

What other nations are doing to manage their nuclear wastes

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A Talk in Three Parts

- A brief and selective review of national nuclear waste and repository programs
- The Canadian repository program - a process in progress
- Some concluding thoughts



The Repository World

- Disposal in a geologic repository remains the preferred ultimate solution, with or without reprocessing
- Much of the technical community has confidence in determining site suitability
- A number of geologic media are being pursued
- Most programs have experienced substantial difficulties
- Siting remains the biggest hurdle
- Increasing recognition of multi-disciplinary nature
- Select ideas have become prominent, e.g. volunteer/veto, retrievability, monitoring, phased management
- We will have storage for decades
- Hope springs eternal...



Some Highlights and Lowlights

- National programs have been abandoned or siting stopped
 - France, U.K., Canada, Germany, Spain, Switzerland, U.S.A. (e.g. Lyons, 1st repository, 2nd repository)...
- National (re)reviews have been undertaken
 - Canada, France, U.K.,...
- Schedules have been delayed
 - Almost everywhere
- Some countries have moved forward and others have restarted
 - Finland, Sweden, U.S.A., France, Canada, Japan, U.K....



An (Optimistic) Current Snapshot

- Countries with candidate sites
 - Finland, Sweden, U.S.A.
- Countries with programs underway
 - Canada, France, Belgium, Japan, U.K., Switzerland,...
- Countries “thinking about it”
 - Spain, South Korea, China, India,...
- Countries starting out
 - Argentina, Slovakia, Slovenia, South Africa,...



A Few Current Issues

- The linkages between disposal and new nuclear build
- The impacts of direct disposal v. reprocessing
- Attention and controversy regarding multinational or international repository programs
- The growing awareness of the relationship among nuclear waste management, national security, and the spread of nuclear power



Some of the Key Issues that Distinguish National Approaches

- The extent to which countries that have disposal laws and programs
 - Those with definitive schedules and processes
 - Those with indefinite programs or programs “on hold”
 - Those with storage only at present
- Role of government, waste generators in program management
- Countries that have both civilian and defense wastes
- Countries that will or might reprocess v. direct disposal
- Self-contained programs v. regional/international aspirations
- Countries that hope to send back/away wastes
- Countries that may consider take back/away of others wastes
- Public v. private generation and/or waste management



The Canadian Program - an example



The Seaborn Panel Conclusions (1998)

- “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.”

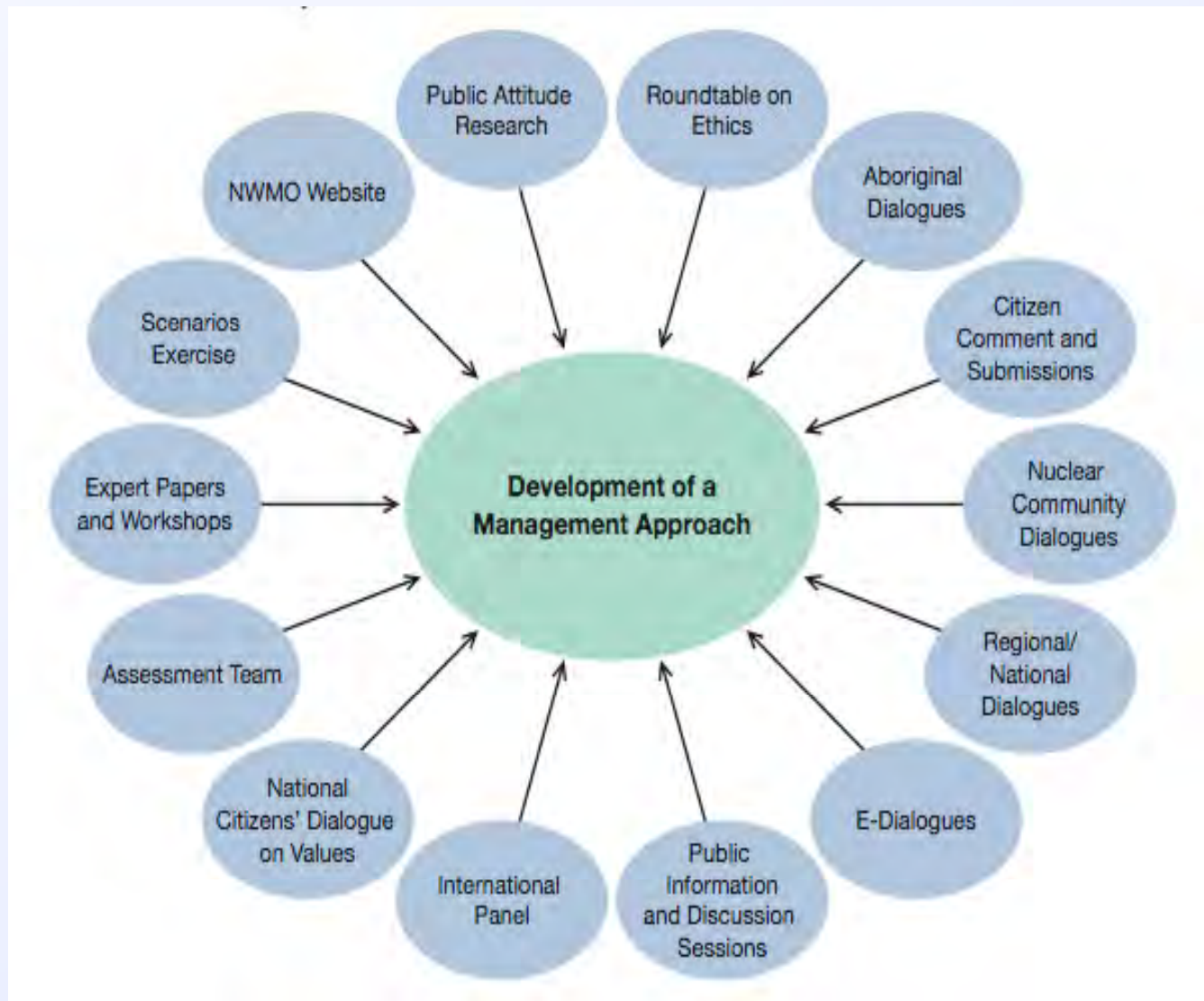


The Nuclear Fuel Waste Act (NFWA)

- Nuclear Fuel Waste Act (NFWA) came into force November 15, 2002 establishing the NWMO to study:
 - Deep geological disposal in the Canadian Shield (AECL Concept)
 - Storage at nuclear reactor sites
 - Centralized storage, either above or below ground
- NWMO required to study proposed approaches for the long-term management of used nuclear fuel.
 - Detailed technical descriptions
 - Comparison of benefits, risks & costs
 - Ethical, social, economic and aboriginal considerations
 - Implementation plan
- NWMO to conclude study within 3 years (by Nov. 15, 2005)
- Waste owners to finance long-term management of used nuclear fuel through segregated trust funds.



NWMO Techniques for Broad Engagement

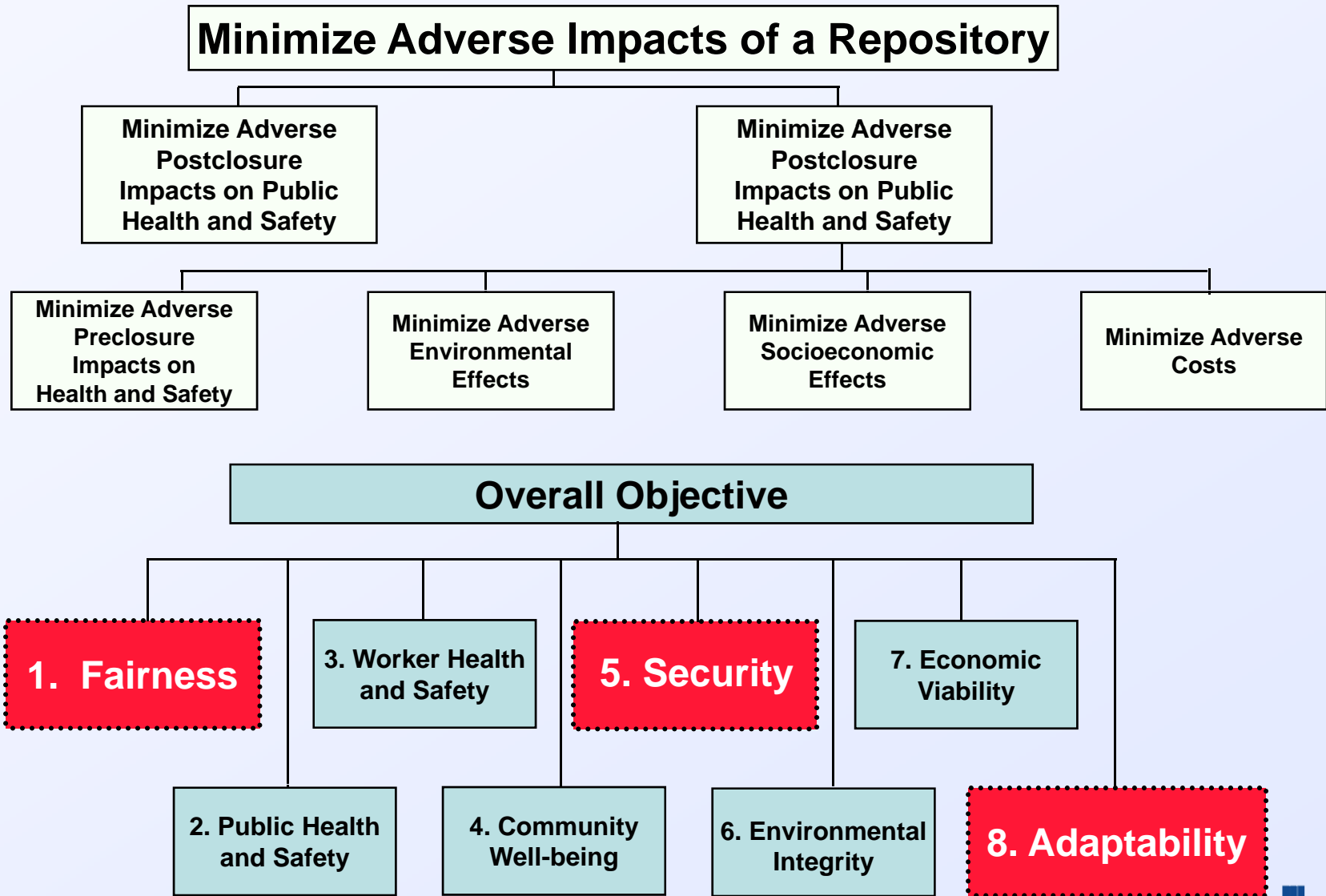


“Choosing a Way Forward”: The Foundation

- “...this generation of citizens which has enjoyed the benefits of nuclear energy has an obligation to begin provision for managing that waste.”
- “...our obligation is to give them (succeeding generations) a real choice and the opportunity to shape their own decisions while at the same time not imposing a burden which future generations may not be able to manage.”



A Comparison of Objectives 20 years apart: The U.S. and Canadian Objectives Hierarchy



“Choosing a Way Forward”: Some Key Recommendations

- Sequential decision-making and flexibility in the pace and manner of implementation through “Adaptive Phased Management”
- Ultimate centralized isolation in a deep geologic repository
- Option for interim step of shallow underground storage at the central site
- Program of continuous learning and R&D
- Long-term monitoring with potential for retrievability
- Seek an informed, willing community as host



The Current Status of the Canadian Program

- The Government accepted the NWMO recommendations
- NWMO is in a 2-year phase to develop a siting process
- Engagement with stakeholders to begin later this year
- NWMO is moving from a recommending to implementing organization
- The NWMO Board has been broadened, but questions about balance remain
- Technical and social research programs expanded
- Canada is considering a “New Build” that some believe is tied to the repository
- Siting will still be the key step



What makes nuclear waste management special?

- The technical challenge
 - Performance over geological time
 - “Proof” not possible
 - Central role of “ologists”

 - The institutional challenge
 - The extraordinary time frame
 - Siting
 - Linkage to other agendas
 - Values and ethics in conflict
 - Political implications
 - Nuclear stigma and fears
- » But there are unique advantages...



Virtues of a Repository

- Passive
- Occurrences will be slow
- No inherent energy to release materials
- Retrievable
- Only a repository upon closure, when future generations are comfortable



NAS “Rethinking” Report (1990)

- Approach too inflexible and prescriptive
 - Relies too heavily on predictions from mathematical models
 - Rigid schedule
 - Defines “perfect” system in advance
 - Must “get it right the first time”
 - Safety is in part a social judgment
- Recommends flexible, incremental approach
 - Define goal broadly
 - Learn as you go/improve as you learn
 - Combine “a conservative engineering approach and designed-in maximum flexibility



NAS “Rethinking” Report (1990)

- Moral and ethical issues
 - Very long times for performance
 - Concentration of waste
 - Central role of a fair process
 - Problem of promising more certainty than can be delivered
 - Not acting has consequences as well



Some Key Enduring Features

- Program need convincingly established
- Core, stable goal
- Roles and responsibilities clear
- Clear, open, and transparent decision making process
- Respect for fairness and societal consent apparent
- Sequential decision-making and contingency planning
- Possibility of altering or reversing course
- Appropriate compensation



Some Potential Lessons Learned

- Take the necessary time - go slow in order to go fast
- Assign importance to the societal considerations as well as the technical ones
- Having senior officials involved makes a difference
- There are many ways to effectively engage the public and key stakeholders
- Listening, respecting, and then responding can build trust and even advocacy, particularly with local community
- Plan carefully and involve the right experts
- Be prepared to respond in real time to unexpected events
- Promise, then deliver, then do it again and again



Some Emerging Issues

- The tie among nuclear power, waste management and non-proliferation/security
- Spent Fuel Take-Back
- Regional/Multi-National Facilities for spent fuel storage and disposal

Waste management is part of the fabric of the nuclear regime.
It should be an instrument of security and well being, not a dump



Some Elements of a Vision

- Countries have access to nuclear power at market prices
- Nuclear fuel supplies are assured at competitive prices
- Rationale for enrichment/reprocessing eliminated for all but selected few under international control/oversight
- All excess weapons-usable material is secured, put in unattractive form, brought under international control in appropriate countries, and reduced as close to zero as practical
- SNF is returned to appropriate countries for management and disposal
- Any moves toward weapon development or nuclear material acquisition are surely, quickly, and clearly apparent

