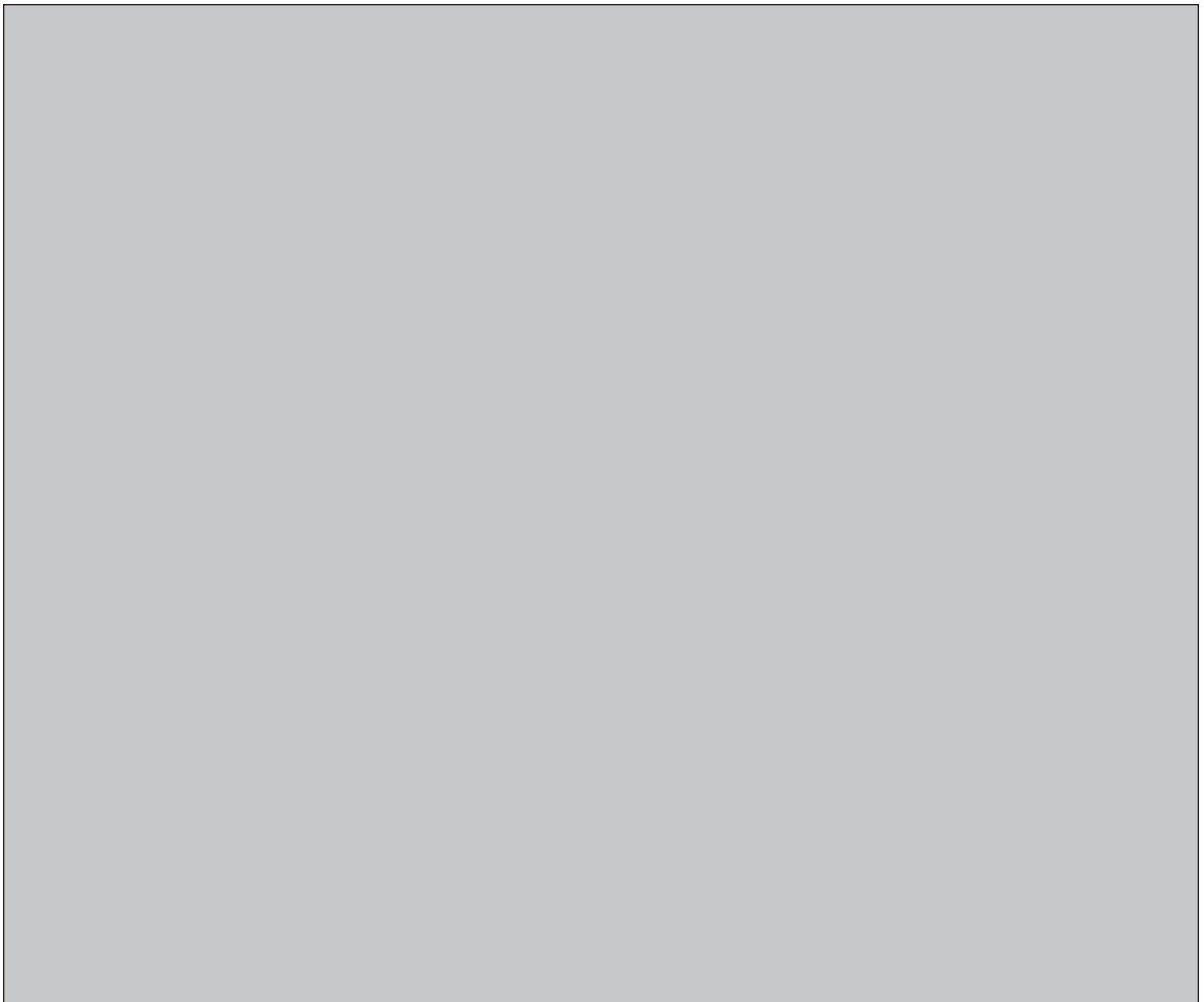


NWMO BACKGROUND PAPERS
7. INSTITUTIONS & GOVERNANCE

**7-11 METHODOLOGIES FOR ASSESSING SPENT NUCLEAR FUEL
MANAGEMENT OPTIONS**

EXECUTIVE SUMMARY

ETV Canada Inc., OCETA, Risk Wise Inc., Science Concepts International



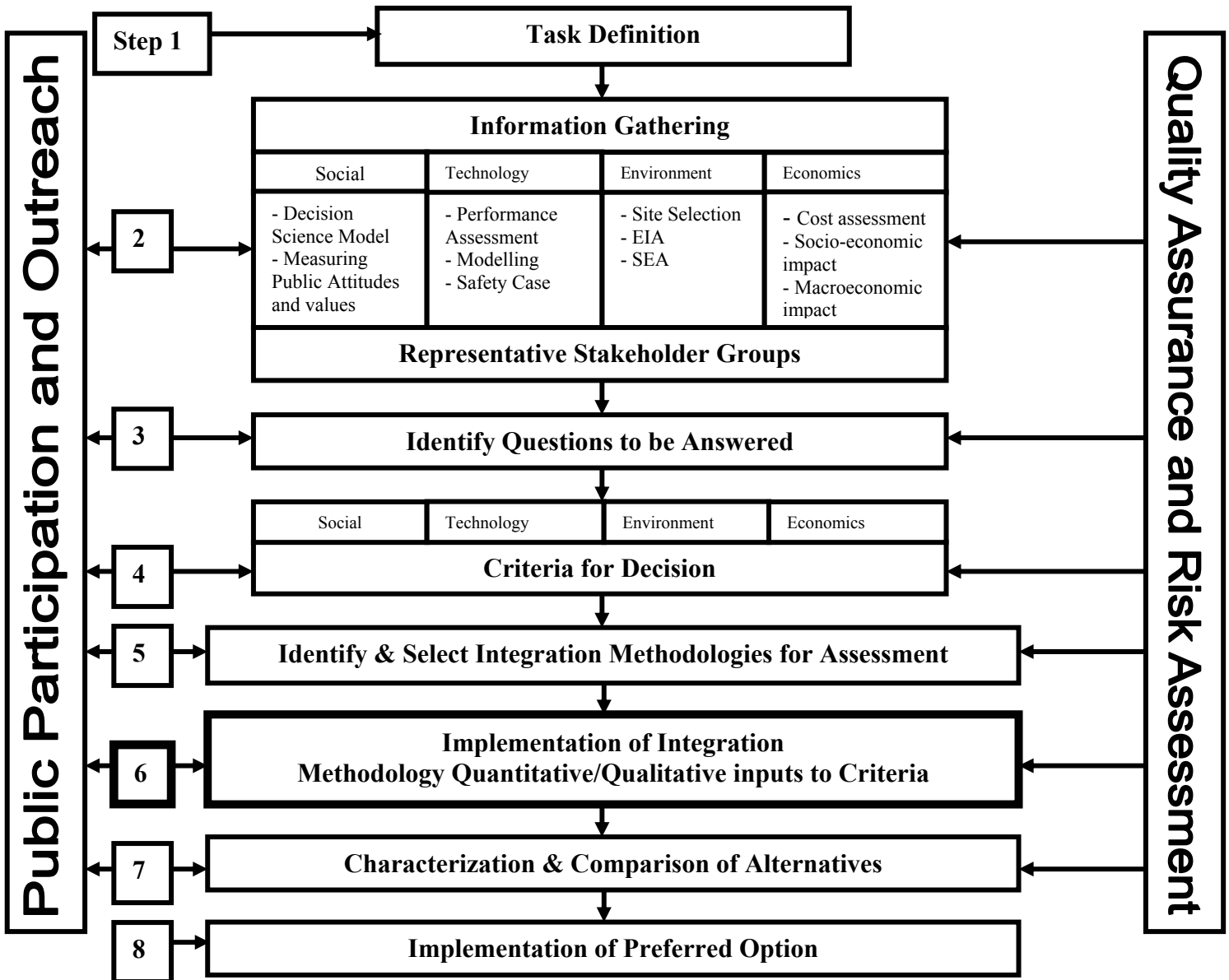
EXECUTIVE SUMMARY

The mandate of NWMO is to conduct a comprehensive study of approaches for the long-term management of used nuclear fuel, to recommend a preferred approach to the Government of Canada and to implement the approach approved by the government on the recommendation of the Minister of Natural Resources.

The primary objective of this report is to compile a comprehensive inventory of available methodologies and tools which may be applicable to the assessment of options for the long-term management of used nuclear fuel, and to present them within an overall assessment framework. The assessment framework utilized is a generic model, developed through a review of methodologies being utilized in Canada and internationally, to address policy decisions involving social, ethical, technical, economic and environmental issues. The report is intended to provide input to the NWMO assessment process in developing recommendations for preferred approaches for waste management based on three technical methods – deep geological disposal, storage at nuclear reactor sites, centralized storage either above or below ground, or possible additional methods which could combine two or more of the above three methods, and/or another technical method. It is beyond the scope of this report to recommend which assessment methodologies should be selected by the NWMO.

A number of overarching considerations are presented as a prelude to the main discussion, reflecting the NWMO approach to public consultation, as well as recognition of the experiences in other countries in attempting to obtain social and ethical “buy-in”. The following overarching considerations are considered to be fundamental – (1) credibility, (2) transparency, (3) compliance with legislation, (4) sustainability, (5) security, (6) ethics implementation, (7) perspectives of aboriginal communities, (8) learning-by-doing, and (9) institutions and governance mechanisms applicable to present and future generations.

In approaching the task of creating an inventory of methodologies, the research team identified some generic or universal analytical approaches which have been developed and utilized that could serve as an assessment framework for the inventory. As shown in the figure below, the Assessment Framework can help create an understanding of where and how generic and individual decision support tools fit into an overall analytical approach. The assessment process for addressing complex problems such as waste management for nuclear fuel must integrate many threads of information and earlier stages of decision making, and then must be capable of comparing various alternatives, with weighted and hierarchical criteria.



This generic assessment framework is consistent with the broad decision analysis approach of NWMO, as outlined in its first discussion document, *“Asking the Right Questions...”*. The assessment framework also reflects the commitment of NWMO to involve the public and key stakeholders throughout the decision making process.

A substantial body of technical work has already been completed to build a credible safety case for any one of the primary waste management methods under consideration. However, there will be considerable new work that is necessary to augment the safety case for the selected option. NWMO wishes to review augmentation of existing management strategies, such as the safety case, and to go beyond the Seaborn¹ environmental assessment panel, that addressed many of the technical and environmental issues. In this inventory of methodologies, the only included methodologies are those that have relevance to the NWMO’s mandate.

Some Canadians may still view these waste management options with concern. For them, risk tolerance at the level of *“what does it mean to me?”* is a key issue, particularly in relation to their expectations about health, safety, and environmental protection. Thus, a precautionary approach is needed, incorporating risk assessment throughout, and characterized by the following questions:

- What can happen (i.e., what can go wrong or right)?
- How likely is it?
- What are the consequences (including costs, and potential losses and rewards)?

Risk assessment methodologies attempt to respond to these questions by developing and applying:

- Scenarios outlining potential hazards and benefits
- Sets of consequences for the scenarios (providing a full accounting of potential benefits, losses and costs)
- Probability distributions
- Timeframes over which the risk will be considered, in order to establish the scope of the risk
- A perspective of reality.

In further describing the key underpinnings of integrated assessment, the report presents decision support and assessment methodologies relevant to the following areas:

- Social, including methodologies for measuring public attitudes and values (e.g. surveys, polling, public consultation, etc.)
- Technical, including methodologies that can be used to make quantified estimates, or "predictions", and to quantify the uncertainties in these predictions (e.g. safety analysis methods, root cause analysis and geological repository modelling).
- Environment, including Environment Impact Assessment (EIA) and Strategic Environmental Assessment (SEA), as well as biosphere and geosphere modelling.
- Economic, including economic assessment methods based primarily on cost valuation of options (e.g., Cost Effectiveness Analysis, Cost Benefit Analysis, and Multi-Criteria Analysis).

Integration of all inputs must be the culmination of the information gathering and criteria identification phase of the assessment process. Therefore, the choice and implementation of the integration methodology is the most critical part of the process (steps 5 and 6 of the Assessment Framework).

Questions concerning sustainable management of nuclear waste are characterized by conflicting and/or overlapping economic, environmental, social, technical, and ethical objectives. It is difficult to arrive at a straightforward and unambiguous solution without the assistance of one or more decision support tools that provide for the integration and structuring of complex information. Multi-criteria decision tools have been found to be useful to support decision making under such conditions. Criteria can be assessed on both quantitative and qualitative scales. An example of such an approach is Multi Criteria Decision Analysis (MCDA), which serves as an aid to the analysis and decision-making process of an expert assessment group. Software support is available and its use can be considered where the specifics of the analysis may be enhanced. A further aid to analysis is to apply weighting criteria in different ways to emphasize several different perspectives (e.g. an economic emphasis, or an environmental emphasis).

The topic of independent validation is introduced in the final section of the report. In developing a management approach, NWMO is involving many experts, and many segments of Canadian society. As the NWMO process evolves, biases are likely to emerge, and incomplete examination of some key points could occur. Furthermore, given that there are many different specialized knowledge areas which combine within the assessment framework, the possibility exists that, as a result of the integration, some important factors may not have been considered or adequately addressed in the assessment. Thus, there may be a role for independent, third party, validation of all or part of the assessment process, particularly for those steps of the assessment process where it is important to demonstrate credibility.

In preparing this report, the research team also examined some of the assessment methodologies being utilized in other countries addressing the issue of long-term nuclear waste management. The intent of this was to identify some of the experiences of other jurisdictions. Although this survey is not comprehensive, it is apparent that the NWMO approach to involving Canadians in the decision process is the most thorough and comprehensive approach to date.