Response to:

The United Church of Canada

Submissions to NWMO

Prepared by:

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Introduction

As a former member of the Federal Environmental Assessment Panel on the Management and Disposal of Nuclear Fuel Waste in Canada (also known as the Seaborn Panel), I have followed with much interest the many submissions to the Seaborn Panel (1989-1998). As an active member of the United Church of Canada (for over 50 years), I am particularly interested in what the UCC has had to say on the subject, and in particular in its submissions to the Nuclear Waste Management Organization (NWMO) during the past three years of broad public consultations. As some of your representatives know I also have been an independent participant in this long time process at NWMO regional and national dialogues.

From early childhood by inclination and as a Professional Engineer by formal training and long time professional practice I am committed to define and attempt to solve complex problems or challenges, find solutions acceptable to society and protect the public. In that, my approach may well be different from others in society.

Environmental Assessments

I know from many years of study and hearings, that the subject of disposal of nuclear waste is an emotional and controversial one for many people, especially to those who link this, and not without logic, to the whole of the nuclear fuel cycle and the whole of the world's nuclear industry. The Seaborn Panel as well as the NWMO were specifically barred from dealing with the whole nuclear fuel cycle and energy generation and had to focus on the specific nuclear waste related issues. Nevertheless, many submissions to the Seaborn Panel and the NWMO based their agenda on curtailing or abandoning the nuclear industry in Canada. Their strategy is to block any progress on nuclear waste disposal as a means to force discussion and public process on the question of nuclear power in Canada. By doing this these participants attempt to create a barrier to curtail or end all nuclear power generation in Canada. As a matter of policy, the submissions from the United Church of Canada follow that pattern.

There is a dread of the unknown that pervades and was expressed in many submissions to the Panel at the time and was recognised in its final report in 1998, and more recently (2003 -2005) in the public consultations and dialogues held across the country by the current Nuclear Waste Management Organization. Much of the controversy stems from the use of nuclear power for military purposes during World War II and accidents that have occurred since then, mainly in other countries. This fear has been projected into the peaceful use of nuclear science in the applications of energy generation, advanced medical and other scientific purposes. The language and tenor of the arguments used by opponents to the nuclear industry in their written submissions or verbally in radio phone-in shows or other public venues reflects his fear.

There is a growing awareness of another, more immediately pressing issue unrelated to radioactivity in the environment: that of the emission of greenhouse gases from fossil fuel-based electrical energy production and its correlation with climate change and global warming. As more information and observation are becoming public, this issue is now gradually being taken into account in the dialogue on nuclear power. That issue is now

entering into the debates about energy options, but has been avoided in many of the submissions to the Seaborn Panel and the NWMO. This can be found in more detail in this Response under the heading *Environmental Impacts.*

Key Principles

As stated in the NWMO Final Study *Choosing a Way Forward* on the Future Management of Canada's Used Nuclear Fuel, the primary motivation is that of safety and security. As identified in the Final Report of the Seaborn Panel, there are two fundamental ethical and social principles that form the basis on which any discussion on waste disposal is premised.

The first is the "polluter pays" principle, in which the producers and the owners of the waste must ensure that funds and other means are available for the disposal and management of the waste.

The second is the principle of not passing the burden to future generations. It is also called the inter-generational fairness principle.

As reflected in the Nuclear Fuel Waste Act (NFWA) the sentiments and values of Canadian Society are that, *inter alia*, this generation of citizens which has enjoyed the benefits of nuclear energy has an obligation to manage this waste. This is consistent with the "polluter pays" principle. As waste already exists, this generation does not want to leave as a legacy the burden of managing the waste we, as a society, have created. Safety and security are the key considerations that must drive the rationale for the selection of options.

History of 40 Years of Studies

The history of study of disposal and management of nuclear fuel waste began in 1977 with the completion of the 'Hare Report' (A study prepared under contract for the Minister of Energy, Mines and Resources, chaired by Dr. F. K. Hare), which concluded that: "of the various options for disposal of reactor waste and irradiated fuel, we consider underground disposal in geological formations to be the most promising within Canada". They also recommended to have an operating repository[1] capable of receiving the waste by 1995-2000. Subsequently, Atomic Energy of Canada Limited (AECL) in close co-operation with Ontario Hydro developed the Deep Geological Disposal Concept in the Canadian Shield and the Environmental Impact Statement, for submission to environmental assessment.

This assessment took place over a nine-year period from 1989-1998 by the Federal Environmental Assessment Panel on the Management and Disposal of Nuclear Fuel Waste in Canada (also known as the Seaborn Panel) and its supporting Scientific Review Group. Members of the Seaborn Panel and those of the Scientific Review Group were chosen from many disciplines and background, independent of the nuclear industry.

[1] Definition of Repository: An engineered site designed for disposal of radioactive material.

The Panel studied the technical and social issues in great detail and held extensive hearings across Canada. The Panel reported in its final report one of the key conclusions: "that from a technical perspective safety of the AECL concept has been on balance adequately demonstrated for a conceptual stage of development, but from a social perspective, it has not."

This, and many recommendations contained in the final report led to the formation of the Nuclear Waste Management Organization, which has held public dialogue sessions and workshops over the past three years in Canada. Their Final Study report was based on their mission statement:

> "… integrating the elements of sustainable development; a pre-eminent focus on safety and security; a perspective that takes the long view; a framework of ethics and values; and a recognition of the requirement for citizen engagement."

Hearings and Dialogues

The Seaborn Panel heard from a total of 531 registered speakers and received 536 written submissions. The NWMO reports that dialogue sessions were attended by some 500 people in 12 communities. These hearings and public dialogues of broad public consultations, are examples of participatory democracy at work. They also represent the most exhaustive studies of a broad range of social and ethical issues not seen in other environmental assessments in Canadian history, with serious attempts to avoid or correct actual or perceived injustices incurred in the past.

Certainly after almost forty years of study, public dialogue and consultation, the time is right to come to a conclusion and implementation of the concept judged to be safe by all official and independent bodies. Further consultation and public participation will continue as the site selection process begins and the Canadian Nuclear Safety Board process 'kicks in' as Canada's nuclear regulatory agency in site-specific environmental assessments.

The United Church of Canada Position

The United Church of Canada policy framework in its response to the nuclear waste issues comprises twelve points dealing with a wide range of humanitarian, social, environmental, sustainability, biodiversity and global responsibility issues.
The UCC Report purports to present a holistic view, but it is silent on the overall impact of Canada's nuclear industry and any of the beneficial aspects of this industry on society, in spite of the stated principles relating to the Earth in its wholeness. The UCC submission is focused on the waste issue within the nuclear fuel cycle, without taking into account the broader ramifications on society and the environment resulting from the existing nuclear industry in Canada. This is less than a holistic approach to the issue, which one expects to hear or read from their submissions or oral presentations.

The UCC position relating to nuclear waste disposal is essentially aimed at opposing any immediate steps towards implementation of the waste management and disposal process,

thereby clearly passing the burden to future generations. This is as inconsistent as the position advanced by other anti-nuclear groups, when the UCC professes that it wants to protect future generations from the burden of dealing with existing used nuclear fuel, yet at the same time opposing the adoption of any of the immediate disposal options.

The UCC opposition to any "early" start of implementation is inconsistent with the fundamental principles of inter-generational fairness. By virtue of the extended period of public consultation the burden of implementation has already been passed on to future generations. Any further delay in this process does not reflect an ethically defensible position vis-à-vis future generations. If and when re-use of used nuclear fuel is required, technically and economically feasible, future generations can still retrieve the spent fuel and reprocess it as needed, regardless how and where it is stored.

There is also an undercurrent of distrust of Canada's nuclear industry corporations in the UCC position papers; a distrust extended, if only by inference, to the many Canadian scientists and other professionals who have dedicated the better part of their lives to researching and developing acceptable solutions to perceived and identified problems. This distrust is manifested in many negative statements throughout their documents.

Why would the UCC want to diminish the continuing and dedicated efforts of these individuals (many of whom are UCC members) and corporations working towards a safer and more secure environment in which to live? Doing so fans the flames of fear in the minds of the general public of all things nuclear, and specifically of the waste disposal aspects, irrespective of the real dangers or risks involved.

In today's corporate world there is a growing movement towards Corporate Social Responsibility (CSR). Good corporate citizenship is defined as more than just an excercise in PR. It is a living and breathing involvement with the larger community manifested not only in producing safe products and services, but in contributing and participating in many aspects of community life. That is the new paradigm.

In spite of the apparent mistrust, Canada needs the corporate sector (80% of all businesses in Canada are small and medium size, family-owned and operated), if for no other reason than to provide the tax revenues from which government spending is funded and NGOs, including religious organizations, derive their financial benefits.

Proper oversight over all health and safety aspects by Canada's regulatory bodies can and will ensure that any corporation involved in the nuclear industry complies with national and international standards and regulations on health and safety, determined to protect workers and public alike. Discrediting these collective efforts directly or by inference is destructive, not constructive.

Environmental Impacts

The assessment of emission of greenhouse gases and the impact on climate change and global warming is a multi-faceted and multi-disciplinary science, the correlation and cause and effects of which are now being studied and made public in more detail.

World leaders grapple with the thorny question of how to slow the effects that greenhouse gases and climate change have on our planet Earth. We witness the devastating environmental impacts from hurricanes that are becoming more severe; the impact of the late onset of freeze-up on the survival of Canada's polar bears; the impact of the droughts in Africa resulting in the starvation of 150,000 children in Niger alone; the risk of low-lying coastal nations being swamped by rising ocean waters, to name just a few of the more easily recognizable impacts. This is the reality of environmental and ecological concerns being faced today.

This, and how to meet the accelerating demands for energy of the fast growing world populations and the industrialization of developing nations, pose the greatest ecological challenges to this generation. Failing to meet these challenges in a decisive and constructive manner and soon, will ensure that these burdens are passed on to future generations to solve.

With respect to the overall impact of Canada's nuclear industry domestically and internationally it might be worthwhile to examine the spin-offs, other than the production of its by-product, the used nuclear fuel. Taking a more holistic view, looking at the impact of nuclear energy generation, we find that:

Over the last 30 years, use of the 22 CANDU nuclear power reactors in Canada has avoided putting 1.8 billion tonnes of carbon dioxide (greenhouse gases) and 3.3 million tonnes of sulphuric dioxides into the atmosphere. This has avoided about 85 million tonnes of GHG per year. This is the equivalent of the GHG produced by 17 million cars and trucks (estimated as about the total number of cars and trucks in Canada) – about 12% of total GHG emissions in Canada. Saskatchewan's Uranium reserves of 800 million pounds is equivalent to 19 billion barrels of oil or 4 billion tonnes of coal, potentially avoiding the release of enormous quantities of GHG into the atmosphere.

If all nuclear power plants in the world were replaced by modern fossil-fuelled power plants, GHG emissions would rise 8% worldwide. The 20th century has seen the greatest warming in at least a thousand years, and natural forces can't account for it all. There has been a rise in CO_2 level of over 17% in the last 50 years, compared to a rise of 14% over the preceding 100 years. Both greenhouse gases and temperature are expected to continue rising. While CO_2 may not be the main contributor, there is increasing evidence to establish a link between GHG emissions from burning fossil fuels and climate change and global warming.

Nuclear Energy Production

Nuclear energy is one important option available today to meet the energy base loads in an environmentally responsible and economically sustainable manner. The methods to dispose and manage its waste product has now been studied in Canada and elsewhere in the world for about a half century. Canada's approach has been one of extreme caution, both from a scientific and technological perspective as well as from a sociological and

ethical perspective, with more than ample opportunity for open and fair hearing of all opinions.

We do not have the luxury of postponing a decision to act on the many congruent conclusions and recommendations that have been produced on the disposal of used nuclear fuel over the past several decades. Opponents to nuclear energy already use Canada's cautionary approach as an indication to them that technology does not exist; either believing that Canada's scientific community is incapable of finding a workable solution, or lacking adequate knowledge of Canada's substantial work and contribution to the international body of knowledge in this field.

Many nations of the industrialized world today rely to a significant degree on nuclear power to meet base load energy demands to sustain their economies. Alternative renewable energy sources are still in early stages of development and produce only a fraction of total energy demands. The high cost, inherent inefficiency and limited practicality of solar and wind power make these unsuitable for supplying large energy loads to such industrial activities as mining and heavy industries. More research and development needs to take place to develop niche markets for these technologies.

Reliance on clean coal technology has limited application, although many parts of the world still rely heavily on this. Coal mining with its many fatalities each year remains one of the most dangerous occupations in the world. In contrast to the waste products stemming from coal-fired generating stations, the waste products of nuclear power are small in bulk.

Electricity is a manufactured product that cannot be stored in large amounts. It must be used as soon as it is produced. Of the world's total energy about thirty percent is applied to generate electricity. Seventeen percent of the world's electrical energy is produced by nuclear power – offering significant benefits to our global environment:

In Canada the dependence on nuclear power is as follows:

Ontario:	35% of energy is produced by nuclear power
New Brunswick:	30% of energy is produced by nuclear power
Quebec:	2.5% of energy is produced by nuclear power.

How could we not consider the nuclear option to meet the increasing energy demands of a rapidly growing world population? How can we justify going back to burning fossil fuel by phasing out existing nuclear power generating stations, even when today the (direct) cost of a new nuclear reactor is roughly equivalent to natural gas generation. When considering energy options, it would be disingenious not to take into account the overall economic and ecological effects and human costs of all available options, including nuclear.

Excerpt from *Scientific American*, December 2005 issue:

> "The overall economics of any energy source depend not only on the direct costs but also on what economists call "externalities", the hard to quantify costs of outside

> effects resulting from using the technology. When we burn coal or oil to make electricity, for example, our society accepts the detrimental health effects and the environmental costs they entail. Thus, external costs in effect subsidize fossil-fuel power generation, either directly or via indirect effects on society as a whole. Even though they are difficult to reckon, economic comparisons that do not take externalities into account are unrealistic and misleading."

The safety of nuclear energy generation and the on-site storage of its waste has a remarkable record. In 40 years of nuclear energy in Canada, NO member of the public has been harmed as a result of a radiation leak from a nuclear power plant or a waste storage facility. This fact runs counter to opinions expressed by some members of the public.

Medical Applications of Radiation

One of the major beneficial aspects of Canada's nuclear industry is its leadership and contribution to the world's medical technologies. The medical profession has come to rely extensively on diagnostic and therapeutic procedures using radiology. In fact, patients demand such treatments to determine the causes of their illness and the remedy that such procedures offer. Long waiting lists are indicative of such demands and attest to the continued need to use these technologies. It is inconceivable that we turn the clock back to the pre-radiology era. Radiology is a direct and beneficial 'offshoot' of Canada's nuclear industry.

Canada has been a pioneer in the use of radiation for medical purposes. This includes radiation used for cancer therapy treatment. Cobalt 60 is an artificially produced isotope, made in Canadian designed and manufactured CANDU nuclear reactors. Cobalt 60 sources emit gamma rays that can be used for X-rays and in cancer treatment and also in diagnosis, analysis of tissue and sterilization of equipment. The development of cobalt 60 for the purpose of cancer therapy treatment was the result of Canadian research at the University of Saskatchewan in Saskatoon. The first commercial cancer treatment unit using cobalt therapy was installed in the University Hospital in Saskatoon in the early 1950's.

On Oct. 27, 1951, Dr. Ivan Smith's cancer clinic at Victoria Hospital in London, Ont., was the first in the world to treat a patient with radiation. The Saskatchewan team followed with its first treatment 12 days later (the Saskatchewan unit had an illustrious career, treating almost 7,000 patients over the next 21 years).

From those humble beginnings, Canada became a world leader in the production of medical radioisotopes and radiation therapy devices. Today, Canada - through a private supplier - is responsible for 80 per cent of the world's radioactive cobalt for industrial and medical use, as well as a majority of the market for other important medical isotopes. One Canadian company (MDS Nordion Inc.) supplies most of the major diagnostic isotopes used in the world. These isotopes are produced at Canada's Chalk River Laboratories in Ontario.

The Canadian developed cobalt isotope treatment of cancer has been adopted throughout the world, with a saving of 500,000 lives per year. Over 40,000 medical procedures using radioactive isotopes are performed each day in North American hospitals and clinics to diagnose and treat various diseases.

Diagnostic Procedures

Radioisotopes are isotopes that give off radiation. These radioisotopes are used in various diagnostic procedures. These nuclear diagnostic techniques often take the place of exploratory surgery. The ionizing radiation sent out by these radioisotopes allows the material to be detected in a manner similar to exploring uranium. It is used to:

- establish whether the organs in the body are functioning properly
- locate tumors
- measure whether the lungs are functioning properly
- analyze blood and tissue samples

Phasing-out of the Canadian nuclear power, as the UCC recommends, would deprive Canada and the world of important medical advances. This would be irresponsible and ethically indefensable in light of the detrimental consequences flowing from such a move.

Other Uses Of Radioactive Isotopes

Industry uses radiation and radioisotopes in various applications. Here are some examples of the uses of radioactive isotopes derived from Canada's nuclear industry.

- Nuclear technology helps find land mines. Both X-rays and gamma rays have been used successfully in detecting land mines that kill or injury an estimated 23,000 people annually.

- Neutron radiography is used in inspection of turbine blades in jet engines to ensure there are no hidden flaws and reduces the potential for these blades to break in flight and damage the engine, the wing or even the aircraft's fuselage.

- Canada's Okanagan Valley fruit growers use radiation to sterilize insects, which when released produce sterile eggs and diminish insect populations. This method is used to control insect infestation, where chemical treatment failed.

Examples of other everyday uses are abundant and diverse:

- Nuclear batteries - for use in pacemakers and lighthouses. The batteries have an extremely long life.
- Smoke detectors - One type of common detector operates on the principle of detecting smoke particles in an ionization chamber. The product uses a very small

amount of the radioactive element americium which bombards air particles with alpha particles creating ions. The smoke particles disrupt the process by neutralising some of the ions. This process is detected as a drop in electrical current flow.

- Petroleum industry - Drilling operations use radioisotopes to measure the density of the material being drilled through; pipeline operations use them to test welds.
- Research companies - Radioisotopes are used to follow the path of pollutants in the air, water and soil. The information is used in research and technological development in the pollution control area.
- Analysis of substances - Neutron activation analysis is a method of chemical analysis of substances using neutrons produced in a chemical reactor. Each element that makes up a substance exhibits specific characteristics of radioactive decay, allowing even a minute amount of that element to be detected. This method has been used to detect arsenic in a homicide victim by analyzing a single hair.
- Slowpoke reactor - This reactor was developed as a research tool; uses water as fuel.
- Radiography - The production of photographs is completed by means of x-rays (using cobalt-60).
- Factory ventilation - may be studied using potassium-42.
- Preventing static electricity - is accomplished by using strontium-90.
- Iron-55 and copper-64 are used to continuously measure and control the manufacture of tinplate, sheet metal and papermaking and in electroplating.
- Carbon-14 is used to study thermal and photochemical reactions and in tracing biochemical reactions in living things e.g. photosynthesis.
- Sulphur-35 and phosphorus-32 are used in steelmaking. Also used in tracing the fate of fertilizers in soils and plants.
- Argon-37 and sulphur-35 are used to improve the distillation process.
- Manufacture of products - Radiation is used to harden wood, plastics and the non-stick coatings on pots and frying pans.

Radiation has been used for over 30 years in the agriculture and food industry. Food spoilage can be reduced by treating agricultural products with ionizing radiation. The harmful micro organisms that would normally contribute to spoilage are destroyed.

No Military Applications

No nuclear weapons are made using Saskatchewan uranium. Canada exports uranium only to countries that are signatory to the international non-proliferation treaty. This ensures that Canada's uranium will only be used for peaceful purposes. Quoting examples of the use and effects of nuclear weapons material elsewhere in the world is not relevant to Canada's nuclear industry, nor to the disposal of the used nuclear fuel in Canada. Security and protection of radioactive materials from radical elements is an issue to be addressed. Today, in the post 9/11 era, this latter issue is more visible and dominant than at the time of the Final Report of the Seaborn Panel (1998), thus placing a higher

degree of urgency on dealing with this issue immediately rather than at some distant time in the future.

Conclusions

Clearly we have a moral responsibility to future generations, beginning with those who are the immediate next generation to whom we hand off our unsolved problems. Christianity, Judaism and Islam all honour human rights (extremists on all sides notwithstanding), the Earth's resources and the well-being of children. For decades scholars have debated how those shared tenets should apply to tomorrow. We cannot avoid or substitute the responsibility to immediate generations for dealing with the uncertainty of events that may or may not happen to distant future generations 10-, or 100,000 years from now.

Dealing with used nuclear fuel on its own merits now is a responsible way of dealing with these issues; postponing decisions for whatever ulterior motives is not. Taking into account and building on the collective knowledge in Canada and the international scientific community, to begin the implementation process with flexibility, preferably within the current generation, is a morally responsible way of moving forward.

Within the broader framework we also have a responsibility to explore renewable energy sources as alternatives to the continuation of burning fossil fuels and the subsequent growth in the production of greenhouse gases. The transition to a totally 'green economy', if indeed it is achievable, is perhaps the ultimate goal. In the meantime we cannot ignore the impacts of the resulting global warming on today's world population. These are problems facing the current and the immediately following generations.

When making the assessment of the broader issues of the nuclear industry in Canada, we must take into account that in Canada we live in a sophisticated world where we depend on the many uses of radiation as an integral part of our daily lives. Many of the applications and benefits derived from these multiple applications, whether in generating electrical power, in applying medical procedures, in industrial or agricultural and food production practices, contribute to the health and well-being of citizens of Canada and elsewhere in the world.

If the UCC wants to discuss the disposal and management of used nuclear waste it must do so on the merits and demerits of the technological, ecological and social aspects of that specific issue, outlining their views on the positive and negative impacts.

If the UCC wants to discuss the whole of the nuclear fuel cycle and the issue of electrical power generation in Canada, it should do so separately within that broader framework and outline their views on the merits and demerits of the technological, ecological and social aspects, identifying the positive and negative impacts of that multiple spectrum of technologies on Canadian society.

To mix the two issues distracts from the credibility of their submissions, if for no other reason than that the environmental assessments on the management and disposal of used nuclear fuel were, by government directives, prohibited from addressing these two issues together. In this response, I have attempted to illustrate why the UCC submissions falls short in both these assessments.

The church has to adjust to a changing world. The world is a dynamic place in which we live, adjustment is needed to remain 'in sync' with the reality of the times: "Adapt or Perish". The challenges we face today are different from those that were identified only fifty years ago, or for that matter in Biblical times. Those that do not adjust will be relegated to irrelevancy, losing credibility of their positions. This is generally true for society as a whole, and for the church in particular.

The church has a leading role to play in building a socially responsible and caring society. To be effective and credible, it must do so in support of those who strive for a better, safe and secure environment, not in the constraint of long-term opposition.

I urge the United Church of Canada to rethink its opposing position to the issue of nuclear waste disposal; to work closely with the scientific community and engineering profession in ensuring that adequate societal safeguards are in place; and use its influence in a positive way to help solve remaining social issues.

In this year 2005, being the year of commemorating our veterans of past wars, remembering those who have fallen and honouring those who survived, we should be mindful of the purpose of their sacrifices.

The message the UCC transmits should honour the efforts of past generations, encourage present generations to leave a strong and positive legacy and inspire future generations to continue building a caring, strong and resilient Canada.

Respectfully submitted:

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