Canadian Nuclear Society
Société Nucléaire Canadienne
480 University Avenue, Suite 200, Toronto, Ontario, Canada M5G 1V2 Website: www.cns-snc.ca
Telephone: (416) 977-7620 Fax: (416) 977-8131 E-mail/Courriel: cns-snc@on.aibn.com

"Supporting nuclear science and technology for over 25 years"
"Plus de 25 ans de promotion de la science et de la technologie nucléaires"

CNS Presentation to the NWMO Advisory Council

2005 February 1

PREAMBLE

The Canadian Nuclear Society (CNS), established in 1979 and independently incorporated in 1998, is a not-for-profit learned society with a nation-wide membership of over 1000. The CNS is dedicated to the exchange of information on the peaceful applications of nuclear science and technology. This encompasses all aspects of nuclear energy, uranium, fission and other nuclear technologies such as occupational and environmental protection, medical diagnosis and treatment, the use of radioisotopes, and food preservation. CNS members join as individuals (there is no corporate category of membership), and are drawn mainly from the various fields mentioned above, including from within the academic community.

The CNS welcomes the opportunity to discuss with the NWMO Advisory Council its views regarding the management of used nuclear power reactor fuel in Canada, and the NWMO process.

1. AN ETHICALLY DEFENSIBLE HISTORY OF DEVELOPMENT

1.1. Nuclear power is an available technology for economical, large-scale electricity generation that has both low public health risk and low environmental impact. CANDU nuclear technology, first developed in Canada in the 1950s, today provides about 15% of Canada's electricity requirements[1] and 45% of the consumption in Ontario[2]. Its net benefit to society makes it an ethical choice as a contributor to Canada's energy needs.

1.2. The used fuel from Canada's nuclear power reactors is managed in a safe and responsible manner, using in-ground water pools and above-ground dry canisters, casks, and modules located at the reactor sites. The volume of used nuclear fuel produced in Canada is not large. For example, the total volume of used nuclear fuel produced by Canada's power reactors from 1962 to 2033 will be roughly equal to the volume of domestic solid waste currently produced by the City of Toronto in one day[3]. The current approach of on-site storage and monitoring is sustainable for many decades, but is not intended to represent a long-term solution.

1.3. The long-term management of used nuclear fuel has been investigated by the Canadian nuclear industry from the outset of nuclear power development[4]. In the early years the research focused upon the reprocessing and subsequent recycling of the useful fraction of used fuel, due to the then-perceived limited availability of uranium ore. In this case, for example, the leftover waste from reprocessing would have been incorporated into glass blocks, which had been confirmed through field tests to be resistant to leaching. Later, with uranium known to be an abundant Canadian resource, the focus shifted to a once-through fuel cycle and the direct disposal of the resulting used fuel without reprocessing. Therefore, whether focused on the reprocessing or the

[1] Source: Natural Resources Canada
[2] Source: The Independent Electricity Market Operator, Ontario, 2003
[3] The Nuclear Waste Management Organization (NWMO) expects that 3.6 million used fuel bundles will exist in Canada by the end of 2033. With a volume of roughly 0.004 cubic metres per bundle, the total volume of used fuel from Canada's CANDU reactors over 70 years would be 14,400 cubic metres (a volume the size of a soccer field to a height of 2.25 metres). The volume of solid domestic waste currently shipped by Toronto to Michigan is about 5 million cubic metres per year, or on average about 14,000 cubic metres per day.
[4] The R&D effort in the area of waste management during the earliest days of the Canadian nuclear industry is evident in public reports by Atomic Energy of Canada Ltd. (AECL) dating back to the early 1950s, around the time that planning and early design work for a Canadian nuclear power program were initiated.

sequestering of its waste products, nuclear power development has proceeded with ethically defensible attention to its long-term liability. In 1975 the industry defined its objective to be to "... *isolate and contain the radioactive material so that no long term surveillance by future generations will be required and that there will be negligible risk to man and his environment at any time. ... Storage* [sic] *underground, in deep impermeable strata, will be developed to provide ultimate isolation from the environment with the minimum of surveillance and maintenance.*"[5]

1.4. In 1978 the federal and Ontario governments jointly initiated the Nuclear Fuel Waste Management Program (NFWMP), under the aegis of both Atomic Energy of Canada Ltd. (AECL), which developed the science and technology of deep geological disposal for used power reactor fuel, and Ontario Hydro (now Ontario Power Generation), which had responsibility for studies of interim used fuel storage and transportation. In 1988 the Environmental Impact Statement (EIS) developed by the NFWMP was submitted to the federal government, which subsequently referred it to an Environment Assessment Panel (the "Seaborn Panel"). The Seaborn Panel's final report in 1998 found the EIS to be technically sound, but lacking broad public support. The response of the federal government to the recommendations of the Seaborn Panel resulted in the passing of the Nuclear Fuel Waste Act, and the subsequent creation of the Nuclear Waste Management Organization (NWMO), in 2002[6].

2. THE NEED FOR A DECISION

2.1. A decision on the long-term management of used nuclear fuel is needed under the principle of sustainable development, requiring that the current generation take steps to minimize the liability it transfers to future generations[7]. The low volume and manageable nature of used nuclear fuel are consistent with the principle of sustainable development, inasmuch as these features minimize the future burden of the used fuel. However, a means of long-term management, requiring minimal on-going human intervention, is needed to fully meet the current generation's obligation to future generations.

2.2. While the principle of sustainable development implies that such a long-term strategy needs to be decided upon and implemented by the current generation, it does not suggest the nature of the strategy. For example, permanent disposal of used nuclear fuel may be considered to be inconsistent with the principle of sustainable development if it prevents future generations from utilizing the remaining considerable energy content of the fuel. On the other hand, surface or near-surface storage imposes a responsibility for ongoing care on future generations.

2.3. A decision on the long-term management of used nuclear fuel is also needed to maintain nuclear power technology as an available energy option for future generations, which the CNS supports as an ethical goal given the technology's net benefit to society as claimed in paragraph 1.1. In general, the public currently sees the lack of a committed, socially acceptable plan for the long-term management of used nuclear fuel as a significant deficiency of the nuclear power option.

2.4. While the above discussion establishes the need for a decision on the long-term management of used nuclear fuel, all the details of the implementation need not be decided upon quickly, nor all at once. Interim storage for decades remains a viable, albeit demanding, practice, provided that serious work also starts and continues steadily on preparing long-term storage or disposal facilities. Step-by-step progression along the chosen route, with full assurance provided at each step, may be necessary to gain the fullest public acceptance. This suggests a more satisfactory

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[5] Peter J. Dyne, "Managing Nuclear Wastes", AECL-5136, May 1975.

[6] The NWMO was created with the purpose "*to develop collaboratively with Canadians a management approach for the long-term care of Canada's used nuclear fuel that is socially acceptable, technically sound, environmentally responsible and economically feasible.*" (source: NWMO website) The NWMO has been charged with recommending to the federal government by 2005 November 15 an approach to the long-term management of Canada's used nuclear fuel. The NWMO will then implement the approach decided upon by the government.

[7] In 1987 the World Commission on Environment and Development (the Brundtland Commission) defined sustainable development as *"development that meets the needs of the present without compromising the ability of future generations to meet their own needs."*

strategy, from a sustainable development point of view, of "convertible storage", a hybrid option which is discussed in paragraph 4.4.

3. THE NATURE OF PUBLIC CONSULTATION

3.1. Public consultation, involving as broad a representation of various constituencies as possible, is important for the social acceptability of any long-term used nuclear fuel management program. The selection of a long-term management option for used nuclear fuel depends as much upon value judgments, and the establishment of trust and confidence in the organizations that will ultimately implement and regulate the process, as it does on any remaining technical uncertainties.

3.2. While public consultation, such as that currently implemented by the NWMO, may be sufficient to assess the values held important by the public as they apply to long-term used nuclear fuel management, it is inherently insufficient to provide a realistic measure of "broad public support", as described in the Seaborn Report[8]. Such support should necessarily be based upon a broad public understanding of the issues involved, both technical and social, and would be demonstrated, in part, by an informed and broad public response to public interaction programs such as those of the NWMO. However, it seems unlikely that the NWMO will be able to obtain an informed and broad public response. Failing this, public consultation can still indicate a level of "public acceptance" (a more passive response) of the prevailing long-term waste-management strategy, as well as the values held important by the public, and this information will be useful to an organization like the NWMO in guiding its recommendations to the government. However, it is essential that a clear definition of "acceptable" be put forth in any assessment of the public consultation process.

3.3. Notwithstanding its importance in determining public values and perceptions, and in establishing public trust and confidence in the implementing organizations, public consultation cannot be used to determine the real level of safety associated with any of the long-term waste-management options. The distinction between public acceptability and safety, clouded in the Seaborn Report by the creation of the concept of "safety from a social perspective", must be made in order for a clear conclusion, with clear responsibilities and a clear path forward, to be established.

4. THE OPTIONS

4.1. Several options for used nuclear fuel management, including deep geological disposal, are understood well enough technically to be credible and viable. Deep geological disposal, in particular, is in an advanced state of scientific and technical understanding within Canada, while many of the principles and technologies of used fuel storage have been demonstrated for years at reactor sites within Canada. The NWMO on-line documents present the technical and non-technical pros and cons of the options comprehensively enough to capture the important differences between the options. The CNS endorses the NWMO's scrupulously neutral approach to date on which option should be recommended for government decision.

4.2. Deep geological disposal has been investigated by several countries, including Canada, as a promising technology for long-term management of used nuclear fuel. The concept is attractive because it represents a relatively simple isolation strategy that closes the fuel cycle with minimal long-term impact on the biosphere. At the same time it minimizes future dependence on social stability, intellectual and industrial capacity, funding, and commitment. In principle the currently defined process of deep geological disposal is reversible at any point; that is, retrieval of the used fuel is a feasible option, albeit at an increasing cost the further the disposal process has been implemented.

[8] Source: "Report of the Nuclear Fuel Waste Management and Disposal Concept Environmental Assessment Panel", Blair Seaborn, chair, February 1998.

4.3. This concept of reversibility (retrievability) is attractive because it is consistent with the principle of sustainable development: it initiates a process of isolation with the intent of limiting the liability transferred to future generations, while not precluding future generations from either (a) benefiting from the used nuclear fuel if they so desire (e.g. through reprocessing), or (b) applying an alternative waste treatment technology if they deem it preferable (e.g. partitioning and transmutation of the long-lived radionuclides into shorter-lived nuclides).

4.4. The CNS therefore encourages the NWMO to take a more detailed look at an option of "convertible" deep geological storage, which combines the best features of geological storage and disposal. "Convertible" storage could consist of excavating a deep geological repository capable of receiving used fuel either in storage casks for storage (until a decision is made regarding retrieval and treatment of the used fuel), or in disposal containers for immediate permanent emplacement and backfilling of the disposal galleries and connecting tunnels. The decision between implementing storage or disposal need not be taken now in any event, as site characterization, environmental assessments and regulatory authorization processes, and facility construction will extend over a decade or more before the underground facility is ready to receive any fuel. If it is later decided to reprocess the fuel for recycling (and to dispose of only the actual waste fraction of the fuel), or to partition and transmute the long-lived nuclides in the fuel (to shorten or eliminate the required period of waste isolation), the necessary facilities can later be co-located with the repository, as long as those possibilities are borne in mind during the original siting decision. Even if storage is begun, the fuel casks could easily be retrieved and (if necessary) the fuel could be repackaged in disposal containers for re-emplacement and backfilling. Like deep geological disposal, the "convertible" storage approach achieves consistency with the principle of sustainable development, by initiating the steps leading to possible permanent isolation of the waste during the stewardship of the current generation. At the same time it proceeds in a step-wise fashion and is adaptable, deferring important decisions until they must be made.

4.5. Part of the public uncertainty regarding any off-site sequestering strategy for used nuclear fuel concerns the nature of the siting process. It is important for gaining social acceptance, therefore, that the NWMO release for public discussion its proposed siting procedure. The CNS supports a principle of "informed voluntarism" in any siting process; that is, one implemented with adequate preparation, involving clear and factual communication of all risks and benefits, before inviting community participation.

5. SUMMARY AND RECOMMENDATIONS

5.1. Nuclear power is an ethical choice for energy generation in Canada, with waste products that have been managed in the short- and intermediate-term in a safe and responsible manner from the outset of the industry. (Ref: paragraphs 1.1 and 1.2)

5.2. Nuclear power development in Canada has proceeded from its outset with ethically defensible attention to the long-term management of its waste products. (Ref: paragraphs 1.3 and 1.4)

5.3. A decision on the long-term management of used nuclear fuel is needed under the principle of sustainable development, although this principle suggests neither the nature of the management strategy, nor the timing of detailed implementation decisions. (Ref: paragraphs 2.1, 2.2, and 2.4)

5.4. A decision on the long-term management of used nuclear fuel is needed to maintain the option of nuclear power technology for future generations, which the CNS believes is an ethical goal. (Ref: paragraph 2.3)

5.5. Value judgments and public trust will be as important as technical considerations in determining Canada's long-term used nuclear fuel management strategy. Public consultation is vital in assessing these value judgments and establishing public trust. (Ref: paragraph 3.1)

5.6. Public consultation, as currently (and practically) implemented, cannot determine a level of "broad public support" for used nuclear fuel management technologies, nor can it be used to determine the safety of these technologies. (Ref: paragraphs 3.2 and 3.3)

5.7. Several options for used nuclear fuel management are understood well enough to be technically viable and credible, and the public information disseminated by the NWMO is sufficiently comprehensive to highlight the main differences between them. (Ref: paragraph 4.1)

5.8. The concepts of retrievability and disposal both have features that make them consistent with the principle of sustainable development. Therefore an attractive compromise strategy is one of "convertible" storage that synthesizes the best features of each (from the point of view of sustainable development). The NWMO is encouraged to consider this concept. (Ref: paragraphs 2.4, 4.2, 4.3, and 4.4)

5.9. Public acceptance of any off-site strategy will need full public discussion of a proposed siting process. The NWMO is encouraged to initiate such discussion, and to incorporate a principle of "informed voluntarism" in the proposed process. (Ref: paragraph 4.5)

Presented on 2005 February 1 to the NWMO Advisory Council by:

Jeremy Whitlock, PhD
Past-President, Canadian Nuclear Society, www.cns-snc.ca

Reactor & Radiation Physics
AECL Chalk River Laboratories
Chalk River, Ontario, Canada, K0J 1J0
phone: 613-584-8811 ext.4265
fax: 613-584-8198
email: whitlockj@aecl.ca