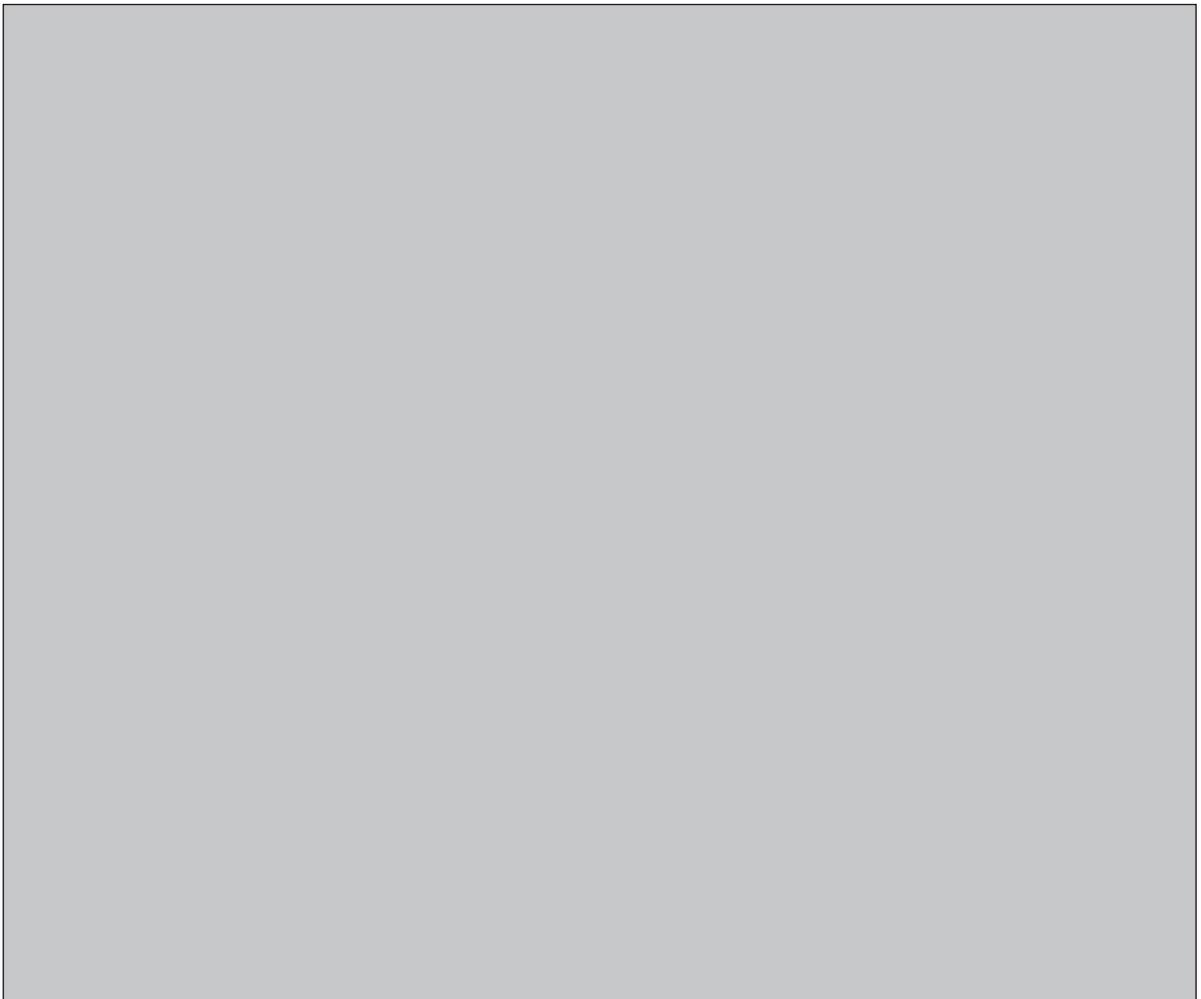


NWMO BACKGROUND PAPERS

8. WORKSHOP REPORTS

8-1 DEVELOPMENT OF THE ENVIRONMENTAL COMPONENT OF THE NWMO ANALYTICAL FRAMEWORK

Coleman, Bright Associates; Patterson Consulting



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Development of the Environmental Component of the NWMO Analytical Framework

~ Workshop on the Environmental Aspects of Nuclear Fuel Waste Management ~

WORKSHOP REPORT

Submitted by:

Coleman, Bright Associates

382 Chapel St., Ottawa ON
Tel: (613) 232-7514

Patterson Consulting

98 Patterson Ave., Ottawa ON
Tel: (613) 594-3281

1.0 Introduction

The Nuclear Waste Management Organization (NWMO) was established in November 2002 to provide recommendations to the Government of Canada on the long-term management of used nuclear fuel.

The Nuclear Fuel Waste Act (June 2002), which led to the creation of NWMO, requires the organization to study at least three methods for the long-term management of nuclear fuel waste including:

- i) deep geological disposal;
- ii) storage at the nuclear reactor sites; and
- iii) centralized storage, either above or below ground.

Responsiveness to environmental considerations is a central part of NWMO's mandate. NWMO is building on significant available research and studies, including the Report of the Environmental Assessment Panel (February 1998), chaired by Blair Seaborn, which reviewed a deep geological disposal concept proposed by Atomic Energy of Canada Ltd. (AECL).

NWMO will include environment as a key component of an Analytical Framework it is developing. The framework will also include: social and ethical; economic; and technical considerations.

2.0 Workshop on the Environmental Aspects of Nuclear Fuel Waste Management

2.1 Workshop Participants, Method and Format

A one-day Workshop was convened in Ottawa on September 15, 2003 to discuss the environmental aspects of nuclear fuel waste management. Eleven experts attended the session. All participants had recognized senior level experience in decision-making on environmental issues. They had expertise in business, industry, non-governmental, academic or public sectors.

Workshop participants were asked to provide advice on two areas:

- i) *the general environmental parameters that govern decision-making; and*
- ii) *key environmental questions that need to be answered respecting the management of spent nuclear fuel.*

2.2 Discussion Paper Proposed Three-Part Approach

A Discussion Document was provided to participants prior to the Workshop. It proposed a structured approach to the Workshop in order to organize dialogue. The approach borrowed heavily from previous work where three issue areas or themes were identified.

1. Science for decision-making.
2. Environmental assessment.
3. Governance.

The views of Workshop participants were considered during the preparation of this Report but its contents are the sole responsibility of the authors.

3.0 Environment Workshop Report

3.1 Introduction

Reality points to the fact that regardless of the ultimate management approach selected, storage will be a necessity for at least the next 30-70 years, in the sense that even a disposal option would require a long period before any decision to seal the repository is taken. During that period, a capability for monitoring and retrievability would be maintained. Thus storage and disposal are not mutually exclusive options. While the bulk of operational experience in the world to date has been with storage, some disposal options have been studied in great detail.

There was a declared recognition that all options should be adaptable to change based on experience. Storage technologies are inherently most adaptable to change. There was a stated aversion to irreversible decisions.

The challenges of managing nuclear waste, by any selected option, are essentially scientific, environmental and technical and are largely known or knowable. However, there are at the same time, the challenges of “accepting” the responsibilities, costs, benefits and risks to enable the management to proceed are societal, ethical and a matter of democracy and politics.

It was noted that Canadian society is becoming increasingly diverse, and along with other countries, shows a marked reduction in deference to authority.

3.2 Science for Decision Making

3.2.1 *Environmental Science Needed to Predict Effects of Nuclear Fuel Waste*

There is a substantial body of relevant science performed according to accepted scientific principles. This allows for the prediction of the consequences of exposure to spent nuclear fuel on the resiliency of the ecosphere (e.g., atmospheric and terrestrial resources, biodiversity and fresh water quality, water bodies and shoreline resources) and ecological processes (such as, carbon and nitrogen cycles, wetlands productivity, preservation of endangered species). The effects of exposing people directly and through the food chain is the most acute public concern.

The current body of scientific information is used now to make decisions on the management of waste nuclear fuel. It is possible to develop scientific information on ecosphere and ecological processes, and the health of people and their food chain, allowing comparison of these effects on the different management options under review. The Seaborn Panel examined deep geological disposal and the Canadian Nuclear Safety Commission has made numerous decisions on surface storage. Participants noted, for example, that subsurface facilities reduced exposures to people compared with facilities on the surface.

Questions of risk, and the factors affecting technical design, the operation of whatever management method is chosen, and the monitoring of its performance all have very important environmental temporal and spatial dimensions.

3.2.2 *Calculating and Communicating Risk*

There are different approaches to calculating risk. One is the established expert process of calculating probabilities, consequences and significance of various conditions, and is routinely applied to different technologies and site-specific proposals. The other more experimental approach is determined by listening to members of the public, and eliciting their questions, fears and apprehensions and responding to them. It was the view of the participants at the Workshop, that both approaches were essential. The NWMO is trying new approaches to listen to and communicate with interested public and its experience will be of benefit.

In order to address the public's perception of risk and benefits, new information and new science will be required. With their full collaboration, this would lead to a science plan to serve the public good. The public should also decide who they want to perform this new science. This constructive engagement at the earliest stages will do much to meet the healthy skepticism and distrust of scientists that the public often exhibits. Also, it will permit the public to see, first hand, the scientific process at work and to understand that challenge; dissent and differing views are inherent.

There was agreement that environmental issues are dynamic, complex and interconnected. They are fully integrated with the social, ethical and economic matters.

Other parties from both public and the expert communities could also be engaged in improving the understanding of and communication of risks and benefits. This could include local community and environmental groups, as well as institutions like the Royal Society of Canada, the Canadian Institute for Advanced Research and professional associations. Understanding the differences between perception of voluntary and imposed risk can provide valuable insights to the issues at hand. Understanding how the public has formed its views on risk associated with human activities like air transport and smoking would be useful. The consequences of low probability, high impact events such as catastrophic failure of containment systems play an important role in public perception and should be addressed directly.

NWMO should be developing approaches to assessing and communicating risk for use now and in its eventual proponent phase.

3.2.3 Monitoring and Reporting

Whatever proposal is accepted, long term monitoring of environmental effects is crucial. The system established should address both environmental effects and technology performance. It should include:

- measurements at key points in the process to indicate technology performance or influences on the technology such as, radiation flux or redox potential of groundwater;
- environmental indicators that are both instrumented and biological and measure whether radioactivity/chemical contamination is contained or released; and
- the ability to weigh the relative importance of the environmental effects of nuclear wastes relative to those imposed by other causes such as, thinning of the ozone layer, climate change, etc.

Monitoring information should be provided actively and responsively to the public and other parties who have either a relevant public good or a science responsibility. The information should be freely available in both raw form and formats deemed most useful by the recipients.

Monitoring provides essential information to various communities of interest, including scientists, as well as feedback that allows for adaptive management.

The development of the monitoring system design should follow the same approach as that proposed for the design of the science plan in the previous section (3.2.2). It would be useful to understand people's information needs and use it as part of the design of the monitoring and reporting function.

The institution accountable for reporting on performance should be separate from the implementing organization, and should take advantage of the work of the monitoring agencies, and take note of the role the Environment Commissioners of both the Governments of Canada and Ontario.

3.2.4 *New Science*

In Canada, issue specific processes are used to update, integrate and synthesize science for decision-making, for example, the Seaborn Panel, the NWMO. No continuous process to do this currently exists.

Concern was expressed during the Workshop regarding the capacity and long-term viability of the infrastructure for nuclear science at universities, in government and the private sector.

It was proposed that there is a need to continue active research on the environmental aspects of the effects of ionizing radiation with particular reference to impacts on microbiota.

3.3 Environmental Assessment

3.3.1 *Scope*

Three different types of environmental assessment could be necessary: (i) at the concept level to evaluate different technologies, and (ii) then once a technology is chosen, at the site-selection level – sometimes referred to as a regional level assessment, and (iii) then at the specific site proposal level. It may be possible to combine levels (ii) and (iii).

Environmental Assessment is a process with established procedures, including public participation, for determining information needs for the steps listed above. This could include a science plan developed in line with the suggestions in the section on risk (3.2.2).

Some argued that there is a need to compare or relate the environmental effects of the nuclear energy life cycle, including waste management, by the selected option, with the environmental effects from other energy life cycles or major industrial activities.

3.3.2 *Process*

Good guidance on process for the disposal option is contained in the Seaborn Report and could be adapted to other technologies.

The formal environmental assessment process should not be the only or even the primary means of communication at the time that a specific proposal is before

the public. Complementary processes and institutions should be mobilized as described in the section on risk (3.2.2). Results should be provided to the formal process to inform its deliberations and to demonstrate at the earliest stage the capacity for adaptive management on this issue.

Funding will be required for participants in these processes.

3.4 Governance

The environment is a public good. Effective systems of governance dealing with the environment have the characteristics of transparency, lack of bias, accessibility, inclusion of all interested parties, competence and public accountability. Good environmental knowledge will always be required to predict local and regional responses to the effects of long-lived wastes. This will help equip society with the information needed to take the challenging decisions included in the charge to NWMO.

Environmental considerations are and will continue to be integrated into the decision-making of many existing institutions on the grounds of both efficiency and effectiveness. This approach should be maintained. At the same time, new roles, approaches and functions have been suggested which are not in the mandate of any current organization and will be required beyond the remit of the NWMO.

Can these be achieved through existing organizations? If so, how are leadership, coherence and mutual reinforcement of effort to be achieved? How is adaptive management to be practiced? How is the continuity of functions over future decades to be assured? Are new institutions preferred? What can be learned from the Canadian Round Table experience of the '90's?

4.0 Some Possible Questions for NWMO to Answer by November 2005

As noted previously, Workshop participants were asked to provide advice to NWMO on two areas:

- i) *the general environmental parameters that govern decision-making;*
and
- ii) *key environmental questions that need to be answered respecting the management of spent nuclear fuel.*

The preceding sections describe from an environmental perspective some of the general parameters that need to be considered in decision-making.

In reviewing and assessing possible approaches for the management of spent nuclear fuel, the following key environmental questions should be considered.

NWMO Environment Workshop Report

- Q.1 Does the proposed approach adequately consider the cumulative effect on the resources of the ecosphere (atmospheric and terrestrial, biodiversity and fresh water quality, water bodies and shorelines)?
- Q.2 Does the proposed approach adequately consider the effects on ecological processes such as, atmospheric transportation of pollutants; carbon and nitrogen cycles; wetlands productivity; preservation of endangered species?
- Q.3 Does the proposed approach adequately predict the effects on the health of people and other living things in both the short and long term?
- Q.4 Does the proposed approach adequately consider the ecological effect of potential catastrophic failure of containment systems, including those used in transportation, and do we have adequate contingency measures?
- Q.5 Does the proposed approach adequately describe the ecological effects of the long-term residual impacts that may occur?
- Q.6 Does the proposed approach adequately take into account the effects of imposed environmental change through forces such as climate change, ozone depletion, glaciation, etc.?
- Q.7 Does the proposed approach adequately engage the public in terms of their perception of ecological risk for present and future generations?
- Q.8 Does the proposed approach adequately define an appropriate monitoring and reporting system to ensure effective public involvement and transparent decision-making?
- Q.9 Does the proposed approach give due consideration to the environmental roles and responsibilities of current, and possible new institutions, necessary to ensure long-term ecological integrity?

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NWMO ENVIRONMENT WORKSHOP PARTICIPANTS LIST

R.W. Slater, Consultant

Chris Hanlon, Consultant

Michel Fugère, Le Conseil Régional de l'Environnement du Centre du Québec
(CRECQ)

Rick Findlay, Director, Pollution Probe

Donald Lush, Ph.D., Stantec

Jagmohan S. Maini, O.C., Ph.D., Consultant

Dougal R. McCreath, Ph.D, P.Eng, FEIC, Laurentian University

Robert Morrison, Ph.D, Carleton University

Brad Parker, International Joint Commission

John Roberts, Stantec

Fred Roots, Ph.D, Science Advisor emeritus

Peter Victor, Ph.D, York University

Donald R. Wiles, Ph.D, Carleton University

Attending:

Elizabeth Dowdeswell, President, NWMO

John Neate, NWMO

Jo-ann Facella, NWMO