

Strategic Action in Nuclear Waste Disposal: Canada's Adaptive Phased Management Approach

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Abstract

It has been noted that Sweden's SKB has shifted emphasis in its waste management approach, from an emphasis upon geological barriers to engineering barriers. This shift has been called strategic adaptation, though, with the appearance of responsiveness to external demands actually allowing the piloting of previously preferred options. This paper argues that a similar case of strategic adaptation has taken place in Canada, with the NWMO using dialogue with the public and an emphasis upon adaptability in order to pilot through decade-old technical preferences. Is dialogue a cure-all for participatory democracy advocates, and what implications does strategic adaptation have for discussions of the risk society?

Nuclear waste disposal programs are now routinely confronting the question of whether to limit the notion of 'risk' to a quantitative discourse about biological and physical effects or allow the discussion to broaden to considerations of social perceptions of acceptability. While the effects of a limited discourse are well studied, this paper explores the other side of the coin, analyzing institutionalized discourse about radwaste management that has broadened to include social perceptions of acceptability. The case in question is Canada's Nuclear Waste Management Organization (NWMO). Despite its inclusive rhetoric, this paper suggests the NWMO's participatory discourse is in fact strategic adaptation: the construction of 'socially acceptable risk' co-opts social acceptance in the preservation of previously preferred technical and policy options.

This alternative reading is consistent with trends in other nations, while posing difficult questions for risk society theorists. In both the Finnish and Swedish cases, Lidskog and Litmanen showed that relatively stable social definitions of the risk situation have been packaged differently as local circumstances demand. Strategic arguments have been used to defend and/or justify more basic social definitions (Lidskog and Litmanen, 1997, 75). In a later study of the Swedish Nuclear Fuel and Waste Management Company (SKB; Svensk Kärnbränslehantering AB), Lidskog and Sundqvist (2004) argued that SKB has strategically adapted to external stakeholder demands. On their analysis, the technical core of the 'KBS method' has been kept immune from negotiations via a de-emphasis of the geological barrier as a criterion and the use of public communication as an instrument to aid implementation. The NWMO strategy has involved similar strategic adaptation. After a public hearings in 1996-97 resulted in negative findings, the disposal concept presented at the hearings was judged to have numerous technical deficiencies while also lacking social acceptance (CEAA, 1998), the NWMO was established in 2002 to develop a socially acceptable waste management approach. The NWMO has attempted to do this by using dialogue, plus incorporating demands for adaptability, yet their efforts can also be represented as piloting previously decided technical and policy decisions.

Lidskog and Sundqvist refrained from making general conclusions about the pros and cons of the SKB strategy (Lidskog and Sundqvist, 2004, 263), yet consideration of the NWMO strategy may provide a comparative case with which to push toward more general conclusions. As such, I situate those general conclusions within discussions of the risk society. This paper suggests a precautionary tale, as the appearance and performance of self-reflexivity can be a means to an end, rather than, as suggested by

Beck's risk society thesis, the goal itself. The motivation for this paper is thus to explore Lidskog and Sundqvist's suggestion that "what is needed . . . is a strategy characterized by dialogue, discussion and deliberation, where social learning . . . is put at the centre" (2004, 266). The NWMO advertises itself as doing just that, and here I provide a sociopolitical background for this advertised strategy. The thesis of the paper is that the strategy of the NWMO is to use public dialogue as a means to implement technical objectives. Public dialogue is not the goal of strategic adaptation, but the means to strategically adapt. A corollary is that Beck's notion of reflexive modernity ought to be viewed as a flexible resource, not a 'state' that an institution achieves.

2. The Co-Production of the Nuclear Waste Problem

Atomic Energy Canada Limited (AECL) is the research and development arm of the Canadian nuclear industry. As part of an Environmental Impact Statement (EIS) preceding a full public review in 1996-97, AECL put forward a disposal concept in 1994 (AECL, 1994). The repository concept involved: a vault about 500-1000 metres deep in the Canadian Shield; containers made of titanium and copper and capable of acting as a bucket of water entered the container; sealing the containers, and the vault itself, in clay and cement materials; the use of both geological and engineered barriers; no monitoring and retrieval provisions. If it seems as this description isolates an unambiguous technical core, the impression is correct, and serves to remind us that the technical and the political are co-produced as technical experts and political actors negotiate just what *are* 'the technical' and 'the socio-political' issues (Jasanoff, 2004), the domains of science and politics mutually shape each other. Two examples here will suffice to make the point: pace of development and volume of waste, the former appearing a political matter of policy choice and the latter a technical matter of quantification.

Prior to public hearings to review AECL's disposal concept, AECL argued that it was already in possession of all the knowledge and technical experience it needed to dispose of nuclear waste, hence the slow pace of development in Canada was dangerous and socially irresponsible (AECL, 1995). In contrast, anti-nuclear Non-Government Organizations (NGOs) at Canada's public hearings on nuclear waste management (1996-97) claimed on day one of testimony that the pace of development was too quick (cf. Rubin, 1996, 34). The volume of waste has also been controversial, showing how difficult it can be to unambiguously assign the label scientific or political in the face of conflicting evaluations. AECL presented four production scenarios in its EIS of 1994 (AECL, 1994, 114 & 263). As noted in the official report of the Panel that oversaw the public hearings, if approving a 'concept' for disposing of waste was used as justification for expanding the nuclear industry (and thus increasing the volume of waste), this would constitute a default political decision that should in fact be the subject of a separate inquiry into the future of nuclear power (CEAA, 1998). Subsequent work by the NWMO as seen the 'base case' of the EIS (slow growth) modified, in one publication the projected volume was limited by the current life of existing facilities (NWMO, 2004, 39). Whatever the volume will in fact be, it will be a product that is simultaneously political and technical. When political choices shape technical evaluations, and technical evaluations code for political choices, any boundary between the technical and political becomes a site of strategic action.

3. Canada: From 'Bison Mentality' to Adaptive Phased Management (APM)

Analysts of Canadian nuclear development agree that Canada's nuclear industry was set up in terms of centralized control, with a tight group of technical and policy elites almost granting institutional blessing to nuclear endeavours up until the 1980's. The Boards of Canadian regulatory (AECB) and development (AECL) agencies were inter-locking until 1952, staff flowed between the organizations regularly until the late 1980's, and there was little to no public involvement in nuclear decision-making until 1990 at least. This story is well told so I will pass over its details here.

Table 1 Time-line of Canada's nuclear power and nuclear waste policy development

1946-1971	Birth, growth & stabilization of commercial nuclear power
1968-92	Commercial construction & operation of power reactors (Pickering A (1971-73; 4 reactors), Bruce A (1977-79; 4 reactors), Point Lepreau (1980), Gentilly 2 (1983), Pickering B (1983-86; 4 reactors), Bruce B (1985-87; 4 reactors), Darlington (1990-92; 4 reactors). Total = 22 reactors (2 million used fuel bundles as of 2005).
1977-87	Internal (government & nuclear industry) policy-making

1984-89	Internal federal/provincial government & AECL/Ontario Hydro negotiations concerning the terms of reference of a future public inquiry
4 Oct. 1989	Seaborn Panel established to over-see the environmental assessment process
4 Oct. 1989	Final terms of reference released, establishing the definition of the public inquiry and its boundaries (its 'mandate')
1990	Scoping sessions (outline the details of which critical parameters & potential project impacts should be assessed; discuss scope of the mandate)
13 June 1991 – 16 Sept. 1991	Draft guidelines for AECL Environmental Impact Statement (EIS) released for public review ('adequacy & completeness' criterions)
18 March 1992	Final guidelines issued to AECL and made public
1994	AECL releases its EIS: pre and post-closure assessment studies, plus 9 supporting documents; discusses a 'concept' alone (deep geological repository), not any site; there is no official implementing agency identified.
1995	65 written submissions regarding the adequacy & completeness of the EIS
1996-97	Public hearings held in 3 phases
March-May 1996	Phase 1 (social issues of long-term management of nuclear fuel waste)
June & Nov. 1996	Phase 2 (discussed scientific and engineering issues)
July 1996	Natural Resources Canada, <i>Policy Framework for Radioactive Waste</i>
Jan-March 1997	Phase 3 (discuss final opinions; review the issues)
Feb. 1998	Panel releases its report, with two primary findings. 1) From a technical perspective, the 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. 2) "As it stands, the AECL concept for deep geological waste disposal has not been demonstrated to have broad public support."
Dec. 1998	Government of Canada response to the Panel findings.
Nov. 2002	Nuclear Fuel Waste Act (NFWA), or Bill C-27, passes in federal legislature (establishing the Nuclear Waste Management Organization (NWMO). Bill-C-27 differed from the Panel recommendations in four key areas. 1) Panel's references to "social safety" (it had not been shown) was translated into "the public is misinformed and needs to be educated" 2) AECL/nuclear corporations as implementing agencies, despite Panel wishes for an arm's length agency (trust issues) 3) The (NWMO) Advisory Board does not <i>necessarily</i> have to include as broad a constituency as the Panel wished (i.e.: sociologists, ethicists) 4) Ministerial review of final NWMO report (not multiple review mechanisms)
Nov. 2002 – 15 Nov. 2005	NWMO commences 3 year project to review approaches to and recommend a long-term approach for managing used nuclear fuel.
3 Nov. 2005	NWMO recommends Adaptive Phased Management as both a method and system

As Table 1 suggests, negotiations regarding how to manage nuclear waste, including discussion of the terms of a public inquiry into the problem, remained internal to technical and policy elites between 1977 and 1990 (Murphy & Kuhn, 2001). The emphasis the NWMO places upon public dialogue is a recent phenomenon, so that NWMO rhetoric should be viewed as a dramatic shift in public presentation.

Despite recent criticisms of the standard genealogy of anti-nuclear opposition (a 1970s birth), even sophisticated critics such as Welsh (2000) assume the nuclear industry maintained a formidable and well-organized *public* face. This assumption is incorrect in the Canadian context, where the public face of the nuclear industry can be represented as a relatively steep growth-curve. For instance, it was clear to the former curator of an 'Atoms at Your Service' exhibit at the Royal Ontario Museum, sponsored by the nuclear industry 1959-60, that the industry was unclear of what message it wished to present (Interview, 1998b). Interviews with the former general manager of Canada's premier nuclear lobby group, the Canadian Nuclear Association (CNA), revealed that as the 1970s began the CNA was far behind its American cousin (the US Atomic Industrial Forum) in terms of finances and organization (Interview, 1998a). Yet the capacity of the CNA and the nuclear industry to respond to public opposition increased dramatically in the 1970s. In response to a perceived "anti-science back-lash" (Weller, 1990, 10), the CNA

engaged in a sustained public relations campaign throughout the 1970's. Several glossy and detailed brochures and extensive public opinion studies were published, culminating in a full-fledged public relations manifesto aimed to persuade the public of the goodness of nuclear power (CNA, 1976a).

Nevertheless, a 1976 conference for industry spokespersons held in Toronto demonstrated the gap between public and private faces. Successive speakers described anti-nuclear opponents as more a threat than terrorist action against a reactor, doomed to "inevitable demise", and as "professional malcontents" (CNA, 1976b). As late as 1987 an industry spokesperson claimed opposition to nuclear power was a kind of "bison mentality" (Siddall, 1987). The public face of the NWMO stands in stark contrast to the nuclear industry rhetoric of the 1970s and 1980s. In a series of discussion documents, the NWMO progressively honed its public relations skill. Discussion document one presented nuclear waste management as an issue with "many dimensions . . . not addressed in technical and engineering concepts." The NWMO invited the public to "reflect and to help guide . . . to help shape the study" and select the "right questions" (NWMO, 2003, 2-5). In discussion document two the attribution of a bison mentality to the public is replaced by the commitment to "approach this task with humility in the face of uncertainty and complexity, but also fortified by the inherent wisdom of citizens" (NWMO, 2004, 3). In the Draft study report, the NWMO shifts from AECL's position of 1995 that all was sufficiently known to proceed to disposal, to the acknowledgement that "we do not live in a risk-free world . . . What we must not do is pretend that we have all the answers for all time. A measure of humility will be essential as we move cautiously but surely, one step at a time" (NWMO, 2005a, 11-12).

The NWMO public face is a major public relations reversal of strategy. As Murphy & Kuhn (2001) demonstrated, and Table 1 suggests, public involvement with the policy process was non-existent prior to 1990-98. Scoping sessions, and a public inquiry roundly critical of industry proposals, has forced "social acceptability" to the forefront of public policy. Hence, the NWMO Draft report (2005a) trumpets "citizen involvement" (7) and notes that "engagement will need to become increasingly a local dialogue" (24). A rhetoric of "greater and lesser confidence" (11) has replaced earlier industry rhetoric of certainty, and the NWMO is at pains to acknowledge that "trust must be built" (44). The outcome of these sentiments is encapsulated in Adaptive Phased Management (APM), which appears to follow directly from the NWMO's position that "the most profound challenge lies not in finding an appropriate technical method, but in the manner in which the management approach is implemented" (67). APM is presented as a risk management approach with characteristics including: centralized isolation and containment in a deep geological repository, flexibility in pace and implementation, an interim step of shallow underground storage, continuous monitoring, potential for retrievability, and constant public engagement (10). Table 2 outlines a possible APM schedule (adapted from NWMO, 2005a, 15-18, 145-153, 197-201, 221-223, 247-260).

Table 2 Adaptive Phased Management (possible schedule)

Phase	Time	Task
Phase 1 Prepare for central used fuel management	2005-2006	Government accepts APM
	2005-2015	Develop siting process
	2015	Initiate Siting (a central location with rock formations suitable for Shallow Underground Storage (SUS), an Underground Research Laboratory (URL), and a Deep Geological Repository (DGR)). Initiate licensing process
	2025	Decide whether to construct centralized storage facility (CSF) or leave used fuel at reactor sites No: maintain at reactor sites. Skip to Phase 3 Yes: initiate CSF. Go to Phase 2
Phase 2 Central storage and technological demonstration	2025-2035	Obtain construction license for URL If 'Yes', obtain construction license for SUS and begin transporting used fuel to CSF.
	2035-2055	Operate URL as test-case for DGR Confirm CSF is suitable for DGR Operate SUS & transport used fuel to SUS
	2055	Finalize design of DGR, decide when to construct it, and obtain a license to construct it.

Phase 3 Long-term containment, isolation, and monitoring	2065-2095	Transport used fuel to DGR and begin monitoring
	2095	Used fuel is now fully placed in DGR Continue monitoring
	2095-2305	Decide when to close and decommission DGR
	2305	Close access tunnels and shaft Implement post-closure monitoring if desired

4. From Deficit to Dialogue in the Risk Society

The NWMO emphasis upon dialogue, its acknowledgement that a bland presentation of facts is insufficient, and its explicit references to the sociopolitical value systems of different audiences, represents a large shift away from typical ‘deficit model’ (Wynne, 1995) public consultations.

Yet this shift appears to be of a strategic kind, the aim being to pilot already chosen technical and policy options. As indicated, AECL’s proposal was permanent disposal without provision for monitoring or retrieval. Natural Resources Canada (NRCan) supported this option, arguing *prior* to public hearings that a policy framework supporting this option was required by the need to “... make the nuclear option more acceptable as a source of energy, and reassure customers of the CANDU ...” (NRCan, 1995, 1). Such political and technical preferences were dealt a blow by the public inquiry. The Panel overseeing the hearings reported that this strategy implicitly sought to achieve a default political victory via technical choices (CEAA, 1998; Durant, forthcoming). Hence the NWMO came into being, and shifted industry rhetoric toward participation, compromise, humble respect for complexity and uncertainty, and a dialogue about grounding assumptions (NWMO, 2005a, 2005b).

Whatever the ultimate result of this new rhetoric might be, my point here is that the NWMO strategy shadows that of Sweden’s SKB, as described by Lidskog and Sundqvist (2004). Lidskog and Sundqvist noted that SKB strategically adapted in the face of demands from actors outside the company, shifting from a reliance on geological barriers as a guarantee of safety to an emphasis on engineered barriers. SKB created a shared frame of reference for itself and outside actors, which in effect represented a top-down approach in the guise of public consultation. SKB’s adaptation was meant to “pilot an already formulated technology rather than open it up for negotiations and substantial changes” (Lidskog and Sundqvist, 2004, 252-53). In the case of the NWMO, similar strategic adaptation has occurred, but in this case an emphasis upon dialogue has allowed the NWMO to present its approach as inclusive of public demands. Most specifically, APM incorporates key demands of public groups during the public hearings, including a call to allow for monitoring, potential retrieval of waste, and a step-wise approach (CEAA, 1998). The general demand for adaptability was revealed in focus group research sponsored by the NWMO (Watling et al, 2004, xi, 19, 29-30). In its proposal for APM, the NWMO argues the “key weakness” of ‘Option 1’ (AECL’s original proposal) was “adaptability” (NWMO, 2005a, 20). The relationship between adaptability, dialogue and public policy is as follows. Dialogue with external actors is presented as giving rise to adaptability, thereby correcting a key weakness in the AECL proposal. Simultaneously, the recommended waste disposal option is decoupled from default policy-making, for the necessity of political choices at key junctures (see the phases in Table 2) is built into the approach.

Should we consider the emphasis upon dialogue as a goal achieved, or as a strategic means to adapt? I suggest the latter, premised on the argument that the emphasis upon dialogue still fails to address a key concern of participatory democracy ideals, that of involvement in front-end framing issues. Both pluralist and direct participation models of democracy, for instance, concur on the importance of empowerment, and value the co-determination of decisions as a criterion of both success and legitimacy. Empowerment is not about downstream effects (risks and impacts from research, innovation and policy-making), but upstream framing issues (who is producing knowledge and why; politically-based challenges to knowledge making and application). What is crucial here is that, for all the emphasis upon dialogue, the co-determination of decisions remains obscure and empowerment seems minimal. For instance, the emphasis upon adaptability itself was a late strategic shift for the NWMO. In their discussion document of September 2004, the NWMO does not mention monitoring and retrieval as a part of any management approach, while adaptability is discounted because permanent disposal would minimize the need for flexibility (NWMO, 2004, 42-52, 71). Co-determination is also weak given that the NWMO membership consists solely of waste owners, not the broad constituency recommended by the Seaborn Panel. Similarly, the NWMO reports directly to the responsible Federal Minister, without provision for further public inquiry. Regarding empowerment, the NWMO still retains control and discretion over upstream framing issues, which it manages by policing the boundary between the technical and the political.

Given that upstream framing issues often turn on whether an issue is to be considered technical or political, the strategic value of dialogue is that the NWMO can claim it has drawn the boundary in response to public input. Thus in its first discussion document (NWMO, 2004), the NWMO refers to the social and political as “dimensions” (20), associating them with “the fears and insecurities of Canadians” (4). In contrast to the upstream “factual information and expertise” represented by “technical input” (10), social aspects are downstream matters of “implications” (11) and “impacts” (20). Another means by which the NWMO retains discretion over upstream framing issues is via the absolute separation of waste management approaches from broader questions of the future use of nuclear power. In discussion document one, the NWMO states it has not taken a position on the future role of nuclear energy (NWMO, 2003, 20). In the Draft Report and Final Report, the same line is used: “Our study process and evaluation of options was [were] intended neither to promote nor penalize Canada’s decisions regarding the future of nuclear power” (NWMO, 2005a, 26; 2005b, 20). In managing the boundary between the technical and the political, the NWMO declares its own actions to be precisely neutral.

In similar fashion to Lidskog and Sunqvist’s (2004) analysis of SKB, dialogue for the NWMO can be conceived of as strategic adaptation directed toward the preservation of already formulated policy. Though Lidskog and Sundqvist refrained from generalizing from the Swedish case, the Canadian case suggests strategic adaptation is a more general phenomenon. Yet does this mean national organizations for managing radioactive waste, given their role as mediating institutions between politics and science, are prime exemplars of the reflexive and adaptive organizations Beck identifies as required of ‘reflexive modernity’? Beck (1992) stipulated the risk society notion meant modernity’s institutions were self-refuting, and Beck’s solution was ‘reflexive modernity’, in which modern institutions save themselves from themselves by becoming more self-reflexive about their rationalist discourses. The institution of science was announced as they key institution in reflexive modernization, premised on the supposed skepticism and reflexivity at the heart of science. Are organizations such as the NWMO and SKB self-refuting, or does the fact of their foot in the institution of science preserve them from the charge?

At least in the case of the NWMO, Beck’s call for a new kind of politics appears to be borne out. Beck (1994) argued that the process of modernization underwent two phases, from a residual risk society in which effects and self-threats are produced, yet fail to become the subject of public dispute, to a risk society in which the dangers of the industrialized world become a focal point of public, private and political debate. In his call to thus reinvent politics, Beck argued for the need to focus on ignorance and the unanticipated (1994), rather than knowledge and planning. The NWMO makes both proclamations of ignorance and acknowledgements of uncertainties. Yet ignorance and uncertainty appear to be strategic elements of arguments which, in the context of the NWMO seeking to secure social acceptance for its preferred waste management approach, appear to reproduce the very rationalist discourse of control and reductionism that Beck attributed to non-reflexive modernist institutions.

In the case of the NWMO, public dialogue has been an instrument to secure acceptance of preferred technical options. The situation appears much closer to the thesis of Wynne (1993), who argued that modern science typically lacks the reflexive capacity to problematize its own founding commitments. The result is an imposition onto lay publics of particular identities, such as ‘emotional response’ rather than reasoned judgment, and a preservation of hierarchical social relations that preserve technical autonomy and maintain social dependency. The ironic conclusion, hinted at earlier on, is that the very act of being self-reflexive, such as engaging in debates about the founding commitments of both those supportive of geological disposal and those opposed, has been the means by which the NWMO has implemented previously preferred technical options. In conclusion, Beck’s reflexive modernity can also be strategic action, so that it would be a mistake to view reflexive modernity as some kind of state that an institution attains. Rather, reflexive modernity, whatever it might be, remains a flexible resource, capable of being drawn upon as a strategic element of argument. The appearance and performance of self-reflexivity can be a means to an end rather than, as suggested by Beck’s risk society thesis, the goal itself.

References

1. AECL (1994). *Environmental Impact Statement on the Concept for Disposal of Canada’s Nuclear Fuel Waste*, AECL-10711, COG-93-1 (Whiteshell: AECL).
2. AECL. (1995). Research and Development Advisory Panel (RDAP) to the Board of Directors of AECL, Nuclear Fuel Waste Disposal Concept Environmental Assessment Panel, *Compendium of Public Comments on the Adequacy of the Environmental Impact Statement on the Nuclear Fuel Waste Management and Disposal Concept*, 2 Volumes (Ottawa: August 1995), Vol. 2, Pub. TEC 007.

3. Beck, Ulrich. 1992. *Risk Society: Towards a New Modernity*. London: SAGE.
4. Beck, Ulrich. (1994). "The Reinvention of Politics: Towards a Theory of Reflexive Modernization." In – Ulrich Beck, Anthony Giddens, and Scott Lash, *Reflexive Modernization: Politics, Aesthetics, and Tradition in the Modern Social Order*. Cambridge: Polity Press, 1-55.
5. Canadian Nuclear Association (1976a) *Nuclear Power and the Canadian Public*.
6. Canadian Nuclear Association (1976b) *Proceedings: CNA Seminar for Industry Spokesman, 1976*, (Toronto: CNA, November)
7. CEAA (1998) Canadian Environmental Assessment Agency (1998). *Nuclear Fuel Waste Management and Disposal Concept: Report of the Nuclear Fuel Waste Management and Disposal Concept Environmental Assessment Panel*. February. Hull.
8. Durant, Darrin. Forthcoming. "Burying Nuclear Waste on Either Side of the 49th Parallel." *Technology and Culture*
9. Interview (1998a). Interview by author with Jim Weller, former General Manager of the CNA (1971-1991), Thurs. 27th August 1998.
10. Interview (1998b). Interview by author with Walter Tovell, curator of the 'Atoms at your Service' exhibit and later Director of the Museum, Wed. 22nd July 1998.
11. Jasanoff, Sheila (ed.). 2004. *States of Knowledge: the co-production of science and social order*. London: Routledge.
12. Lidskog, Rolf and Tapio Litmanen (1997). "The Social Shaping of Radwaste Management: the Cases of Sweden and Finland," *Current Sociology*, Vol. 45, No. 3, July, 59-79.
13. Lidskog, Rolf., and Sundqvist, Göran. (2004). "On the right track? Technology, geology and society in Swedish nuclear waste management," *Journal of Risk Research*, Vol. 7, No. 2, March, 251-268.
14. Murphy, Brenda L and Kuhn, Richard G (2001) "Setting the Terms of Reference in Environmental Assessments: Canadian Nuclear Fuel Waste Management," *Canadian Public Policy – Analyse de Politiques*, Vol. XXVII, No. 3, 249-266.
15. Natural Resources Canada (NRCan) (1995) "Discussion Paper on the Development of a Federal Policy Framework for the Disposal of Radioactive Waste in Canada". Ottawa: Ministry of Supply.
16. NWMO (2003) *Asking the Right Questions?: The Future Management of Canada's Used Nuclear Fuel*, Discussion Document 1, November (Toronto: NWMO)
17. NWMO (2004) *Understanding the Choices: The Future Management of Canada's Used Nuclear Fuel*, Discussion Document 2, September (Toronto: NWMO)
18. NWMO (2005a) *Choosing a Way Forward: The Future Management of Canada's Nuclear Fuel Waste (Draft)*, Draft Study Report (Toronto: NWMO, May)
19. NWMO (2005b) *Choosing a Way Forward: The Future Management of Canada's Nuclear Fuel Waste*, Final Report (Toronto: NWMO, November)
20. Rubin, Norm (1996). Energy Probe submission, Environmental Assessment Review Agency, *Nuclear Fuel Waste Management and Disposal Concept Environmental Assessment Panel Public Hearings Transcripts*, Vol. 1 (Toronto: Farr & Associates Reporting Inc). Monday 11th March, 1996, Toronto.
21. Siddall, Ernest (1987) "A Risk Perspective", in Canadian Nuclear Society, *Proceedings of the Nuclear Power and Nuclear Fusion Programs of the Canadian Nuclear Society*, Montreal, May 18-22 (Toronto: CNS)
22. Watling, Judy, Judith Maxwell, Nandini Saxena, and Suzanne Tascheereau. (2004). *Responsible Action: Citizens' Dialogue on the Long-Term Management of Used Nuclear Fuel*, Research Report P/04 by the Canadian Policy Research Network conducted for the NWMO (July)
23. Weller, Ian (1990) "The CNA Turns 30: an overview of the CNA history spanning 30 years," in CNA, *Nuclear Canada: CNA Yearbook 1990* (Toronto: CNA), 9-16.
24. Welsh, Ian (2000) *Mobilizing Modernity: The Nuclear Moment* (London: Routledge)
25. Wynne, Brian. 1993. "Public Uptake of Science: a case for institutional reflexivity." *Public Understanding of Science* Vol. 2, No. 4, 321-337.
26. Wynne, Brian (1995), "Public Understanding of Science", in Sheila Jasanoff, Gerald E Markle, James C Petersen, and Trevor Pinch (eds.), *Handbook of Science and Technology Studies* (Thousand Oaks, CA., Sage), 361-391.