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Re: Finding the Right Answers:

On the recent CBC series "Fueling the Future," Vancouver panelist Michael Brown warned, if we do not address global warming, his, mine, and your, grandchildren's grandchildren will be the last generation.

A consensus that emerged from the Fueling the Future panel was, "energy is not the problem, climate change is."

James Lovelock whose Gaia theory inspired the Green movement declared in an August 2001, "Telegraph," article, We need nuclear power, says the man who inspired the Greens, "Nuclear is the only practical energy source that we could apply in time to offset the threat from accumulating greenhouse gases." In terms of the waste problem associated with nuclear, he stated, "There seems no sensible reason why nuclear waste should not be disposed of in the deep subducting regions of the ocean where tectonic forces draw all deposits down into the magma."

The panel agreed that proliferation was the greatest impediment to expanding nuclear power. Waste was a close second.

The most significant and socially beneficial entrepreneurial opportunity is the challenge of addressing these concerns and Canada is fortuitously placed to capitalize on this market.

The need to prevent the spread of nuclear weapons has been evident from the first days of the nuclear era. In 1945, the United States, the United Kingdom, and Canada proposed the establishment of a United Nations Atomic Energy Commission for the purpose of "entirely eliminating the use of atomic energy for destructive purposes." The Baruch plan of 1946, offered by the United States, sought to forestall nuclear arms proliferation by placing all nuclear resources

under international ownership and control. The opportunity exists currently for Canada to revive that approach.

A recent adaptation of the Baruch plan was offered by the U.S. Baker/Cutler task force, which recommended the buying and removal as quickly as possible of all the nuclear weapons and weapons-usable material Russia is prepared to sell.

The Subductive Waste Disposal Method, for which I hold U.S. and Canadian patents, affords then the sole practical means to eliminating these materials and sequesters and eliminates, spent fuel and chemical or biological toxins equally as well. It is also a solution that can be implemented at a fraction of the cost of current approaches with a Canadian site providing the opportunity for the U.S. to reciprocate to Russia's disarmament, as that country would surely demand.

Environmentalists have recently been banning together to purchase habitats they wish to preserve. The purchase of global stocks of nuclear weapons materials would be a rational exercise in self-preservation.

Saying "recent events have made it clear that the nonproliferation regime is under growing stress," Mohamed ElBaradei, the director general of the International Atomic Energy Agency, recommended to the Fifty-Eighth Regular Session of the United Nations General Assembly, November 3, 2003, limiting the processing and production of nuclear materials that can be used for bombs and placing facilities under international control.

In presenting his annual report to the General Assembly, El Baradei said, "In light of the increasing threat of proliferation, both by states and terrorists, one idea that may now be worth serious consideration is the advisability of limiting the processing of weapon-usable material in civilian nuclear programs, as well as the production of new material through reprocessing and enrichment, by agreeing to restrict these operations exclusively to facilities under multilateral control."

"We should equally consider multinational approaches to the management and disposal of spent fuel and radioactive waste. Over 50 countries currently have spent fuel stored in temporary locations, awaiting reprocessing or disposal. Not all countries have the appropriate geological conditions for such disposal - and, for many countries with small nuclear programmes, the financial and human resources required for the construction and operation of a geological disposal facility are daunting." Dr. ElBaradei advised.

The U.S. Congressional Research Service has identified space and placement deep beneath the ocean floor as the only locations where nuclear weapons materials can be rendered irretrievable.

In its 1995 Screening Process to Determine Reasonable Alternatives for Long-Term Storage and Disposition of Weapons-Usable Fissile Materials the U.S. Department of Energy determined that only 3 of the 23 options considered rated high for Environmental Safety and Health criteria. Sub Seabed disposal and deep

borehole emplacement, both of which are elements of the Subductive Waste Disposal Method, were 2 the other was taking no action at all.

“What is to be done with the spent fuel? Here I have a specific and emphatic recommendation-- the creation of competitive, commercial, mined geologic repositories to be certified by the IAEA for spent fuel and nuclear waste; the acceptable forms of spent fuel and nuclear waste would need also to be certified by IAEA. In the era of globalization, it is ridiculous to insist that Switzerland or Belgium or England each do the research and development and find within its limited territory a site for the geologic disposal of nuclear waste,” Richard L. Garwin, Philip D. Reed Senior Fellow for Science and Technology, Council on Foreign Relations said in an address entitled Can the World Do Without Nuclear Power? Can the World Live With Nuclear Power? to the Nuclear Control Institute, April 9, 2001. In another interview Dr. Garwin declared, “Ultimately, disposal under the deep seabed may be the solution, with continued surveillance to avoid poaching to obtain long-decayed spent fuel for its plutonium content.”

Our governments' claims seabed disposal is proscribed by the London Dumping Convention. The Subductive Waste Disposal Method is not. *"While sub-seabed disposal of nuclear waste-filled canisters thrown from vessels apparently is regulated by the London Convention, and will certainly be regulated by the Protocol, sub-seabed disposal is not prohibited or regulated by the London Convention when accessed via land-based tunnels. Sweden has been practicing this method of sub-seabed disposal since 1988, when a repository for reactor wastes was opened sixty meters below the Baltic seabed. This project has been widely cited by politicians from other countries as a great example of solving the nuclear waste problem.*

*Because of Sweden's initiative, nuclear waste is already being deposited under the seabed. Other countries could follow Sweden's example and dispose of nuclear waste under the seabed via land-based tunnels. Special attention must be given to shore-accessed seabed burial of nuclear waste because current international coverage of this problem is extremely deficient. Neither the London Convention nor the Protocol regulates this activity because the waste is not dumped from the ocean, but from land. UNCLOS does not regulate this activity because it occurs outside the Area and within the national jurisdiction of Sweden."* LEGAL, POLITICAL, AND SCIENTIFIC RESPONSE TO OCEAN DUMPING AND SUB-SEABED DISPOSAL OF NUCLEAR WASTE by James Waczewski Florida State University Journal of Transnational Law & Policy.

The Congressional Research Service acknowledges that sub-seabed disposal negates any potential for plutonium poaching.

In the December 25, 2001 Current Science article, Radioactive waste: The problem and its management (<http://tejas.serc.iisc.ernet.in/currsci/dec252001/1534.pdf>) K. R. Rao declares the Subductive waste disposal method "is the state-of-the-art in nuclear waste

disposal technology. It is the single viable means of disposing radioactive waste that ensures non return of the relegated material to the biosphere. At the same time, it affords inaccessibility to eliminated weapons material. The principle involved is the removal of the material from the biosphere faster than it can return. It is considered that 'the safest, the most sensible, the most economical, the most stable long-term, the most environmentally benign, the most utterly obvious places to get rid of nuclear waste, high-level waste or low-level waste is in the deep oceans that cover 70% of the planet".

The English Channel "Chunnel", the closest analogy to this solution, is actually three tunnels of a combined length of 95 miles and was completed at a cost of \$15 billion. The U.S. Yucca Mountain repository currently consists of a 5 mile tunnel, which is anticipated to be extended 35 miles to accept America's waste at a cost approaching \$60 billion. Close to \$30 billion of this is earmarked for the repository alone. Much of this increased cost results from the necessity for expensive engineered barriers because the mountain is incapable of sequestering radionuclides geologically. In addition the cost for disposing of 100 tons of Russian and American plutonium, less than half of the 260 tons of weapons plutonium that has been produced worldwide for weapons, not including separate plutonium from commercial operations, has been estimated at over \$6 billion.

An embodiment of my invention would require two tunnels, one for access and the other for ventilation, each of length 30 miles, to reach the preferred geology off the Brooks Peninsula of Vancouver Island, British Columbia. Add 35 miles for the repository and you have the combined length of the Chunnel at half the cost of the Yucca Mountain repository. Add another 35 miles of tunnel and an international repository is created with intrinsic economies of scale.

The Chunnel was expected to cost \$6.2 billion but finished at \$15 billion because engineers were working with completely new technology. No one had dug tunnels that deep or that long before and cost overruns, in large part, were due to financing costs. This project would benefit from both record low interest costs and existing tunneling expertise.

Dr. Burton Richter, Noble laureate in Physics, addressing the nuclear waste problem at the July 15, 1999, World Experts Meeting on Accelerator Transmutation of Waste, stated, "It can be done if it is done right and the public is correct in their concern that it be done so. If we would dump all this stuff in subduction zones in the ocean, or if we would bury it half a kilometer deep in the deep sediments of the ocean floor, no one would ever have to worry about it."

Lord Oxburgh, the head of Britain's House of Lords Science Committee, wrote a year ago, "I too have been interested in the possible use of subduction zones for the disposal of waste. . . I rather regret that this possibility has not been explored further. That said, I do not believe that the political timescale for gaining international acceptance of subduction zone disposal matches the urgency of the UK problem.

The proliferation of weapons of mass destruction and their means of delivery in conjunction with the spread of international terrorism is considered by some the pre-eminent threat to mankind. Others consider climate change to be that threat. This solution addresses both issues. The political reality is the public is concerned with politicians who will not address these threats. This is a political problem that can be turned on its head if our government steps up to its avowed commitments to global security and the environment. *"This method is definitely irrelevant to the London Dumping Convention because waste would never go through seawater during the disposal process. Moreover, political difficulties would be greatly reduced by implementing the process within the 200-mile economic zone of the host country,"* Dr. Masao Kasuya, Ph.D. geology and radiation physics.

Five circumstances currently mitigate in favour of a Canadian resolution to this problem:

1. As a major supplier of both uranium and reactors to the global market Canada has an obligation to provide for the by-products and to do everything possible to prevent proliferation.
2. There is a growing recognition and discomfort amongst Canadians with our country's steadily eroding international influence as exemplified by the recent Canadian Time magazine cover and feature article, "Would Anyone Notice If Canada Disappeared? – The nation's influence in the world is shrinking. How-and why-it should be rebuilt." (There is no better way than for this country to walk its own talk with respect to global security and the environment.)
3. British Columbia, where this solution would be implemented, is amongst the most underperforming regions economically on this continent.
4. Transportation makes the Subductive Waste Disposal Method the best option for an international repository as is the practical solution for this continent and the only viable alternative for many countries. In the September 1990, Special Issue, "Energy for Planet Earth," of the Scientific American, Wolf Hafele, in an article "Energy from Nuclear Power," relates such a scenario located on an island or peninsula. Preferably under the auspices of an international institution. He states, "International storage facilities offer several advantages. They encourage the development of global institutions that would be immune to national politics. Such facilities would allow the nuclear-power industry the time it needs to develop scientific, technological and institutional final waste disposal methods. Access to these facilities would give countries that steered clear of nuclear power because of the waste issue a chance to develop nuclear energy. The sites could also play a key role in disassembling nuclear weapons and ensuring non-proliferation of nuclear material." This is in effect the Baruch plan revisited.
5. Many countries consider international institutions the best offset to U.S. unilateralism.

A few cold war submarines might best be diverted to the usage of transporting spent fuel or weapons material from the East Coast of North America, Europe or the Baltic to a Pacific Coast repository via the Northwest Passage because cross country transportation is touted as any mid continent repository's principal drawback.

The Subductive Waste Disposal Method is the final waste disposal method Hafele affirmed is still being sought and is the logical extrapolation of the intermediate fuel element storage/reprocessing plant scenario he described though the once through cycle, for security reasons, is preferable.

Sixty years into the nuclear era, despite global expenditures of billions, not a single ounce of high-level nuclear material has been permanently isolated. A dozen years after the end of the Cold War, not an ounce of plutonium has been destroyed. Dr. Garwin is right, the market can do it better, faster and cheaper and that is precisely what is required. As former U.S. Senator Nunn articulates it, "the new arms race is terrorist racing to acquire weapons of mass destruction, while the rest of us have to run even faster to prevent such an eventuality."

Where spent fuel disposition is resisted by the public, as burning plutonium in commercial reactors, its elimination in conjunction with weapons material becomes a saleable proposition.

Intellectual integrity is critical to the resolution of this problem for which the public will accept nothing less than the state-of-the-art.

The precedent for this solution has been set. At the 1996 G-8 Moscow summit on nuclear safety and security Prime Minister Chrétien agreed in principle to consider using U.S. and Russian weapons-grade plutonium as fuel in Canadian reactors. The rationale was Canada is committed to, and strongly advocates, world nuclear disarmament. Eliminating the risk of theft and proliferation posed by plutonium from nuclear weapons helps mankind to reach this goal. Other countries view Canada as a safe and responsible country that can act as a respected third party in converting both Russian and U.S. weapons-grade plutonium.

The same rationale applies to an international repository in which spent fuel, which can either be harvested for plutonium or used in a dirty bomb, or nuclear weapons materials will be eliminated directly, rather than first being irradiated before being placed in a Canadian repository, as would have been the case had the Prime Minister's offer been taken up.

The anticipated savings this proposal affords over a Yucca Mountain repository would provide a substantial down payment on the global inventory of nuclear weapons materials plus the means to safely transport them to the proposed repository.

This method is an adaptation of Nature's own recycling mechanism, which is an analogy we disregard at our peril.

In a recent interview Dr. Garwin stated, "The Bush Administration is ready to spend more than \$100 billion on a ballistic missile shield. In our opinion, existing loose nuclear materials represent a much greater threat to national security than potential "rogue" missiles. We judge it far more responsible for the Bush administration to review its priorities and support--at a substantially lower price tag--the prophylactic measure of Cooperative Threat Reduction."

Dr. Frank W. Dickson, a research professor at the University of Nevada, has recently registered a scientifically based objection to the proposed U.S. repository at Yucca Mountain, which has ramifications for all land based geologic nuclear waste disposal. Professor Dickson's work was published at a Symposium on Engineering Geology and Geotechnical Engineering at the University of Nevada, Reno in March, 2003.

Professor Dickson's concept is based on the principles that processes in the Earth require energy in excess of equilibrium, or excess energy. In an August 14 op-ed article, "Yucca Mountain: Wait until we know", published in the Reno Gazette-Journal, <http://www.rgj.com/news/stories/html/2003/08/14/49340.php> Prof. Dickson stated, "I realized that placing our waste in one place underground would concentrate excess energy. Mobilized matter would move upward. Energy is transported more effectively in fluids rather than in solid rocks. Energy released in shallow sites above and below the water table creates convection cells. Hot springs and fumaroles result. Deeply buried waste would liquefy rocks. Liquid bodies with waste constituents would move upward in two ways. If light enough, they float as diapers. Or, they move chemically in my recently conceived reaction cells, which dissolve rocks above and precipitate minerals below. Radioactive volcanoes would be emplaced on the surface."

Heat and water are the mechanisms driving Professor Dickson's reactions.

Hydrothermal convection is an efficient conductor of heat. As the temperature gradient decreases away from the crest of an oceanic ridge where hot mantle materials rise and create new oceanic crust the circulation of water decreases. Hydrothermal circulation of seawater through the oceanic crust is an important process for only about five million years after crust formation. Most of the metamorphic alteration of mid-ocean ridge basalts takes place in the first one or two million years, after which water is locked up in hydrated form in the crust. Oceanic crust older than two million years is therefore the only accessible geology in which hydrothermal convection; and its potential to return radionuclides to the biosphere, would not occur. Wastes deposited in the oceanic crust could not be mobilized until they reached a depth of approximately 100 kilometers in a subduction zone, which in the case of the Explorer Plate, off Vancouver Island, would take 10 million years – presuming a subduction rate of 2cm per year and a horizontal distance of 200 kilometers from the trench to the

volcanic arc. By then the radiological hazard of the waste as well as its excess energy would have been greatly dissipated.

Subduction zones are also relatively the coolest places on the planet as the subducting oceanic crust moderates the surrounding rock.

Professor Dickson has stated of the Subductive Waste Disposal Method, **“it looks like the only alternative left to us.”**

It is also the only viable means to combating proliferation and eliminating nuclear weapons.

In his 2000 budget speech, Paul Martin declared, “Today, the strength of a nation is measured not by the weapons it wields, but by the patents it produces; not by the territory it controls, but by the ideas it advances; not only by the wealth of its resources, but by the resourcefulness of its people.”

It is time Canada started showing some of that strength and addressed two of mankind’s greatest threats in the process.

The October 22, 2003 Harvard Project on Managing the Atom report, “Preventing Nuclear Terrorism, A Progress Update”

([http://www.nti.org/c\\_press/analysis\\_cnwmupdate\\_102203.pdf](http://www.nti.org/c_press/analysis_cnwmupdate_102203.pdf)) concluded with the declaration, “The terrorists have made clear that they want nuclear weapons, and are working to get them. A continuing stream of attacks and intelligence analyses makes clear that al Qaeda is regrouping, recruiting and training new operatives, and still seeking to carry out catastrophic attacks on the United States and other countries. President Bush has eloquently warned that “history will judge harshly those who saw this coming danger but failed to act.” The question remains: on the day after a terrorist nuclear attack, what will we wish we had done to prevent it? And why aren’t we doing that now?”

Your dismissive analysis that, “Little attention has been paid to Subduction Zone disposal because of the inability to predict the fate of waste. It has been suggested that waste might return to the surface via volcanic eruptions. This method has also been seen as a form of sea disposal (and so would be prohibited by international conventions),” is wrong, myopic, dated, not based on fact, not good science and dangerous. The government of Canada’s entire effort with respect to nuclear waste has been an abuse of public office. The Nuclear Waste Management Organization is a waste of time we may not have. Asking the Right Questions is a rehash of efforts that have failed fifty times in as many countries. It demonstrates you bring nothing new to the table.

If the government of Canada is ill prepared to address the threats to mankind it should have the grace to get out of the way. Our grandchildren’s grandchildren deserve and need their futures.

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