

April 28, 2005

Dr. Elizabeth Dowdeswell
President
Nuclear Waste Management Organization
49 Jackes Avenue, First Floor
Toronto ON M4T 1E2

Re: Study of Subduction for Nuclear Waste Disposal

Dear Dr. Dowdeswell,

In a telephone conversation with me Dr. Michael Stephens of the AECL suggested that I contact you and Dr. Frank King of the OPG with my thoughts on the problem of the disposal of nuclear waste, more specifically perhaps the disposal of spent fuel rods.

I realize that the NMWO has been charged with examining this problem for a number of years, with the main thrust being the study of the potential of 1) deep geological repositories, 2) centralized above-ground or shallow below-ground storage, and 3) at-reactor storage. Other methods, particularly ones receiving international attention were to be kept on a "watching brief".

In the Discussion Document 2 of the NMWO, Understanding the Choices, I noticed that under "Methods of Limited Interest" (Table 4-1) disposal in subduction zones was relegated to the column of "Insufficient Proof-of-Concept", and two paragraphs on pg. 108. I would like to suggest to you that this method be investigated much more thoroughly to establish such a "Proof of Concept" and beyond. The time to carry this out is right now, in the light that a major study of plate tectonics is being initiated currently in our own backyard, on the Juan de Fuca Plate off Vancouver Island, Washington and Oregon. The study, the Neptune Project (www.neptunecanada.ca) includes the marine geology and ecosystem, fisheries and potential mining, as well as other studies, but nothing on the potential of subduction for nuclear waste disposal.

The study, a joint US-Canada venture, is being funded in part by about \$ 30 million from Canadian CFI (Canadian Foundation for Innovation) funds, with the remainder primarily funded from US funds to about \$ 230 million. I noticed that among the projects planned, there was no involvement of AECL or any other nuclear power agency. There should be.

Let me give you a few reasons in terms of numbers to see if I can peak your interest. Tectonic plate movement occurs at a speed of about 14 cm per year for the fastest (the plate on which Hawaii rides moves at about 10 cm per year), whereas at the other extreme some plates have ceased to move. The Juan de Fuca plate has been measured to move at between 4.7 to 2.9 cm/year. If one takes a 5 cm/year rate for ease of calculation, then the Juan de Fuca plate moves 1m in 20 years, and 100 km in 2 million years. The

subduction zone, where the Juan de Fuca plate moves under the North American continental plate is about 100 km off-shore west of Vancouver Island. The plate then moves downward and is about 40 km deep by the time it reaches the level of Vancouver Island.

Imagine boreholes in the Juan de Fuca plate, containing spent, or processed, nuclear fuel rods at the edge of the subduction zone, moving slowly under the North American continental plate. Theoretically, by 20 years a 1m hole in the Juan de Fuca plate would have moved completely under the North American plate, completely sealing it with an ever-thickening natural lid. After 2 million years, at the edge of Vancouver Island and 40 km underneath it, even the longer-lived radioactive isotopes in the fuel rods will have decayed substantially. And by the time the plate Juan de Fuca plate moves deep enough to become part of the molten magma near the volcano zone (Mt. St. Helen, Mt. Rainier, Mt. Baker, etc.) some 200 km further inland, a reason raised for not studying subduction, another 4 million years will have passed. Moreover, since the Juan de Fuca plate, like all moving sub-ocean plates, is created at its "mid-ocean ridge" 300 to 1000 km off-shore, there will always be new areas at the subduction edge for new boreholes.

A substantial advantage as well is the fact that this plate is at a relatively shallow depth, quite accessible at about 2500 m below sea level. Virtually every other subduction zone in the world is lower, with the Middle America Trench as deep as 6662 m, the Peru-Chile Trench at 8055 m, and with the Marianas Trench in the Pacific taking the record at 11022 m deep. The depth of such other subduction zones is at least one reason why other countries have not considered them. The Juan de Fuca plate is clearly so accessible that the Neptune Project is proceeding.

I think the scenario of the use of subduction of the Juan de Fuca plate is worth investigating. The Neptune Project itself envisions remote earth moving machinery, drills, etc. They need materials that can withstand being in the ocean environment for many decades, and say that those are now generally available commercially off-the-shelf. Certainly much experience exists in off-shore drilling for oil, and the laying of communication cables. Moreover, in reading the Neptune plans, it was enlightening to learn that many boreholes already exist in areas that are potentially useful for their studies, and, more importantly, that the solid basement of the plate is either clear of accreted sediment or easily accessible in many places for the drilling of new boreholes that would contain their seismic measuring instruments. Therefore I expect that areas for drilling boreholes for solid nuclear waste at the subduction edge should similarly be accessible.

However, there was no indication that any exploration would be directed specifically at the potential of using subduction for nuclear waste disposal or any other purpose. It should be.

That is where AECL, OPG, and our nuclear industry in general, should become part of this study. It would be economical to become part of this bigger team, it would be scientific, it would be practical, it would provide a required proof of principle or even

more. It would be Canadian, and we could lead the world to a safe way of nuclear waste disposal, providing the solution to the real bottleneck to the safe use of nuclear energy.

If one concern is that the spent fuel would be lost forever to potential reprocessing, then one could carry out the disposal in stages, extracting useful isotopes first, and then disposing the rest. This staged process is suggested even now in your NWMO planning process.

What are your thoughts on the matter? Or can you suggest a forum or group of individuals that I should address in addition to you? The CNS conference on Waste Management, at which you will speak on Tuesday, May 8, seemed like a good venue. But the program seems pointed in rather differently set directions.

Yours sincerely,

Peter Ottensmeyer

F.P. Ottensmeyer PhD FRSC
Professor Emeritus
Department of Medical Biophysics
University of Toronto