with Blind River to Elliot Lake along the Lake Huron north shore east of Sault Ste. Marie. There are three locations in Saskatchewan.

NWMO has stated they expect others which may well include others within the basin.

All these communities are relatively small, are located in a 'rural setting' and most if not all are experiencing economic challenges. NWMO has not targeted them for that reason but certainly is aware.

THE PROCESS

What is certain is that NWMO is looking for political/social acceptance of the concept and it is being promoted for its economic benefits. They also state that safety for the public is the foremost guiding principle. In a communication with NWMO I was corrected in my use of the term 'preferred site', they told me that they had no 'preferred site', it simply had to be suitable.

My conclusion is that they are looking for a site that gains political/social acceptance that would meet the regulatory requirements BUT though they have not quite said it this way, at the lowest cost to the industry. This means that communities which wish to continue will be in a competitive process (that is what the process says) to both demonstrate this 'willingness' and also provide the best economic case.

The \$20 + billion dollars NWMO talks about is actually the total cost over a 300 to 400 year period. Site selection and licensing would take at least 15 years and operations at least are 25 years away. Operations then would be for at least 30 years before final closure but if increased in size, could be longer with monitoring required for hundreds of years after closure.

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In the next 15 years there would be some local economic benefit but the type of work to be conducted would not create hundreds of jobs. There may be an office with some employees but the drilling for example likely would be carried out under contract, likely short term by outside companies.

Nuclear waste management is under federal law. Very little provincial law actually applies. The only municipal jurisdiction would be under the Planning Act if the site was on private land within a municipality. It is highly unlikely that enough private land (6 sq km) with suitable rock exists within any municipality. If they use Crown Land, which NWMO said is likely, that comes under the Public Lands Act which is provincial jurisdiction and municipal official plans do not apply to Crown land. First Nations do have certain rights concerning Crown Land which have in part been dealt with in the courts.

NWMO does not use the term 'community' to mean a municipality. They recognize that the site may well be outside municipal boundaries and uses language to indicate that community means more than one settlement area (or accountable authority). The NWMO siting process states:

The NWMO requires formal expression of interest from an accountable decision-making body, supported by a compelling demonstration of willingness among those living in the local area. Communities that are unwilling or cannot demonstrate willingness in a compelling manner will cease involvement in the siting process.

CURRENT STATUS

NWMO is following a nine step process. Most communities who have expressed interest are now at Step 3 which requires a supporting resolution to continue. NWMO released a new document dated November 2011 which outlined a Phase I and a Phase II for Step 3. The first phase will be several years of primarily paper exercises to evaluate and create a more detailed feasibility study and the second phase will include on the ground investigations. It appears that some communities may be eliminated from the process during this step. NWMO has stated that they will not spend 'millions' in every community expressing interest. Others who express interest will first undergo a Step 2 initial screening before advancing to Step 3.

QUANTITY OF NUCLEAR WASTE

Canada currently has something in excess of 2 million fuel bundles with a total weight of 44 thousand metric tons (as of 2010). NWMO (2010) has a 30 and 60 year projection which is based on existing reactors and refurbishment. The total would range from 2.8 million to 5.1 million fuel bundles (55 thousand to 102 thousand t.). New builds could add up to another 1.9 million fuel bundles (31 200 t). So the potential total is as high as 7 million bundles (133 200 t). NWMO is using a mid range of 3.6 million bundles in its planning (66 600 t). They have said that there will be only one repository. By the time it is actually licensed and built the total would be different.

Note:

Canada has only 7 reactor sites (not counting a university research site) with the Bruce generating plant in Kincardine Ontario being the largest in the world. Along with Pickering and Darlington, Ontario produces about 90% of Canada's high level waste. The Chalk River Ontario facility produces radioactive isotopes for medical purposes and makes Canada a world leader in this.

TO PUT THIS IN CONTEXT:

At present there is not one pound buried (anywhere) in a DGR

Current World Inventory (World Nuclear Association) = 270 thousand t
Unites States** (Nuclear Energy Institute December 2010) = 65 200 t
Canada (as above) = 44 thousand t

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** This total is for used fuel only in the US, produced in 40 states and stored in about 120 locations and would not include wastes such as much of that which exists in Hanford Washington, the site of the largest quantity of radioactive waste in the US where there are millions of gallons of liquid waste from reprocessing.

Sweden & Finland

These two countries have the most advanced Deep Geological Projects. NWMO states that they have modeled their approach after that carried out in these two countries, in particular Sweden. However, there are differences between these 2 countries and Canada. In addition to repository size differences include transportation distances, aboriginal engagement and the actual sites themselves and the land use regime associated with that.

Sweden DGR design capacity = 12 thousand t
Finland DGR initial** design capacity = 6.6 thousand t

** The initial 'application' in Finland was for this amount. This site is described as a 'characterization site'. After the site selection process was completed an application for increasing its size up to 12 thousand t based on the proposal to increase nuclear capacity was made. A construction license is not yet 'granted' but may be this year which may include a higher quantity. According to the POSIVA OY website, disposal may begin in 2020 in Finland.

Finland with the most advanced DGR project is continuing to carry out testing of the most expensive part of the whole process, the repository containers themselves and the placement of them. (NWMO has stated that the cost for copper per container at today's prices would be about \$25 thousand, and Canada would need somewhere in the 15 to 20 thousand range.)

The United States

The US invested about \$10 billion into the YUCCA Mt. site in Nevada until Obama cancelled the project in 2009 with funding ending in 2011. Attempts to 'resurrect' the project apparently have failed. About 77 thousand t of used fuel was associated with that proposal.

The Obama administration established a "Blue Ribbon Commission" to examine ways of dealing with the high level waste. It released a 192 page interim report in August 2011 and a final report is due Jan. 29, 2012. The Sandia National Laboratories (funded by the US federal government) published a 114 page report dated August 2011 called "Granite Disposal of U. S. High Level Radioactive Waste". This report references Sweden, Finland & Canada. Also it identifies the Lake Superior region, specifically Minnesota, northern Wisconsin and Michigan as "*The most stable region of granite outcrops in the U.S. – part of the N. American Continent stable craton.*"

The report does not make any reference to 'specific sites as other areas in the US are also identified but there is specific reference for various areas worldwide whose granite formations have been 'studied'.

In early January the Duluth Tribune ran an editorial entitled "*Our View: Nuclear waste here? Actually, why not?*" This resulted from the identification of the Lake Superior basin in that report as having host granitic formations.

THE DOMINO EFFECT

There is a long history of cooperation/collaboration between the US and Canada going all the way back to WW2 and the Manhattan project. There is no reason to believe that this has not continued, if not at the political, certainly at the 'agency' level and at conferences etc. It is clear that the US is going down the same 'path' as Canada for a process to store high level fuel waste. The US documents from the Blue Ribbon Commission and the Sandia report could be deemed to be an almost 'carbon copy' of Canadian approaches.

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Note: Though the Sandia report is for granitic formations, worldwide there continues to be work done on other types of rock including sedimentary and salt domes. The US has done work on this as has Canada. NWMO has studied S. Ont. sedimentary formations. They are just as suitable which is why the low/medium waste repository is being developed in Kincardine near the Bruce plant.

Whether or not nuclear waste becomes an 'issue' in the upcoming US elections, once over the US will likely move very quickly to put into place a 'siting' process. The Blue Ribbon Commission has recommended this. A success on the Canadian side would lend credibility to that process as Canada has relied on Sweden and Finland.

If a site within the Lake Superior basin is selected on the Canadian side, then this would increase the credibility on the US side to use the granitic rocks that the US has said are the best in the country, in the Lake Superior basin.

Transportation logistics are far more complex in the US with 120 storage sites, and waste coming from 40 different states. Canada has 7 sites. NWMO has told me that it is highly unlikely they would ship by water, in part due to the need for a special built ship and US territorial waters. However, about 24 thousand t of the US waste is in states bordering the Great Lakes. Then, if a site was 'ship accessible' it increases the probability that the US would want to ship through the Great Lakes system and Canada then could follow suit as the vast majority of Canadian waste is adjacent to Lake Huron & Lake Ontario. There is substantially more that could be shipped from the east coast through St. Lawrence Seaway including from Quebec and New Brunswick.

Another 'effect' could be that once a 'solution' is found for the storage of high level waste there would then be pressure to expand nuclear power. That debate is not simple. However, that is what happened in Finland and likely would happen in Canada and maybe even more so in the US which has a policy of reducing energy dependency on foreign sources.

Note:

Cameco owns a plant in Blind River, Ontario which is the largest such facility in the world (according to their website). They are undergoing a review to renew their current five year license for ten years with increased capacity in anticipation of increased market demand. This plant processes 'yellowcake' (from Saskatchewan) into uranium trioxide. This product is then shipped to Port Hope Ontario where it is then processed into fuel for reactors. Port Hope is subject to a billion dollar cleanup of low level radiation. The Hanford site is subject to a multi-billion dollar clean up.

FAST TRACKING

Despite the rhetoric, the process is now beyond the 'learning stage'. (One could argue there is much more to learn which is true.) The NWMO has indicated that it wishes to get the 'list' smaller in Step 3. They have said that they are not going to spend millions in every community that 'expressed interest'.

There are a number of possible reasons which may include:

- The present provincial government is supportive of nuclear power, but is a minority, and a new government may not be so supportive.
- Communities now showing interest for the most part are 'economically' challenged, and that could change if there is an economic recovery, in particular in forestry, which might make an undefined 'economic benefit' 15 to 20 years down the road less attractive. NWMO wants that commitment now so communities will not change their minds, which has happened repeatedly over the last 40 years.
- There has not been any 'outcry' from the southern population on environmental grounds etc. It has been for the most part a non-issue which may be in large part because there are those who may view the storage as 'NIMBY' and see the north as some vast unpopulated area and who cares if it goes there type of thing. It was different during the

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debate on the Adam's mine for Toronto garbage. It will be interesting to see what happens with the interest shown in the Bruce area including from a total cost perspective to the industry.

- The jobs and careers of the NWMO staffers are dependent on the successful implementation of the very process they created. Many of these people come from the nuclear industry.

- NWMO likely knows that providing support in the manner originally envisioned to all the communities that have 'expressed interest' may prove to be more costly than originally anticipated, therefore NWMO wants to more quickly get it down to a smaller number to limit these costs.

CONCLUSION

The end result could be the storage of 70 thousand t on the Canadian side (if not more) and an equal amount from the US in the Lake Superior basin. This would be equivalent to about ½ of the current world inventory. The Canadian repository alone would be the 'largest' storage and 'greatest' transportation of high level nuclear waste in the history of the world and would be that until the US makes a decision, in which case the US could be larger.

Note:

If a Lake Superior site was chosen in Canada, using NWMO numbers, this would represent about 20 million km of one-way 'loaded' traffic to the site. Accident statistics use a major accident frequency rate in the order of 0.9 per million km. This can vary with type of road (4 lane etc.). It is safe to predict then that there is an expectation of 15 to 20 major incidents. Though they have said the transportation containers are not likely to experience any issues, they cannot guarantee that, any more than anyone can guarantee social/political/economic stability for hundreds of years.

The former Soviet Union is a good example of what happens when that does not exist with the Chelyabinsk area known as the most contaminated spot on the face of the earth. The US is not without either with the Hanford site in Washington being listed on the world's top ten and which contains the largest amount of high level waste in the US, including millions of gallons of liquid waste associated with reprocessing.

Technology is not perfect and can go wrong. No amount of modelling can 100% predict the unexpected. A hundred years ago the TITANIC was technically promoted as 'unsinkable' ---- it sank on its first voyage.

UNITED STATES BLUE RIBBON COMMISSION (August 2011 – Interim Report)

A "new integrated strategy" is needed, it says, including a "new approach to siting nuclear waste storage and disposal facilities." Among the report's key recommendations are:

1. An approach to siting and developing nuclear waste management and disposal facilities in the U.S. that is "adaptive, staged, consent-based, transparent, and standards- and science-based."
Canada: Canada has adopted what it terms Adaptive Phased Management.
2. A new, single-purpose organization to develop and implement a focused, integrated program for the transportation, storage, and disposal of nuclear waste in the U.S.
Canada: The Nuclear Waste Management Organization (NWMO) was established in 2002.
3. Assured access by the nuclear waste management program to the balance in the Nuclear Waste Fund and to the revenues generated by annual nuclear waste fee payments.
Canada: Nuclear power producers contribute to such a fund.
4. Prompt efforts to develop, as quickly as possible, one or more permanent deep geological facilities for the safe disposal of spent fuel and high-level nuclear waste.

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Canada: This is the mandate of the Nuclear Waste Management Organization.

5. Prompt efforts to develop, as quickly as possible, one or more consolidated interim storage facilities as part of an integrated, comprehensive plan for managing the back end of the nuclear fuel cycle.

Canada: Interim storage is 'on site' at the seven locations. An interim shallow repository was originally proposed in 2005 but is not part of the current DGR proposal.

6. Stable, long-term support for research, development, and demonstration (RD&D) on advanced reactor and fuel cycle technologies that have the potential to offer substantial benefits relative to currently available technologies and for related workforce needs and skills development.

Canada: NWMO has stated that a 'centre of excellence' will be established in the host community.

7. International leadership to address global non-proliferation concerns and improve the safety and security of nuclear facilities and materials worldwide.

Canada: The process documentation refers to such objectives.

Other findings include:

- Continuing the division of rulemaking responsibilities for long-term repository performance between the U.S. Nuclear Regulatory Commission (NRC) and the U.S. Environmental Protection Agency (EPA).
- The jurisdictions of safety and health agencies should be clarified and aligned.
- The roles, responsibilities, and authorities of local, state, and tribal governments (with respect to facility siting and other aspects of nuclear waste disposal) must be an element of the negotiation between the federal government and the other affected units of government in establishing a disposal facility.
- Recognizing the substantial lead-times that may be required in opening one or more consolidated storage facilities, dispersed interim storage of substantial quantities of spent fuel at existing reactor sites can be expected to continue for some time.
- The National Academy of Sciences (NAS) be tasked with carrying out an assessment of the lessons learned from Fukushima and their implications for conclusions reached in earlier NAS studies on the safety and security of spent fuel and high-level waste storage arrangements.
- Spent fuel currently being stored at shutdown reactor sites should be "first in line" for transfer to consolidated interim storage.
- Although regulatory standards for different types of facilities will differ, the new organization should be responsible for developing consolidated interim storage and permanent disposal facilities and should apply the same principles of decision making to all aspects of the waste management program (i.e., science-based, consent-based, transparent, phased, and adaptive).
- Siting processes for future waste management facilities should include a flexible and substantial incentive program.
- Planning and coordination for the transport of spent fuel and high-level waste is complex and should commence at the very start of a project to develop consolidated storage capacity.
- The federal government should take steps to resolve ongoing litigation between the DOE and the utilities regarding fuel acceptance as expeditiously as possible.
- A well-designed federal RD&D program will enable the U.S. to retain a global leadership position in nuclear technology innovation.
- A portion of federal nuclear energy RD&D resources should be directed to the NRC to accelerate a regulatory framework and supporting anticipatory research for novel components of advanced nuclear energy systems.

SOURCE: The Canada comments were inserted for comparison purposes.

http://www.kleanindustries.com/s/environmental_market_industry_news.asp?ReportID=475905

NOTE: A screening of an hour+ long documentary called "Into Eternity" concerning the Finnish DGR (Onkalo) is scheduled in Duluth (February 20th) and Houghton also in February. Detailed information is not available at this time.