

The Continuing Quest: An Acceptable Approach to Long-term Nuclear Waste Management

Elizabeth Dowdeswell¹

Abstract

Long-term management of nuclear waste illustrates well the conundrum that societies face in moving toward sustainability. It is an issue that requires an understanding of resilience, vulnerability, and the dynamic interaction between nature, technology, and society. It is an issue that requires consideration of scientific and technical factors, but as well fundamental social, ethical and economic factors that go to the heart of our values and priorities as societies—how we want to live.

Canada's Nuclear Waste Management Organization (NWMO) has been tasked to design a responsible, responsive, and acceptable path forward. We have chosen to design this path forward collaboratively with Canadians, in a way that ensures the management of the used fuel will be socially acceptable, technically sound, environmentally responsible, and economically feasible. In implementing a study process that provides a forum for recognizing divergent viewpoints while seeking common ground in an iterative dialogue with citizens, the NWMO has sought more broadly to redefine the process of developing public policy. Mid-way through its three-year process of study, this article describes some of the organization's efforts to date.

Introduction

In the early years of this new millennium our world is changing dramatically. This is a time of blinding technological change, increasingly interconnected economies and growing alienation between citizens and their institutions. A sustainable world is not an unreachable goal, but any critical environmental, social or economic analysis would certainly raise questions about our current trajectory.

The issue of the long-term management of nuclear waste illustrates well the conundrum that society faces. It is an issue that embodies scientific complexity and uncertainty. It inspires fear and insecurity and polarizes citizens. It is very long-term in character, raising questions of intergenerational equity quite inconsistent with the time frames of elected governments. It raises discussion of trade-offs: energy sufficiency versus significant financial investment and long-term security. In sum, it is an issue that requires much better understanding of resilience, vulnerability and the dynamic interaction between nature, technology and society.

All nuclear nations have faced significant challenges in their quest for an acceptable approach for the long term management of the nuclear waste they generate. The story behind that fact illustrates the degree to which the nuclear industry is being shaped by factors much beyond the scientific and technical.

Social, ethical and economic considerations are now being recognized as legitimate aspects of the public policy process. This article describes some of Canada's experience in responding to this evolving environment.

Background

The question of what should happen to Canada's nuclear energy waste is one that has taken the time and energy of more than a generation of Canadians. Notwithstanding considerable research about the science, technology and engineering of possible storage and repository approaches, the task of implementation has proven challenging. In 1988, Canada's Minister of Energy, Mines and Resources requested that a federal environmental assessment panel conduct an assessment of an Atomic Energy of Canada Limited (AECL) proposal for deep geological disposal under the requirements of the federal environmental assessment and review process. This led to formation of the Nuclear Fuel Waste Management and Disposal Concept Environmental Assessment Panel (The Seaborn Panel) in 1989. Based in Mississauga, Ontario, with laboratories and other offices in Canada as well as in China, South Korea, and the United States, Atomic Energy of Canada Limited (AECL) is a nuclear technology company that provides services to nuclear utilities worldwide.

An intensive and lengthy period of delibera-

tion was undertaken by the Seaborn Panel. In 1998, after conducting a close to ten year review, the Seaborn Panel provided insight and direction on key issues that had to be addressed in order to move the decision-making forward. With respect to the AECL proposal, the panel concluded 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.
- As it stands, the AECL concept for deep geological disposal has not been demonstrated to have broad public support. The concept in its current form does not have the required level of acceptability to be adopted as Canada's approach for managing nuclear fuel wastes.

The Government of Canada considered and responded to the Seaborn Panel Report, and in November 2002 brought into force the *Nuclear Fuel Waste Act* (an Act respecting the long-term management of nuclear fuel waste). The Nuclear Waste Management Organization (NWMO) was established in late 2002 in response to this federal legislation requiring Canada's nuclear energy corporations to create an organization to investigate and develop an approach for the long-term management of their used nuclear fuel. An independent Advisory Council acts as a guarantor of the public interest. The companies were also required to put in place trust funds to ensure that the money will be available to finance the nuclear waste management approach ultimately adopted by the government.

The NWMO has been given three years to study, at a minimum, three approaches including deep geological disposal, storage at the nuclear reactor sites and, centralized storage, either above or below ground. We must examine the risks, costs and benefits, develop implementation plans and consult with Canadians and in particular aboriginal peoples. Once the Government of Canada takes a decision on our recommendations the NWMO will be responsible for the managerial, operational and financial implementation.

In Canada, used nuclear fuel is safely managed by its owners in interim storage facilities at nuclear reactor sites, in strict accordance with the regulatory requirements of the Canadian Nuclear Safety Commission. If Canada's 22 licensed commercial nuclear power reactors run

to the end of their currently projected lives it is estimated that about 3.6 million *bundles* of used fuel will result. A *bundle* is the term used to refer to the assembly of uranium dioxide ceramic pellets sealed inside zirconium alloy tubes that are about the size of a fireplace log. These tubes are inserted into a nuclear reactor as fuel for the generation of electricity and, after about a year, removed as waste.

Listening and Learning

It is reasonable to ask, "What will make this attempt any different than those of the past?" The answer may lie in our search to understand the deeply held values of citizens and to review our options through a multidimensional lens that is in part shaped by citizens themselves.

Sustainable development is our conceptual underpinning. We see as our purpose, to develop collaboratively with Canadians a management approach that is socially acceptable, technically sound, environmentally responsible and economically feasible.

Our approach includes a focus on broad engagement of society; a comprehensive (not just technical) review; a study built around three milestone documents so that we could learn together with citizens—first about the framework for the study itself, then the assessment and, finally the recommendations and implementation plan. We provide a forum for recognizing divergent viewpoints and seeking common ground.

Our journey from dialogue to decision began with preliminary conversations with a broad cross-section of Canadians. Those citizens brought perspectives and ideas that were instrumental in advancing our knowledge and understanding. We were asked to approach the study in manageable steps that would encourage citizens to think about complex issues, and provide informed, thoughtful feedback. In response, the NWMO developed an iterative study plan that involved a series of milestone documents. The documents openly shared NWMO's thinking as it evolved at key stages. They served as the basis for dialogue and deliberation and enabled citizens to shape and direct subsequent steps in the study and to participate in developing the recommendations. The intent was also to make transparent NWMO's deliberations. We listened

and learned.

The first discussion document "Asking the Right Questions? The Future Management of Canada's Used Nuclear Fuel" defined the problem, communicated potential choices and posed a way of assessing the alternatives. The analytical framework was derived directly from key questions raised by citizens. Through a series of engagement activities these questions were validated before continuing to the next step. Our journey from dialogue to decision was well underway.

The challenge for the NWMO is to develop and apply, as much as possible, a societally directed framework—one that is consistent with the collective sense of how Canadians want to live. The following initiatives were designed to guide us.

A Focus on Ethics

A Roundtable on Ethics was established early in the NWMO's mandate to deliberate on the range of ethical considerations which should be factored into the NWMO's work. It was composed of six individuals, expert in the field of ethics and drawn from a variety of disciplines ranging from medicine to business and the faith communities. The Roundtable helped the NWMO make explicit and ensure the systematic integration of ethical considerations into the assessment of options and the ultimate recommendations of a management approach.

Among the early advice received was that rather than treating ethics as a separate and distinct assessment area, it would be preferable to embed ethical and value considerations in all aspects of the NWMO study. With this in mind, ethical considerations were considered as one of the "overarching aspects" in the analytical framework. The key question raised for discussion was as follows. Is the process for selecting, assessing, and implementing the management approach fair and equitable to our generation, and future generations?

To answer this question, consideration was given to such matters as:

- Have ethical-impact analyses been undertaken to address environmental justice and violations of rights to know, of due process, of equal protection, to free informed consent, and compensation for harms/threats of harm?

- Has the management approach been tested for its capacity to ensure a fair sharing of costs, benefits, risks and responsibilities both now and in the future?

- Has the deliberative decision-making process undertaken by the NWMO been tested, to ensure it has been carried out in an ethical fashion?

The Roundtable developed an "Ethical and Social Framework" composed of a list of principles and questions to help guide the NWMO's activities throughout the study. The six principles that form the core of the framework are:

- Respect for life in all its forms, including minimization of harm to human beings and other sentient creatures.

- Respect for future generations of human beings, other species, and the biosphere as a whole.

- Respect for peoples and cultures.

- Justice (across groups, regions, and generations).

- Fairness (to everyone affected and particularly to minorities and marginalized groups).

- Sensitivity to the differences of values and interpretation that different individuals and groups bring to the dialogue.

Canadian Values

We realized that public confidence in our recommended approach had to be built. The starting point was for us to understand what really mattered to Canadians. To explore the values which citizens bring to bear in thinking about the long-term management of used nuclear fuel, the NWMO launched a collaborative research project with the Canadian Policy Research Networks (CPRN). A cross-section of citizens from coast to coast participated in a National Citizens' Dialogue on the Long-Term Management of Used Nuclear Fuel.

CPRN is a nonpartisan, nonprofit organization specializing in social and economic policy research and public engagement. It has been using public dialogue since 1995 as a means to involve citizens more directly in research and public policy discussions on issues such as health care, quality-of-life indicators, Canada's children, aging and the society to which Canadians collectively aspire.

In these dialogues 462 Canadians gathered

in 12 cities across Canada between January and March 2004, to talk with each other about the key characteristics they feel are important in a long-term management approach. All the participants were randomly recruited by a professional polling firm to be as representative as possible of the Canadian population, 18 years of age or older. They came to these dialogue sessions as unaffiliated individuals, not as representatives of stakeholder or special-interest groups. Before arriving they received background information explaining the dialogue process. On arrival they were given a specially prepared workbook providing key factual information. Dialogue participants were presented with four scenarios, each representing a plausible view that could be held by a segment of society. They could choose or reject elements from different scenarios, or identify their own new ideas, in arriving at their own preferred scenario. The scenarios provided to citizens for this dialogue addressed the issues that society is best placed to answer. They were presented with arguments in favor and against each perspective, reflecting different values that people hold dear.

The first set of scenarios asked:

- How do we best share rights and responsibilities across generations?
- Should we emphasize using the knowledge we have today?
- Should we emphasize choice for future generations?

The second set of scenarios asked:

- How do we best ensure confidence and trust in a management approach?
- Should we emphasize the role of governments?
- Should we emphasize the role of affected communities and civil society?

As people deliberated, key characteristics of a desirable long-term management approach were developed and from these areas of common ground, core values were identified. The values summarized below reflect the choices they made, the conditions they imposed and the reasons they gave for choosing one outcome over another.

One overriding need underpins the values that emerged—that is, the basic human need to feel safe from harm. This need did not arise from a sense of fear, or from an expectation of

a risk-free world, but rather from a sense of responsibility to this generation, and future generations, to take the necessary precautions. Citizens talked about safety and security in the context of recent events that posed risks to public health and the environment, and expressed concerns about possible acts of terrorism, both now and in the future. To manage these risks, they looked to governments to fulfill their responsibilities as regulators and standard setters. And they called for better information, greater transparency and inclusiveness in decision-making to build public confidence about their overall safety.

Responsibility—We Need to Live Up to Our Responsibilities and Deal with the Problems We Create

Citizens want to leave a legacy for their children and grandchildren that they can be proud of. They want to take concrete steps to deal with problems. Dialogue participants were surprised and upset that the decision to use nuclear fuel was made 30 or more years ago without a plan in place to manage the used fuel for the long term. As the generation that has consumed the energy and created the used fuel, they felt a sense of responsibility to the extent possible to act now and to pay now.

Adaptability—Continuous Improvement Based on New Knowledge

Citizens do not presume that we have the best answers today. They looked back over the last century and saw how dramatically technology had changed their lives, and they expect this advancement to continue. They wanted to make deliberate investments in research so that future generations would have safer, more efficient ways to deal with the used fuel. They also wanted to invest in measures to ensure that future generations would have the knowledge and capacity to fulfill their own responsibilities with respect to the used fuel. Therefore, they wanted to ensure that future generations would have access to the fuel so they could apply new knowledge. They wanted a flexible, step-by-step management approach that would regularly take stock of new knowledge and adapt accordingly.

Stewardship—We Have a Duty to Use All Resources with Care, Leaving a Sound Legacy for Future Generations

The concepts of reduce, reuse and recycle have become deeply embedded principles, and citizens want to use all resources wisely. They want to address issues in an integrated, holistic way, looking at all possible costs and benefits of decisions on used fuel and on broad energy policy.

Dialogue participants saw reducing the volume of waste as a necessary part of the management approach. They acknowledged their own responsibility to reduce the amount of electricity they use, and recognized the challenge in changing behaviour. They called on governments to provide leadership to individuals and industry to reduce consumption by offering incentives and providing more information on the real costs of energy and the environmental and health impacts. They sought greater use of alternative energy sources like wind and solar. They wanted more research into how to safely extract more energy from the uranium, as well as to try and reduce the toxicity of the waste.

Accountability and Transparency

Citizens hold governments, especially the federal government, as ultimately accountable for the public good, but their level of trust in government and industry is low. Dialogue participants imposed the following conditions on governments:

- There must be real engagement of experts, citizens, communities and other stakeholders before any decision is made;
- People must be told the truth. There must be greater transparency in decision-making and monitoring by both government and industry. Citizens will want to know why decisions are made and how they are being implemented. They will want full disclosure of financial and management information;
- Citizens will seek assurance that decisions will not be made simply for political expediency or profit; and,
- They will hold governments responsible for ensuring safety and security, including enforcing strong regulations and standards.

Knowledge—A Public Good for Better Decisions Now and In the Future

Citizens are embracing the idea of knowledge as a public good to help make better choices, both now and in the future. Their surprise at their own lack of awareness about the used nuclear fuel led to an urgent call for better efforts to ensure people are informed so they can engage in an informed way to support better decisions and investment in the education of young people to ensure that future generations have technical expertise and social institutions necessary to manage the used fuel.

Inclusion—The Best Decisions Reflect Broad Engagement and Many Perspectives; We All Have a Role to Play

Inclusion is about having a voice that is heard. Dialogue participants believed that better decisions would be made by involving as many perspectives as possible. Consumers, energy producers and those from related industries, scientists and other experts, affected communities, governments and citizens all have a role in the decision-making process and for contributing in an ongoing way to the management of used fuel over the long term.

Aboriginal Views and Perspectives

The approach taken by the NWMO is dependent on working together with and being guided by the values of those who stand to be affected by whatever management strategy is chosen. Since its inception, the NWMO has sought dialogue with the aboriginal community to share information on the issue of managing used nuclear fuel over the long term, to understand how this information is processed by the aboriginal community and in turn, to learn from the reactions, insights and concerns that are expressed as a result.

Aboriginal peoples of Canada (Inuit, First Nations and Métis peoples) told us that it is essential that they be involved in the study of long-term management approaches for a number of reasons, including lands that may host waste management facilities that are occupied or used by aboriginal people; traditional ecological knowledge should be integrated into the

development and assessment of management proposals; and, as stewards of the land, they feel a strong sense of responsibility to ensure that we provide well for future generations.

Aboriginal people emphasized the need for consultations to be designed and conducted in a manner that is culturally appropriate and sensitive to their traditional methods of discussion. The NWMO has entered into collaborative dialogues with national organizations representing the aboriginal peoples of Canada (Inuit, First Nations and Métis peoples as mentioned) and with regional/local organizations in the vicinity of nuclear fuel cycle activities. In these collaborations, the dialogues are designed and executed by aboriginal people on behalf of their organizations and the NWMO. More than 30 reports have emerged from these dialogues and have been input to the NWMO's study by aboriginal organizations, and more reports are expected as the study progresses. In addition, with few exceptions aboriginal people have been invited and/or have participated in all NWMO activities.

In the early stages of the study, many of the observations and insights emerging from the dialogue with aboriginal people echo those emerging from the broader dialogue. For example, the highest priority concern expressed is for safety and security for people and the environment. The issue of fairness in the distribution of costs, benefits, risks and responsibilities is a focus of concern as is, among some, the need to reduce the use of energy as part of a larger discussion of energy policy.

Many of the observations and insights also reflect special perspective that derives from the particular history, experience, and concerns of Canada's aboriginal peoples. For example, many spoke to: the importance of recognizing aboriginal rights, treaties and land claims in any decisions which are made; the need for nuclear industry agencies to earn the trust of aboriginal peoples as a first step in establishing a lasting and positive relationship going forward; and, the importance of incorporating traditional aboriginal knowledge throughout the study.

There is much to learn from the holistic and broadly integrative approach inherent in traditional aboriginal knowledge. Traditional aboriginal knowledge has provided some preliminary

insight into the principles inherent in this philosophy. To the extent that the NWMO was able, these principles were carried forward as part of the values foundation on which the study proceeded:

- **Honor** involves the wisdom that can be garnered from speaking to elders in both the aboriginal and non-aboriginal communities.
- **Respect** involves the opinions and suggestions of all who take the time to provide insight into this process.
- **Conservation**, particularly as it applies to the consumption of electricity, must be a major part of the solution, not just a footnote in the NWMO process.
- **Transparency** is essential to the process when NWMO, which was created by the producers of the problem, has to suggest a solution.
- **Accountability** must be part of the fabric of any solution so that those responsible (whether for the concept or the delivery) are held to high account by the public for their actions.

A Work in Progress

The three initiatives described above are illustrative of the manner in which NWMO has sought to redefine the process of developing public policy by focusing on the ethical and societal dimensions. As well, scenario workshops helped us imagine the future. Workshops with environmental interests, representatives of aboriginal communities and those with technical and scientific expertise contributed insights about expectations and concerns, the knowns and unknowns and suggested possible ways forward. Papers were commissioned to capture the current state of knowledge on a broad range of technical matters as well as evolving concepts related to our work. And of course we benefited from the experiences of other countries around the globe.

For the past year and a half two interrelated tracks of activity continued: an assessment which thoroughly examined the options and an engagement program through which we tested our initial observations and refined our thinking. This iterative process of seeking input and exposing our evolving ideas will continue until our task is completed.

A multidisciplinary assessment team developed an assessment methodology that built

upon the framework identified by citizens. It was applied to each of the alternatives, identifying the risks, costs and benefits and describing the social, economic and ethical considerations associated with each of them. The team also tested the robustness of different approaches against different time frames contemplated in the earlier scenarios workshops. All of this work was shared with the public for review in our second discussion document "Understanding the Choices" before recommendations were developed.

To give evidence of transparency, we made a commitment to share with the public our study report and recommendations in draft form before submitting them to the federal government. That document "Choosing a Way Forward" attempted to present as honestly as possible the path that led to our recommendation. It responded to all of the required elements of our mandate and reported back to all of those who had collaborated with us in the process. It will be the subject of public dialogues, open houses, workshops, focus groups and electronic dialogues. The insight gained from these exercises will be captured in the final study report completed in November 2005.

Preliminary Observations

The question of what constitutes "responsible action" in the long-term management of used nuclear fuel has been central to the complex and, at some times, impassioned discussion we have had with Canadians. We have heard participants in our dialogues propose values and objectives to guide our decision-making and serve as a platform for moving forward. As a true product of collaborative development, these values and objectives reflect the common ground of individuals and groups with many diverse perspectives on this issue. They suggest the terms and conditions of a collective journey to implement a long-term management approach for Canada which acknowledges both the areas in which we all agree and are prepared to proceed quickly and the areas in which greater confidence needs to be gained before proceeding.

We have heard that people wish to proceed. In fact, they expect to immediately begin the process of implementing a long-term manage-

ment approach for Canada. While some are very comfortable to move quickly to implement a final or definitive solution, we have heard from others they are only prepared to proceed with caution. These people would like the opportunity to learn more, understand better, and build greater confidence in decisions before they are taken, particularly if these decisions are difficult to reverse.

We believe that the evidence of common ground that has emerged from the dialogues provides the foundation for a staged and adaptive approach to be taken. This should be an approach which has a clear direction and end in mind, but which has built into it flexibility to further explore the areas where citizens wish to gain greater confidence. At each point in the process, the safety of people and the environment needs to be assured, and contingency plans need to be put in place. A clear and appropriate decision-making process needs to guide the journey, and strong and independent oversight needs to help ensure that we continue to progress towards our goal. It is this understanding, and the detailed guidance from dialogue participant which forms the foundation for our recommended approach.

Concluding Thoughts

In designing a responsible and responsive path forward we became very aware of the fact that there are no "right" answers to many of the ethical questions. How do we accommodate the desires of the current generation while recognizing that the decisions we make now may affect the lives of our children, their children and many generations to come? How heavily should we rely on emerging technologies? What forms of institutions and governance inspire trust and confidence?

These questions and more are fundamental to meeting the challenge of managing used nuclear fuel in an appropriate and acceptable manner. To be able to choose the right technical solutions we must first ask what requirements the technology has to live up to. Despite the fact that scientific and technical research into waste management options has been going on for decades a solution has eluded us. Perhaps that is because there has been no agreement on the

societal values we wish to protect. Perhaps also because we have been arrogant in our assumptions that expertise resides only in the minds of a select few.

Within Canada and internationally, the landscape against which our study is being conducted is shifting. Issues of energy policy, security, health and safety, environmental protection, and good governance are prominent on the public agenda.

How we approach this challenging public policy issue will say a lot about our values and priorities as a society—how we want to live. Fundamentally it is about developing a contract between science and society: a contract that allows us to benefit from technology while managing the risks and respecting the values of Canadians. We approach this task with humility in the face of uncertainty and complexity, but also fortified by the inherent wisdom of citizens.

Notes

1. Elizabeth Dowdeswell is president of the Nuclear Waste Management Organization, 49 Jackes Avenue, First Floor, Toronto, Ontario M4T 1E2 Canada. She may also be reached by e-mail at edowdeswell@nwmoo.ca and by telephone at 416-934-9814. She serves as a Pierre Elliot Trudeau Foundation mentor, helping to guide the public-policy research of Trudeau scholars. From 1993–1998 she was Under Secretary General of the United Nations and Executive Director of the United Nations Environment Programme. She holds a behavioral science M.S., awarded in 1972 by the then Department of Home Economics Education of Utah State University. She is the recipient of eight honorary doctorates—six Doctor of Law degrees from different universities an honorary Doctor of Humane Letters degree from Mount Saint Vincent University, Halifax, Nova Scotia, Canada and a Doctor of Environmental Sciences from Utah State University, Logan, Utah, USA. Charles University, Prague, Czech Republic, has awarded her its distinguished Memorial Gold Medal.

References Cited

The core of our engagement program is our website. It is becoming a significant repository of information and an active venue for engagement

and exchange. It offers simple polls and short surveys, invites more comprehensive electronic submissions and hosts moderated e-dialogues. All of the activities and reports referred to above are available at www.nwmo.ca. For example, please see:

Barnaby, Joanne

2003 "NWMO [Nuclear Waste Management Organization] Background Paper 8-3: Drawing on Aboriginal Wisdom: A Report on the Traditional Knowledge Workshop." Toronto: Nuclear Waste Management Organization.

Brook, Andrew, and Wesley Cragg, Georges Erasmus, David MacDonald, Arthur Schafer, and Margaret Somerville

2004 *Ethical and Social Framework*. Toronto: NWMO Roundtable on Ethics, Nuclear Waste Management Organization

Nuclear Fuel Waste Management and Disposal Concept Environmental Assessment Panel

1998 *Nuclear Fuel Waste Management and Disposal Concept. Report of the Nuclear Fuel Waste Management and Disposal Concept Environmental Assessment Panel*. Ottawa: Canadian Environmental Assessment Agency.

Nuclear Waste Management Organization

2003 *Asking the Right Questions? The Future Management of Canada's Used Nuclear Fuel*. Toronto: Nuclear Waste Management Organization.

2004 *Understanding the Choices*. Toronto: Nuclear Waste Management Organization.

2005 *Choosing a Way Forward: The Future Management of Canada's Used Nuclear Fuel (Draft Study Report)*. Toronto: Nuclear Waste Management Organization.

Watling, Judy, Judith Maxwell, Nandini Saxena, and Suzanne Taschereau

2004 *Responsible Action—Citizens' Dialogue on the Long-term Management of Used Nuclear Fuel*. Ottawa: Canadian Policy Research Networks