

Resistance to Nuclear Waste Disposal: Credentialed Experts, Public Opposition and their Shared Lines of Critique

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Volume 30, numéro 1, 2007

URI : <https://id.erudit.org/iderudit/800524ar>

DOI : <https://doi.org/10.7202/800524ar>

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Éditeur(s)

CSTHA/AHSTC

ISSN

0829-2507 (imprimé)

1918-7750 (numérique)

[Découvrir la revue](#)

Citer cet article

Durant, D. (2007). Resistance to Nuclear Waste Disposal: Credentialed Experts, Public Opposition and their Shared Lines of Critique. *Scientia Canadensis*, 30(1), 1–30. <https://doi.org/10.7202/800524ar>

Résumé de l'article

Dans cet article, nous nous interrogeons sur la spécificité des actes de résistance des associations citoyennes lors de controverses techniques. Nous explorons cette question par l'analyse d'une des controverses publiques les plus importantes au Canada au cours des dernières décennies : la gestion des déchets nucléaires. Arrivés sur la scène politique en 1977, les déchets nucléaires demeurent un enjeu limité au gouvernement et à l'industrie nucléaire jusqu'à ce que les termes de références pour une enquête publique soient annoncés en 1989. Les possibilités pour le public de faire valoir son point de vue se multiplient dès l'annonce de l'enquête : des séances d'information en 1990, la réception de commentaires entre 1994 et 1996 sur une étude d'impacts environnementaux (EIE) préparée par Énergie Atomique du Canada Limité (EAEL), des audiences publiques à la grandeur du pays en 1996 et 1997, et une consultation publique continue depuis 2002. Cet article s'intéresse aux commentaires sur l'EIE, et discute plusieurs arguments que partagent les associations citoyennes et les experts techniques : la contestation du jugement expert de l'EAEL, la critique de l'absence d'évaluation par les pairs, l'accusation de manque de fiabilité, et l'attribution des carences de l'EIE à l'étroitesse des termes de références et à une pauvre culture institutionnelle. L'article recommande une lecture dramaturgique des textes techniques, et révèle les conditions de notre incapacité à séparer clairement les critiques techniques et sociales des projets techniques.

Resistance to Nuclear Waste Disposal: Credentialed Experts, Public Opposition and their Shared Lines of Critique

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Abstract: This article asks the question whether, in regard to controversial technical decision-making, lay public groups advance different kinds of resistance than credentialed experts. This question is explored via a case-study analysis of one of Canada's major public controversies of the past quarter century – nuclear waste disposal. Having arrived on the policy radar in 1977, nuclear waste remained an internal government/nuclear industry matter until terms of reference for a public inquiry were announced in 1989. Several access points for public input followed that announcement: scoping sessions in 1990, comments received during 1994-96 on an Environmental Impact Statement (EIS) prepared by Atomic Energy Canada Limited (AECL), nation-wide public hearings in 1996-97, and ongoing public consultation since 2002. This article focuses on the comments on the EIS, and discusses several lines of shared resistance: the expert judgment of AECL was disputed, the lack of peer review was criticized, accusations of unreliability were made, and general deficiencies in the EIS were attributed to narrow terms of reference and poor institutional culture. This article recommends the use of a dramaturgical approach to technical texts, and reveals the assumptions framing the dualist notion that one can unambiguously separate technical and social criticisms of technical projects.

Résumé : Dans cet article, nous nous interrogeons sur la spécificité des actes de résistance des associations citoyennes lors de controverses techniques. Nous explorons cette question par l'analyse d'une des controverses publiques les plus importantes au Canada au cours des dernières décennies : la gestion des déchets nucléaires. Arrivés sur la scène politique en 1977, les déchets nucléaires demeurent un enjeu limité au gouvernement et à l'industrie nucléaire jusqu'à ce que les termes de références pour une enquête publique soient annoncés en 1989. Les possibilités pour le public de faire valoir son point de vue se multiplient dès l'annonce de l'enquête : des séances d'information en 1990, la réception de commentaires entre 1994 et 1996 sur une étude d'impacts environnementaux (EIE) préparée par Énergie Atomique du Canada Limité (EACL), des audiences

publiques à la grandeur du pays en 1996 et 1997, et une consultation publique continue depuis 2002. Cet article s'intéresse aux commentaires sur l'EIE, et discute plusieurs arguments que partagent les associations citoyennes et les experts techniques: la contestation du jugement expert de l'EACL, la critique de l'absence d'évaluation par les pairs, l'accusation de manque de fiabilité, et l'attribution des carences de l'EIE à l'étroitesse des termes de références et à une pauvre culture institutionnelle. L'article recommande une lecture dramaturgique des textes techniques, et révèle les conditions de notre incapacité à séparer clairement les critiques techniques et sociales des projets techniques.

In the domain of controversial technical decision-making, do lay public groups advance different kinds of resistance than credentialed experts? Departing from the tenacious myth that dissent in regard to technical claims *necessarily* has a different basis and different style if performed by lay public groups or credentialed experts, this paper discusses several lines of *shared* resistance that were on display in a major public controversy. The controversy is the Canadian debate over nuclear waste disposal. Since the mid-1970s Canadian policy makers have supported deep geological disposal, in the plutonic rock of the Canadian Shield, as their preferred nuclear waste management approach. Following internal negotiations (1984-89) between federal/provincial governments and Canada's major nuclear industry players (primarily Atomic Energy Canada Limited (AECL) and Ontario Hydro), the terms of reference for a public inquiry were settled by 1989. Public input was sought at scoping sessions in 1990. Public hearings were held 1996-97 (run by a Panel chaired by Blair Seaborn). The inquiry mandate limited discussion to debates about a 'concept' only (a proposed deep geological repository), rather than any specific sites, an implementing agency, or the future of nuclear energy. Before the hearings AECL released an Environmental Impact Statement (EIS) in 1994. This paper concentrates on the 65 written submissions to the Seaborn Panel (submitted 1994-96) regarding the adequacy and completeness of the AECL EIS.

The Seaborn Panel established guidelines¹ in 1992 for AECL to follow in preparing an EIS. The guidelines included directions to make the EIS accessible to a broad audience, to make clear the basis of support for the concept, and to include discussion of differences of opinion within the field. Participants at this stage (1994-96) were asked to conclude, not on whether the concept was feasible, but on whether the EIS was adequate, complete, and in conformity with the guidelines. If we jump to the

1. Canadian Environmental Assessment Agency (CEAA), *Final Guidelines for the Preparation of an Environmental Impact Statement on the Nuclear Fuel Waste Management and Disposal Concept*, Canadian Environmental Assessment Panel (Ottawa: Public Works and Government Services Canada, March 1992).

conclusion of the public inquiry, in 1998 the Seaborn Panel cited a host of social and technical shortcomings that rendered the disposal concept a good start for a conceptual project, but otherwise lacking in public acceptability and in need of a fresh start. The Panel recommended the formation of an arm's length (from industry) agency to work toward a disposal concept based on "social safety."² The federal Government response was premised on a specific interpretation of the Panel findings: technical matters were largely on a sound footing, the remaining problem being that of social acceptability.³ This implicitly divided resistance to the disposal concept into narrow technical complaints versus a more diffuse public distrust. The former could best be left to technical agencies such as AECL or Ontario Hydro. The latter could be managed by an industry-based agency (the Nuclear Waste Management Organization (NWMO)), established in 2002, to make proposals for disposal that would be socially acceptable.

This dualist strategy institutionalizes a perceived dichotomy between technical and social sources of resistance. It simultaneously projects onto particular groups a model of their own cognitive and social action. Policy-maker assumptions that a clear split exists, with groups advancing either technical or social criticism, are built into policy itself. The policy projects onto particular groups models of themselves, in the form of *a priori* categorization of responses as technical-social, either/or. Coding responses according to this division solidifies and retroactively justifies the built-in assumptions. In effect the dualist strategy deletes the possibility that shared reasons and styles inform(ed) resistance. Acknowledging the existence of shared lines of dissent would contradict the assumption that credentialed experts advance rational and informed critique, in contrast to the emotional and subjective critique of public groups. Hierarchical policy solutions would also be disrupted, making it more difficult to justify a policy response structured by differential treatment of dissenters. If the type of resistance is the same across different groups, then why respond to different groups in different ways? To highlight the shared lines of resistance, this paper makes use of the dramaturgical framework articulated by Stephen Hilgartner, who analyzed science advice as "a form of drama, examining how it is produced, performed, and subjected to critique."⁴ Both those who produce advisory or technical reports, and

2. CEAA, *Report of the Nuclear Fuel Waste Management and Disposal Concept Environmental Assessment Panel*, Canadian Environmental Assessment Panel, No. EN-106-30/1-1998E (Ottawa: Public Works and Government Services, February 1998).

3. Natural Resources Canada, *Government of Canada Response to Recommendations of the Nuclear Fuel Waste Management and Disposal Concept Environmental Assessment Panel* (Ottawa: Canada Communications Group Inc., December 1998).

4. Stephen Hilgartner, *Science on Stage: Expert Advice as Public Drama* (Stanford: Stanford University Press, 2000), 6.

those who critique them, are performers—artful presentations and stylized productions are all part of the theatrical contests we know of as debates about socio-technical social problems.

Hilgartner's metaphor of the 'stage' builds upon standard emphasis upon the metaphor of the 'text'. The metaphor of the text draws attention to the rhetoric and narrative of a performance, such as the mobilization of allies, or the boundary work engaged in to distinguish science and politics. For Hilgartner the metaphor of the stage focuses attention upon "the dialectic of self-revelation and concealment through which advisors present themselves."⁵ Modes of information control, in which some things are deliberately displayed—the front stage—and some things actively concealed—the backstage—are central to the success of any performance. This paper thus discusses the narrative style and rhetorical character of the EIS, treating it as a public performance to gain credibility.

As a dramatic act, I begin with an analysis of how the EIS was performed both as narrative and rhetoric. I then move to an analysis of the backstage work: the individuals and groups that commented on the EIS prior to the public hearings and what they said, how the evidence on display in the EIS was questioned, and the work done to actually get the EIS produced in the first place. The thesis of the paper is two-fold. One, questioning the performance takes the critic full circle to the conditions of production, while endorsing the performance simultaneously backstages the conditions of production. Two, shared lines of resistance were prominent in critiques of AECL's EIS: there was a shared resistance to the rhetoric of expert judgment, and to the perception of a lack of independent peer review. An accusation of unreliability was common. The causes of the deficiencies in the EIS were collectively located in the political negotiations (1981-89) over the terms of reference for the public inquiry and the 'body language' (how the institution behaved; the social interests perceived to reside within it) of AECL.

The empirical materials utilized for this paper are as follows (Table 1). One is the EIS itself,⁶ which (along with its nine supporting documents) was available for review from 26th October 1994. Two, the two volumes of comments received on the adequacy of the EIS.⁷ These were received during the period 8th November 1994 – 8th August 1995. Individual citizens, Non-Government Organizations (NGO), public interest groups, First Nations, government, industry, and technical specialists all reviewed

5. *Ibid.*, 11.

6. AECL, *Environmental Impact Statement on the Concept for Disposal of Canada's Nuclear Fuel Waste*, AECL-10711, COG-93-1 (Pinnawa: AECL, 1994).

7. CEAA, *Compendium of Public Comments on the Adequacy of the Environmental Impact Statement on the Nuclear Fuel Waste Management and Disposal Concept*, Nuclear Fuel Waste Disposal Concept Environmental Assessment Panel, 2 Volumes (Ottawa: Minister of Supply and Services, August 1995).

the EIS and sent comments to the Panel. Three, there is the contribution by the Scientific Review Group (SRG), which reported to the Panel as an independent body of scientific advice. The relevant SRG documents are the report itself, the transcript of proceedings when the SRG appeared before the Seaborn Panel prior to the public hearings, and a later SRG addendum to their original report.⁸ Four, I analyze the Atomic Energy Control Board (AECB)⁹ Regulatory Document R-71,¹⁰ on geological disposal of nuclear waste.

Table 1. *Selective chronology of Canada's nuclear waste disposal controversy.*

Date	Publication/Event
1977-89	Internal Provincial-Federal Government Policy-Making AECB Regulatory Document R-71, <i>AECB R-71</i> [note 10]
4 October 1989	Seaborn Panel established; terms of reference released for public inquiry
1990	Scoping sessions
18 March 1992	EIS Guidelines issued to AECL [note 1]
1994	AECL releases its EIS [note 6]
1994-96	65 public responses to the EIS [note 7]
1995-96	SRG responses to the EIS [note 8, 9, 10]
1996-97	Public Inquiry held across Canada
February 1998	Panel releases its report [note 2]
December 1998	Federal Government response to Panel [note 3]
November 2002	Federal <i>Nuclear Fuel Waste Act</i> enacted, and Nuclear Waste Management Organization (NWMO) established
November 2005	NWMO final recommendations [note 96]

8. CEA, *An Evaluation of the Environmental Impact Statement on Atomic Energy of Canada Limited's Concept for Disposal of Canada's Nuclear Fuel Waste*, Report of the Scientific Review Group, Advisory to the Nuclear Fuel Waste Management and Disposal Concept Environmental Assessment Panel (Ottawa: Supply and Services, October 1995); Transcript of Proceedings with the Scientific Review Group (Ottawa: Supply and Services, November 1995); An Addendum to the Report of the Scientific Review Group, Advisory to the Nuclear Fuel Waste Management and Disposal Concept Environmental Assessment Panel (Ottawa: Supply and Services, September 1996).

9. The AECB is now known as the Canadian Nuclear Safety Commission (CNSC), which came into being on 31 May 2000. I have retained the older name.

10. AECB, "Regulatory Policy Statement. Deep geological disposal of nuclear fuel waste: background information and regulatory requirements regarding the concept assessment phase," Regulatory Document R-71 (Ottawa: AECB, January 1985).

Front Stage: The Identity and Narrative of the EIS

As Hilgartner suggests, public identity is an ambiguous entity: (theoretically) it can be either a stable artifact deployed in interactions with audiences, or a construct formed by the perceptions and understandings of an actor's audience(s). Given such ambiguities, Hilgartner cautions that an actor's public identity is best conceived of as both situated and formed in the interactions between actors and audiences. Nevertheless AECL and Ontario Hydro embody the technical expertise promoting and developing nuclear power in Canada. The AECL EIS represented authoritative scientific testimony (rather than fictional writing) *because* it emanated from these organizations: it represented what technical elites within the Canadian nuclear industry regarded as an accurate, reliable, scientific appraisal of the concept of deep geological disposal of nuclear waste. Yet the EIS was more than a technical report. The public identity of AECL and Ontario Hydro, as policy actors, established the EIS as a contribution to policy-making.

The narrative of the EIS does not allow the reader to settle in one place. First, the EIS is a very large document. In fact the EIS is not a single document, but one accompanied by allied documents. There is the obligatory (policy) summary,¹¹ plus nine "primary references," each several hundred pages in themselves.¹² The effect is to force the reader, if he/she wishes to pursue claims, to go deeper and deeper into supporting documentation. Second, the EIS refers to thousands of semiotic characters, or characters that may exchange signifying roles.¹³ These semiotic characters range from "CANDU reactors" to "owners of used fuel," from "host communities" to "radionuclides," and from "salt water salinity" to "hydrogeologist." In effect AECL was able to distribute agency across nature and the experienced judgment of AECL scientists, as the reader was constantly confronted by differing sources of authority (nature speaks, but so do nuclear experts).

Ideally a sense of the persuasive rhetoric of the EIS could be conveyed by a detailed exposition of the story AECL tells concerning its history and

11. Atomic Energy Canada Limited, *Summary of the Environmental Impact Statement on the Concept for Disposal of Canada's Nuclear Fuel Waste*, AECL-10721, COG-93-11 (Pinnawa: AECL, 1994).

12. There is the R-Public, which will be discussed in this paper, and then eight other primary references: Site Screening and Site Evaluation Technology (R-Siting), Engineered Barriers Alternatives (R-Barriers), Engineering for a Disposal Facility (R-Facility), Preclosure Assessment of a Conceptual System (R-Preclosure), Postclosure Assessment of a Reference System (R-Postclosure), The Vault Model for Postclosure Assessment (R-Vault), The Geosphere Model for Postclosure Assessment (R-Geosphere), and The Biosphere Model, BIOTRAC, for Postclosure Assessment (R-Biosphere).

13. Bruno Latour, *Science in Action: How to Follow Scientists and Engineers through Society* (Cambridge, MA: Harvard University Press, 1987), 53.

purpose. Following a suggestion to use dialogues to bring out the persuasive force of scientific reports,¹⁴ Hilgartner constructed a dialogue between an imaginary skeptic, and verbatim answers drawn from an analysis of the American National Academy of Science report *Diet, Nutrition, and Cancer*.¹⁵ Lacking the space to do so here, I take up Hilgartner's second suggestion. This involves using 'concept maps' to represent the structure of narratives.¹⁶

The act of skepticism is always, in principle, open-ended. We can thus note from Figure 1 that any skeptic would have to challenge a good deal of people and things. The skeptic would have to challenge the whole Nuclear Fuel Waste Management Program (NFWMP), for one thing. The EIS made clear that the NFWMP formed part of the broader organizations of AECL and Ontario Hydro, each one consisting of qualified technical experts. If the skeptic follows the logic of the EIS, which identified AECL as the "proponent," then the skeptic was faced with challenging AECL.

The members of AECL should not to be thought of in individualistic terms. Rather they are *representatives* of domains of technical expertise, or "delegates from the disciplines or other social and cognitive institutions which form their background."¹⁷ As delegates, the members of AECL speak for their areas of specific knowledge. Overall the EIS was always more than the sum of its parts: the mixture of experts and broad consultation situated the EIS as part of a broader constituency. As is common in public hearings, participants discover that one of the conditions of representation is how to negotiate the relation between the group represented and the delegate representing them. Delegates give voice to groups, simultaneously drawing upon their collective power in the act of creating that collective via representation. Yet it is always available to combatants to attempt to dissociate the delegate from the collective, reducing their symbolic power. Our skeptic would thus be faced by the many chains of associations that link AECL to other organizations, institutions, projects of research, and individuals of special merit.

Figure 1 presents chains of associations, and is designed to give a visual impression of the scope and complexity of the challenge that would be required in order to dispute the EIS.

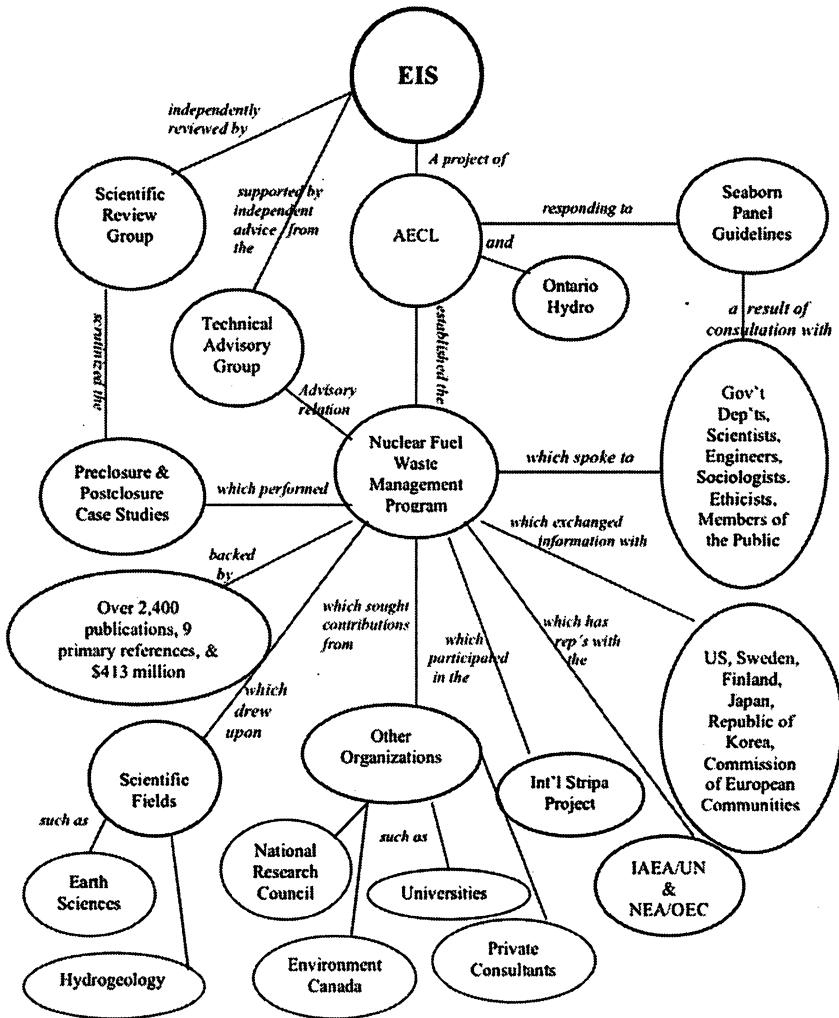
14. Bruno Latour and Françoise Bastide, "Writing Science – Fact and Fiction" in *Mapping the Dynamics of Science and Technology: Sociology of Science in the Real World*, eds. Michel Callon, John Law, and Arie Rip (Basingstoke: MacMillan, 1986), 51-66.

15. Hilgartner, 46-48.

16. Hilgartner, 49. On concept maps, see Joseph D. Novak and D. Bob Gowin, *Learning How to Learn* (New York: Cambridge University Press, 1984).

17. H.M. Collins, *Changing Order: Replication and Induction in Scientific Practice* (London: SAGE, 1985), 148.

Figure 1. A Conceptual Structure of the EIS Narrative.



This map presents the conceptual structure of the narrative-style arguments the EIS makes to warrant its authority. Reading through the nodes (circles) and links (lines, with accompanying text) of the map produces statements that summarize aspects of the EIS narrative.

Challenging the credibility of the EIS involves questioning the collective resources of specific scientific fields, other contributing organizations, the experience gained from participation in international research projects, the connections made by representatives on international agencies dealing with nuclear regulation, the value gained from exchanging information

with other countries, the perspective gained by speaking to a broad constituency of interested parties and groups, and AECB regulatory competence. As a text, the EIS thus set up a formidable defense against challenge by constructing a web of associations. The entities in that web carried mixtures of different kinds of prestige: technical, political, social. The EIS derived a little bit of authority from each link to a reputable organization, known scientific specialty, and example of broad consultation. The EIS also used several 'props' to bolster its authority, such as 'the evidence' mobilized (2,400 publications) and the funds spent (\$413 million).

As we move into the backstage, we will see that pieces of the web can be criticized without undoing all of the associations. A web of associations thus provides both a defense against challenge and an opportunity to tinker with parts of the web. The strength of the web is thus related, not simply to the number of nodal points and the connections between them, but also to the strategic opportunities afforded by allowing local criticisms that do not thereby have global repercussions (throughout the web).

Front Stage: The Rhetoric of Expert Judgment

Aside from the structure of the narrative, Hilgartner notes that advisory and technical reports use discursive devices to build authority and credibility. Drawing upon the work of Gilbert and Mulkey on discourse analysis, Hilgartner suggests many advisory and technical reports weave together rhetorics that enhance their authority in one of two ways: either by letting scientific evidence simply speak for itself or by displaying interpretive conclusions reached by qualified experts through judicious, rational deliberation.¹⁸

Gilbert and Mulkey previously described two repertoires for establishing the character of scientific actions and beliefs.

In the empiricist repertoire actions and beliefs must be seen to be universal and impersonal, so that the author's actions are irrelevant to the content of knowledge claims—"nature has spoken." In the contingent repertoire, actions and beliefs are related to the vagaries of time and place, or the judgments of specific individuals within particular social spaces.¹⁹ Hilgartner situates the rhetoric of expert judgment in between these two repertoires. While such rhetoric does not present knowledge claims as simple mirrors of nature, it is at pains to present claims as the product of careful deliberation by experienced practitioners. The EIS certainly contains examples of the empiricist repertoire, but its rhetoric of expert

18. Hilgartner, 51.

19. G. Nigel Gilbert and Michael Mulkey, *Opening Pandora's Box: A Sociological Analysis of Scientists' Discourse* (Cambridge: Cambridge University Press, 1984), 39-62.

judgment was apparent to both supporters and critics of the EIS. Yet praising or questioning this judgment did not align neatly with supporter and critic (as one might expect). Rather, the problems and pitfalls of expert judgment were a resource for both critics and supporters alike.

Two tasks the EIS had to accomplish concerned environmental safety and justifying the choice of plutonic rock for the repository. Long term environmental safety predictions appealed to local familiarity: "Our expectations are based on an understanding developed during more than 15 years of field and laboratory research conducted in Canada and internationally."²⁰ The suitability of plutonic rock hinged on what "we judge to be important,"²¹ and also upon "our investigations at field research areas"²² in regards to the Canadian Shield characteristics and plutonic rock. This combination of experience-based claims and competent judgment was a consistent feature of the EIS. Thus in discussing the disposal vault and disposal containers AECL both appeals to its own scientists and their "laboratory experiments to study the behaviour of glass and glass-ceramic waste forms in groundwaters,"²³ while also reaching out across its web of associations to recruit the "extensive experience in mining and construction" of other trusted bodies of expertise.²⁴ Where limitations to knowledge arose, such as monitoring in disposal rooms, discrimination between options was firmly rooted in expert judgment: "we believe the limitation ... would be better addressed [via some kind of fault tree analysis]."²⁵

Public and government concern extended to transporting waste as well. AECL's strategy here involved simultaneous appeal to the experience and competence of parts of its web of support, Ontario Hydro's experience with transporting waste, and the assurance of quantification: 22,000 shipments, 4 million kilometers, 3 accidents, no fatalities;²⁶ an accident rate of 0.01%. What about local socio-economic effects? Again experience is the key: local residents near the Point Lepreau reactor, or the Saskatchewan uranium mines, and the waste treatment facility at Swan Hills in Alberta, had all experienced employment benefits.²⁷ Any danger to workers at such places was minimized by the experience of Ontario Hydro and Transport Canada.²⁸ Even if employment stops because of

20. AECL, *Environmental Impact Statement on the Concept for Disposal of Canada's Nuclear Fuel Waste* (hereafter, *EIS*), 82.

21. *Ibid.*, 95.

22. *Ibid.*, 106.

23. *Ibid.*, 143.

24. *Ibid.*, 111.

25. *Ibid.*, 180.

26. *Ibid.*, 189-90.

27. *Ibid.*, 198.

28. *Ibid.*, 247.

decommissioning, experience with and knowledge about “stringent criteria, guidelines and standards” would ensure safety.²⁹

When AECL turned to its postclosure assessment study, the combination of oscillating between the experience of AECL and the consistency of AECL’s experience with other chains in its web of associations was paramount. Thus assuming the disposal vault would be immediately saturated upon closure was presented as a conservative assumption “consistent with assumptions made in other countries.”³⁰ It is confirmed, in fact, by “experience at the underground research laboratory” in Whiteshell, Manitoba.³¹ Moreover AECL’s “confidence in the performance of containers [...] is shared by [...] other countries.”³² Sometimes confidence might be difficult because of the indeterminacy of the problem, such as identifying potential and significant scenarios (anywhere from earthquakes to glaciation and human intrusion). Nevertheless AECL reminded the reader “expert judgment played a major role”.³³ AECL’s expert judgment was that identifying worst-case scenarios was nothing more than “highly subjective” speculation that was likely to lead to “very unlikely situations” dominating the analysis.³⁴ In effect AECL drew a boundary around what their expert judgment could show and what subjective judgment could fabricate unnecessarily. Hence one place for negotiating the boundary between expert judgment and non-expert judgment consisted of the nodes where very unlikely events were considered.

In the EIS conclusions AECL moved from a statement that disposal is “needed” to the justification that “current storage practice is a safe interim measure, but not a permanent solution.”³⁵ The EIS narrative thus sounded distinctly like a story in which a crisis is presented, options for securing protection from harm are outlined, and the impression of choice is thus given. However that choice quickly dissipated, as AECL made clear storage could not be relied upon. Active disposal remained the only safe option. Next section sees what different groups had to say about this story.

29. *Ibid.*, 251.

30. *Ibid.*, 268. Though other countries have made alternative judgments. For instance the Americans opted for ‘dry is good’. Cf. Allison Macfarlane, “Underlying Yucca Mountain: The Interplay of Geology and Policy in Nuclear Waste Disposal,” *Social Studies of Science* 33, 5 (2003): 783-807, esp. 794-96.

31. AECL *EIS*, 270.

32. *Ibid.*, 271.

33. *Ibid.*, 278.

34. *Ibid.*, 317.

35. *Ibid.*, 336.

Front Stage: Who Said What?

Following the issuing of guidelines (March 1992), comments were solicited regarding the adequacy, sufficiency, and completeness of the EIS. Table 2 codifies the 65 submissions to the Panel regarding the adequacy and completeness of the EIS. The horizontally-arranged spectrum can be read as moving left to right, following degrees of approval across to different degrees of disapproval, culminating in very strong disapproval.

Table 2. Respondents to the EIS, and Responses.

AFFILIATION	EIS not addressed, but approves concept	Ritual citation	EIS adequate; justification &/or options; next stage	EIS adequate; minor probs; next stage	EIS adequate, but more work needed	EIS adequate, but major revisions needed	EIS not addressed, but opposed to concept	EIS inadequate, but deficiencies only minor	EIS inadequate, and deficiencies significant	Unclear position	Total
	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	
NGO's			1						12		13
Public Interest				2	1		1		3		7
Private Citizens				3					7	1	11
Utilities/Industry		6	1								7
Government				4	1	1				2	8
Technical Society			1	5	1	1				1	9
First Nations				1					9		10
Total	0	6	3	15	3	2	1	0	31	4	65
		9%	5%	23%	5%	3%	2%		48%	6%	

Source : CEEA, Compendium of Public Comments (see note 7).

Position #1 (EIS not addressed, but approval for concept) has no inhabitants, but was placed in the chart because of position #7 (EIS not addressed, but opposed to concept), which has one inhabitant. In this latter case, the respondent was violently anti-nuclear and extremely emotional, making for a contrast in which no respondent thought it appropriate to be rabidly pro-nuclear.

In regards to position #2 (ritual citation), 9% of respondents, all of them affiliated with the nuclear industry in some fashion (e.g.: uranium mining, lobby groups) or a nuclear utility, submitted very brief submissions. I call them 'ritual citations' because they merely praise the "thorough documentation" and "credible work" of AECL before strongly recommending progress to siting or public hearings.

Position #3 (EIS adequate; justification &/or options; next stage) approved of the EIS, but unlike the ritual citations either discussed plausible options on some technical point or gave some other kind of justification for their sport, before recommending siting or hearings. Only one NGO took position #3 (The National Council of Woman of Canada).

Regarding position #4 (EIS adequate; minor problems; next stage), numbering 23% of respondents (60% of whom were government or technical bodies), the criterion here meant groups recommended siting or hearings, approved of the EIS, but believed there were a few minor omissions or minor technical errors/problems that needed to be addressed. These minor deficiencies ranged from AECL being too cautious and too safety conscious, to disagreements over some modeling techniques or risk estimates. One First Nations group, the Meadow Like Tribal Council, took this position (in contrast to 9 other First Nations groups who were strongly opposed), essentially giving the green light to serious dialogue with AECL about siting a repository on their tribal lands.

Position #5 (EIS adequate, but more work needed) is the closest this debate gets to 'neutral'. In this case 3% of respondents argued for more information in order to make a full recommendation, though they had a positive response in general.

Position #6 (EIS adequate, but major revisions needed) was held by the Scientific Review Group (SRG) and Environment Canada. The SRG argued that AECL's case for the generic concept of waste disposal was fundamentally flawed. The problem was not the concept itself, nor the need for waste disposal, nor the premises of reducing burden on future generations or the unreliability of institutional controls. Rather, the SRG opposed the way in which AECL based its case for the disposal concept on its own postclosure reference study. In the EIS there are two case studies presented, one by Ontario Hydro (preclosure; hypothetical generic facility) and one by AECL (postclosure; site specific, with use of modeling programs). The SRG was ambiguous about the Ontario Hydro preclosure study (see below), but generally found it to be sufficiently like

other nuclear projects, such as building a nuclear power plant, to be acceptable. However, the SRG found the AECL postclosure study “unreliable,” “narrow,” and dependent upon questionable modeling and unknown expertise.³⁶ Both the SRG and Environment Canada advanced major criticisms of the EIS, but endorsed it as adequate nevertheless.

Position #8 (EIS is inadequate, but deficiencies only minor) is again an empty set, yet its emptiness is instructive. If we combine positions #4 (23%) and #6 (3%), and possibly add the (almost) neutral position #5 (3%), we have approximately one third of respondents indicating either minor or major deficiencies with the EIS, but who refuse to label it inadequate. An instructive contrast here is a private citizen taking position #4 (J. A. L. Robertson, a long-time AECL employee and well-known ‘nuclear warrior’ in Canada), who emphasizes that

The major point I wish to make in this submission is that none of the omissions need delay public hearings on the EIS.³⁷

In contrast, a private citizen taking position #9 (EIS inadequate, and deficiencies significant) emphasizes that :

Any serious attempt to patch up this “environmental impact statement” would be equivalent to trying to cure cancer by applying a bandaid.³⁸

An NGO taking position #9 quotes the EIS to the effect that progressing towards disposal would increase public confidence in Canada’s ability to manage waste safely, and responds to this emphasis on haste as such.

Surely the point is to develop and implement a safe plan for waste management, not merely to act quickly in hopes of minimizing public concerns about a process which, in fact, should be of great concern to the public.³⁹

Of the 65 submissions, 48% adopted position #9, finding the EIS inadequate and riddled with serious deficiencies. Of that 48%, no utility/industry group, government agency or technical society adopted position #9.

Finally, there was also position #10 (unclear position), which included respondents who made some criticisms of the EIS but did not make a clear case either way (adequate or inadequate). The low number in this set (4, or 6%) is consistent with general impressions that, in this particular debate, all parties have an opinion and few remain non-partisan or dispassionate.

One interpretation of the lack of overlap in position #9 is that the more informed sectors of the interested parties ‘know enough’ to know the EIS

36. *SRG Report*, 4, 16-17.

37. J.A.L. Robertson, *Public Comments*, Pub. 005, 1.

38. Phyllis Robbins, *Public Comments*, Pub. 010, 8.

39. Concerned Citizens of Manitoba, *Public Comments*, Pub. 034, 2-3.

is adequate. However comparison of the critiques of the SRG, Environment Canada, and several technical societies, reveals a great deal of overlap with many of the NGO critiques (which were typically more detailed than that of private citizens). Representative NGOs in this regard would be Energy Probe, Northwatch, Campaign for Nuclear Phaseout, Nuclear Awareness Project, Saskatchewan Environmental Society, and the Canadian Coalition for Nuclear Responsibility. The switch to labeling the EIS inadequate is, on a general level, the switch to anti-nuclear positions regardless of the EIS. On a more specific level, the switch to labeling the EIS inadequate is also a political statement that developments should not continue any further. The solidarity that exists between those with minor or major criticisms and their semi-distant cousins who contribute ritual citations, is matched in polar-fashion by the solidarity between those who feel threatened and/or excluded (the 9 First Nations groups adopting position #9; 14% of respondents overall) and their semi-distant cousins who believe only a very strong show of disapproval (48% across all groups) will gain the attention of policy-makers.

Initial coding of the written comments suggest critics of the EIS (as inadequate) strongly distrust AECL and Ontario Hydro, which could be a reason in itself to label the EIS inadequate (tainted by the source). Yet difficulties arising from the specificity of many critiques (limited by Panel directives to discuss the conformity of the EIS with the guidelines) mean much is implicit in the critiques, rather than explicit. The pace of development was one issue that featured explicitly in many critiques. Labeling the EIS inadequate was a response to the perception of genuine deficiencies in the EIS, but the one third of respondents who perceived deficiencies but did not label the EIS inadequate indicates perceiving deficiencies alone cannot compel the application of 'inadequate'. To label 'inadequate', the respondent also saw some danger in the nuclear industry wanting to speed up the time-line to approving disposal. If any confirmation of this perception was needed, and most long-term anti-nuclear NGOs already regarded themselves as in possession of such an understanding, then the submission of the Research and Development Advisory Panel (RDAP) to the Board of Directors of AECL provided ample confirmation.

The Panel [RDAP] is frankly disturbed by the extraordinarily prolonged character of the decision process. Merely to obtain federal acceptance of the concept of deep geological disposal will have taken nineteen years since its formulation in 1977. Site screening for a possible repository cannot even begin until the basic concept is accepted ... [RDAP] is disturbed at several aspects of the slowness of the proposed action [operation of repository between 2025-2065, with closing in 2065].⁴⁰

40. Research and Development Advisory Panel to the Board of Directors of AECL, *Public Comments*, Pub. TEC 007, 3-4.

Backstage: Questioning the Evidence

As we move to consider the backstage, that area of activity the EIS seeks to conceal or control impressions about, we begin first with the very ability to access what goes on backstage.

The Panel guidelines called for the EIS to be written in “the clearest terms possible, and to use language ... that can be readily understood by the public.” AECL was instructed to indicate “... important areas of knowledge where differing opinions within the physical community remain unreconciled...”⁴¹ However, many respondents regarded the document as inaccessible. Virtually every respondent mentioned the lack of an index, poor cross-referencing between the EIS and its primary supporting documents, and poor cross-referencing between the Guidelines and the EIS. NGO criticisms ranged from “...the organization of the EIS is unnecessarily confusing,”⁴² to “... the EIS seems at times to be designed to confuse as to enlighten.”⁴³ Sometimes all subtlety was dispensed with: “...when you go down in the subsections you start to feel lost in a labyrinth of jargon and jargonized jargon ... the cornucopia of details is used specifically to lose the reader very soon.”⁴⁴ The impression of lack of clarity was not expressed by those submissions that argued the EIS was adequate. Technical groups, for instance, despite indicating deficiencies, found that “[i]n general, the Group found the documentation to be well written and presented ... the EIS ... weights the presentation in a manner suitable for a broad readership.”⁴⁵

More consensus existed regarding the issue of whether AECL had given due consideration to other points of view. This critique took the form of questioning the basis of AECL’s expertise and documentation: whether the expertise was sufficiently grounded in relevant experience and fields of knowledge, whether it was in fact credible and trustworthy, and whether the documentation of the EIS was independently peer reviewed. On this topic, critics and supporters alike found the AECL case deficient; though they disagreed about whether this deficiency rendered the EIS inadequate (see above). The EIS documentation thus provides a window into the backstage of AECL activities. An analysis of this documentation reveals that just over 16% of the references require directly contacting the production source. Moreover, the EIS cites just 8 out of 427 (2% overall) AECL-affiliated supporting-documents as having appeared in recognizable and independently peer-reviewed journals. One finds a similar

41. *Panel Guidelines*, 2, 7, 44.

42. Campaign for Nuclear Phaseout, *Public Comments*, Pub. 027, 3.

43. Concerned Citizens of Renfrew County, *Public Comments*, Pub. 031, 3.

44. Ecosystem Approach Group – P. Boldrini, *Public Comments*, Pub. 033, 6.

45. Report of the OECD Nuclear Energy Agency Review Group, *Public Comments*, Pub. TEC. 001, 19.

pattern in the 'R-Public' primary reference, designed to address social issues and one of the most widely accessed and referred to primary references:⁴⁶ just over 14% of the cited sources require directly contacting the production source. Of journals cited, there were 23 overall (9%), but just 1 AECL-affiliated supporting-document was published in a peer-reviewed and independent journal.

Critics of the EIS pointed to similar statistics: "126 references out of 263 references [in the R-Public]—that is, 46 percent of the total—are from the nuclear industry, of which 57 are in-house AECL documents."⁴⁷ Supporters and critics alike commented upon the lack of independent peer review. Tables 3 and 4 present selected examples.

Table 3. *Supporters Attack the EIS for Lack of Independent Peer-Review.*

The Supporters

"We conclude that the AECL documentation of the research that has been done is excellent ... but much is in the grey literature of AECL reports."⁴⁸

The "presentation of the Impact Statement is glib, in some respects. There is a tone of 'we are right, believe us ... [I]t was not clear to what extent the research and studies of the proponents have been vetted by independent expertise ... [hence it is] still matters of interpretation by them."⁴⁹

Table 4. *Critics Attack the EIS for Lack of Independent Peer-Review.*

The Critics

"To an overwhelming degree, the references given consist of internal AECL documents ... They are subject to internal biases, however innocent and/or sub-conscious they may be."⁵⁰

"How many of these documents have been submitted to proper peer review – that is, to a scientific assessment conducted by persons who do not derive income from AECL related activities?"⁵¹

"AECL is very careful in not presenting the opponents case."⁵²

"AECL relies on and uses as references their own in-house documents ... [which serve] ... more as scientific posture than as sources of a substantive basis for the proposal."⁵³

46. M.A. Greber, E.R. French and J.A.R. Hillier, *The Disposal of Canada's Nuclear Fuel Waste: Public Involvement and Social Aspects*, R-Public. AECL-10712, COG-93-2 (Pinawa: Whiteshell Laboratories, 1994).

47. Canadian Coalition for Nuclear Responsibility, *Public Comments*, Pub. 049, 17.

48. Canadian Geoscience Council, *Public Comments*, Pub. TEC. 002, 28-29.

49. Royal Society of Canada, *Public Comments*, Pub. TEC. 003.

50. Phyllis Robbins, *Public Comments*, Pub. 010, 2.

51. Campaign for Nuclear Phaseout, *Public Comments*, Pub. 027, 36.

52. Ecosystem Approach Group – P. Boldrini, *Public Comments*, Pub. 033, 2.

53. Northwatch, *Public Comments*, Pub. 046, 3-4.

What such a shared critique illuminates is that critics and supporters alike were implicitly claiming there was *too much* backstage activity.

As a front stage public performance the narrative of the EIS appeared to bring the backstage activity to light, but in fact the rhetoric of expert judgment served to conceal from view the backstage activity. Yet it was that backstage activity that informed AECL's experience-based judgments, and it was such judgments that constituted the front stage personae. When critics and supporters alike referred to the degree of backstage activity, or the degree of in-house documentation that had not been clearly peer-reviewed by independent sources, they were attacking the boundary that the rhetoric of expert judgment attempted to erect. Who did the studies? How were they done? Were they credible studies? Are they appropriate pieces of information on which to rest policy decisions? Why were so many not brought before the trials of the peer-review system? These are all questions about the conditions of production. Simply critiquing the amount of backstage activity does not directly answer these questions, but it does signal a call to open up the backstage to critical scrutiny. Questioning the narrative of the EIS and its rhetoric of expert judgment thus takes the skeptic back to the conditions of production. For supporters of the EIS, endorsing the EIS backstages the conditions of production. Even if minor or major revisions are called for the implicit answer is that the conditions of production are sufficiently credible to warrant the EIS being labeled adequate. For the critic, being shielded from the backstage conditions of production is grounds for distrust and rejection. For the supporter that same shielding is unfortunate, glib, bad public relations, and possibly even understandable in AECL's situation (as a regulated, or tasked group, lacking unlimited freedom)—but not grounds for labeling the EIS inadequate or incomplete.

The concealed backstage thus became an issue in itself. The more AECL attempted to control information flow, the louder critics called for a transparent process. Respondents took the absence of any display of conflicting judgments as showing that AECL was concealing uncertainties and differences. Left to reconstruct possible backstage activity, criticisms of the EIS focused on the credibility of the expert judgments themselves. Table 5 depicts three 'species' of specific criticisms of the EIS (with representative examples).

Table 5. *Species of Criticism.*

Misrepresentation	Concealment	Unreliability
<p>1. An NGO-critic discussed R-Public claims to the effect that survey data supported the AECL belief that residents close by a proposed repository would be accepting of the repository. The counter-claim was that, upon inspection of the cited documents, the survey data showed just the opposite relation.⁵⁴</p> <p>2. A submission representing several large First Nations (FN) groups claimed the EIS literature review regarding FN issues was doubly deficient: while appearing to address FN issues, it in fact treated FN's as obstacles and, because of a lack of direct consultation, passed over the oral culture of FN's.⁵⁵</p>	<p>1. A Public Interest Group critic points to an ambiguity in AECL's definition of 'nuclear fuel waste' (NFW) to suggest political options for reprocessing (Rp) spent fuel are being smuggled into the disposal concept. An earlier AECL author is cited to the effect that NFW is fission products from fuel burns, plus small amounts of Pu and U. The EIS definition refers to the fact that Rp is not done or planned in Canada, but if it were then NFW would be solidified. The EIS then defines NFW as either used fuel or solidified waste (that is, <i>both</i>). The critic thus claims the definition of NFW leaves room for Rp, and thus conceals political intent.⁵⁶</p>	<p>1. The SRG argued the postclosure reference study by AECL was unreliable: it was site specific and thus too narrow to support claims about a generic concept; the geosphere models were based on a potentially unrepresentative area; the BIOTRAC models for the biosphere study were unrealistic; the GEONET model for vault analysis did not factor in likely changes; relevant experts are not identified.⁵⁷</p> <p>2. Most NGO critics advanced similar claims, but also made more general unreliability claims: AECL and Ontario Hydro could not be trusted, they were biased; financial incentives rendered their expertise suspicious.</p>

The species of criticism identified as 'unreliability' is a prime example of common ground between critic and supporter of the EIS. For instance, consider two specific criticisms of the EIS. One, criticism of the risk analysis and risk characterization found in the EIS. According to the SRG,

54. Canadian Coalition for Nuclear Responsibility, *Public Comments*, Pub. 049, 16.

55. Andrew J. Orkin, on behalf of Federation of Saskatchewan Indian Nations (FSIN), The Assembly of Manitoba Chiefs, The Assembly of First Nations of Quebec and Labrador, and The Grand Council of the Crees (of Quebec), *Public Comments*, Pub. 044, *passim*.

56. Ecosystem Approach Group – P. Boldrini, *Public Comments*, Pub. 033, 9.

57. *SRG Report*.

the EIS risk characterization “does not demonstrate compliance” to AECB guidelines.⁵⁸ The anti-nuclear group Energy Probe made precisely the same criticism.⁵⁹ More significantly, the specific criticism is the same: both the SRG and Energy Probe criticize the SYVAC3-CC3 computer-modeling program used in the risk analysis. Specific shared criticisms were: the model only generates results concerning individual doses and not risk on the basis of total population; the model data is limited because it is drawn from site specific results (Manitoba); parameter values in the model are arbitrary and inflexible; too much emphasis in the postclosure reference study is placed upon such computer modeling.⁶⁰

A second criticism concerned the modeling work done to understand the geosphere and biosphere. The SRG is explicit in its distaste for the GEONET and BIOTRAC models used by AECL in the postclosure assessment study. In the formal context of its October 1995 Report, the SRG argues that these computer models are flawed because they are site specific, because they assume invariant flow paths (of microorganisms and radioactive contaminants), and because BIOTRAC in particular ignores microbial activity. Moreover, these models under-estimate significant scenarios and do not explore possible human activity and climate change.⁶¹ In the more informal verbal presentations to the Seaborn Panel, prior to the commencement of public hearings, SRG members were more forthright. Here we find the BIOTRAC model labeled a “house that jack built” kind of model, while the use of the inadequate SYVAC model was suggested to be a function of a “managerial decision” to develop SYVAC as a source of revenue for AECL.⁶² In similar fashion NGO critics argued that the AECL models failed to use “plausible data,”⁶³ and that “so many camels are being swallowed in one mouthful that the credibility of the entire exercise is called into question.”⁶⁴ The BIOTRAC model, argued another NGO critic, is deficient for precisely the same reasons offered by the SRG: it ignores microbial activity and human interaction with the biosphere, contains arbitrary assumptions, and is site specific.⁶⁵

With so much of the backstage absent from view, critics and supporters alike outlined general unreliability claims as well. Prominent anti-nuclear groups consistently signaled AECL out as especially untrustworthy and lacking in credibility. As one succinctly stated:

58. *SRG Report*, 14.

59. Energy Probe, *Public Comments*, Pub. 014, 4.

60. *SRG Report*, 80-81; Energy Probe, *Public Comments*, Pub. 014, 3-7.

61. *SRG Report*, 60-69.

62. *SRG Transcript*, 34 and 112-113.

63. Energy Probe, *Public Comments*, Pub. 014, 8.

64. Canadian Coalition for Nuclear Responsibility, *Public Comments*, Pub. 049, 40.

65. Ecosystem Approach Group – P. Boldrini, *Public Comments*, Pub. 033, *passim*.

One needs only look at the trail of bribery, secret deals, circumvention of safeguards, human rights abuses, and other questionable AECL behaviour in its export business to question whether its hands are the ones in which we want to be placing the safety of Canada's present and future generations.⁶⁶

Yet the SRG also found its lack of insight into the backstage of EIS production troubling:

Expert judgment obviously played a major role in AECL's scenario analysis, yet the experts used to develop the initial list of factors and the screening arguments were not identified, nor were their qualifications given. Moreover, SRG notes that non-expert stakeholders are not mentioned as part of the group that initially developed and then screened factors.⁶⁷

Here the SRG alluded to the same criticism as groups such as Energy Probe and the Canadian Council for Nuclear Responsibility. Not only was it perceived that the EIS ignored the Panel guidelines to both involve and address a broad set of interested parties, but one consequence of this omission was that 'publicly dreaded events' were not seriously discussed.

From the SRG perspective, deliberately excluding consideration of the worst possible case was to commit a methodological error: "they have not worked the problem backwards."⁶⁸ NGO critics went further, suggesting the omission implied "AECL seems overly fearful of analyzing scenarios in which something really bad goes wrong."⁶⁹ Despite common ground in their critique of the EIS handling of significant scenarios, supporter and critic end up in different places. This last example of criticism can serve as an analogy for the broader picture. The SRG endorses the EIS even though it has major criticisms. Even if the SRG uses the contingent repertoire here and there to bring into doubt the objectivity of AECL choices (such as regards the use of SYVAC), by and large the SRG critique extends to methodological and professional grounds only. Other technical criticisms stop at a similar point. NGO and other public critics of the EIS, those who have reservations and who find the EIS inadequate, push beyond questioning methodology and professional credentials. Such critics extend the critique to moral, ethical, social and political objections. In whichever case we encounter, the act of questioning pushes the inquirer back toward the conditions of production.

66. Submission of the National Action Committee on the Status of Women – Environment Committee, *Public Comments*, Pub. 026, 18.

67. *SRG Report*, 13.

68. *SRG Transcript*, 155.

69. Canadian Coalition for Nuclear Responsibility, *Public Comments*, Pub. 049, 41.

Backstage: Before the EIS

Inquiring about the conditions of production means we have to go backstage. Clearly what goes on backstage greatly influences the front stage performance and, as Hilgartner's notion of 'drama' emphasizes, a dialectic of concealment and revelation characterizes such performative acts. Thus what does the front stage performance of the EIS simultaneously reveal and conceal? Let me broach this question by steadily unpeeling the backstage.

Some general assumptions the analysts can make about the backstage activity of AECL include the fact that differences of opinion, and negotiations about interpreting results, would have been standard. Degrees of differences in interpretation are routine aspects of science across all contexts: from esoteric debates,⁷⁰ to highly controversial and politicized areas,⁷¹ and whether or not informal⁷² or more formal contexts are involved.⁷³ Nevertheless the EIS adopts (reveals) a unified voice and avoids presenting (conceals) dissenting opinions (contrary to Panel guidelines). In effect this kind of backstage detail is carefully eliminated from the front stage performance. The SRG also utilized a univocal voice in the formal context of its Report and subsequent Addendum. Yet that unity dissolved in its informal testimony before the Seaborn Panel (1st Nov. 1995), and in doing so SRG members offered an explanation for AECL's univocal performance.

When an SRG member indicated the SRG envisioned a century-long time scale for a disposal operation, a Panel member responded that 'the public' was concerned, not about technology (which could change), but the time-scale.⁷⁴ Seaborn later pursued this theme, asking which criticisms the SRG thought AECL could respond to within a relatively brief period of time.⁷⁵ An SRG member responded to the broader question of consensus opinion by stating that:

I agree that we do not have a well developed consensus within the SRG regarding the questions that you have posed. And so when we speak we are speaking as individuals and not as a team as we were when we presented our report ... The

70. Collins, *Changing Order*, 79-112.

71. Pam Scott, Evelleen Richards and Brian Martin, "Captives of Controversy: The Myth of the Neutral Social Researcher in Contemporary Scientific Controversies," *Science, Technology, and Human Values* 15, 4 (1990): 474-94.

72. Caroline J.S. Picart, "Scientific Controversy as Farce: the Benveniste-Maddox counter-trials," *Social Studies of Science* 24, 1 (1994): 7-37.

73. John Law and R.J. Williams, "Putting Facts Together: A Study of Scientific Persuasion," *Social Studies of Science* 12, 4 (1982): 535-58.

74. *SRG Transcript*, 100-101.

75. *SRG Transcript*, 105.

generic system seems feasible, but the postclosure performance assessment is not reliable.⁷⁶

Other SRG members made clear how that unreliability might be linked to AECL's univocal voice. An SRG member referred to his own experience when suggesting "expert opinion is sometimes coloured by who you work for and where you come from." The SRG member later concluded that AECL needed to "completely rethink their uncertainty analysis,"⁷⁷ the implication being that an AECL affiliation had skewed the uncertainty analysis. As Schattschneider once commented, "organization is the mobilization of bias."⁷⁸

Evidently even other technical elites thought internal organizational imperatives structured the univocal voice of the EIS. Yet what was the social environment within which AECL operated? In 1987 anti-nuclear groups had claimed the policy environment in nuclear matters was akin to a subgovernment: a tight alliance of interest groups, administrative agencies, and government executive engaged in monopoly decision-making.⁷⁹ Mehta has also noted the dominance of nuclear policy-making in Canada by an insular policy community of manufacturers, suppliers and utilities (such as AECL and Ontario Hydro), their associated lobby groups (such as the Canadian Nuclear Association), regulators (AECB), and sympathetic government ministries. Mehta argued this insularity had resulted in both a lack of accountability to broader citizen goals and environmental integrity, and active hostility to citizen participation, on behalf of the nuclear policy community.⁸⁰ Murphy and Kuhn have extended this analysis by showing how AECL actively sought to maintain this insularity as the terms of reference for the public inquiry were being negotiated. AECL was largely successful, as the mandate of the inquiry (released in 1989) focused on a disposal concept alone and excluded discussion of policy-implications, such as the future of nuclear energy.

76. *SRG Transcript*, 106-07.

77. *SRG Transcript*, 132-35.

78. E.E. Schattschneider, *The Semi-Sovereign People: A Realists View of Democracy in America* (New York: Holt, Rinehart, and Winston, 1960), 71.

79. Ted Schrecker, "The Atomic Energy Control Board: Assessing Its Role In Reactor Safety Regulation, Submission to the Ontario Nuclear Safety Review, Prepared for Energy Probe, 1st September 1987" in *The Safety of Ontario's Nuclear Power Reactors, A Scientific and Technical Review*, F.K. Hare, 2 Volumes (Ontario: Ministry of Energy, 1988), Vol. 1: 1-32. On page 11.

80. Michael D. Mehta, "Regulating Nuclear Power: The Mismanagement of Public Consultation in Canada" in *In the Chamber of Risks: Understanding Risk Controversies*, ed. William Leiss (Montreal and Kingston: McGill-Queen's University Press, 2001), 102-124; "Energy Mixes and Future Scenarios: The Nuclear Option Deconstructed" in *The Integrity Gap: Canada's Environmental Policy and Institutions*, eds. E. Lee and A. Perl (Vancouver: UBC Press, 2003), 105-132.

Murphy and Kuhn demonstrated this restrictive mandate evolved as competing parties sought to shape the agenda.⁸¹ AECL favoured a narrow technical review since the late 1970's. Yet by 1986 internal federal/provincial government negotiations had leaned toward a broader review, as well as an agreement to utilize a federal publicly inclusive assessment process. AECL won some battles: the technologies and methodologies needed to implement a concept were emphasized over and above socio-economic and environmental considerations, the word 'alternatives' was replaced by 'other approaches' (to limit discussion primarily to the AECL concept), and discussion of Canada's future energy policy was prohibited. Yet AECL lost other battles. The public inquiry would not be restricted to a technical review, as shown by a compromise to have the SRG but have the SRG subordinate to the Panel. AECL had preferred a parallel SRG-Panel set up, which would have allowed technical specifications to be discussed in relative isolation of broader public deliberation. Prior to the terms of reference being released, NGOs had indicated the residual insularity embodied by the narrow mandate (no discussion of future energy policy) was politically unacceptable.

Indeed Kuhn found that at scoping sessions in 1990, held to allow public input into the definition of the scope of the inquiry and discuss the details of parameters of assessment, that 88% opposed the review process as limited in scope. Kuhn concluded that having one stakeholder (AECL) define the problem "is to attempt to evade ideological conflicts over the goals of energy and nuclear politics."⁸² Thus in explaining the front stage performance of the AECL EIS, the relevant backstage activity is AECL's organizational experience of operating within an insular policy environment and the resulting commitment to and preference for a narrowly conceived technical evaluation of the disposal concept. In effect the EIS was an *apparatchik*; a formidable technical agent of Canada's politically insular nuclear policy community. If the political responsibility of the EIS was to win consent for the disposal concept, then clearly this effort failed. Elsewhere I show that, at the public hearings in 1996-97, lay citizens and NGOs routinely rejected the disposal concept *because* it was seen to be a political agent of nuclear expansion.⁸³ A further piece of the

81. Brenda L. Murphy and Richard G. Kuhn, "Setting the Terms of Reference in Environmental Assessments: Canadian Nuclear Fuel Waste Management," *Canadian Public Policy – Analyse de Politiques* 27, 3 (2001): 249-266.

82. Richard G. Kuhn, "Public Participation in the Hearings on the Canadian Nuclear Fuel Waste Disposal Concept" in *Canadian Assessment in Transition*, ed. A.J. Sinclair, Canadian Association Public Issues Committee, Series No. 5 (Waterloo: Department of Geography, University of Waterloo, 1997), 40.

83. Darrin Durant, "Public Consultation as Performative Contradiction: Limiting Discussion in Canada's Nuclear Waste Management Debate" in *Nuclear Waste Management in Canada: Critical Issues, Critical Perspectives*, eds. Darrin Durant and Genevieve Fuji Johnson (Vancouver: UBC Press, forthcoming).

backstage thus becomes relevant, for it was clear during the public hearings that many lay citizens and NGOs did not think the EIS addressed *their* concerns.

Yet this does not mean that AECL did not seek to address the public *per se*. Indeed the front stage performance of the EIS must be seen in light of backstage acknowledgements that consultation with the public was a political reality. The backstage is thus not exhausted by technical negotiations, differences of interpretation, or a history of insular policy making. The contentious process of setting the terms of reference for the public inquiry had presented AECL with a number of tensions to resolve. Despite the history of nuclear fuel waste management in Canada developing largely in isolation of public consultation and deliberation, what I have referred to as a process of ‘unfolding’,⁸⁴ these tensions meant AECL had to creatively adapt. The tensions involved a public audience demanding broad public participation and wide-ranging discussion, and a regulatory audience *both* technocratic (AECB) *and* desiring of discussing alternatives and social issues (Environment Canada, the Government of Ontario). With its own interest in restricting the scope of discussion, AECL had to balance these tensions in order to stage a successful EIS performance.

Backstage: Following Guidelines

The answer to these tensions was a decision to follow the guidelines, not of the Panel, but of the AECB. As several NGO critics pointed out, AECL appeared to treat Panel guidelines as obstacles to be overcome rather than points of serious dialogue. First Nations groups (with the exception of the Meadow Lake Tribal Council) consistently claimed AECL had ignored their concerns entirely. Prominent NGOs claimed social and ethical aspects were treated as irrationalities to be overcome, that AECL displayed an indifference to public involvement, and that the Panel guidelines were willfully disregarded. All respondents argued that discussion of alternatives to geological disposal was cursory and that documentation concerning dissenting opinions was completely absent. Yet the EIS *does* follow the guidelines of the AECB regulatory policy document on deep geological disposal of nuclear fuel waste, known as R-71 and released in January 1985.⁸⁵

Several NGO critics pointed to this relationship, though in various degrees of specificity. Energy Probe described the EIS as conforming to the “self-regulatory” approach of the AECB.⁸⁶ The Campaign for Nuclear

84. Darrin Durant and Anna Stanley, “A History of Nuclear Fuel Waste Management in Canada” in *Nuclear Waste Management in Canada*.

85. AECB R-71.

86. Energy Probe, *Public Comments*, Pub. 014, 1.

Phaseout argued that the “current AECL ‘EIS’ is an engineering feasibility study [with] origins as an engineering document [R-71].”⁸⁷ Northwatch bluntly argued the “indifference to public aspects of the review” and “scientific posturing” of the EIS was directly related to its origins as a technical document (the R-71).⁸⁸ What is R-71? Released in January 1985, R-71 addressed the scope and schedule of a concept assessment phase for disposing of high-level nuclear waste, and outlined what form a concept assessment document (CAD) should take. In R-71, geological disposal is indicated to be the preferred option, and a thorough public scrutiny is envisioned. The overview notes the core issues: engineered and natural barriers to isolate wastes, a generic concept assessment with no mention of a specific site, and long-term evaluation based upon predictive modeling with only a broad range of potential site variables provided. Acceptability was defined in the following way:

If Concept Assessment does demonstrate the likelihood that deep disposal in a pluton can satisfy the technical requirements for health, safety, security and environmental protection, the AECB will consider this concept to be acceptable. The concept of disposal in plutonic rock will be judged on its own merits without reference to other options.⁸⁹

AECL’s battle from 1986 to 1990, to keep “alternatives” out of the concept assessment phase, can be seen in the context of the AECB’s policy directive that deep geological disposal would be judged in isolation of considering other options.

Note the AECB criterion concentrates on technical requirements, implying both the secondary nature of social requirements and their unambiguous separation. Critic’s contention that social aspects were neglected can thus be traced back to this policy context. Note the assumed dualism in the way R-71 addresses social aspects:

Since the disposal of nuclear fuel waste raises social and economic questions as well as those of a technical nature, the AECB will endeavour to ensure that, concurrently with the technical review, the social and economic issues are also given due consideration.⁹⁰

If critics are correct that the AECL EIS derived its form and character from the AECB R-71, one means to test this contention is to explore what ‘due consideration’ (of social and economic aspects) meant in the context of R-71.

The AECB R-71 outlines two kinds of requirements for a CAD: those that apply to the disposal concept itself (section 2.2), and those that apply

87. Campaign for Nuclear Phaseout, *Public Comments*, Pub. 027, 11.

88. Northwatch, *Public Comments*, Pub. 046, 3.

89. *AECB R-71*, 6.

90. *Ibid.*

to the assessment and documentation of the concept (section 2.3). In section 2.2, the AECB outlines pre-closure and post-closure periods, indicates its preference for predictive modeling assessments of the post-closure study, and emphasizes that a design for the repository should avoid dependence on human intervention or maintenance. In section 2.3, the AECB requested: a separation of the subject into its constituent parts, an acknowledgement of limitations in data, clear arguments linking models to reality, an establishment of technical feasibility, the provision of dose calculations for members of the public, an analysis of human intrusion scenarios and environmental impacts, a quality assurance program, and an evaluation of both existing and future technology. The penultimate requirement listed “generic issues pertaining to socio-economic impacts,”⁹¹ such as public perception of risk, availability of resources to do the job, transportation, the skill base available, job creation, community services and the effect on property values. The final section was the most specific, listing twelve points concerning predictive modeling that ought to be addressed.⁹²

The R-71 emphasizes social and economic *impacts*, as opposed to the Panel guidelines call to explore social and economic issues in a broad fashion. The R-71 assumes a technical presentation is appropriate, whereas the Panel guidelines demand the technical presentation be couched in a fashion accessible to a broad audience. The EIS also conforms to the R-71 outline of a CAD. The EIS is divided into pre and post-closure studies, it relies heavily upon predictive modeling, and it emphasizes technical feasibility as the criterion of success. Recall that Murphy and Kuhn⁹³ argued AECL opposed the movement, in negotiations concerning the terms of reference, away from a very narrow technical review to one that included a broader discussion. We can see this opposition as structured by ‘organizational bias’ to remain close to the AECB guidelines, as outlined in R-71.

The backstage activity that went into the production of the AECL EIS thus included a residual commitment to the notion of a narrow technical review. What we have thus seen is that the more one questions the performance of AECL in the EIS, the more one is taken back to the conditions of production. From a front stage performance characterized by a unifying narrative of dialogue and consultation, and the rhetoric of expert judgment, following the EIS back stage takes one to a host of possible position-statements regarding the adequacy of the EIS. Further exploration of the EIS backstage revealed a number of criticisms, from questioning the clarity of the document to a shared critique (critic and

91. *AECB R-71*, 14.

92. *AECB R-71*, 14-15.

93. Murphy and Kuhn, “Setting the Terms of Reference.”

supporter) of AECL's expertise and judgment. A good deal of backstage activity was thus revealed, as critiques of the lack of independent review of EIS documentation pointed to a shared claim that too much activity was being backstaged. The extent of concealment undermined the front stage rhetoric of expert judgment, as critic and supporter alike began to ask questions about the conditions of production and the degree to which AECL was neglecting uncertainties and differences of opinion. Misrepresentation, concealment, and unreliability claims were thus made against the AECL EIS. Groups such as the SRG suggested implausible modeling work was related to a mobilized bias. NGO-critics suggested backstage political decisions shaped the EIS front stage performance. The conditions of production—the ultimate backstage—were thus highlighted, as a history of contentious political negotiations came into view. A policy origin-point (the AECB R-71) strongly suggests a technocratic focus structured the front stage performance of the EIS.

By 1995 the SRG and NGOs were already arguing that accepting the AECL disposal concept was akin to 'swallowing camels in the house that jack built'. Nevertheless the federal government response to the Seaborn Panel report of 1998 was to formulate one response for the public and a different one for 'the technical' side. The guiding assumption in this dualist strategy is that resistance to deep geological disposal took two forms: credentialed experts and their technical objections, and public opposition groups and their social objections.

Despite such an unsound assumption, the NWMO largely takes for granted the ability of 'the experts' to independently solve any technical deficiencies. The NWMO recommendation to Government of November 2005 implicitly divided appropriate technical methods of disposal from social acceptance of an implementation plan.⁹⁴ Elsewhere I have shown how the NWMO has concentrated its efforts on how to make technical proposals socially acceptable.⁹⁵ This technical-social dualism implicitly proscribes normative models. Credentialed specialist and their home agencies are thus presented as advancing 'technical deficiencies', not 'social concerns'. The lay public is presented as advancing 'social concerns' that probably cloud their ability to make independent and informed 'technical evaluations'. This technical-social dualism implicitly minimizes the expectation that shared lines of resistance might prevail. Research in both the social study of technical controversies, and the public understanding of science, have done much to reveal the inadequacy of any view that postulates context-independent strategies for establishing

94. Nuclear Waste Management Organization, *Choosing a Way Forward: The Future Management of Canada's Nuclear Fuel*, Final Study (Toronto: NWMO, November 2005), 162.

95. Darrin Durant, "Managing Expertise: Performers, Principals, and Problems in Canadian Nuclear Waste Management," *Science and Public Policy* 33, 3 (2006): 191-204.

and/or disputing credibility. However this body of work can also be taken as showing that particular dualisms, boundaries, strategies and rhetoric vary in how they are deployed, according to context, while simultaneously remaining as symbolic resources that form part of standard narratives for making credibility-claims.

For instance in a study of opposition to a waste disposal isolation plant in New Mexico, Downey showed how strategies for undermining or establishing credibility varied according to the cultural identities of speakers, audiences, and the content of their communication.⁹⁶ In a study of expert disputes in Canada's MacKenzie Valley Pipeline Inquiry, Campbell showed how uncertainty and the level of knowledge could be used strategically in arguments. Campbell found (expert) uncertainty could vary according to the social circumstances of organizations.⁹⁷ In both cases it remained situationally dependent whether 'identity' or 'uncertainty' formed part of oppositional claims, and whether they formed part of successful claims or not. Yearley found a similar result for 'impartiality', in a dispute involving conservationists and government agencies over a proposed Marina in the Northern Irish town of Killyleagh. Yearley showed how failures to establish neutrality varied according to the situational success of separating facts and values, and with specific features of the adversarial context itself.⁹⁸

In all of these cases symbolic resources remained available to be discursively drawn upon according to the goals of the particular disputing party. In Yearley's case, competing sides vied for the label of 'impartial'. In Campbell's case, disputing experts made different things out of the presence of uncertainty. Actors put these cultural resources to use for their own purposes. Mercer has found this kind of social action in an Australian public inquiry into whether electric and magnetic fields, associated largely with powerlines, are harmful to health.⁹⁹ Mercer showed that method discourses, while not drawn upon in a mechanical fashion—as they could vary in how they were used according to the specific conclusions of studies—remained valuable resources for channeling interpretations of data toward previously preferred policy/technical conclusions. It is this flexibility of cultural resources—identity, uncertainty, impartiality,

96. Gary L. Downey, "Structure and Practice in the Cultural Identities of Scientists: Negotiating Nuclear Wastes in Mexico," *Anthropological Quarterly* 61, 1 (1) 1988: 26-38.

97. Brian L. Campbell, "Uncertainty as Symbolic Action in Disputes Among Experts," *Social Studies of Science* 15, 3 (1985): 429-53.

98. Steven Yearley, "Skills, Deals and Impartiality: The Sale of Environmental Consultancy Skills and Public Perceptions of Scientific Neutrality," *Social Studies of Science* 22, 3 (1992): 435-53.

99. David Mercer, "Scientific Method Discourses in the Construction of 'EMF Science': Interests, Resources and Rhetoric in Submissions to a Public Inquiry," *Social Studies of Science* 32, 2 (2002): 205-233.

method discourses, and so on—that is systematically deleted from view when the technical-social dualism is deployed.

The result of this kind of dualism is a default encoding of dissent as either scientific criticism or social evaluation. The either/or relation is analogous to the categorical distinction between risk and ethics. Drawing upon the case of genetically modified organisms, Wynne argued the distinction between risk and ethics patronized the public as intellectually vacuous. It also serves to obscure public judgments about the quality of expert institutions, and is thus implicated in a deep-seated cultural move in which expert institutions systematically misread public complaints about exaggerated claims as a misunderstanding of the nature of risk.¹⁰⁰ In a similar fashion, Wynne also argued that contemporary institutionalized policy discourse constructs the public as only concerned with risk and consequences rather than a plurality of meanings tied up with the purposes of knowledge.¹⁰¹ I suggest the technical-social dualism performs similar functions of institutional legitimacy and deletion.

The technical-social dualism obscures the fact that both experts and the lay public make discursive use of similar sets of resources when disputing technical claims. Constructing the public as only venturing ‘social criticism’ can be a means to present public critique as lacking legitimacy to the extent social criticisms remain the oppositional strategy of the lay public. This preserves a domain in which only credentialed experts offer ‘reasoned considerations’. The technical-social dualism thus performs *work* for institutions involved in policy-making, serving to maintain a hierarchy in which ‘technical claims’ can be immunized against ‘social concerns’. A focus on shared lines of dissent is one way of disrupting this hierarchy. The technical-social dualism must be viewed as an *ex post facto* strategy for procuring preferred socio-technical policy options, rather than an accurate portrayal of the nature of dissent. In this case, shared pathways of dissent included suspicion about the rhetoric of expert judgment, criticism of a lack of independent peer review, a judgment of unreliability, dissatisfaction regarding narrowly conceived and internally-negotiated terms of reference, and a judgment that AECL displayed poor ‘body language.’ A technical-social dualism results in this shared resistance being rendered as public misunderstanding, and thus not a part of considerations about technical claims. Challenging the dualism, by showing the shared lines of dissent, is one useful stratagem for displaying the full spectrum of cultural evaluations of sociotechnical policy-making.

100. Brian Wynne, “Creating Public Alienation: Expert Cultures of Risk and Ethics on GMOs,” *Science as Culture* 10, 4 (2001): 445-481.

101. Brian Wynne, “Risk and Environment as Legitimatory Discourses of Technology: Reflexivity Inside Out?” *Current Sociology* 50, 3 (2002): 459-77. For a critical analysis of Wynne, see Darrin Durant, “Accounting for Expertise: Wynne and the autonomy of the lay public actor,” *Public Understanding of Science* (forthcoming).