



NUCLEAR WASTE
MANAGEMENT
ORGANIZATION

SOCIÉTÉ DE GESTION
DES DÉCHETS
NUCLÉAIRES

NWMO APPROACH TO DEVELOPMENT OF ANALYTICAL FRAMEWORK

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This is the NWMO's first effort to describe the key elements of its approach to development of the analytical framework which will be used to assess used fuel management options, and the range of activities contemplated for Phase 2 of the study. This plan evolved out of the spirit of the earlier Phase 1 Conversations about Expectations. A variety of activities are under way, and others are under consideration. It is posted here for your contemplation. It will evolve as the NWMO learns more, and as Canadians become engaged in the study.

Approach to Development of Analytical Framework

1. The Objective

From its inception, the NWMO has committed 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.”¹ The analytical framework reflects the decision-making process that will be used to determine a recommended management approach or option, the factors that will be considered, and how these factors will be identified and combined. The approach which is used to develop and apply the analytical framework is an important element of the demonstration of NWMO’s commitment to collaborative development.

The analytical framework will be used to ensure the management option recommended by the NWMO is:

- Socially Acceptable;
- Technically Sound;
- Environmentally Responsible;
- Economically Feasible.

The NWMO has not defined what these four phrases mean. It will look to its dialogue with Canadians to help define these phrases, understand the breadth and range of activity required to address each, and to identify additional areas to be considered.

2. The Challenge

Collaborative development of the management approach requires, at a minimum and from the perspective of Canadians, the NWMO both ask the ‘right’ questions and answer these questions ‘well’.

The challenge of the analytical framework is to ensure that the core questions which drive the framework both protect and reflect the interest of Canadians. The challenge is to ensure that the way in which the questions are answered is both robust on behalf of Canadians, and also reflective of the broader context of societal thinking within which Canadians will measure the appropriateness of any management option recommended.

Society as a whole, and not science alone, needs to shape the questions to be addressed in the study. And society, with the assistance of science, needs to judge the benefit or harm, and assess the social implications of a decision to implement a particular management option. It is understood that to a large extent, notions of benefits and harms are societally constructed. The assessment of risk is an important example of this. While science can speak to the probability of the occurrence of an event, science cannot speak to social tolerance for its occurrence. *What* poses risk, *how* the risk should be *measured*, and what is considered *relevant* for measurement are all decisions which are influenced by societal considerations.

The objectives we set for the management options, and the values we weigh in making a decision, need to be consistent with our collective sense of how we should live. The challenge for the NWMO is to develop and apply, to the extent feasible, a societally directed framework to guide both the development of the management options, and also the assessment of these options. Without such a societally directed framework, implementation of any management option will be extremely difficult.

¹ See NWMO website

3. The Approach

The following flow chart broadly outlines the planned process and approach to the construction of the analytical framework and its application to the assessment of management options.

i) Starting Point:

The Nuclear Fuel Waste Act has set a requirement that the framework which is used to consider the management options must include social, ethical and economic considerations. The planned approach to development of the analytical framework is designed to include each of these as important elements in the framework. The Act specifically states:

Each proposed approach must include a comparison of the benefits, risk and costs of that approach with those of the other approaches, taking into account the economic region which that approach would be implemented, as well as ethical, social and economic considerations associated with that approach. [12 (4)]

The approach is also designed to be responsive to the direction of the Seaborn Panel Report, the result of a multi-year study of the geological disposal option conducted as part of an Environmental Assessment by the Government of Canada. Particular attention has been paid to the suggestion that the framework needs to reflect broad societal direction, and incorporate both societal and technical perspectives in both the *determination* of criteria and the *application* of these criteria. The approach is also designed to be responsive to the Seaborn suggestion that the framework identify, and make explicit, the range of considerations and assumptions which underlie or form the context for any criteria selected. (A more complete list of framework direction contained in the Panel Report is included in Appendix A.)

ii) Determining the Broad Parameters of the Framework:

The planned approach has the analytical framework developed through societal direction, and supported by expert knowledge from a wide variety of perspectives. In order to elicit this societal direction, a series of papers will be prepared, or workshops convened and used, to form the initial substantive basis for broad public discussion.

- **Concepts:** A series of papers is being commissioned to describe a number of concepts which are often used to understand and identify solutions to difficult public policy issues. Each paper will identify the broad questions and requirements suggested by the concept when it is applied to the issue of long term management of used nuclear fuel. Initial concepts to be explored include: Sustainable Development; Precautionary Approach; Risk and Uncertainty; Adaptive Management; and, Security. These concepts were identified as important through NWMO's Phase 1 dialogue – "Conversations About Expectations".
- **Alternative Perspectives:** Broad questions and requirements will also be identified through commissioned papers and/or specialized workshops in a number of expert knowledge areas such as: Ethics; Traditional Aboriginal Knowledge; Communities which host nuclear waste management facilities; Science and Technology; Finance and Law; and International Best Practice. These alternative perspectives were identified as important through NWMO's Phase 1 dialogue – "Conversations About Expectations".
- **Visioning the Future:** Broad questions and requirements concerning the likely needs of future generations are being explored through a set of scenario workshops. In these workshops, experts from a diverse range of civil society knowledge areas are asked to come together to identify possible future scenarios for our society, which could be considered in the assessment of management options. These scenario workshops are one of the innovative approaches NWMO is implementing in order to identify, and understand,

the range of issues which must be addressed in the study. The need for innovative approaches, such as this, was identified through both the Seaborn Panel Report² and NWMO's Phase 1 dialogue – "Conversations About Expectations".

These papers and workshops will be used to build what is hoped to be a common and balanced information platform for a public dialogue on the broad parameters of the analytical framework. The questions raised through these papers and workshops will be summarized and presented as the initial articulation of the analytical framework in NWMO's First Discussion Document. Interested Canadians will be asked to consider the questions which have been raised, and redirect the work if necessary, to ensure that at a high level the analytical framework has captured the full range of questions which should be asked and answered in the study.

By using multiple concepts and alternative perspectives for exploring the issue at hand, and by allowing additional concepts and perspectives to be added to this list during the course of dialogue, it is hoped that a sufficiently broad platform will have been created that the foundation elements for the framework can be determined with public confidence.

Examples of the type of broad parameters and/or key questions which may be suggested for inclusion in the analytical framework, drawn from work on another issue³, include:

- Does the management option entrench effective engagement processes?
- Will the management option ensure that people's well-being is maintained or improved?
- Will the management option ensure that the integrity of the environment is assured over the long term?
- Is the economic viability of the management option assured and will the economy of the community and beyond be better off as a result?
- Will the management option address traditional and non-market activities in the community and surrounding area such that they are accounted for in a way that is acceptable to the local people?
- Does the management option enjoy a foundation of rules, incentives, programs and capacities that ensure all operational consequences will be addressed over the long term?
- Will the management option lead to an overall improvement in human and ecosystem well being over the long term?

iii) Developing the Criteria:

Once the high level questions or broad parameters for the framework have been identified, and these have been tested to ensure they in fact reflect societal direction through dialogue with interested Canadians, the task of identifying the criteria will be addressed.

Individuals with expert knowledge from a wide variety of perspectives and other interested Canadians will be engaged to help assemble a range of criteria which could be used to explore each of the high level questions or broad parameter areas identified earlier. The NWMO's Second Discussion Document will present for discussion among Canadians: 1) the high level questions or broad parameters as they have been refined through dialogue following the First Discussion Document; and 2) the first articulation of the criteria to be used to explore each question or parameter. Canadians will be asked to consider the criteria both in general, and as they have been applied to describe the management options as presented in the Second Discussion Document. Through the dialogue following the Second Discussion Document, Canadians will help the NWMO

² See page 2 of *Report of the Nuclear Fuel Waste Management and Disposal Concept Environmental Assessment Panel*: "To be considered safe, a concept for managing nuclear fuel wastes must be judged, on balance, to ... be based on thorough and participatory scenario analyses ..."

³ See *Seven Questions of Sustainability*, a mining related study.

understand whether the way in which it proposes to answer the questions posed in the study, through the criteria selected, is appropriate.

iv) Determining the Relative Importance of Criteria and Making a Recommendation:

Once the broad parameters of the framework have been determined, and criteria have been identified for each, the issue of the relative importance of the parameters, and of individual criteria within parameters, will need to be addressed. Direction on this difficult issue will come from a broad public dialogue concerning relative importance and acceptable trade-offs leading up to the NWMO's Draft Study Report.

In formulating its recommendation the NWMO will need to have understood and imputed an importance to individual criteria, and determined and implemented acceptable trade-offs. The NWMO will need to be able to explain to Government, and Canadians, how the decisions it has made in both of these areas are responsive to the societal direction it has received. The need for this ultimate explanation and account will drive decisions on the extent to which a more or less formal weighting scheme will be identified and applied.

v) Testing and Feedback at Key Points:

The evolution of the framework will be tested, and feedback solicited, at multiple points in the process in order to ensure that societal direction is appropriately carried through the evolution of the framework and its application. Testing of, and feedback on, the framework is built in to the process at the following points:

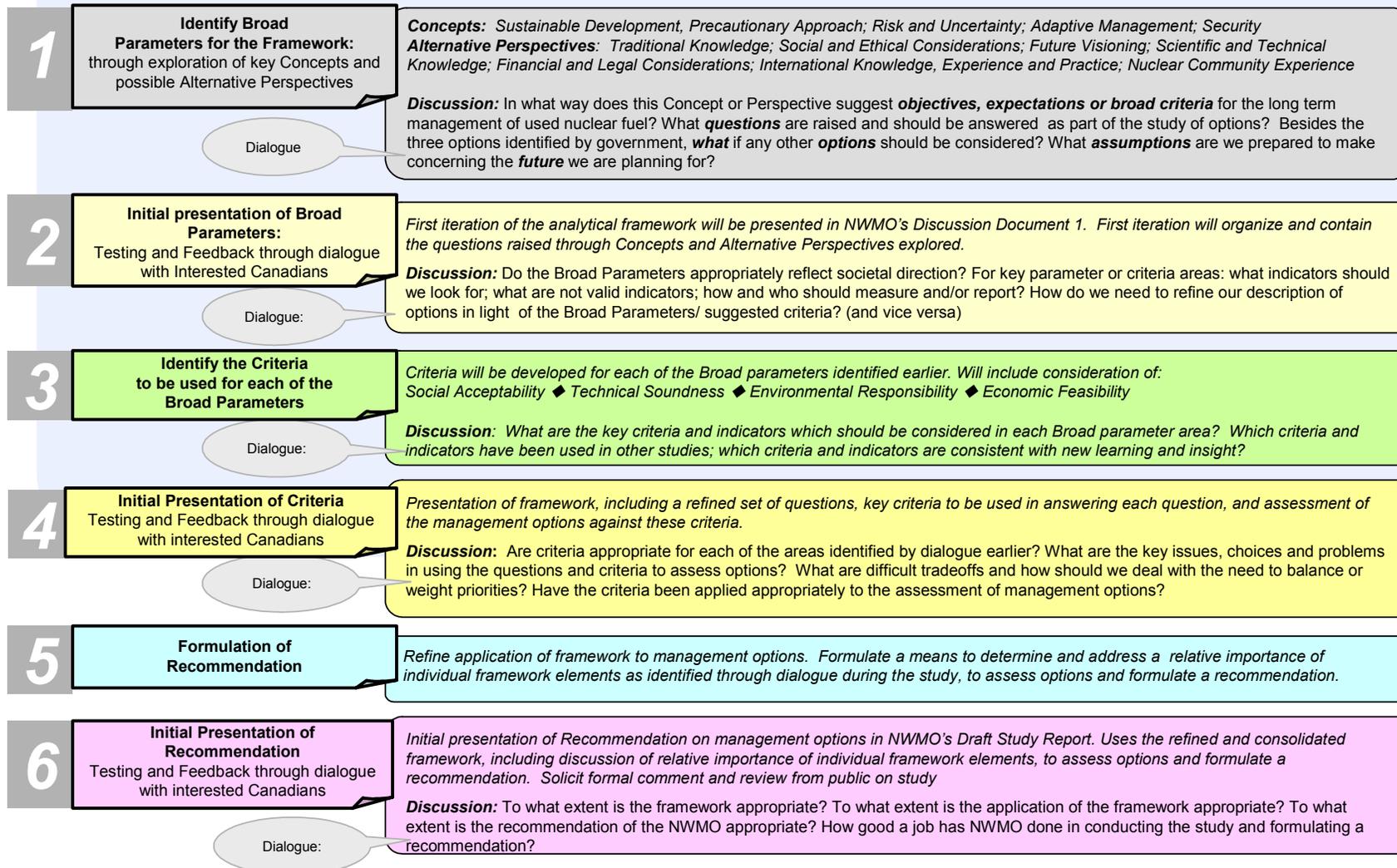
- Determination of broad parameters (key questions) for the framework, as presented in NWMO's First Discussion Document
- Determination of key criteria (how the key questions will be addressed) to be used to explore each broad parameter, as presented in NWMO's Second Discussion Document
- Formulation of a recommendation, including discussion of relative importance assigned to different criteria and acceptable trade-offs, as presented in the Draft Study Report

Feedback is to be solicited from Canadians concerning ongoing responsiveness to societal requirements; and from experts in a variety of civil society knowledge areas concerning the integrity and appropriateness of the process and the extent to which best available knowledge and insight has been incorporated.

Analytical Framework – Summary of Overall Approach

Seaborn Direction:
Analytical framework elements should reflect broad societal direction

Acceptability: Including broad public support and support of Aboriginal people
Safety: Technical and social
Societal values: Options measured against predominant values of Canadian society
Social issues and priorities: Address social and environmental issues/priorities
Societal context: Includes societal priorities, values, value systems differing cultural/ ethical approaches



4. Initial Work Plan – Leading Up to NWMO’s First Discussion Document

This section describes an initial plan of work for the identification of broad parameters of the analytical framework to be presented in NWMO’s First Discussion Document. As discussed earlier, this first iteration of the analytical framework is to focus on an initial identification of the broad elements of the framework, and key questions which will need to be addressed in the comparison and contrasting of long term management options for used fuel.

In the period leading up to the First Discussion Document, the focus is on exploration of elements of the framework among experts in a wide variety of knowledge areas and other interested Canadians. More extensive review and comment will be solicited from Canadians with the release of the First Discussion Document. In the course of this initial development work, a number of reports will be produced. This material will be posted on the website as part of NWMO’s efforts to “think out loud”.

Key Concepts And Alternative Perspectives

An exploration of key concepts and alternative perspectives will contextualize or serve as an “umbrella” for the focused work on the broad elements of the framework. A series of Concept Papers, in conjunction with Scenario Workshops focused on visualizing possible and alternative futures against which the study should plan, are the key substantive elements in this work. The application of these concepts and perspectives will be carried through the focused work on the broad elements.

<i>Exploration of Key Concepts and Alternative Perspectives</i>
<i>Learning from Expert Knowledge - wide variety of perspectives</i>
<ol style="list-style-type: none"> 1. Concept Papers – Exploration of key concepts and how they apply by international experts <ul style="list-style-type: none"> • Adaptive Management • Security • Precautionary Approach • Risk and Uncertainty • Sustainable Development • Others? 2. Scenario Workshops – Multidisciplinary group to develop possible future scenarios, which the assessment of management options could address; explore possible needs and requirements of future generations specifically
<i>Learning from Citizens</i>
<ol style="list-style-type: none"> 3. Comment regarding issues and key questions raised in Concept Papers <ul style="list-style-type: none"> • Deliberative Survey on website • E-Dialogue and/or submissions
<i>Supporting Activities</i>
<ol style="list-style-type: none"> 4. Based on the Concept Papers and citizen engagement, the key concepts and questions will be summarized and described for the purpose of the First Discussion Document

Focused Work To Develop Broad Elements

1. Social Acceptability

Social Issues
Learning from the Past
1. Review social issues raised in Seaborn Panel hearings
Learning from Experts in Social Issues knowledge area
2. Background Paper suggesting state of current knowledge and understanding; suggestion of key questions
3. Workshop to review, modify, add to list of questions suggested in paper
4. Aboriginal Traditional Knowledge workshop
Learning from Citizens
5. Comment regarding issues and questions raised in paper and workshop
<ul style="list-style-type: none"> • Deliberative survey on website • Formal comment and submissions on website
Learning from Nuclear Experienced Communities
6. Specific insight of communities with nuclear experience through community dialogue activities

Ethical Considerations
Guidance from NWMO Advisory Council
1. Initial guidance from Advisory Council; ongoing periodic consideration
Learning from past work
2. Review of insight from Seaborn Panel hearings and report
3. Presentation to Advisory Council by selected Seaborn Panel members
Learning from Experts in Ethics
4. Background Paper suggesting state of current knowledge and understanding; suggestion of key questions
5. Convene an Ethical Expert Roundtable
6. Comment and review paper by Ethical Expert Roundtable
7. Post minutes of meeting, and direction, of Ethical Expert Roundtable on website
8. Aboriginal Traditional Knowledge workshop
Learning from Citizens
9. Comment regarding issues and key questions raised in paper
<ul style="list-style-type: none"> • Deliberative survey on website • Formal comment and submissions on website
Learning from Nuclear Experienced Communities
10. Specific insight of communities with nuclear experience through community dialogue activities
Learning from International Experience and Work
11. Identify and review documents and studies of potential interest

2. Technically Sound

Technically Sound
Learning from the Past
1. Review technical issues raised in Seaborn Panel hearings
Learning from Experts in Technical knowledge areas
2. Commission series of Background Papers suggesting state of current knowledge and understanding; suggestion of key questions
3. Review of Background Papers and suggestion of questions to be considered for the framework
4. Workshop to review, modify, add to list of questions suggested
5. Review available nuclear industry work
Learning from Citizens
6. Comment regarding issues and key questions raised in workshop through comment and submissions on website
Learning from International Experience and Work
7. Review Background Papers and Concept Papers

3. Environmentally Responsible

Environmentally Responsible
Learning from the Past
1. Review environmental issues raised in Seaborn Panel hearings
2. Review environmental issues raised in nuclear waste related environmental assessments
Learning from Experts in Environmental knowledge areas
3. Review Background Papers and Concept Papers and suggestion of questions to be considered for the framework
4. Workshop to review, modify, add to list of questions suggested
5. Aboriginal Traditional Knowledge workshop
Learning from Citizens
6. Comment regarding issues and key questions raised through workshop <ul style="list-style-type: none"> • Deliberative survey on website • Formal comment and submissions on website
Learning from International Experience and Work
7. Review Background Papers and Concept Papers

4. Economically Feasible

Economically Feasible
Learning from the Past
1. Review economic issues raised in Seaborn Hearings
2. Review economic issues raised in nuclear waste related environmental assessments
Learning from Experts in Economic knowledge areas
3. Review Background Papers and Concept Papers and suggestion of questions to be considered in the framework
4. Roundtable or panel discussion
Learning from Citizens
5. Comment regarding key questions raised, through submissions to website
Learning from International Experience and Work
6. Review Background Papers and Concept Papers

5. International Panel

An International Panel composed of 8 - 10 technical experts in a wide variety of knowledge areas will review the analytical framework at various stages in its development to ensure the framework robustly addresses technical, scientific and social acceptability assessment criteria and that insight from evolving international research is incorporated into the assessment of the management options.

APPENDIX A: Analytical Framework Criteria Identified in Seaborn Panel Report – Safety and Acceptability Criteria --

i. Acceptability Criteria

The Panel set out a list of criteria which it believed need to be addressed in order that a concept for managing nuclear fuel wastes be considered acceptable. Included in the list is for the concept to have been developed within a sound *ethical and social assessment framework* (item c). Safety (item b) is discussed separately and in more detail including identification of a list of Safety Criteria, each of which are understood to have both social and technical aspects.

According to the Panel, an *acceptable* concept must:

- a) have broad public support;
- b) be safe from both a technical and a social perspective;
- c) have been developed within a sound ethical and social assessment framework;
- d) have the support of Aboriginal people;
- e) be selected after comparison with the risks, costs and benefits of other options; and
- f) be advanced by a stable and trustworthy proponent and overseen by a trustworthy regulator⁴.

ii. Safety Criteria

The Panel identified seven criteria for evaluating safety from both a technical and a social perspective. The Panel suggested the two perspectives (social and technical) are not evident in the criteria themselves, but in their application.

To be considered safe, a concept for managing nuclear fuel wastes must be judged, on balance, to

- a) demonstrate robustness in meeting appropriate regulatory requirements;
- b) be based on thorough and participatory scenario analyses;
- c) use realistic data, modelling and natural analogues;
- d) incorporate sound science and good practices;
- e) demonstrate flexibility;
- f) demonstrate that implementation is feasible; and
- g) integrate peer review and international expertise⁵.

iii. Societal Values

In order to assess broad public acceptability, the Panel considered it important that the management options be measured against the predominant *values* held by Canadian society. The Panel identified these values as the following:

- the rights and responsibilities of current and future generations;
- responsibilities to the environment and ecological integrity;
- societal versus individual rights;
- the needs of significant minorities who may incur risks involuntarily;
- the degree to which the public should be able to hear different schools of thought in discussions preceding decisions;
- risks that are worth taking, given the probability of harm;
- procedures for arriving at collective consent; and
- retrievability versus irretrievability of the wastes, and which option is morally preferable⁶.

⁴ *Report of the Nuclear Fuel Waste Management and Disposal Concept Environmental Assessment Panel (Seaborn Report)*, Pages 34 - 35

⁵ *Seaborn Report*, Page 37

⁶ *Seaborn Report*, Page 72 - 73

iv. Societal Issues and Priorities

The Panel considered it important that the framework also address *social and environmental issues and priorities*, which would entail:

- socially oriented siting criteria, such as valued cultural and ecosystems components;
- the consistency of the options with Canadian policies on hazardous waste management, environmental protection and sustainable development;
- effects on communities' self-image, economic vitality, social development and cohesion, and relationship with the land;
- trade-offs in terms of potential siting territories, affected natural resources, economic advantages and disadvantages, and social controversies;
- the degree to which a demonstration project should be part of a waste management approach;
- liabilities in case of accidents; and
- cost effectiveness⁷.

v. Societal Context

The Panel advised that “[a]ssessment of the safety and environmental implications of any major proposal is likely to involve related social and ethical questions. ... Technical, social and ethical aspects of nuclear fuel waste management are inextricably related and must be viewed within the full context of contemporary societal thinking⁸

Included in this context are *ethical questions* such as the following:

- collective versus individual rights and obligations;
- intergenerational and intragenerational equity and responsibilities;
- acceptability of regulatory standards;
- conflicts between human and environmental values;
- appropriate consultation of Aboriginal people;
- the actual urgency of actions required; and
- the lack of information about, and a forum for discussion of, alternative approaches to managing nuclear fuel wastes, let alone energy options⁹.

Among the important *societal priorities* named by the Panel were the following:

- the appropriate allocation of scarce human, financial and physical resources to nuclear fuel wastes in relation to the other problems besetting society¹⁰.

Among the *changing societal values* mentioned by the Panel were:

- the importance of the obligations of current generations not only to themselves but also to future generations and to the well-being of planet Earth itself;
- the need to reduce consumption and waste generation;
- the importance of reusing and recycling resources;
- a trend away from disposal as a waste management approach¹¹.

Differing value systems based in differing cultural or ethical approaches is suggested to include:

- emphasis on economic growth to improve the lot of humankind versus the need for sustainable growth;
- value the natural environment primarily for its usefulness to humans versus a less anthropocentric view;

⁷ *Seaborn Report*, Page 73

⁸ *Seaborn Report*, Page 17 – 18.

⁹ *Seaborn Report*, Page 17

¹⁰ *Seaborn Report*, Page 17

¹¹ *Seaborn Report*, Page 17

- faith in rationality, science and technology to solve difficult technical problems versus a lack of such faith¹².

vi. **Other Inclusions**

The Panel also suggested that a *sound ethical and social assessment framework* would include:

- justification of the need for and timing of action;
- equitable distribution of costs, risks and benefits among groups, areas and generations;
- a net benefit for society at large and for those directly affected, commensurate with protection of the environment;
- acceptable costs, commensurate with risks and benefits;
- consideration of issues of public concern directly related to the nuclear fuel cycle, such as the future of nuclear power and the importation of nuclear fuel wastes;
- input from social and applied scientists; and
- a voluntary siting approach in which a potential host community gives its consent freely and without undue economic pressure.¹³

¹² *Seaborn Report*, Page 17

¹³ *Seaborn Report*, Pages 35-36