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ENVIRONMENTAL ASSESSMENT AND THE CONCEPT FOR THE
DISPOSAL OF HIGH-LEVEL NUCLEAR WASTE:

TECHNOLOGY, THE ENVIRONMENT AND THE POLITICAL
CONTESTATION OF CULTURE

Anne Wiles
September 1994

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"Environmental Assessment and the Concept for the Disposal
of High-Level Nuclear Waste: Technology, the Environment
and the Political Contestation of Culture"

submitted by Anne Wiles, B.A.

in partial fulfillment of the requirements for
the degree of Master of Arts

Thesis Supervisor

Chair, Department of Geography

Carleton University

September 23, 1994

ABSTRACT

The conflict over the proposal to dispose of high-level nuclear waste, examined through an analysis of submissions to Environmental Assessment and Review Process hearings, is an instance of the political contestation of culture. The two opposing positions are based in socially constructed realities in which a social construction of the environment and the inherently political nature of technology are central. The present policy-making process perpetuates cultural misunderstandings and privileges the dominant position: a more equitable process that accommodates the values of both sides is proposed. It is concluded that in a democracy, environmental assessment should reflect the cultural and political meanings of the environment that are of concern to participants in environmental disputes.

ACKNOWLEDGEMENTS

The case study of submissions of intervenors to the scoping hearings of the Nuclear Fuel Waste Management and Disposal Concept Review and the analysis of the areas of possible accommodation between the pro-nuclear and anti-nuclear positions, which form the substance of this thesis, were carried out for the Environmental Assessment Panel conducting this review. These documents are a product of a 15-month process in which I consulted with the Federal Environmental Assessment Review Office (FEARO) on issues of risk and ethics for this review. I am grateful to the panel and to Guy Riverin of FEARO for permission to use portions of those documents in this thesis.

I would also like to thank John McEwen of FEARO for information he provided on the evolution of the Environmental Assessment Review Process review of the high-level nuclear waste disposal concept. In addition, I am grateful to Bob Whillans, T. E. Thexton and Geraldine Underdown of Natural Resources Canada for information they provided on the Canadian nuclear industry and the review of the waste disposal concept.

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CHAPTER 1

INTRODUCTION

On September 28, 1988, the Honourable Marcel Masse, federal Minister of Energy, Mines and Resources, announced an environmental review of a concept for the disposal of Canada's high-level nuclear waste. The Minister called this review "One of the most important environmental assessments ever carried out in Canada" (EMR 1988: 1). The review would be carried out by the Environmental Assessment Review Process (EARP), and was to study the safety and acceptability of the concept for the disposal of used nuclear fuel, or "high-level" nuclear waste, 500 to 1 000 metres deep in stable rock formations in the Canadian Shield.

The proponent in this review is Atomic Energy of Canada Limited (AECL), the Crown corporation responsible for the design, construction and marketing of CANDU reactors in Canada and abroad, which is charged with preparing an Environmental Impact Statement on the disposal technology. AECL had researched the disposal concept at its Whiteshell research facility at Pinawa, Manitoba, for about ten years. The disposal concept is widely viewed as viable: as the Canadian Nuclear Association (CNA) points out, "Canadian scientists and their colleagues around the world agree that a practical method of permanent disposal would be to place the used fuel in deep, underground vaults" (CNA 1991- 10).

Canada's nuclear power program uses domestically developed CANDU reactors that use natural uranium fuel that is plentiful in Canada. The new fuel "bundles" can be held by

hand before they are put in the reactor, but after about two years in the reactor they are highly radioactive and remain so, though at continually declining levels, for many thousands of years. Immediately after removal from the reactor the used fuel bundles are placed in water-filled bays at the reactor site; one year after removal from the reactor the used fuel is 100 times less radioactive. After five years it is 1,000 times less radioactive, and has cooled sufficiently that it can be transferred to above-ground storage in concrete storage canisters (CNA 1991-03; 1991-10).

After 500 years "most of the highly penetrating radiation will be gone" (CNA 10-1991). The Canadian Nuclear Association estimates that "the average 600 MW CANDU nuclear reactor produces about 20 cubic metres of used fuel bundles per year. The bundles in storage in Canada at the end of 1990 would fill one olympic size swimming pool" (CNA 1991 -03).

The concept for the disposal of used nuclear fuel waste involves the placement of used fuel bundles in corrosion-resistant containers, which are then put in disposal rooms in vaults deep in the rock. The containers would be surrounded by compacted clay, and the rooms backfilled and sealed. The tunnels and shaft of the entire vault could be backfilled, and the surface area returned to normal use (CNA 1991 -10). The CNA states that "a single disposal vault could hold all the used fuel from 100 years of operation of all Canadian nuclear generating stations" (CNA 1991-10). The advantages of this method of nuclear waste management are that it is permanent and safe, and would not require the constant monitoring that must currently be carried out of used nuclear fuel stored at reactor sites - indeed, once filled and closed, it would not require any

human supervision.

On announcing the EARP review of the disposal concept the Minister noted that:

a disposal facility will not be required for several decades . . . since the small volume of used nuclear fuel from Canada's nuclear power program can be stored safely and economically at reactor sites. . . . No site selection for an actual site will begin until a disposal concept has been accepted as safe. . . . Nevertheless, it is urgent that we move forward and address public concerns about nuclear fuel waste management" (EMR 1988: 2).

The official rationale for this review was that though nuclear fuel wastes are safely managed and pose no danger to health or the environment, people are concerned about the continued safety of these wastes and the risks they may pose in the future. Sharing this concern for future generations, the government selected a disposal method, devoted much time and resources to researching the actual implementation of the technology, and was now, with this review, submitting the disposal concept itself to review by experts and the public. As Masse said, "the concept must be subjected to thorough public and scientific scrutiny before decisions are made about the long-term management of these wastes" (EMR 1988: 2).

The scoping hearings of the review, an early round of public hearings at which intervenors presented the issues they believed should be addressed by the review and by AECL in its Environmental Impact Statement, were held in the fall of 1990. It was clear from the submissions to these hearings that the public did not share the government's view of the rationale for pressing ahead with disposal, did not trust the review process, did not have confidence in scientists' assurances that the disposal technology was safe and effective, and did not consider that disposal

should even be discussed before a complete public inquiry had been held on nuclear power itself and had resulted in a clear public mandate to continue with nuclear power or phase out the use of the technology in Canada. The arguments and tensions that had characterized the contentious debate over nuclear power throughout the Western world were all evident in the nuclear waste disposal issue in this review: the two sides did not understand each other, respect each other, or trust each other. In his Nuclear Fear Spencer Weart observes that it is typical of the nuclear power dispute that:

In formal debates nobody seemed able to refute anyone else's statements; arguments flew past each other almost without touching. Observers began to notice that the two sides held widely divergent assumptions about not only reactors but many other things. Sometimes the debaters spoke what amounted to different languages, using different words and expressing themselves in different modes (Weart 1988: 348).

Objectives of this Thesis

This thesis focusses on the assumptions, values, and rationalities of the two positions on nuclear power that are so divergent, from their founding definitions and principles, as to be separate social value systems, worldviews, or 'paradigms'. Through an examination of the conflicting positions on the disposal of high-level nuclear waste, as expressed by intervenors to the scoping meetings, I study how the paradigms themselves have shaped and justified their positions on nuclear power and on the proper way of relating to the environment within a historical and political context. The conflict over nuclear power has evolved in a philosophical and structural context that has been instrumental in shaping the two positions on nuclear energy. This is also an environmental conflict: the definition of "nature" and the uses of the

environment that are embedded in each worldview are integral elements of the two positions on nuclear power. The interplay between the political structures and the two paradigms in turn influences further political decisions and directions, as the worldview context in which decisions are made leads to a certain perception of the opposition's actions and to attempts to retain or gain legitimacy.

The two main themes of this thesis are reflected in the theories of the cultural construction and meaning of the environment, and the social construction of reality. First, this is a case of the political contestation of culture involving the political contestation of the environment. Second, being embedded in the objectified realities of their contrasting worldviews, the opponents in this conflict did not understand each other and did not know that they did not understand each other, and were thus mired in confused and turbulent cross-cultural misunderstandings. The process by which policy decisions on nuclear power have been made, and which continues in this review, is part of the politics of the conflict, being an outgrowth of the dominant worldview: it has itself contributed to and perpetuates the bias, misunderstanding, hostility and inequity that characterize the nuclear conflict.

The main objectives of the thesis are to unravel the misunderstandings, clarify the pivotal values at issue and suggest a process that may step clear of the main weaknesses of the present style. I trace the values and logic of both worldviews and their full positions, so that key values on the environment and social relations in relation to nuclear power can be identified. With this understanding, I begin to develop a process that extracts itself from the politics of the conflict - which is of

course a political stance in itself - and serves as a more equitable forum for the debate of important social issues. An understanding of the intrinsically political nature of the environment, and how this is manifested in the particular worldviews involved, is essential in 'diagnosing' some of the deep hostility of the conflict, and clarifying the core values and definitions of each worldview so they can be accommodated in an equitable and less contentious process.

Beginning Chapter 2 with the theoretical assumptions of the social construction of the environment and of the principles of the construction of a social order that frame the entire thesis, then, I move to the content that is specific to the nuclear conflict, describing the dominant and environmental paradigms as formulated by environmental sociologists from survey research. In Chapter 3, I discuss the historical background and political context of this review, outlining the origins of the Canadian nuclear industry and the opposition to it, environmental decision making in Canada and the origin and mandate of the review. I also discuss briefly two other processes adopted for the siting of nuclear waste repositories, as the political milieu in which decisions on the process for this review were made.

In chapters 4 and 5 I analyze the pro- and anti- nuclear positions, as expressed by intervenors to the scoping meetings of the review of the concept for the disposal of high-level nuclear waste, in the context of theoretical work on the major points raised in order to gain a more complete understanding of the rationality of the worldview. Chapter 6 outlines a philosophical rationale for the direction taken in the proposal for the terms of an improved process. I conclude that the two positions are

grounded in two different but internally coherent worldviews and are supported by fundamental values that must be considered legitimate. The process instituted by the dominant worldview functions, in this context of significant cultural divergence, as a violation of the democratic rights promised by the dominant ideology to all members of society.

In the final section of the study, in Chapter 7, I analyze the possibilities for commonality and accommodation between the two sides in the effort to find the outline of the issue as it will have to be defined in an equitable process. How can the contrasting values of the different paradigms be integrated into the terms of one review so that a decision may balance and reflect the values of both sides? Given that "the environment" means such different things to the two sides, what does an "environmental review" need to incorporate in order to address the concerns of both sides? What conditions have produced the 'politicized' positions, as distinct from the core values of each paradigm, and what changes might help reduce them? An understanding of the two types of difference between the two sides gives a greater understanding of the elements in the conflict over nuclear power and of the different measures that might be taken to begin to reduce the tension, increase cooperation and show the way to a resolution of the issue.

Learning the detailed content of the values and concerns at issue is the primary method here. A major task is to describe the 'divergent assumptions', 'different languages' and 'different modes' that seem to prevent the participants in this controversy from entering into a constructive debate on what has become a potent symbol of late twentieth-century society and the critique of it, and

complicate and confound attempts at public hearings and inquiries. This is a function of the involvement of two different paradigms: as we all perceive the world through our own paradigm, we tend to project our values and assumptions onto other paradigms. Understanding and acknowledging the validity of the assumptions and logic of a different paradigm is difficult and could undermine the credibility of our own, which, since saving the integrity of our own paradigm is important, we are reluctant to do. Milbrath has noted that "persons whose thinking is embedded in a given paradigm cannot perceive the reality that is seen by those whose thinking is embedded in another paradigm - it is like the blind talking to the deaf" (Milbrath 1994: 117).

These characteristics of socially constructed paradigms produce the contentiousness, the confusion and the often paralyzing mutual misunderstanding in major social conflicts like that over nuclear power. We have noted Weart's observation that "nobody seemed able to refute anyone else's statements, [and] arguments flew past each other almost without touching" (Weart 1988, 348). Milbrath calls this "incoherence across paradigms" and describes it as "especially problematic as the world's leaders try to solve problems in a traditional way (eg by accelerating economic growth) while simultaneously trying to make the planet's life systems sustainable" (Milbrath 1994 117). As Liora Salter and Debra Slaco observe, often left out of public inquiries are "the participants' particular perceptions of the issues, the rationality they bring, and the priorities they see for recommendations." Salter and Slaco continue:

Without understanding this rationality, the issues addressed at a hearing appear superficial, the data inconsequential, the barriers to participation procedural, and the resulting decisions

incomprehensible. . . .

It is deeply significant for inquiries that issues cannot be properly resolved until the logic that lies behind the various arguments is fully appreciated (Salter and Slaco 1981, 57).

The Study and the Intervenors

This is not a formal content analysis and does not attempt to quantify references to a predetermined set of points or correlate values expressed with demographic characteristics. It is a textual analysis of the submissions, in which care has been taken to allow the submissions themselves to form the structure of the analysis. The result is a composite picture of each position, rather than a description of what any one intervenor expressed or a statement of the prevalence of these positions in Canadian society. Since it is also, inevitably, an interpretive exercise, the value positions derived from the submissions are documented fully in the text.

The categories used in this analysis were derived from the concerns and values expressed by the intervenors, with the result that the categories are not the same for the two sides. The 'theoretical context' sections are interspersed through the intervenors' positions rather than presented separately, in order to have the theory follow and explicate the framework of the intervenors' arguments. These sections present a fuller articulation of the positions expressed by the intervenors, along with the philosophical basis that supports them, and are meant to be representative of the formal expression of these positions and of academic and theoretical positions on them, rather than conclusive arguments in favour of any position or exhaustive commentary on the subject.

The sample of intervenors studied for this analysis was selected more or less at random from the published submissions to the scoping meetings in 1990 that dealt with issues beyond the strictly technical. Since this is an analysis of underlying values, submissions that did not describe the intervenor's position on the appropriate scope of the review, or did not set out the rationale for a position on nuclear power and the acceptability of the disposal concept, were not included.

In general, the intervenors who supported nuclear power either were or had been associated with the nuclear or a related industry, or had business or professional affiliations with the industry. They were located, for the most part, in major business, industrial, or research centres. The following submissions, with the location and affiliation of the presenters, where available, served as the basis for the analysis of the pro-nuclear position:

K.D. Hester, P. Eng. (Hester & Associates)

John K. Sutherland

Association of Major Power Consumers of Ontario
(Borden & Elliot, Barristers and Solicitors,
Toronto)

Canadian Nuclear Association

D.F. Meraw (Canadian Nuclear Society, Central Lake
Ontario Branch)

B. Rouben and S. Smith (Canadian Nuclear Society,
Toronto Branch)

J.A.L. Robertson (Deep River, Ontario)

Wardrop Engineering (E.C. Card, P. Eng., Toronto)

Roger Steed (Canadian Nuclear Society, New Brunswick
Chapter)

M. Fereday, P. Eng.

T. Jamieson and F. Boyd (Canadian Nuclear Society,

Ottawa Chapter)
 Association of Professional Engineers of Saskatchewan
 (Regina, Saskatchewan)
 Egon Stanik, P. Eng. (CN Rail, ret'd.)

The intervenors who opposed nuclear power tended to be community or social associations with an environmental or cultural interest, such as aboriginal, women's, or church groups. Many of the groups studied here are community groups from rural areas or small centres distant from major centres of business, although several anti-nuclear and environmental groups have their headquarters and much of their membership in major cities. The intervenors representing the anti-nuclear position, with their presenters' affiliations and organizations' locations, where available, were the following:

Environment North

The Golden/Red Lake Environment Group (High-Level Nuclear Waste Study Subcommittee)
 Atikokan Citizens for Nuclear Responsibility (John Pringle, Margaret Wanlin, John Stradiotto)
 Northwatch (Brennain Lloyd, North Bay, Ontario)
 Temiskaming Environmental Action Committee (Terry Graves, District of Temiskaming)
 Council of the Whitefish River First Nation (Birch Island, Ontario)
 Saskatchewan Environmental Society (Ann Coxworth, Saskatoon, Saskatchewan)
 Nishnawbe-Aski Nation (Deputy Grand Chief Charles D. Fox, Fort William Reserve, Thunder Bay, Ontario)
 Concerned Citizens of Manitoba (Dave Taylor)
 National Action Committee for the Status of Women (Anne Lindsay)
 Evangelism and Social Action Council of the Conference

of Manitoba and Northwestern Ontario, the United
Church of Canada (Reverend Janet Silman, Winnipeg,
Manitoba)

CHAPTER 2

THEORETICAL FOUNDATIONS

On the face of it, the conflicting positions expressed on the acceptability of the proposed concept for the disposal of high-level nuclear waste appear to constitute a dispute over the siting of a technology believed to pose a physical risk. The review is preliminary to an actual siting process, and the selection of the location of a waste disposal site was referred to by intervenors in relation to such considerations as suitable geological features, impacts on the local environment and residents, the probability of an eventual site's being located in a remote region far from the centres for which most of the electricity from nuclear power plants is produced, and the process by which siting decisions are made. In addition, arguments were made on both sides about the level of the risk posed by a waste repository, and its severity relative to other technologies and activities.

It was not primarily as a siting dispute or as a technical risk issue, however, that this conflict was expressed by intervenors in this review. First, despite the declared long-term trajectory of this process, the review is explicitly not a siting process: the review is of the safety and acceptability of the disposal concept itself. No general regions or possible specific locations are to be discussed at all, so there are no potentially affected communities, identifiable geographical areas or features, weather patterns, wildlife habitat, or transportation routes to be argued for selection or exemption. Discussion in the scoping meetings focussed on the viability of the disposal technology proposed by AECL and on a range of political and ethical considerations of nuclear fuel waste

disposal per se, and in relation to broader considerations of nuclear power. In addition, the review is not complete and the submissions analyzed are those presented at the scoping meetings, which were intended to determine the issues that were relevant to the disposal concept and of concern to the public.

Secondly, and more importantly, the positions on the disposal of nuclear fuel waste are conceptually and strategically embedded in positions on nuclear power, more than they are tied to arguments over particular locations that are supported or rejected by different groups of people. The opposition to nuclear power, though it is often portrayed as essentially a question of the determination of, and the acceptability of, a level of physical risk, is grounded in two principles: a fundamental cultural and social value complex in which nuclear power, as a large-scale, centralized and inherently risky technology, simply does not belong; and the history of policy-making on the technology, through which the public, and non-technical and non-economic community and environmental concerns, have been systematically excluded and marginalized. In this climate of opposition to nuclear power on philosophical and political grounds, the disposal of nuclear fuel waste has connotations that relate to the broader positions and strategies of the two sides, regardless of siting.

Timothy O'Riordan has argued for an understanding of the complexities of energy policy and political and economic strategy, rather than technical aspects of physical risks, in analyzing decisions on nuclear energy:

. . . risk appraisal of energy supply options intermingles with political and economic considerations that may be of much greater significance when determining a nuclear energy

strategy. The intermingling of risk appraisal with matters relating to pricing policy, the viability of an important industrial sector in a faltering economy, precedent, and political expectations, render of dubious value any analysis of the risk component in isolation of an energy strategy (O'Riordan 1983: 105-6).

In his review of the Sizewell B inquiry in Britain, a public inquiry held in 1983 and 1984 on the proposed construction of Britain's first pressurized water reactor at Sizewell, O'Riordan examines the proposal for the reactor in terms of the "stated energy policies of successive governments" (O'Riordan 1984: 171). He notes that the proposal to construct the Sizewell B reactor was made in the context of a general energy policy that both overestimated future energy demand and lacked commitment to energy conservation as an alternative to building increased capacity. The construction of a new plant would contribute to a recommended steady nuclear construction program to maintain the industry's skilled workforce and give the ailing industry a needed boost. In addition, the Sizewell B reactor would help diversify Britain's energy supply, increasing the proportion generated by nuclear, to "weaken the power of all major energy supply unions, most notably the National Union of Mineworkers (NUM), so that no trade union group has too much control over electricity supply" (O'Riordan 1984: 178). Weakening the NUM would facilitate the reduction of subsidies given to the coal industry, and the rationalization of coalfields.

The distinctive character of siting disputes as locational conflicts is itself in dispute among geographers and others studying community and environmental group opposition to technology, particularly nuclear technology. O'Riordan discusses the Sizewell debate in terms of political and economic strategy rather than location. R. Kemp takes a similarly political approach in his analysis of public

opposition to the public consultation program carried out in Britain by UK Nirex Ltd., a nuclear industry group, on the deep geological disposal of low and intermediate level radioactive wastes. He rejects the standard approach that relies on "a pluralistic, social-psychological interpretation of the role and activities of public opposition to site-specific proposals" (Kemp 1990: 1256).

Kemp argues that the NIMBY interpretation of these disputes as simple matters of siting is too limiting, and "distorting of often deeply held and fundamental public concerns" (Kemp 1990: 1240). He contends that a more careful analysis of why people oppose the disposal of nuclear waste is necessary: his own study argues that "historical, structural and contextual factors predetermined the types of responses received from the general public" (Kemp 1990: 1248). The technical rationality used in technology assessment and institutional decision processes shape a range of "vocabularies of motive" that are available to be used by the public in opposition to a proposed project. The agenda and the terms of discussion, that is, are set by institutional bodies and the public's response is constrained by these terms. Kemp outlines the "radical" foundation of his argument, which is that

. . . there is a need to move away from the NIMBY characterisation in order to expose the key influences upon public attitudes, and the vulnerability of these attitudes to certain major determinants of what are deemed to be legitimate modes or arguments which can be raised in public debate. This move will enable us to examine the relationship between public expressions of opposition to the disposal of radioactive waste and the processes of political power and 'structuration' whereby the exercise of power is not judged to occur in abstraction from the existing context of sociopolitical relations (Kemp 1990: 1247).

The radicalism of Kemp's position in geography is

consistent with the 'new' cultural geography discussed by Cosgrove and Jackson, who point out that a fundamental assumption in this work is

. . . the centrality of culture in human affairs. Culture is not a residual category, the surface variation left unaccounted for by more powerful economic analyses; it is the very medium through which social change is experienced, contested and constituted (Cosgrove and Jackson 1987: 95).

Cosgrove and Jackson note that "a key area of debate concerned the relationships between dominant ('elite') and subordinate ('popular') cultures with more than a hint on the part of some writers that the study of the latter has been undervalued in geography" (Cosgrove and Jackson 1987: 95). Cosgrove and Jackson conclude that "cultures are politically contested . . . culture can always be represented as a politically contested social construction. Moreover, the geography of cultural forms is much more than a passive spatial reflection of the historical forces that molded them; their spatial structure is an active part of their historical constitution" (Cosgrove and Jackson 1987: 99).

Kemp concluded that the public response to Nirex's consultation document "is constructed in such a way that its vocabulary conforms to the context set by the policy background. . . ." It is also "not mere NIMBY. It is a carefully reasoned exposition of those factors which affect the local public perception of the risks of the disposal of radioactive waste" (Kemp 1990: 1255). The political history of the nuclear issue, the way in which decisions have been made and the terms in which the issue has been defined, shape the way people think about it and determine the way they can make their own cases to decision makers. Even arguments about the relative merits of a location for a disposal site are shaped by these factors.

To committed opponents to nuclear power, the conflict over the disposal of nuclear fuel wastes is thus more a battle over the legitimacy of the industry itself and the process by which it was established by decision makers than it is a dispute over where a waste repository should be located. In the EARP review there was little sense that environmentalists will be indifferent to a nuclear waste repository that is located in someone else's back yard: anti-nuclear intervenors did not appear to have participated simply out of a concern that their region would likely be selected as a disposal site, and they did not take the opportunity of the panel hearing to argue why their region should be exempted in a future siting process and another location selected. In fact many participants were from areas that seem unlikely to host an eventual disposal site: Manitoba, Saskatchewan, Quebec, New Brunswick and southern Ontario. Most intervenors, from remote and from urban locations, seemed to be engaged in advocacy for their community or the environment rather than local interest, speaking on behalf of the natural environment, and in opposition to industrialization, simply on principle.

Nuclear waste disposal is at once a symbolic matter of the viability of an industry and a very real battle over the political conditions that may determine its future. Opponents to nuclear power agree that nuclear fuel waste is not acceptable anywhere, and attempts to site it will likely be opposed not only by local residents on behalf of their own environment and communities but also by long-time activists who believe that the real battle is over the simple ability of the industry to dispose of its wastes, or the blocking of the industry's attempt to do that.

This perspective is based on the assumption that the

presence of radioactive wastes is a major difficulty to the image and viability of the industry: 'solving' the problem of the long-term management of these wastes thus facilitates the advancement of the industry, while maintaining the obstruction to the industry caused by the continued presence of the wastes in the environment continues to hamper the industry until a legitimate, more representative or inclusive process has resulted in a nuclear policy that has the assent of the public.

It is not suggested that the environment is an irrelevant factor in what has become a matter of the exercise of power, and that location is not a concern in a dispute driven by political principle. There is no doubt that residents of a community which ended up hosting a repository would feel that the risk of injury had been added to ideological insult, but intervenors also left no doubt that non-residents who oppose the disposal of nuclear waste in any otherwise "unspoiled" landscape would also feel that they had lost an important battle for the environment. Spatial equity is indeed a factor, and many opponents of nuclear power felt that the waste should be stored and disposed of on nuclear power plant sites near the cities that are the greatest consumers of the electricity produced.

The emphasis on the nuclear dispute as an instance of the political contestation of culture brings the environment into the political formulation of the nuclear conflict. It argues that nuclear opponents' use of the term 'environment' is radically different from that of the pro-nuclear political and economic establishment, so different that we are forced to employ a much more fundamental level of analysis that treats the environment as a central element in the social construction of reality. I argue

that far from being a purely "political" issue divorced from environmental concerns, the conflict over nuclear power is essentially an environmental conflict, that is, a profoundly political contestation of the definition and use of the environment by human society.

The dominant and subordinate conceptions of the environment are definitive constituents of the two worldviews that shape and support the social relations and political processes that are in conflict over nuclear power. Rather than study the cultural meaning and "vocabularies of motive" of the subordinate culture against the structural backdrop of the dominant social order, I assume that there are structures of meaning that shape, legitimate and constrain both sides. That is, the political structure is itself shaped by a conception of the environment and of social relations that justifies its institutional structure and decision making process. It is the interaction of the two over the issue of nuclear power, including their mutual misunderstandings, that can be described as the nuclear conflict.

The conflict over nuclear power can be reduced - or exploded - to the confrontation of two worldviews, or social orders or paradigms, grounded in different visions of nature and social relations. Nuclear power both symbolizes and is, in a very material sense, a particular way for humans to interact with the environment, and the organization of human relations in a manner most congenial to relating to the environment in that way. It is thus both supported and opposed for its key role in achieving that social relation to the environment by those who, respectively, approve and oppose that social order.

Cultural Geography: the Social Construction of the Environment

The analytical perspective on the environment as a component in the political contestation of culture is grounded in cultural geographers' principles of humans' social construction of their environments, and the deep integration of the cultural meanings and physical use of the environment with social relations and political institutions. Many cultural geographers begin with the fundamental assumption that humans' conception of the environment is a social construction:

The earth's surface is highly varied. . . . But the ways in which people perceive and evaluate that surface are far more varied. No two persons see the same reality. No two social groups make precisely the same evaluation of the environment. The scientific view itself is culture-bound - one possible perspective among many (Tuan 1974: 5).

Yi-Fu Tuan surveys different cosmologies and perceptions of the physical environment, both historically and through a range of cultures in various physical settings (Tuan, 1971, 1974). Clarence Glacken describes the evolution of cosmology and environmental concepts in Western culture from ancient times to the eighteenth century (Glacken 1955, 1967), J.B. Jackson distinguishes patterns of different cultural organizations left by cultures on the land itself (Jackson 1984), and Alexander Spoehr discusses the different interpretations of natural resources made from different cultural perspectives (Spoehr 1955). Kenneth Hewitt argues that "the dominant view . . . belongs to an historically special culture that seeks to interpret the world through its underpinnings in material phenomena and mechanism" (Hewitt 1983: 18).

In all these accounts, the initial concept is that humans organize experience of the physical world into a system of meaning. As Glacken notes, "what is most striking in

conceptions of nature, even mythological ones, is the yearning for purpose and order" (Glacken 19967: 3). Humans are not determined biologically, but socially and culturally:

Man has few instincts to guide him. To live comfortably among the welter of sense impressions he must know how to organize them. A man without a system of values is as lost and unable to survive as an animal deprived of its instinctive patterns of behavior. . . . Peoples everywhere have their own system of categorizing phenomena and rationalizing action (Tuan 1971: 17).

This categorizing and rationalizing shapes the actual use humans will make of the environment. As Spoehr explains

. . . any group "interprets" its natural resources within the framework of its own social structure. The point at which this probably is most apparent is in the organization of production, for it is in production that the manner of control and the use of natural resources are most evident. . . . Our own concepts of "ownership" may be viewed as the conjunction of our own particular social system and limited resources. Yet Western ideas of ownership are by no means universal and are but one example of how an exclusive right may be so defined (Spoehr 1955: 97).

While humans' conceptions of the environment are socially constructed and shaped, they are not completely divorced from the physical world, nor are they simply abstractions projected and imposed on physical matter. Tuan argues that cosmologies "are not simply fantasies of the mind floating above the hard realities of day-to-day living. They derive from lived experiences and at the same time give them meaning and direction" (Tuan 1971: 24). A worldview is constructed out of "the salient elements of a people's social and physical setting"; Tuan describes the cultural perceptions of the BaMbuti Pygmies, who live in the rainforest, as conditioned by their very dense environment, in which the sun is not seen as a bright disc crossing the sky but "rather patches of flickering light on the forest

floor" (Tuan 1974: 79). He compares these with the ancient Egyptians, whose environment, characterized by the desert and the Nile, with the sun dominating a cloudless sky, was reflected in the language and the religion of the people.

Ideas about the essential character of the natural environment are adopted as models of social relations, as part of the 'dialectic' by which environmental and social reality are constructed. This line of analysis agrees with that made by many anthropologists in related studies: Paul Richards, for example, describes how the world view of the Mende in Sierra Leone depends on systematic empirical observation of the biological world: "ideas about animals, even if cultural constructions, up to a point, are also shaped by systematic scrutiny of the behavioral similarities and differences between humans and other animals" (Richards 1993: 145). Similarly, P. Nowicki argues the "ecological reality in which the cultural reality is embedded," noting that "the native . . . will not interact with his ecological context in a way which will not give at least minimal results" (Nowicki 1985: 273).

Humans also, of course, make physical changes in their environments which stand as records of their particular cultural bias. An inhabited landscape is never a natural phenomenon but is always synthetic,

. . . a man-made system of spaces superimposed on the face of the land, functioning and evolving not according to natural laws but to serve a community - for the collective character of the landscape is one thing that all generations and all points of view have agreed upon (Jackson 1984: 8).

A landscape is the visible manifestation in the environment of a culture's social and environmental relations: as

Jackson says, "No group sets out to create a landscape, of course. What it sets out to do is to create a community, and the landscape as its visible manifestation is simply the by-product of people working and living, sometimes coming together, sometimes staying apart, but always recognizing their interdependence" (Jackson 1984: 12).

E.A. Gutkind is able to interpret conceptual principles inherent in a society's relation with its environment through photographs of settlements and agricultural patterns taken from the air (Gutkind 1955). Jackson also 'reads' landscapes in the United States for the imprints of "political" and "vernacular" cultures. A political landscape, he explains, is "those spaces and structures designed to impose or preserve a unity and order on the land, or in keeping with a long-range, large-scale plan" (Jackson 1984: 150). In a vernacular landscape, on the other hand, "spaces are usually small, irregular in shape, subject to rapid change in use, in ownership, in dimensions . . . there is always a vast amount of "common land" - waste, pasturage, forest, areas where natural resources are exploited in a piecemeal manner . . . its roads are little more than paths and lanes, never maintained and rarely permanent . . . (Jackson 1984: 151).

An inhabited landscape begins to appear as formed by and fully integrated into human culture and usage, being a kind of unity with culture, inseparable from it and an essential manifestation of social order as much as it is an essential organization of material resources. The environment is a foundational element, a shaping and sustaining element, in a social order. It is a truism that humans are physically dependent on the environment: it also appears that a social order is dependent for its continued integrity on the credibility of its particular conception of the physical

environment, and on the continuing sustainability and legitimacy of its particular uses of the environment and natural resources. A social order is committed to its own perception and integration with the environment: it becomes a very political entity.

Jackson argues that in a vernacular landscape spaces "indicate personal relationships, and they indicate in no less complicated manner the involved and often conflicting traditions of the community" (Jackson 1984: 150-151). Indeed, he notes, "no landscape, vernacular or otherwise, can be comprehended unless we perceive it as an organization of space; unless we ask ourselves who owns or uses the spaces, how they were created and how they change" (Jackson 1984: 150). Those who live and work in a landscape, of course, also read in that landscape the social relations that formed and order it, and these may agree or conflict with their own social order. A vernacular culture and landscape may exist within a larger political landscape that stands as a monument to external power; likewise, a subculture or a marginalized culture may live in a landscape shaped by a dominant culture, so that its members perceive a dissonance between their own values and those expressed in the landscape.

Historian Michael Adas describes the discomfort felt by Europeans travelling in Africa and Asia in the eighteenth and nineteenth centuries. They had come from cities with "broad, straight avenues and orderly block layouts . . . complemented by formal, geometrically ordered gardens," with canals, paved roads and railroads carrying these trends to the countryside. "The ascendancy of the commercial and later the industrial bourgeoisie was reflected in the widespread adoption of the gridiron approach to urban planning, which favoured rectangular

layouts over natural contours" (Adas 1989: 260). Explorers in Africa regarded most towns as "jumbles of ramshackle buildings thrown together without apparent design, and they dismissed African roads as meandering footpaths. Robert Knox contrasted the controlled and symmetrical landscapes of 'civilized' European-settled areas in colonies such as South Africa with the 'chaos' of African-occupied areas, which showed little sign of having been transformed by humans" (Adas 1989: 261).

In this respect landscape, the expression in the physical environment of the social order that formed it, displays an intrinsically political character. Ina-Maria Greverus points out that a worldview, including political, economic, technological and scientific levels of development, is "objectified in the formation of space, in cultivated landscape, in settlements and houses and symbolic markers."

A "sick environment" and "sick individuals" are to be found especially in systems where the environmental orientations of the powerful few expropriate the powerless majority. In other words: if one of the environmental orientations gains dominance, perhaps by one-sided accumulation of control over the environment by dominant ideologies, then the environment will become "sick". The ideology of unlimited development, guided by economic rationality, in our modern thought and practice is the most destructive violation of the potential of the environment to provide ecotopes for the establishment of households of life that satisfy human needs (Greverus 1989: 32).

People, says Jackson, "are not content until our social instincts are given form and even a kind of visibility. . . . we are also inhabitants of the earth, involved in the natural order and in a sense even part of it. . . . We have to understand nature and feel at home with it if we are to be true inhabitants of the earth" (Jackson 1984: 11). The environment is a cultural and a political artefact, shaping and expressing social relations, enabling some manners of interacting with nature and each other and precluding

others; it is a key component of culture and a structuring and sustaining factor in social activities and livelihoods. A landscape that expresses someone else's culture, particularly one with which one is in conflict, is alien, alienating, a symbol of subordination or dependence and a physical obstacle to interacting with the land according to one's own culture.

Greverus sees the encroachment of the environmental orientations of a dominant group as a violation of subordinate groups' ability to create a 'home' landscape in which to live and work. The visible expression of the patterns of our lives and work in the landscape in which we make our livelihoods is not only a reflection of our social order in the cosmos, but a testament to our sovereignty and autonomy in our own land.

This perspective stresses the inherently political nature of the environment, placing the definition and legitimate manner of using it at the centre of a major cultural conflict or transition. It unites culture, the environment and politics in a complex dynamic, showing why disputes concerning the use of the environment are so contentious and draw in so many issues that seem to be peripheral to issues of environmental quality or environmental impacts. It also explains what environmentalism, as a very politicized social ideology, has to do with the environment: social constructions of the environment, as core elements of social orders, are key stakes in cultural conflicts and are themselves politically contested.

Any radical social change to an alternative social order must be supported and consolidated by a change in the definition of the environment to one consistent with the new social order. Widespread evidence in the 1970s of

environmental pollution and degradation, habitat destruction and climate change gave environmentalists the access they needed to environmental definitions, to begin to discredit the dominant view of the environment and legitimate their own.

The conflict over nuclear power is an example of the political contestation of socially constructed realities, in which the nature of the environment is also contested: a construction of the environment is a central component in each worldview, supporting and justifying the positions on the use of nuclear power and on broader social values. Nuclear power is also, as will be discussed later, a potent symbol of one of the social orders involved in this dispute as well as an important practical means of that order's ability to consolidate its dominance of the broader society and its manner of interacting with the environment. The environment is one of the elements at stake in the dispute, since a culture's ability both to interact with its environment in a manner consistent with its worldview and to manifest the values of the worldview physically in landscapes is a key aspect in cultural integrity and independence.

The Social Construction of Reality

The nuclear conflict is not simply a confrontation of competing interests in a pluralist society over the siting of a controversial technology: it is a profound difference in social philosophy, values and rationality. Here another approach to the social construction of worldviews - the social construction of a 'paradigm' of reality - is relevant to this thesis, and adds a more explicitly political dimension to the cultural geographers' discussion of the environment as a social construct.

Environmental sociologists describe the 'widely divergent assumptions' of the two sides in this conflict as paradigms, defined by one researcher as "epistemological systems for interpreting reality that ground their picture of 'reality' in their own construction" (Milbrath 1994: 117). As we will see, a paradigm is a worldview and a culture, which defines the nature of the environment and humanity, how people should relate to the environment and to each other, and the reality that is to be known and how that knowledge is achieved; it is an internally coherent system for interpreting the world and giving it meaning.

The assertion that a paradigm is a social construction implies a certain degree of relativism. This relativism is "true," in a detached anthropological way, and is helpful in providing the distance required for an examination of the nuclear conflict that hopes to do more than advocate one side or the other - and more advocacy is something this conflict does not need.

There are significant implications in the acknowledgement of the relativism of paradigms as social constructions of reality. In removing the 'objective' reality of a worldview, the paradigm approach removes its objective superiority and the grounds on which it could dismiss or marginalize another paradigm or value system, and asserts the principle of the equal inherent integrity and legitimacy of all paradigms.

The socially constructed nature of reality also brings into focus the institutions of a worldview as its creatures, as tailored by it in order to sustain it. Yet, as described below, a social order is 'grounded' by its institutional

framework and thereby assumes a material reality that is able to define and constrain the actions of its members, as well as the actions of members of a subordinate alternative paradigm. This institutionalized social order functions as the conditions in which an alternative paradigm evolves and defines itself, and that shape the dynamic in which conflicts between social orders develop. The relativism that is invoked by locating a social conflict in the contest between two socially constructed paradigms appears to be contradicted by the concreteness of the features that have shaped that conflict. As Berger and Luckmann note in their seminal work The Social Construction of Reality, it is "a paradox that man is capable of producing a world that he then experiences as something other than a human product" (Berger and Luckmann 1966 61).

The theory of the social construction of reality alerts us to the cohesiveness of social value systems as paradigms, and to the pervasiveness of social institutions as the structural embodiment of a paradigm. The paradigms are socially constructed and their 'reality' is thus relative, but an understanding of how a social order 'fixes' its worldview in its institutional structure is important to an understanding of how these institutions function as material and substantial features in a conflict between two socially constructed paradigms.

Many of the key principles in the theory of the social construction of reality can be seen operating in the conflict between the two paradigms over nuclear power, and these appear tacitly and overtly throughout this analysis as a kind of 'meta-analytical' framework. The assumption of reality as socially constructed is a fundamental conceptualization that is implicit in this analysis of

contrasting worldviews.

Berger and Luckmann discuss the social construction of reality in terms that echo the cultural geographers' characterization of the social construction of the environment. They begin by defining 'reality' as "a quality appertaining to phenomena that we recognize as having a being independent of our own volition (we cannot 'wish them away')." 'Knowledge' they define as "the certainty that phenomena are real and that they possess specific characteristics" (Berger and Luckmann 1966: 1). With this understanding, they assert that

The world of everyday reality is not only taken for granted as reality by the ordinary members of society in the subjectively meaningful conduct of their lives. It is a world that originates in their thoughts and actions, and is maintained as real by these (Berger and Luckmann 1966: 20).

Humans' relationship to their environment is "characterized by world-openness": it is "very imperfectly structured by [their] own biological constitution" (Berger and Luckmann 1966: 47). That is, people are not determined by any biological features to relate to their environment in any particular way or to relate to only a certain type of environment. A social order, on the other hand, is a biological necessity, and this "biologically intrinsic world-openness of human existence is always, and indeed must be, transformed by social order into a relative world-closedness" (Berger and Luckmann 1966: 51). The basic starting point is a culturally determined relation to the environment that incorporates physical definitions and structures of social meaning.

Human activities become first habitualized, then

institutionalized "whenever there is a reciprocal typification of habitualized action by types of actors" (Berger and Luckmann 1966: 54). When the institutional world is passed on to a new generation, it becomes crystallized as a social world with the 'reality' of the natural world: "an institutional world . . . is experienced as an objective reality" (Berger and Luckmann 1966: 59, 60).

Institutions, by the very fact of their existence, control human conduct by setting up predefined patterns of conduct, which channel it in one direction as against the many other directions that would theoretically be possible" (Berger and Luckmann 1966: 55).

The institutional world must be explained and justified, or legitimated, to make it meaningful to successive generations: "the expanding institutional order develops a corresponding canopy of both cognitive and normative interpretation. . . . Legitimation 'explains' the institutional order by ascribing cognitive validity to its objectivated meanings. Legitimation justifies the institutional order by giving a normative dignity to its practical imperatives" (Berger and Luckmann 1966: 62 and 93). Legitimation provides sanctions for the institutional order and helps ensure compliance among newer generations who may question it; it is thus also adaptable, in a sense, as legitimations can succeed each other to interpret and preserve institutions through successive generations. Berger and Luckmann describe four levels of legitimation; the "incipient," or 'pretheoretical' level of self-evident knowledge; the rudimentary "theoretical propositions"; the explicit theories of institutional legitimation through a differentiated body of knowledge; and the "symbolic universes" that "integrate different provinces of meaning

and encompass the institutional order in a symbolic totality" (Berger and Luckmann 1966: 94-95).

Legitimation is built upon language, through which members of a society articulate and share meaning: "the 'logic' thus attributed to the institutional order is part of the socially available stock of knowledge . . . "(Berger and Luckmann 1966: 64). Knowledge is thus

. . . at the heart of the fundamental dialectic of society. It "programs" the channels in which externalization produces an objective world. It objectifies this world through language and the cognitive apparatus based on language, that is, it orders it into objects to be apprehended as reality. It is internalized again as objectively valid truth in the course of socialization (Berger and Luckmann 1966: 66).

"What is taken for granted as knowledge in the society comes to be coextensive with the knowable," Berger and Luckmann continue; in this way:

. . . any radical deviance from the institutional order appears as a departure from reality. Such deviance may be designated as moral depravity, mental disease, or just plain ignorance (Berger and Luckmann 1966: 66).

When an institutional order is objectified, it may become "reified": that is, perceived as if it were not a human product but "as facts of nature, results of cosmic laws, or manifestations of divine will. . . Through reification, the world of institutions appears to merge with the world of nature" (Berger and Luckmann 1966: 89 and 90).

Inherent in institutionalization is the division of actions and conduct into roles, with certain actions being performed by certain actors; this implies a social distribution of knowledge, as "society's stock of knowledge is structured in terms of what is generally relevant and

what is relevant only to specific roles" (Berger and Luckmann 1966: 77). This situation gives rise to specialists, who have the knowledge required for the institutional role they fulfill, and who 'administer' the sectors of knowledge of those roles. The increasing division of labour in society may lead from the simple specialization of role-specific knowledge to "institutional segmentation," and from there to "subuniverses of meaning" carried by collectivities of specialists. Each of these subuniverses faces the challenges both of internal legitimation, to keep members in, and of legitimating its autonomy to keep outsiders out. "It goes without saying," note Berger and Luckmann, "that this multiplication of perspectives greatly increases the problem of establishing a stable symbolic canopy for the entire society" (Berger and Luckmann 1966: 86).

"Socialization is never complete," say Berger and Luckmann; societies may be challenged by 'deviant' groups that develop within the larger society and come to challenge "the reality status of the symbolic universe as originally constituted" (Berger and Luckmann 1966: 106). These groups may pose "not only a theoretical threat to the symbolic universe, but a practical one to the institutional order legitimated by the symbolic universe in question" (Berger and Luckmann 1966: 107). Even more difficult is a confrontation with a completely different and unknown social order whose symbolic universe is as 'taken-for-granted' as one's own. "The appearance of an alternative symbolic universe poses a threat because its very existence demonstrates empirically that one's own universe is less than inevitable" (Berger and Luckmann 1966: 108). Berger and Luckmann note that the overall collapse of institutional orders, contact with previously segregated

societies, and social marginality are important circumstances that favour "dereification" (Berger and Luckmann 1966: 91-92).

While they are socially constructed, paradigms are not simply imagined into existence and lived in a vacuum. As we have noted with respect to the construction of conceptions of the environment, which incorporate lived experience in the biological environment, the social paradigms evolve in a dynamic, a dialectical process within which they challenge and defend, and develop the specific terms of their vision of reality and the legitimate form of society. The political and institutional structures of society are critical elements in the dynamic that shapes the formation of an emerging alternative paradigm, and the conflict that develops as the alternative challenges the legitimacy of the established paradigm.

As we will see, many of these themes run through the pro- and anti-nuclear positions. Reification can be seen in the 'objectivity' of reality in both positions. The issue of the 'belonging' of opponents of nuclear power within the general social system, and thus of their sharing in the benefits and obligations of that society, is one that is implicit in the positions of both supporters and opponents of nuclear power. Equally relevant is the perception of those who do not share, or agree with, the commonly accepted stock of knowledge, and hence reality, as deviants or ignorant, or as dissenters or completely separate.

The Contrasting Paradigms

As Weart and others have noted, the nuclear conflict is characterized by, indeed almost defined by, a divisive and destructive mutual misunderstanding between participants on opposing sides. The opposing sides, of course, are expressions of the values and assumptions of two different social paradigms, the detailed contents of which form the substance of this conflict.

This cultural contest has reached the stage within the society at large that the dominant culture is beginning to lose legitimacy and credibility in its claim to define nature and reality, and its institutions are seen as ill-suited to and unjustly imposed on those from other cultures. 'Dereification' may be beginning, as this paradigm appears to a growing number of people as a human product rather than objectively 'true', designed to protect the interests of certain sectors of society. The alternative culture is gaining respectability as a coherent paradigm whose vision of 'nature' appears plausible and whose values are legitimate, just as a greater diversity of cultures are gaining recognition as valid in their own terms.

Geographers and environmental sociologists have noted the appearance of a new set of values in Western industrialized societies that began, on a sociological scale, with the counterculture in the 1960s. The alternative values were more fundamental and extensive than a simple attitude change would be; in studying them, researchers have been grappling with "a changed sense of what is real" (Catton and Dunlap 1978: 42). The term 'paradigm' was adopted to describe the profound and definitive values involved, and the completeness with which they shape the individual's and society's perception of reality.

One early goal of environmental sociologists was to account for the rise in environmental values. Inglehart developed a theory, based on a 'scarcity hypothesis' and a 'socialization hypothesis' that were based in turn on Maslow's hierarchy of needs, which suggested that the generation that passed its adolescence, and was socialized, in the relatively affluent and stable post-war years placed higher value on post-materialist values such as belonging and intellectual and aesthetic satisfaction (Inglehart 1981: 881). Other researchers found that early affluence was not sufficient to describe and account for higher post-materialist values, and instead tried to account for the social distribution of values (Cotgrove and Duff 1981). They found that demographic attributes of gender, age, educational level, income and political status were not related to environmental concern: "the relationship between sociodemographic characteristics and environmental concern is still poorly understood" (Samdahl and Robertson 1989: 59).

On a fundamental, ideological level, however, some correlations were found: while political-party affiliation was not related to environmental concern, general political orientation was (Cotgrove and Duff 1981: 99). Central tenets of conservatism, particularly support for private property rights, economic growth, faith in material abundance, and laissez-faire government, had strong negative correlations with environmental concern (Dunlap and Van Liere 1984: 1018-1021). Likewise, the strongest correlation found in another study was between pro-regulatory liberalism and support for environmental regulation (Samdahl and Robertson 1989: 75). Cotgrove and Duff also found a link between paradigm commitment and occupation, but argue that this is less an explanation for than an expression of such commitment: environmentalists

choose occupations that "do not not involve direct commitment to the goals and values of industrialism, and are congruent with their generally anti-industrial sentiments" (Cotgrove and Duff 1981: 102).

Profiles of the values characteristic of materialist and post-materialist values began to be identified as the environmentalist versus the industrialist, or dominant, worldviews. Cotgrove and Duff found that industrialists' ideal society was one that valued economic individualism, in which market forces predominate and risks and achievement are rewarded. The 'clusters' of values that emerged for industrialists were wealth creation, authority, market and individual (Cotgrove and Duff 1981: 98). This 'Dominant Social Paradigm' "has a strong institutional base, as our political, economic, religious and educational systems tend to reinforce commitment to the values and beliefs which have traditionally guided our society" (Dunlap and Van Liere 1984: 1025). Cotgrove states that this paradigm is held by "dominant groups in industrial societies, and . . . serves to legitimate and justify the institutions and practices of a market economy" (Cotgrove 1982: 27). Already in 1978 Catton and Dunlap described the dominant, or what they called the Human Exceptionalism Paradigm:

- 1) Humans are unique among the earth's creatures, for they have culture.
- 2) Culture can vary almost infinitely and can change much more rapidly than biological traits.
- 3) Thus, many human differences are socially induced rather than inborn, they can be socially altered, and inconvenient differences can be eliminated.
- 4) Thus, also, cultural accumulation means that progress can continue without limit, making all social problems ultimately soluble (Catton and Dunlap 1978: 42 - 45).

Environmentalists' social ideals, on the other hand, were

limits to growth, participation, non-market, and collective (Cotgrove and Duff 1981: 98-99). Environmentalism was considered to have evolved into a coherent world view or paradigm, described by Catton and Dunlap in 1978 as characterized by the following assumptions:

- 1) Human beings are but one species among the many that are interdependently involved in the biotic communities that shape our social life.
- 2) Intricate linkages of cause and effect and feedback in the web of nature produce many unintended consequences from purposive human action.
- 3) The world is finite, so there are potent physical and biological limits constraining economic growth, social progress, and other societal phenomena (Catton and Dunlap 1978: 42 - 45).

Geographer Timothy O'Riordan, in his Environmentalism, summarizes the "technocentric mode" as

. . . identified by rationality, the 'objective' appraisal of means to achieve given goals, by managerial efficiency, the application of organisational and productive techniques that produce the most for the least effort, and by a sense of optimism and faith in the ability of man to understand and control physical, biological, and social processes for the benefit of present and future generations. Progress, efficiency, rationality and control - these form the ideology of technocentrism that downplays the sense of wonder, reverence, and moral obligation that are the hallmarks of the ecocentric mode (O'Riordan 1981: 11).

The "ecocentric mode," by contrast,

. . . preaches the virtues of reverence, humility, responsibility, and care; it argues for low impact technology (but is not antitechnological); it decries bigness and impersonality in all forms (but especially in the city); and demands a code of behaviour that seeks permanence and stability based upon ecological principles of diversity and homeostasis (O'Riordan 1981: 1).

In a later work O'Riordan summarizes the two worldviews as the "human-centred, or manipulative mode" and the "earth-centred, or nurturing mode" (O'Riordan 1990: 143). There

is broad agreement on the values of the Environmental and Dominant Social paradigms. Taylor's description closely follows Cotgrove's; Mander's, which lists at length the differences between aboriginal and Western cultural values, describes Western values in much the same way as environmental sociologists do, and also shows that aboriginal and environmental values are similar in many respects. The following is Cotgrove's profile:

Dominant Paradigm

Core Values	Material (economic growth); natural environment valued as resource; domination over nature
Economy	Market forces; risk and reward; rewards for achievement; individual self-help
Polity	Authoritative structures (experts influential); hierarchical; law and order
Society	Centralized; large-scale; associational; ordered
Nature	Ample reserves; nature hostile/neutral
Knowledge	Confidence in science and technology; rationality of means; separation of fact/value, thought/feeling

Alternative Environmental Paradigm

Core Values	Non-material (self-actualization); natural environment intrinsically valued; harmony with nature
Economy	Public interest; safety; incomes related to need *egalitarian; collective/social provision
Polity	Participative structures; (citizen/worker involvement), *non-hierarchical; *liberation
Society	Decentralized; small-scale; communal; *flexible
Nature	Earth's resources limited; nature benign; nature delicately balanced;
Knowledge	Limits to science; rationality of ends; integration of fact/value, thought/feeling

* Some environmentalists want a return to small-scale communities because they provide a traditional organic order - differentiated, hierarchical, and stable (Cotgrove 1982: 27).

Cotgrove and Duff emphasized the strongly ideological nature of the complexes of values that constitute the two paradigms. They explain that "environmentalists are opposed not simply to the way industrial societies go about achieving the goal of wealth creation: they are opposed to its central and dominant economic and material values" (Cotgrove and Duff 1981: 99).

Cultural Theory

The recent incorporation of "cultural theory" into sociological survey research on environmentalism (Johnson 1987; Wildavsky and Dake 1990; Dake 1991;) has highlighted the deeply political nature of the differences between environmental and dominant values, and has also brought into the discussion of environmentalism the notion of risk as a cultural construct. This theory originated with anthropologist Mary Douglas, who developed a sophisticated scheme of social typology based on two factors, grid - "the degree to which an individual's life is circumscribed by externally imposed prescriptions" and group - "the extent to which an individual is incorporated into bounded units" (Thompson, Ellis and Wildavsky 1990: 5). According to this theory, there is a limited number of possible forms of cultural organization, each with its own characteristic definitions of nature, social relations, and the threats to them. The social type called egalitarianism corresponds closely, though not perfectly, with environmentalism as described by environmental sociologists. The Dominant Social Paradigm is a conflation of two other cultural types, market and hierarchy.

Built on Douglas's earlier description of a social system as an 'order' that binds and interrelates cosmology and social structure, and of pollution as being essentially a violation of that order - "matter out of place" (Douglas

1966: 35) - the theory on risk states that different types of societies will pay more attention to those 'risks' that threaten their own order or undermine their social cohesion (Douglas and Wildavsky, 1982; Douglas 1990). The risks perceived as particularly threatening by a social order thus emerge as a distinguishing characteristic of that society, and risk per se becomes a central issue in cultural conflicts between two social orders, both as weapons against the opposing order and as a means of maintaining internal solidarity and enforcing compliance. This theory is very useful conceptually and contains some very compelling insights. It is narrowly based on Douglas's early theory, however, and somewhat dogmatic and restrictive in its insistence that risks are selected for use as social weapons, undervaluing the real importance of a risk, within a particular way of relating to the environment, and the real degradation of the environment. I will continue to refer to the empirically based sociological research when describing attitudes to nuclear power and nuclear waste.

Which "Environmentalism"?

The fundamental social critique embodied in environmental values as researched and described by sociologists pertains to environmentalism as articulated and advocated in the social and political arenas by radical environmentalists. But the word 'environmentalism' has been adopted by everyone from extreme Earth First! groups to grocery chains seeking a new avenue for marketing their products. The "environmental movement" in Canada and other countries is broad and diverse (Adkin 1992) and sometimes divided by philosophical differences (Tokar 1988), but there is one primary distinction that should be observed: radical environmentalists, or ecologists, accept the critique of

industrial society and its values that is described by sociologists as constituting the Environmental Paradigm.

"Mainstream" environmentalists, or conservationists, advocate the preservation of the physical environment within the values of the Dominant Social Paradigm. They share the values of economic growth, centralized social organizations and human dominance of nature. In 1980 the International Union for Conservation of Nature and Natural Resources published a "World Conservation Strategy," which defined conservation as "the management of human use of the biosphere so that it may yield the greatest sustainable benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations" (McNeely and Pitt 1985: 3).

Many radical environmentalists are strongly critical of "mainstream" environmentalists (Bookchin 1980) and see a major part of their task as being the education of mainstream environmentalists about the deep social roots of environmental damage. Cotgrove and Duff distinguish environmentalists who wish simply to protect wildlife and the countryside from the "utopian" environmentalists that their research focusses on, "who argue that the problem requires more than simply a shift in priorities, and that fundamental changes are essential if we are to survive the growing threats to the environment and the exhaustion of materials from a high-growth, energy-consuming, and environmentally-damaging way of life" (Cotgrove and Duff 1981: 93). The environmentalism of the intervenors studied here is of the 'utopian' or radical strain, and accords well with the profiles outlined by the sociologists.

None of the environmental sociologists suggest that the emergence of environmentalism as a coherent worldview

should be interpreted as a wholesale shift of a significant portion of society from a total and unambiguous commitment to the Dominant Social Paradigm to an equally unambiguous commitment to the Environmental Paradigm. Dunlap and Van Liere caution that a clear and coherent distinction between the two paradigms is not apparent - many individuals hold conflicting beliefs, and at the societal level there are many different and competing beliefs and values (Dunlap and Van Liere 1984: 1025). Cotgrove and Duff explicitly distinguish those groups that are strongly committed to either paradigm from the general public: "senior industrialists are significantly more materialist than members of the public of the same age groups, and . . . environmentalists are much more post-material than the public even after controlling for age" (Cotgrove and Duff 1981: 93).

Nevertheless, it is agreed that the Environmental paradigm has reached a degree of maturity in which it "offers an 'ecological worldview' as a full-fledged alternative to the DSP" (Dunlap and Van Liere 1984: 1025). Indeed, the recent development of the environmental paradigm explicitly in opposition to the dominant paradigm is seen by at least one writer as a weakness, as it tends to be simply the obverse of what it opposes and thus perpetuates the dualism it challenges (Taylor 1992: 31). Many environmentalist writers, however, see, or portray, a lineage and a continuity in environmental thought from pre-scientific and even ancient times (Worster 1977), and many sources, traditions and individual thinkers are drawn on as inspiration and viewed as early landmarks and figures in the development of the philosophy (Devall and Sessions 1985). Likewise, many key figures in the evolution of science, technology and economics are focussed on as architects of the opposing paradigm. A rough cosmogony is

described and attributed to the evolution of environmental thought, whether the value system described now as a paradigm has descended in some self-aware fashion from earlier, similar, strains of thought, or was created more recently within the context of a political dynamic of social dissent and environmental degradation.

At issue in this paper is not the opinions on nuclear power as held by individuals or identifiable groups within the public, but the philosophical positions in the support of and opposition to nuclear power, the paradigms that are developed collectively over time and to which people will subscribe in part or entirely. Within the context of an active social conflict, opinion on an issue seems to polarize more than in a general social value context. It has been noted (Nelkin 1977; Nelkin 1979) that public controversies over technology, especially those involving expertise and conflict among experts, tend to polarize opinion. It is certainly characteristic of the nuclear conflict that opinion divides into two sides, though, as will be discussed later, this polarization is not inherent in the philosophies.

Radical environmentalism has become firmly identified with the opposition to nuclear power. As Ronald Babin has noted, the anti-nuclear movement matured as it incorporated the more fundamental social critique of the ecology movement (Babin 1985: 173). Many ecologist writers, such as Murray Bookchin, Jonathon Porritt, and Devall and Sessions, see the opposition to nuclear power as central to their philosophy; Bookchin disparages the populist "anti-nuke" rhetoric that mobilizes support around a celebrity but fails to understand the deeper issues (Bookchin 1980: 49-54). As this analysis will illustrate, nuclear power is opposed both as an ideological symbol and as the practical

enabler of the dominant, pro-growth social order, and the arguments apply on both levels.

Application of Paradigms to Nuclear Energy Debate in this Analysis

The correlation between the intervenors' worldviews and the paradigms profiled by research is very close. This convergence is significant in several respects. First, it places the intervenors' statements in the more general context as coherent, internally logical worldviews that support and shape attitudes and beliefs. Second, it allows us to use the broader profiles from the research to flesh out the intervenors' expression of the values that underlie attitudes to nuclear waste disposal. Third, it suggests that there is a wider base to these value systems and their relation to attitudes to nuclear power, of which these intervenors are representative. As researchers surveying several Western industrialized countries have found similar patterns of values in the populations - one study found environmental values to be similar in England, Germany and the United States (Milbrath 1984) - it is likely that the same patterns may be found among the Canadian public. Although it gives us no idea of how prevalent either value system might be in Canadian society, it offers some assurance that the intervenors represent more than just themselves. And, finally, the convergence between the intervenors and the paradigms profiles allows the worldview profiles described by researchers to function as a 'baseline', so that departures from those profiles may give some insight into some expressions of values and beliefs that are specific to the nuclear debate.

CHAPTER 3

THE HISTORICAL BACKGROUND AND POLITICAL CONTEXT

The Canadian Nuclear Industry

From its origins in the atomic bomb research program during the last years of World War II (Laurence, AECL; Babin, 1985; Knelman 1976; Doern 1980), the work towards the civilian use of nuclear technology for the production of electricity in Canada began in the early 1950s, when an agreement was made between the Province of Ontario, the Government of Canada, Atomic Energy of Canada Limited (AECL) and Ontario Hydro. Ontario needed more energy and had determined that its potential for further hydro-electric development was limited; it decided in 1953 to pursue nuclear energy (Franks 1985: 3). AECL developed the CANDU (Canada deuterium-uranium) reactor, which uses natural uranium fuel that is plentiful in Canada, thus avoiding dependence on the United States for enriched uranium fuel, and deuterium or heavy water for the moderator, a substance that could be produced in Canada (Knelman 1967). This technology was developed in the construction of the Nuclear Power Demonstration (NPD) reactor at AECL's Chalk River site in Renfrew County northwest of Ottawa, intended not to produce electricity on a commercial basis but "to prove the principle of a nuclear power reactor and also provide more realistic cost estimates which could be applied to a larger station" (Doern 1980: 107).

Before the NPD reactor was operational, however, approval was granted to AECL for the construction by AECL and Ontario Hydro of a commercial reactor at Douglas Point, Ontario. This approval came also before the design and development of the new reactor was complete, and before its

true costs were known. Doern cites several factors that could explain this "technological leapfrogging": AECL was competing with Britain and the United States on the reactor export market; "Canadian prestige was at stake since nuclear power was the one 'game' in which it was felt by some that Canada could compete with the big nations in the international sphere"; the government pushed ahead to improve morale after the cancellation of the Avro Arrow project; the government wished to expand the market for stockpiles of uranium, which were causing work slowdowns at mines; and Ontario Hydro was exerting pressure as the province needed more power (Doern 1980: 110-111).

The CANDU plant at Douglas Point went into the Ontario Hydro grid in 1967, followed in the early 1970s by the plant at Pickering, just east of Toronto on Lake Ontario. The Darlington nuclear power station was ordered in 1978, and, "in the interests of speed," the Government of Ontario exempted this project from "most of the processes of public hearings on environmental concerns." Ironically, the timing of the Darlington order coincided with a drop in the growth of electricity demand from the 7% per annum assumed by Ontario Hydro to 4.4% per annum, which resulted in a system overcapacity that might have been avoided if the longer hearing process had been followed (Franks 1985: 11). There are now nuclear generating plants at Gentilly in Quebec, and at Point Lepreau in New Brunswick, though Ontario Hydro remains AECL's biggest customer.

Although ownership and control of natural resources rests with the provinces, the federal government was given jurisdiction over uranium and nuclear matters in 1946 by the Atomic Energy Control Act (Doern 1980: 73). AECL, a Crown corporation funded by the federal government, was initially intended to provide advice on the nuclear aspects

of power plant construction, while private companies carried out the design and construction. However AECL assumed the design and project management of CANDU reactors in 1959, when Ontario expressed its "unwillingness to commit itself to a single, private sector designer supplier" (Franks 1985: 7). In addition, since private industry found international reactor sales and heavy water development to be unprofitable, AECL took over those responsibilities (Franks 1985: 7; Knelman 1976: 54-55). Although the uranium needed to fuel the reactors was mined by private companies, Eldorado Nuclear Limited, a Crown corporation, carried out the refining of the uranium into fuel.

When the high growth projected for the mid-1970s did not materialize and domestic orders stopped due to an over-supply of capacity, international sales of CANDU reactors came to be of central importance to AECL (Franks 1985: 8). Canada continued to supply the uranium fuel for CANDU reactors in other countries. AECL was also involved in the development and marketing of other related technologies, particularly radioisotopes and equipment for cancer treatment.

In the late 1980s the federal government move to privatize AECL and Eldorado Nuclear. Eldorado was to be fully privatized by 1995, and by 1994 its successor, Cameco Corporation, was approximately 70% privately owned. AECL's commercial products functions, which manufactured and marketed radioisotopes and irradiators for medical and industrial uses, were separated from AECL for privatization. Nordion, which makes radioisotopes, was sold to a private company in 1991; Theratronics, which manufactures the machines in which the radioisotopes are used, is still in the process of privatization.

Nuclear policy was, in the early years until 1970, the "almost exclusive product of relatively private behind the scenes discussions dominated by officials and experts, . . . largely a product of close interaction between senior officials of AECL, Ontario Hydro, and key federal and Ontario ministers" (Doern 1980: 68). By 1970 nuclear energy was becoming more controversial: health and safety issues gained prominence and foreign policy became more important and visible, partly because of the international non-proliferation treaty, which permitted the sale of technology and equipment only to countries that had signed the Treaty on the Non-Proliferation of Nuclear Weapons (External Affairs 1990). To oversee these concerns the Atomic Energy Control Board and the departments of Energy, Mines and Resources, External Affairs, Health and Welfare, Treasury Board, Finance and the Privy Council Office secured increased influence in nuclear policy. There was also a greater interest in nuclear issues by the media, politicians and interest groups, and several Canadian and international inquiries had studied various aspects of nuclear energy (Doern 1980: 70-72).

As Doern pointed out, however, this increased 'pluralism' in nuclear policy making was "more illusory than real . . . there is still none the less an internal community of interest within the federal government favoring nuclear power. It is not necessarily stridently pro-nuclear, but it is a community which sees the need to manage this technological and economic asset more sensibly" (Doern 1980: 73). The development of public support for nuclear power rested on industry assumptions that the more people knew about the technology, the greater their support for it would be. A policy process that is more open to the public was not really considered. "Despite its proclaimed faith in the value of public education in generating current and

future support for its industry, the pro-nuclear interests . . . are very selective in their faith in the public. Their positions on opening the nuclear policy process to [a] wider public have been at best ambivalent, and at worst, in outright opposition" (Doern 1980: 41).

Calls for more public hearings in approval processes and on the general matter of nuclear energy policy have been opposed by many in governments and industry. The Government of Ontario disapproved the "unnecessary delays" which a process requiring further hearings could occasion (Rowan 1980: 257): a "prolonged period" is required from the determination of need to the ordering of a plant, due to licensing, public hearings and environmental concerns; it is then about 10 years from the date of ordering to the time a plant is operational (Franks 1985: 11). The chief executive officer of Eldorado Nuclear argued that a federal public inquiry ignores the regional differences in Canadian opinion and in the nuclear industry, and that the public looks not to the federal government but to provincial governments to ensure its health and safety. A "treadmill of provincial inquiries," in which the industry would "continue to demonstrate that it is safe, reliable, and of economic benefit" is therefore preferable (Ediger 1980: 95).

The Anti-Nuclear Movement

As Ronald Babin explains, public support for the peaceful, civilian uses of nuclear power was fairly high until the early 1970s. Through the 1960s the 'ban-the-bomb' peace movement had opposed the military applications of nuclear technology, and had concentrated on nuclear weapons testing and radioactive fallout, and the acquisition of nuclear weapons for Bomarc missiles in Canada and for Canadian troops stationed in Europe (Babin 1985: 144). When, in

1974, India exploded a nuclear device built, in part, from a reactor that had been supplied by Canada, activists noted that civilian uses of the technology were feeding into military applications; the distinction between civilian and military applications faded as civilian nuclear power also became subject to criticisms of the proliferation of nuclear weapons and the potential for terrorist attacks.

In 1975, a scandal over radioactive wastes from a radium mining operation in the 1930s in residential areas in Port Hope, Ontario, revealed carelessness, irresponsibility and secrecy on the part of Eldorado Nuclear and the Atomic Energy Control Board (AECB), the regulatory body responsible for regulating nuclear operations. Energy Probe, an anti-nuclear public interest and energy lobby group, and the media brought these concerns to the public's attention and seriously undermined the credibility of the nuclear industry. After the Port Hope affair further investigations found a series of financial scandals involving AECL and the federal government (Babin 1985: 160-162); the result was that

public sentiment evolved from an initial loss of confidence in government agencies to demands for greater public involvement in the planning process. An informed public was now fighting for open debate, an end to secrecy, full access to relevant information, and consultation with the communities involved (Babin 1985: 163).

Anti-nuclear groups began to be formed; in 1975 the Canadian Coalition for Nuclear Responsibility was formed, and began a campaign demanding an independent commission of inquiry into the nuclear program. This effort succeeded in putting pressure on politicians and in gathering public support, as local groups were formed and demanded access to information (Babin 1985: 165). As Babin says, "the whole process of decision-making became an issue in itself."

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Public protest reflected a deep mistrust of government and concern about the degree to which the ordinary citizen would have a voice in future decisions on technological change" (Babin 1985: 165).

Since the 1970s there have also been calls from outside the anti-nuclear movement for greater participation in decisions on nuclear policy. As Walter Patterson explained, "the civil nuclear industry arose in a climate of weapons-related secrecy, coupled with staunch and generous official support, . . . [and] has until recently been largely unused to unfriendly public scrutiny" (Patterson 1980: 237). Bruce Doern argued at a conference on Canadian nuclear policy in 1978 that

while the recently completed Cluff Lake inquiry [on uranium mining in Saskatchewan] and the ongoing Porter Commission hearings [on electric power planning in Ontario] may suggest that further public inquiries are unnecessary and expensive, it is by no means clear that a major federal public inquiry will not be of value in the near future. This is because existing inquiries, including the Porter inquiry, have insufficient scope in their terms of reference, especially with regard to the economics of the industry and to the implications of nuclear power for Canada as a nation (Doern 1980a: 57).

At that same conference, David Bates agreed that "more information and far more 'openness' [are required] in the regulatory and jurisdictional apparatus than our politicians are willing to concede" (Bates 1980: 320).

As the anti-nuclear movement became more focussed and better organized and began to mobilize the public and lobby governments against nuclear power, the health and environmental effects of the routine operation of nuclear plants and uranium mining joined concerns about accidents. The physical risks of nuclear energy have long been implicit in the opposition to nuclear energy, as the

effects of low-level radiation on human health and the danger of an accident at a plant were integral elements in the demand for public participation in decisions about what risks are tolerable and for what benefit (Knellman 1976: 93-142). Energy Probe became the lead organization of a coalition called the Campaign for Nuclear Phaseout, which presents a comprehensive argument against nuclear power as 'obsolete, dangerous, unnecessary, unable to solve global warming, dirty, unreliable, expensive, creator of few jobs, and linked to nuclear weapons' (Campaign for Nuclear Phaseout).

The Nuclear Liability Act was also challenged, on the basis that individuals' property is not covered by their insurance policies, that manufacturers are exempt from liability in case of an accident, and that the liability of nuclear plant owners is limited to "a fraction of the estimated damages" (Campaign for Nuclear Phaseout). This Act requires nuclear power plant owners, such as utilities, to carry liability insurance to a maximum of \$75 million. The operator is "held to be absolutely liable, that is, claimants do not have to prove negligence on the part of the operator, they need only prove that they have suffered damage" (CNA 1990). Claims exceeding \$75 million would be paid by the federal government, and the Act does not limit what the government would pay. Equipment suppliers must meet standards set for nuclear equipment by the Canadian Standards Association, and are not held liable for potential equipment misuse or operator error - plant owners and operators retain absolute liability in the case of an accident. This coverage makes individual coverage redundant, so damages from nuclear plant accidents are not covered by individual insurance policies (CNA 1990).

After the mid-70s the anti-nuclear movement began to mature

into a broader social movement, incorporating aspects of the ecology movement that had begun with the 'alternative lifestyle' movement of the 1960s. This movement articulated a thoroughgoing critique of capitalist, industrial society as inherently and inevitably destructive of the environment, and gained ground in the early 1970s as evidence and concern increased about serious environmental pollution, and climate change. "It began to focus more on the fact that nuclear power, like other high tech projects, would lay the foundations for technocratic rule . . . [it] was . . . fighting for a different kind of modernization, one in which the public would play a more important role in deciding the pattern of development" (Babin 1985: 173).

The Environmental Assessment Review Process and Environmental Decision Making in Canada

The 'first wave' of popular environmentalism in the early 1970s resulted in some new government regulatory authority. Environment Canada itself was created in 1971 in response to demands for protection of the environment. The Environmental Assessment Review Process (EARP) was introduced by a Cabinet directive in 1973, "to ensure that 'environmental matters were taken into account by all federal departments and agencies in the planning and implementation of projects, programs and activities that originated with the federal government, that planned to use federal funds, or that required federal property'" (Brown 1992: 28).

EARP was criticized for its weakness, as the initiative for conducting an environmental review remained in the hands of the department initiating the project. The process was strengthened in 1984 with revisions under a 'Guidelines Order', which made the process more systematic and clarified responsibilities. Nevertheless, a review panel

has recommendary powers only, and there is "no legal force to ensure compliance from intransigent departments" (Hoberg 1991: 18). VanderZwang and Duncan note that initiating departments still "self-assess" proposals to determine whether environmental implications necessitate a review. The Guidelines still contained "numerous legal cracks" that "allowed for further interdepartmental and federal-provincial political manoeuvrings and opened the door for environmental lip service to be paid in the name of economic progress" (VanderZwang and Duncan 1992: 10).

Hoberg points out that the "resources, knowledge and will to make effective use" of the new regulatory authority given in the early 1970s in environmental matters was lacking (Hoberg 1991: 7). In addition, business and industry are organized and well financed, giving them an advantage over environmental groups, which have no comparable centralized interests, organizational structure, or political and economic power. Policy making in Canada was thus still characterized by a 'bipartite bargaining' style in which representatives of government and industry formulated policy decisions. As Hoberg explains, "power relations within this policy style are best characterized by a relatively weak state, strong business interests, and weak environmental interests" (Hoberg 1991: 7).

The 'second wave' of environmental interest in the late 1980s followed the Bhopal disaster in 1984, the discovery of the ozone hole in 1985, the nuclear accident at Chernobyl in 1986, record-breaking high temperatures in the summer of 1988 amid warnings of global warming, a PCB spill in Kenora, Ontario and a PCB fire at Saint-Basile-le-Grand, and the Exxon Valdez oil spill. This time, the increased interest in environmental issues:

. . . challenged the legitimacy of the dominant

regulatory style. The system's ability to provide adequate levels of environmental protection was called into question, and the regulatory style itself was given a large share of the blame. After a decade and a half of experience, the idea that the state could adequately represent environmental issues was contested, and now appeared to many to be a cloak concealing a system dominated by business interests (Hoberg 1991: 9).

To address new demands for representation of the environment a new consultation process was developing that expanded the bipartite bargaining system to include government, business, environmental groups and labour, and that sought consensus rather than democratic vote in decision making (Hoberg 1991: 10). This 'multistakeholder consultation' process is congruent with the principles of sustainable development in its fundamental assumption that "corporate interests in development can somehow be reconciled with interests in environmental protection" (Hoberg 1991: 10).

In 1986, the Canadian Environmental Protection Act (CEPA) was introduced into the House of Commons. This Act "established an enforcement and compliance scheme which authorized stiff jail terms and fines for polluters" and gave the Environment minister authority over the environmental effects of activities of other federal bodies (Brown 1991: 34). CEPA was also more legalistic than other regulatory statutes had been, being "in effect, if not technically, the country's first 'Environmental Bill of Rights'" (Hoberg 1991: 23). Legalism, Hoberg points out, is different from both bipartite bargaining and multistakeholder consultation: it involves the courts in policy decisions, and is inherently confrontational, assuming an incompatibility between environmental and business interests and resulting in a winner and a loser.

Legalism goes beyond the distrust of the government's ability to represent environmental interests, addressed in multipartite bargaining, to a "profound distrust of government's regulatory capacity generally" (Hoberg 1991: 25).

Many environmentalists prefer legalism to multistakeholder consultations, which still leave them at a disadvantage to business and industry interests. When in 1989 environmentalists launched a court challenge of the Rafferty-Alameda dams in Saskatchewan, which had not undergone an environmental review as provided for in the EARP Guidelines Order, the Federal Court of Canada ruled that the EARP Guidelines Order was legally binding. The government responded with an attempt to remove the non-discretionary duties read into the Guidelines Order by the courts, but that bill died on the order paper. Hoberg notes that the Canadian government has traditionally opposed legalism as a threat to its autonomy, but that it is one of the possibilities for changing processes for decision making on environmental issues.

The Nuclear Waste Siting Milieu: Examples from Canada and the United States

In the United States the 1982 Nuclear Waste Policy Act (NWPA) established a program for the disposal of military and commercial high-level radioactive waste in two mined geologic repositories, one in the west and one in the east or mid-west. Siting was the first step in this program, and a very rapid siting schedule was adopted under pressure from industry. "This search for a new policy was driven by a conviction in the nuclear industry and among utilities that a federal commitment to move quickly to build and operate a permanent repository was essential to the future

of nuclear power in the United States" (Kraft 1991: 4).

The NPPA was established after efforts of the Department of Energy (DOE) in the 1970s to select a repository site had resulted in 19 states enacting bans or moratoria on repository siting (Kraft 1991: 3). These early attempts had disregarded public and state participation. The NPPA program, managed by the DOE, called for federal consultation with states and with potentially affected Indian tribes. For each repository five potential sites were to be studied and environmental assessments carried out, and three of the sites recommended to the president - for the first site by January 1 1985, and for the second repository by July 1 1989. The president was to announce his recommendation to Congress on the first site by March 31 1987, and on the second site by March 31 1990. A full Environmental Impact Statement was required only when a site was recommended to the president, and the facility was also to be licensed by the Nuclear Regulatory Commission (Clary and Kraft 1989:40). The first repository was to be accepting nuclear fuel waste by 1998.

Technical guidelines were determined before the process began, but "many of the geologic, hydrologic, and engineering tests had yet to be developed" (Clary and Kraft 1989: 41). Thus adequate information could not be available by the deadline. In addition, as the Board on Radioactive Waste Management noted, the "predetermined process" in which criteria for safe disposal are established first, then site characterization, licensing and facility operation outlined, "is increasingly vulnerable to being derailed by minor surprises . . . The United States seems to be the only country that has taken the approach of writing detailed regulations before all of the data are in" (Board on Radioactive Waste Management

1990: 26).

Public and state opposition was intense, due in large measure to the "schedule dictated far more by the desire of utilities quickly to locate a facility than by the requirements of scientific study or the need to build public confidence in the process" (Kraft 1991: 18) and the poor credibility of DOE. A "public outreach" approach was taken that did not address public concerns about a repository being imposed, the safety of a repository and the quality of the scientific assessments being carried out. The NWPA was a failure and was revised in 1987 to restrict the search process to the Yucca Mountain, Nevada, site, and the search for a second site was abandoned. Opposition continues: in 1989 the State of Nevada passed a law making it illegal "for any person or government entity to store high-level radioactive waste in the state" (Slovic, Flynn and Layman 1991: 1604). Slovic et al. describe the situation in the U.S. as "a 'crisis of confidence,' a profound breakdown of trust in the scientific, governmental, and industrial managers of nuclear technologies" and argue that the only viable option for nuclear waste management is "to postpone the siting of a permanent repository and store the wastes on site in the interim" (Slovic, Flynn and Layman 1991: 1606, 1607).

A similar failure of government efforts to implement a nuclear waste disposal process occurred in Ontario when the federal government attempted to dispose of low-level radioactive wastes in the Port Hope area. Some of the wastes had been produced by Eldorado Nuclear Limited and had been buried at Eldorado's Port Granby site, and some were 'historic' wastes generated in the 1930s and '40s by a radium refinery in Port Hope. In 1980 Eldorado was directed to decommission the Port Granby site, and in 1982

the Low-Level Radioactive Waste Management Office was formed within AECL, mandated in part to clean up the Port Hope wastes and dispose of them properly. The plan was to dispose of both sets of waste at one new facility, and Eldorado selected two sites for further study before final site selection.

When the Environmental Assessment Panel began preparations for scoping hearings, however, the opposition of people living near both sites was so intense that the scoping meetings were postponed until after the final site selection was made. When the final selection was made, continued public concern forced further reconsideration of the issue, and it was concluded that

. . . the process being used for site selection was faulty. Furthermore, because of the ill-will generated in the Port Hope area, the decision was made to widen the geographic area to be searched as well as change the siting process itself" (Siting Process Task Force 1987: 3).

In December 1986, a seven-member independent Siting Process Task Force was appointed "to assess the most suitable technologies for low-level radioactive waste disposal, the areas with the best potential in the province to use these technologies and the most promising approaches to site selection" (Siting Process Task Force 1987: 3). In its final report the Task Force noted that:

. . . much of the conflict and controversy which surrounds waste management initiatives stem from decision-making processes that are seriously flawed. Essentially, the general public has been excluded in large measure from these processes and, consequently, has become cynical and untrusting of governments, the nuclear industry, and the regulatory agencies responsible for establishing and enforcing safety standards. . . .

We are convinced . . . that gaining public acceptance of, and support for, waste management initiatives will require a fundamental reorientation

of the decision making process, from top-down technocratic procedures toward open and collaborative problem-solving (Siting Process Task Force 1987: 87).

The Task Force recommended that communities should volunteer to host repositories, and have the right "to opt out of the Process at any time, rather than be selected by the project sponsor at its discretion" (Siting Process Task Force 1987: 57). It also recommended that the community should "be a partner in problem-solving and decision making throughout the Process," and that the community "should have the right to select, from given technical options and impact management measures, the ones that are acceptable to it" (Siting Process Task Force 1987: 58, 59).

The Environmental Assessment Review of the Nuclear Fuel Waste Management and Disposal Concept

It was in this social and political dynamic and siting process tradition that the contentious issue of the management of high-level nuclear waste in Canada began to emerge, and the need to resolve it was acknowledged. The option of disposal of high-level nuclear waste deep in granite rock formations was recommended in 1977 by the Hare Report. In 1978 the governments of Canada and Ontario announced a research and development program to assess the feasibility and safety of underground disposal of nuclear fuel wastes. Under this program, AECL researched the immobilization and disposal of the wastes.

A process for the evaluation of the disposal concept was announced in 1981 by the governments of Canada and Ontario, under which AECL conducted research at its Whiteshell facility at Pinawa, Manitoba, where a test shaft was drilled into granite to study the feasibility of disposing of high-level nuclear waste 500 m to 1 km deep in granite

rock in the Canadian Shield.

It was decided that no site selection for a disposal facility should take place until the disposal concept had undergone a public review and had been accepted by both governments. The AECB had been considered the lead agency for carrying out the concept assessment, but in 1985 it was decided that the AECB's regulatory and licensing mandate, and its responsibility for developing the criteria by which the safety and acceptability of the concept would be judged, could place it in a conflict of interest in such an assessment. The Environmental Assessment Review Process was determined to be the best option, and the assessment was referred to the Federal Environmental Assessment Review Office (FEARO).

In 1988, the Standing Committee on Environment and Forestry released its report on high-level radioactive waste. The Eleventh Hour recommended that

the Canadian nuclear fuel waste management concept should be the subject of an independent comprehensive study, which would examine the social, moral, economic and environmental consequences of the Program. . . . The resulting report would be submitted to the environmental assessment panel set up to facilitate public debate on AECL's proposal (Standing Committee on Env't. and For. 1988: 36).

This report also recommended that a moratorium on the construction of nuclear power plants be imposed in Canada until the matter of used fuel management was resolved, and that the AECB "fund an independent scientific assessment of the computer models used to verify the Canadian high-level radioactive waste disposal concept" (Standing Committee on Env't. and For. 1988: 35, 37).

AECL formally submitted its concept for the geologic disposal of nuclear fuel wastes in the Canadian Shield for

review by the Federal Environmental Assessment Process in September, 1988. Since "the bulk of Canada's nuclear fuel wastes is produced in Ontario," the Minister stated that he had initiated the review process with the concurrence of Ontario's Minister of Energy (EMR 1988: 2).

The press release announcing the referral of the disposal concept for environmental review stated that the Minister of Energy, Mines and Resources "called for a wide-ranging environmental assessment. . . This will be one of the most important environmental assessments ever carried out in Canada." The Minister is quoted as saying that "the long-term management of nuclear fuel wastes raises issues of great concern to Canadians . . . The review will provide an opportunity for full public discussions of these issues" (EMR 1988: 1)).

The focus of the review was quite specific, however; to complement the narrow, technical focus on nuclear fuel waste disposal, the ministers of the Environment and of Energy, Mines and Resources were to investigate the appropriate forum for an examination of wider-ranging energy policy and nuclear power issues.

A panel of seven members was appointed in October, 1989, and an eighth member, an aboriginal woman, was appointed in April 1991. A body of independent scientific experts was appointed "to conduct a specific in-depth examination of the safety and scientific acceptability of AECL's concept" (FEARO ToR: 2). This Scientific Review Group is to advise the panel on the technical and scientific acceptability of the concept.

In broad terms, the panel's mandate is to "review the safety and acceptability of AECL's concept of geological

disposal of nuclear fuel wastes in Canada, along with a broad range of nuclear fuel waste management issues" (FEARO ToR: 2). The panel is to "make recommendations to assist the governments of Canada and Ontario in reaching decisions on the acceptability of the disposal concept and on the steps that must be taken to ensure the safe long-term management of nuclear fuel wastes in Canada" (FEARO ToR: 1).

The issues the panel is to consider are the following:

- various approaches to long-term management of used fuel in use at reactor sites
- the impact of transporting the waste to a generic disposal site
- nuclear waste management programs in use in other countries
- the criteria by which the safety and acceptability of a concept for long-term waste management and disposal should be evaluated
- general criteria for the management of nuclear fuel wastes as compared to those for wastes from other energy and industrial sources
- the impact of recycling or other processes on the volume of wastes
- "the degree to which we should relieve future generations of the burden of looking after the wastes. [The panel] should also examine the social, economic and environmental implications of a possible nuclear fuel waste management facility" (FEARO ToR: 4)
- though the review is a concept assessment only, the panel "may review the methodology required to characterize sites and the potential availability of sites in Canada" (FEARO ToR: 4)

There are some issues that are explicitly not to be reviewed:

The energy policies of Canada and the provinces; the role of nuclear energy within these policies, including the construction, operation and safety of new or existing nuclear power plants; fuel reprocessing as an energy policy; and military applications of nuclear technology are issues that are outside the Panel's mandate and should not be addressed during the review (FEARO ToR: 4).

In the fall of 1990, the panel held scoping meetings in fourteen cities "to obtain comments on the identification of issues which should be addressed by the proponent in its E[nvironmental] I[m]pact S[tatement]" (EARP Panel 1991: 1). Though the issue of nuclear waste is not considered relevant only in the provinces that have nuclear power programs and FEARO's mailing list for this review includes people in all regions of the country, for reasons of economy and convenience these meetings were held in major centres in the provinces that have some association with the nuclear industry - Ontario, Quebec and New Brunswick, which have nuclear power programs; Manitoba, where the research facility devoted to the disposal concept is located; and Saskatchewan, where most Canadian uranium is mined. The draft guidelines prepared after the scoping meetings were available to the public for review, after which the panel issued the finalized Guidelines to AECL for the preparation of its EIS. It is the submissions presented by intervenors to the scoping meetings that are the subject of analysis in this paper.

CHAPTER 4

ASSUMPTIONS UNDERLYING THE PRO-NUCLEAR INTERVENORS' POSITION

I. FUNDAMENTAL ASSUMPTIONS

Creation of Wealth for the Improvement of Society:

Intervenors

For pro-nuclear intervenors, nuclear energy is inextricably linked with the achievement of the central value of society: the improvement of living standards through the creation of wealth. Society will need more energy, from a reliable source, if it is to continue to progress toward that goal. As one intervenor put it, "The amount of energy used per capita is a reasonable criterion of the development stage a country has reached" (FEARO 1991: Hester 96). Nuclear power is one of the best means of providing that energy, and is thus not only a good but a necessary technology. It is uniquely able to address two of society's greatest problems:

The most dangerous situations confronting us in society are environmental degradation - partly due to our reliance on fossil fuels - and the threat of energy shortages in winter, as Quebec is now discovering. Nuclear energy is the least environmentally harmful of our options, and can supply all of our energy needs (FEARO 1991: Sutherland, 76).

The Association of Major Power Consumers of Ontario stated that:

. . . Ampco believes that Ontario's economy will continue to grow significantly in the next quarter century and beyond and that, despite the most strenuous conservation efforts, new generating capacity will be needed before the year 2000. . . . Ampco is convinced that the preferred options to meet the need for new electricity are nuclear plants for base load service . . . (FEARO 1990: Ampco p. 2 of sub.).

Several submissions outlined the environmental advantages of generating electricity with nuclear power (FEARO 1990: Ampco vol 1 p. 2 of sub.; Meraw vol. 1; FEARO 1991: Sutherland, 73; Hester, 97): it emits no carbon dioxide or other greenhouse gases, no gases that cause acid rain, and less radiation than is emitted into the atmosphere by coal-fired plants. Nuclear energy also produces relatively small volumes of waste, and that waste is not released into the atmosphere but is contained in the used fuel bundles. In addition, the uranium fuel is plentiful - particularly in Canada, relieving us of dependence on foreign supply for our energy needs - and the cost will continue to be stable. It is a very safe technology for human health, in comparison to the routine risks tolerated from other energy sources, not to mention risks from other activities we engage in voluntarily.

Nuclear energy is also an industry, and as such has generated considerable economic activity. As the Canadian Nuclear Association submission noted, "Approximately 100,000 Canadians are employed directly or indirectly in the nuclear industry. Collectively they generate more than \$4 billion of nuclear-related business within the Canadian economy annually" (FEARO 1990: CNA vol. 1 p. 2 of sub.). Ampco explained that it "is an organization representing 62 member companies all of which are major manufacturers, employers and power consumers. Directly and indirectly Ampco members employ approximately 400,000 people in Ontario and consume 21% of Ontario's total electricity production costing \$650 million annually" (FEARO 1990: Ampco vol. 1 p. 1 of sub.).

We all benefit from nuclear power, either directly from the electricity generated or indirectly from the economic activity, or both. Wardrop said that "nuclear energy is a

reality in Canada today, and will continue to supply a significant portion of Canada's energy needs in the future. Our current generation is enjoying the benefits of the safe, inexpensive and reliable energy produced by nuclear power . . ." (FEARO 1990: Wardrop, vol 1, rec. 2). Rouben and Smith stated that ". . . the permanent disposal of used nuclear fuel is necessary, and that to do so now is indicative of our responsibility to manage the wastes we have generated in deriving the benefits of nuclear power" (FEARO 1990: Rouben and Smith, vol, 1, last p. of sub.).

In terms of the important values of minimizing risks to human health and the environment, and of creating economic development and employment and stimulating economic growth, the decision to implement and support nuclear power was a good one for all of society.

Creation of Wealth for the Improvement of Society:
Theoretical Context

The value of economic growth and the production of material wealth in the effort to raise the affluence of all members of society is the central value of the pro-nuclear intervenors and of the most influential value system of the Western world, the Dominant Social Paradigm. As Cotgrove quotes in his description of this value system, "The creation of wealth in a world of want is a moral duty" (Cotgrove 1982: 27). The Association of Professional Engineers of Saskatchewan expressed their alignment with this value in their definition of the profession of engineering as providing ". . . the knowledge which facilitates translation of capital into wealth-producing assets" (FEARO 1990: Assoc. P. Eng. Sask., vol. 5 p. 7).

Certain natural and human resources are necessary conditions for the continuation of this effort. The

continued availability of natural resources and a dependable source of energy combine with human ingenuity in the development and application of technology to assure the economic growth that provides better living conditions, increasing life expectancy and the quality of life of the members of that society. Many theorists and researchers assume and stress the essential interdependence between economic growth and technology as integral to the fundamental goal of social progress and the practical forces moving Western societies. As Chauncey Starr states:

As one looks back at the first three-quarters of the the 20th century, one cannot fail to be awed by the amazing progress industrial societies have made. At the beginning of this century, the average fully employed man in the United States worked harder and longer for less pay Thankfully, those old days are gone forever, but still with us is the desire to continue the steady improvement of societal welfare achieved in the past. An important contributor to this progress has been the steady gain made in economic productivity which, in turn, has been mainly driven by technical advances in energy-using capital equipment (Starr 1990: 11-12).

Much of the direct improvement in the human condition, facilitated by economic development, is attributed directly to science and technology:

It cannot be a matter of reasonable dispute that technology has had a dramatic positive influence on the safety, health and longevity of our population. Our life expectancies have not gone up by more than twenty years since 1920, and doubled in the last hundred-odd years, just because the stars are in the right places. It is because technology has given us safer and easier ways to do the things we do, has provided energy to replace much of our manual labor, has provided through science ways to make nature an ally in our activities, has endowed us with an enormously productive agricultural system, and has supplied the means for both prevention and cure of many of the most life-threatening scourges of mankind (Lewis 1990: 333-334).

There are two strong themes in this worldview, both of

which confirm and complement the obligation of the developed world to assist with the economic development of the third world. One is that the benefits of science and technology are enjoyed by all members of an industrialized society and are genuine social advances that should be available to everyone. The other is that many of the essential features of a civilized society, within which individuals can flourish, are attributed directly to the advantages of science and technology or were made possible by it. There is a deep distaste for society and the human condition as it is conceived to have been before these advances. One writer interprets Thomas Hobbes's famous phrase in Leviathan as suggesting that before the scientific revolution, humans suffered a miserable existence in a state of nature:

Hobbes believed that in a state of nature all men are equal. Unlike many modern social critics, however, Hobbes did not deduce from his belief that a state of nature was desirable for all mankind. He reasoned that in such a state there would be no justice or injustice; there would be only war: 'No arts; no letters; no society;' he wrote, 'and which is worst of all, continual fear of danger and of violent death; and the life of man, solitary, poor, nasty, brutish and short.' These last four words are Hobbes's most famous, and constitute the most concise and vivid literary description of life before the rise of modern science and technology (Bolker 1986: 18).

The challenge facing the industrialized world today is to sustain this progress for its own citizens, and to extend it to the rest of the world that so desperately needs it. This concern is extended to the desire of developing countries to achieve a similar level of affluence, and the desperate need of some very poor countries to find the resources to feed and house their populations. Gro Harlem Brundtland asks ". . . without growth, how can we provide for twice the present population some time in the next century, when we cannot provide for everybody today?"

(Brundtland 1989: 190). Economic growth is not only desirable, it is essential for improving the human condition. It is poverty that causes people to deplete their environments: helping developing nations share in our affluence through economic development so that they may stop environmentally destructive activities is the pressing ethical and humanitarian duty of developed countries. McNeill, Winsemius and Yakushiji estimate that "if current forms of development were employed, a further five- to tenfold boost in economic activity would be required over the next 50 years to meet the needs and aspirations of 10 billion people" (McNeill et al. 1991: 5)

As Sir Ernest Titterton explains, such growth is closely tied to energy consumption:

The standard of living and industrial capability [in Western nations] have depended on the development of reliable and cheap energy sources in the West. If we are to remove one of the causes of war - the disparity between the standards of living of the "have" and "have-not" nations we have to move to energy equity among the nations of the world. Such a development, which will surely occur in due course, will lead to an enormous increase in the consumption of energy" (Titterton 1990: 144-145).

The consumption of energy and resources in generating economic growth, while it has improved the quality of human life and is essential for a similar improvement in developing nations, is nevertheless recognized as a threat to the environment and to the potential for realizing the goal of world-wide improvement. The concern that environmental degradation on a global scale is a serious threat to the continued creation of wealth for generations yet to come is given official expression by the Canadian federal government in its Green Plan:

. . . is it possible that we who are history's most affluent and technologically sophisticated society will not be able to maintain what we have for ourselves and our children? Have we reached the

limits of the earth's ability to accommodate our aspirations? (Government of Canada 1990: 3).

The use of improved, environmentally benign technology to increase productivity and develop new forms of energy is essential to the growth imperative and to the ecological imperative. As McNeill et al. argue, "the maxim of sustainable development is not 'limits to growth'; it is 'the growth of limits.'" This can be accomplished through institutional changes: changes in styles of decision making, domestic and international policies, and "massive investments in human and resource capital" (McNeill et al. 1991: 16; 27).

Nuclear power is perceived as playing a crucial role in the increasingly important effort to produce sufficient energy to generate economic growth and supply the needs of the world, without contributing to environmental degradation. The pro-nuclear intervenors' emphasis on nuclear energy as environmentally benign is shared by many theorists. Wolf Hafele states that "the greenhouse effect offers a powerful argument for increasing the use of nuclear power" (Hafele 1990: 138). Titterton reviews the environmental advantages of nuclear power, saying that "the experience of the last thirty years has shown that nuclear power is amongst the cheapest, safest and is the most environmentally desirable means of power generation yet devised by man" (Titterton 1990: 142). This position is also taken in Canada, by several reviews of nuclear power and energy issues: Nuclear Energy: Unmasking the Mystery stated that

. . . maintaining the nuclear power option is vital to Canada's interests, as it is vital to the interests of society in general. There is a compelling case to be made in support of continued nuclear development, a case based upon the future inadequacy of conventional petroleum resources and upon the environmental degradation arising from burning coal in progressively

greater quantities for electricity generation
(Standing Committee on Energy, Mines and Resources
1988: 3).

The benefits of nuclear power are, to its supporters, that it assists in the achievement of their social goals, and that it does so economically and with minimal adverse consequences. It is considered a good technology because it produces much-needed energy with less physical risk to the environment and human health than other energy technologies and entails as well a lower risk than do many activities individuals engage in. This position is determined through risk analysis and assessment.

The idea of risk as used by scientists evolved during the scientific revolution and is founded on particular philosophical assumptions. This is a technical exercise that combines "the idea of loss with that of chance or probability" (Lewis 1990: 12), grounded in the fundamental notion of randomness (Lewis 1990: 50). Probability is "connected with the degree of belief warranted by evidence, and it is connected with the tendency, displayed by some chance devices, to produce stable relative frequencies" (Hacking 1975: 1). This particular meaning of the word "probability" developed only in the late seventeenth century, when events began to be perceived by early scientists as occurring randomly in a mechanical universe of physical, amoral matter, instead of as governed by God in an organically and metaphysically integrated world in which natural and human events are part of the divine plan, or sent by God as signs or lessons to humans (Hacking 1975; Thomas 1971).

The idea of risk is not confined to the probability of accidents or harm. Individual risk-taking was an important

feature in nineteenth-century liberalism and in the development of a market society. As Theodore J. Lowi points out, "There is a self-evident relation between risk taking, profit, and productivity, and to deliberately eliminate the element of personal risk from economic endeavour would almost certainly affect the other two variables, profit and productivity" (Lowi 1990: 17-18). Risk is, that is, a specific approach to decision making on issues that may involve costs and benefits, dangers and opportunities, and most of all, uncertainty, in a world that is amenable to quantification and calculation of probabilities. Risk-taking is a valued attitude in life, the means to successful enterprise and social progress.

As it is used to quantify the profile of a technology, risk is defined as probability $\times$ consequence: the characteristics and criteria used in risk analysis are quantitative, and often measured in quantifiable, economic terms, such as years of life lost or cancers produced per year. Recently proposed is a measure of safety as life expectancy, and a measure of quality of life as the level of real gross domestic product per person (Lind et al. 1991).

Risk is generally considered to be a relative measure, since every activity that humans engage in entails some risk. To explicate the relative risks of different activities or toxins, many risk analysts provide risk comparison charts illustrating that some of the things people fear, such as chemical food additives and nuclear power, pose less risk than other things people tolerate willingly, such as the aflatoxins occurring naturally in peanuts and driving our cars. A central goal in risk analysis is to minimize the risks associated with an activity, substance or technology by accurately identifying

the magnitude and character of the risk (Wilson and Crouch 1987), starting from the assumption that the likelihood of harm from everything we do can be measured and compared and ultimately minimized.

Risk assessment is a specialized, professional undertaking that is intended to be, and, according to Kristin Shrader-Frechette, is believed by its practitioners in large measure to be "completely objective, neutral, and value-free." Shrader-Frechette describes the "standard account" of risk assessment as proceeding in three stages:

At the first stage, one identifies a particular threat to human health and safety - for instance, vinyl chloride. At the second stage, scientists such as epidemiologists or environmental engineers estimate the risk of death or injury associated with particular levels of exposure to that hazard. At the third stage, scientists such as economists and health physicists, as well as psychologists and policymakers, evaluate what level of exposure to the risk, if any, is acceptable to society (Shrader-Frechette 1991: 55).

The risk of an activity or technology, once assessed, is balanced against its benefits for a more complete view of the relative utility and costs to society of that activity. The risks of a technology are thus relative not only to the risks of other activities that societies and individuals accept, but also to the risks involved with other means of doing what the technology does, and to the benefits to society of what the technology offers.

Nuclear energy has been found by many studies, employing different methodologies, to be safer for human health than other similar technologies. Sims notes that Herbert Inhaber, in his 1982 Energy Risk Assessment, found that the safest energy source was natural gas, followed by nuclear - the most hazardous were coal and oil. In 1983 John Holdren et al. computed the occupational risks of different energy

sources, and ranked the safest as oil refining, uranium and hydroelectricity. The most dangerous was coal (Sims 1990: 231). Reporting in the Royal Society of Canada's Symposium of the Assessment and Perception of Risk to Human Health in Canada, W. Paskievici compared the effects of four fuel cycles - natural gas, oil, uranium and coal - on the risks from diseases: "the risk of fatalities in the general population is negligible for the natural gas cycle, relatively low for the uranium cycle and relatively high for the coal and oil cycles." Paskievici also found that risks from accidents were "negligible for oil, natural gas and uranium cycles, . . . about 100 times higher for coal than for natural gas and uranium" (Paskievici 1982: 100, 104).

Science, the Environment and Credible Knowledge:

Intervenors

Atomic Energy of Canada Limited stated in its submission that

AECL believes that carefully engineered and controlled burial 500 to 1000 m deep in the massive rock body of the Canadian Shield is a safe way to dispose of Canada's nuclear fuel waste. This belief is based on 13 years of intensive research and development. During this time, the concept has been tested against all aspects of scientific questioning and engineering feasibility that have been raised, either by our own scientists and engineers or by technical experts external to AECL. (FEARO 1990: AECL vol. 1 p. 1 of sub.)

Pro-nuclear intervenors agreed with this perspective: credible knowledge, from which an informed opinion may be formed, is grounded in objective fact and based on science, careful rational evaluation by appropriate experts, and following accepted procedures. A rational opinion is formed by the individual after evaluating the information; scientific consensus that reflects the accumulated weight of a large body of experts' evaluations is very compelling.

An important feature of the pro-nuclear intervenors' perspective is indicated by the minor observation that, almost without exception, each opened with a statement of his credentials or those of the group represented. These took the form of academic and professional qualifications and experience in the field. In some cases a list of the professional accreditations of the individuals represented was appended to the submission. These credentials validate the views of the intervenor and justify his appearance before the panel; in essence, they are a prerequisite to the holding of an opinion on the matter.

Pro-nuclear intervenors felt that there are very real dangers in attempting to evaluate information without the proper knowledge. Decisions made without the benefit of accurate information and rational evaluation are not authoritative, and the individual can misunderstand information or be led astray by information that is inaccurate. The pro-nuclear intervenors showed a strong nervousness about the dangers of being misled by misconceptions, swayed by media or popular opinion, or won over by unscrupulous activists. J.A.L. Robertson noted that panel members were selected for their lack of bias, which also means that they lack knowledge about nuclear power: "They are therefore susceptible to prejudice resulting from false or misleading statements" (FEARO 1991: Robertson 115).

'Irrational' opinions based on emotion or held in political solidarity with peer group or public sentiment are particularly suspect, and have no place in a review of complex economic and technical issues. Worse, their underlying motivation is suspicious: Robertson criticized some of the anti-nuclear intervenors who had appeared

before the panel, whose action was "despicable in that it tries to gain by emotive tricks what it could not by a fair presentation of the facts" (FEARO 1991: Robertson 115).

'Being informed' consists of meeting a demanding standard of accredited expertise in a field that is directly relevant to the issue at hand, and should be required of all those who will be involved in this (or, presumably, any) review. Intervenors argued that experts in non-related fields should not be admitted. Wardrop Engineering, for example, argued that

The Environmental Impact Statement, and the subsequent hearings and evaluations should only deal with specific, verifiable facts, and accepted theories which have been subjected to thorough scientific peer review by qualified experts in the relevant fields. Non-specific statements, unsubstantiated opinions, and innuendo should be rejected out-right. These restrictions should apply equally to the proponent, as well as to all intervenors.

In particular, the Panel should be wary of the opinions of "scientific experts" who are making judgements outside of their sphere of expertise (FEARO 1990: Wardrop vol. 1 rec. 3).

Pro-nuclear intervenors placed great confidence in knowledge, data, and projections that are grounded in good science and have been evaluated by the scientific community. Confidence in technology was also frequently expressed in these submissions. R. Steed claimed that

. . . the proposed scheme for underground disposal provides complete protection for mankind and the environment, since in 500 years the activity of the spent fuel will not be appreciably more than that of the original uranium ore. The concept under review is designed to prevent absolutely any leakage of radioactive material from within the storage containers for at least 500 years (FEARO 1990: Steed vol. 3: 1).

While the pro-nuclear intervenors expressed their

confidence in science and in technology, there were very few references to 'nature'. Most references to the environment described physical properties of certain locations or geological structures in relation to siting a repository or other uses. A few submissions stressed that the proposed disposal technology would not damage the environment (FEARO 1990: Steed vol. 3: 1; FEARO 1991: Steed 47; Sutherland 74-75; Hester 106).. This provision seemed to be one of meeting certain technical criteria: one intervenor, speaking of a possible facility that permitted future waste retrieval, stated that "of course, the system which is established should be environmentally safe" (FEARO 1991: Hester 100). The prevailing attitude to nature is a pragmatic and utilitarian one, interpreting natural phenomena in physical, mechanistic terms. The physical properties of natural and human-engineered impacts and qualities are evaluated in the same terms, along the same axis. Sutherland said that radiation in the used fuel will decay to a level similar to that of the original uranium ore - "The only difference is that, in this case, man is managing it instead of nature" (FEARO 1991: Sutherland 73).

Similarly, standards adopted by governments and regulatory bodies are based on objective measurements and identify levels or limits that are safe, whether the origin of a substance is natural or industrial. "Even making pessimistic assumptions about such leakage, it is very unlikely that any of the existing Guidelines for Canadian Drinking Water Quality would be approached, never mind exceeded, as they are today in many natural uncontaminated waters (FEARO 1991: Sutherland 75).

Science, the Environment and Credible Knowledge:

Theoretical Context

Confidence in science and technology is complemented by

valuing the natural environment as a resource that can and should be dominated and controlled by humans in society's efforts to improve living conditions; experts are influential in a hierarchical society characterized by authoritative structures. Cotgrove explains that "science . . . has exercised a powerful influence on thinking in industrial societies. . . . the key to discovering the nature of reality for science is to penetrate beneath the surface, and to discover the structure and forces underlying appearance. . . . Such quantifiable data lends itself to mathematical analysis and the formulation of law-like statements of uniformities and regularities" (Cotgrove 1982, 62).

Michael Colby describes the dominant paradigm as 'frontier economics', which has dominated since the scientific revolution and rests on a definition of nature as an infinite supply of resources for human use, unlimited faith in progress - constrained by human labour and man-made capital rather than natural limits - in technological advancement and in human ingenuity (Colby 1989: 8-10).

Dorothy Howell defines science as "the systematic knowledge of the physical or material world," and elaborates that

Essential to science as a unique pursuit of knowledge is the scientific method: principles and procedures for the systematic pursuit of knowledge involving the recognition and formulation of a problem, the collection of data through observation and experimentation, and the formulation and testing of hypotheses (Howell 1992: 21).

Liora Salter and Debra Slaco point out differences between science and engineering that are relevant to a review of nuclear power. While engineering data "can be predictive and contribute to a scientific debate,"

. . . science and engineering are characterized by a

different orientation. Science is tied to systematic investigation, while engineering is concerned with empirical problem solving, always with reference to a particular project. Science is exploratory. Engineering is pragmatic, oriented to identifying specific problems and their solutions in the design of a specific project. At their best, scientific questions are open-ended while engineers seek a single, finite answer to a particular problem in order to proceed with construction of the project (Salter and Slaco 1981: 152).

Engineering and science ground their different orientations in the same physical world, however. Alfred North Whitehead explains that the scientific cosmology

. . . presupposes the ultimate fact of an irreducible brute matter, or material, spread throughout space in a flux of configurations. In itself such material is senseless, valueless, purposeless. It just does what it does do, following a fixed routine imposed by external relations which do not spring from the nature of its being. It is this assumption that I call 'scientific materialism'. . . . The great forces of nature, such as gravitation, were entirely determined by the configurations of masses. Thus the configurations determined their own changes, so that the circle of scientific thought was completely closed. This is the famous mechanistic theory of nature, which has reigned supreme since the seventeenth century (Whitehead 1925: 17, 50).

Whitehead describes this theory as the "orthodox creed of physical science," and says that "it worked. Physicists took no more interest in philosophy" (Whitehead 1925, 50). Scientists can now say that "the environment is chemicals. Millions upon millions of them" (CTV 1991: 23).

A fundamental element in the scientific definition of nature is stability, implied by the physical laws by which all nature operates. Howell explains that science is grounded in a certain characterization of the physical world, that is not only observed and assumed but necessary: "[m]odern science is the intellectual endeavour that depends entirely on the assumption that nature is operating according to general laws hidden but discernible through

systematically controlled observation and experimentation." (Howell 1992: 22) This necessity for stability in the order of nature was noted already in the seventeenth century: Clarence Glacken describes the urgency of "the need to believe in the constancy of nature and the regular operation of its laws if any forward-looking attitude toward nature, science, and civilization was to be achieved" (Glacken 1967: 382). Also speaking of seventeenth-century beliefs about nature, Greene refers to the "stability and permanence of the great features of nature: . . . change was recognized as a real aspect of nature, but a superficial aspect. It contributed variety to nature's panorama, but it could not alter her fundamental structures" (Greene 1981: 12). Milbrath relates the necessity for stability in nature to social function: "orderly, sustainable and predictable patterns in biogeochemical systems constitute an essential foundation for order and continuity in society" (Milbrath 1994: 120).

Economics shares these cosmological assumptions of the nature of the physical environment. William E. Rees points out that "the founders of the neoclassical school, impressed with the successes of Newtonian Physics, strove to create economics as a sister science, 'the mechanics of utility and self-interest'" (Rees 1990:124). It is the assumption of an amoral, mechanistic physical environment that permits the scientific enterprise, which in turn facilitates the economic enterprise of, to complete the circle, controlling nature to advance human progress. As Howell puts it, "through its acquisition of knowledge of the natural world, science moves first toward understanding nature, then towards predicting natural events, and, ultimately, into control of natural forces" (Howell 1992: 22).

Nature, is, in fact, being simply "brute matter," intractable or hostile to human endeavours, and must be controlled in order to be of use to society: recall that Lewis argued that ". . . technology . . . has provided through science ways to make nature an ally in our activities." (Lewis, 1990, 333 - 334) This particular conflation of ideas, the use of science and technology and the control of nature, come together to define a social order and a cultural ethos. As Adas notes, "the mastery of nature as manifested in scientific discovery and technological advancement was one of the most critical gauges of human achievement" (Adas 1989: 214). Science thus defines elements of the natural environment in mechanistic, objective terms as natural resources, which in an today's economic context become "stocks of ecological capital" (McNeill et al. 1991: 20).

Both science and economics are founded on and require a conception of nature as raw material in a stable mechanism. It is this conception that provided the universe of randomness operating within certain physical laws that laid the ground for the concept of risk. This definition of physical nature orients people to a certain utilitarian relation to the environment, and likewise to a certain definition of reality and hence of rationality, or the cognitive process best suited to apprehending that reality. The conception of human nature applies principles of economic rationality in the concept of individualism and 'economic man'.

The individualist conception of human agency and social interaction . . . rests on three general assumptions. First, individuals are atomistic, rational, and acquisitive. Second, individuals are autonomous sources of their own conceptions of the good. Third, individuals engage in social relations primarily to obtain benefits which autonomy and self-help cannot provide. These benefits include the

provision of a secure and stable environment in which to pursue various and divergent life plans, and the exchange and collective production of the resources needed to realize these goals (Reus-Smit 1993: 7).

People are fundamentally motivated by principles of economic utility, in which some kind of rough cost-benefit calculation underlies all decisions and actions taken by an individual. Economist Robert Heilbroner explains that the rationality of capitalist civilization is "means-ends calculating" and is characterized by "the predominance of a prudent, accountant-like comparison of costs and benefits" that contrasts with the "'irrational' cultures of previous social formations" (Heilbroner 1988: 46-47). Walter Weisskopf describes economist Alfred Marshall's construction of 'economic man', an individual who conducts himself rationally and systematically in his own best long-term interests, as "moral economic casuistry" (Weisskopf 1955: 180).

The dominant body of psychological research on rationality has been since the 1950s a normative model, grounded, as Helmut Jungermann explains, in the assumption of ". . . a reliable and valid yardstick for the evaluation of judgment and decision, namely, the objective reality, and consequently that there is some kind of objectively veridical mode of information processing which is mapped in the respective normative model" (Jungermann 1986: 632). In research focussing on individuals' judgements under uncertainty, objective reality is measured correctly through statistical probability analysis, and people's intuitive decisions are compared to results obtained through the application of statistical rules (Kahnemann et al. 1982). Jungermann summarizes the deficiencies that are observed in human decision making as inherent in the human mind: 'People are prone to violate principles of

rationality" (Jungermann 1986: 632).

As Howell noted, the laws of nature are hidden and their apprehension requires systematic and rigorous observation: the knowledge sought is of an objective, physical reality that is not always apparent to the untrained layperson. This rationality is not intuitive, but must be learned. The complexity of the physical world, and what we need to know about it in order to make rational decisions guiding our activities in it, therefore place the expert and scientific rationality in a position of authority. Individuals' values and subjective impressions are variable and subject to interpretive biases of many sorts; scientific method is so rigorous precisely because of the variability and distortions of individual perception that must be overcome in the effort to obtain data that are objective and verifiable. Failure to observe these procedures can result in faulty interpretations of data and distortion of the facts: credible knowledge on subjects of any scientific or technical interest is therefore the purview of trained and accredited competence.

Credibility of the Panel and Scope of the Review:
Intervenors

The pro-nuclear intervenors approved of the FEARO review process and the hearings, thanking the panel for giving them the opportunity to present their views. The two major tasks of the panel, they thought, were the identification of technical issues for inclusion in the EIS, and the importance of educating the public, providing accurate and unbiased information on nuclear energy. A corollary of this second task was that inaccurate and biased information, uninformed opinion, should be excluded from consideration in the review.

From their perspective of the definition of credible knowledge, and the rationality on which their conception of the issue was based, most pro-nuclear intervenors stressed that the scope of the review should be limited to technical issues: M. Feraday urged the exclusion of "'fill issues' which have little relevance to the proposed facility. . . ." (FEARO 1990: Fereday vol. 1 p. 1 of sub.); R. Steed stated that "irrational fears must be somewhat discounted . . . and only arguments based on the physical or social sciences be given serious consideration" (FEARO 1990: Steed vol. 3: 2); the CNA urged the Panel "to limit the scope of the review strictly to those matters which are directly relevant to consideration of the acceptability of the proposed disposal concept in meeting clearly defined safety and environmental criteria" (FEARO 1990: CNA vol. 1 p. 5 of sub). Wardrop Engineering advised that "it would be a waste of the Panel's time, as well as that of the proponent and intervenors, to dwell on other concepts which the world's scientific community has judged as unworthy of further study. In particular, the Panel should avoid study of 'pie-in-the-sky' concepts which promise a magical solution, but which have not been subjected to credible, scientific peer review" (FEARO 1990: Wardrop vol. 1 rec. 1; see also CNA vol. 1 p. 1 of sub; Jamieson and Boyd vol 3: 173; FEARO 1991: Robertson 116).

A respect for the rationality of established procedures extended to their expression in government standards and process. The review was seen as an official process and the panel as an official body: one intervenor referred to the panel as "an agent of government" (FEARO 1991: Robertson 116), and the Association of Professional Engineers of Saskatchewan congratulated the panel for "incorporating due process," noting that the Professional Engineer's Code of Ethics "requires him or her to owe a

duty to the state to maintain its integrity and to maintain its laws" (FEARO 1990: Assoc. P.Eng. Sask. vol. 5: 7-8). The panel's mandate had been officially established and thus should be respected: the panel "does not have the authority to alter its terms of reference and any attempt to have them altered at this late stage would be regarded as a breach of faith by those who have not considered it necessary to argue for the present terms of reference" (FEARO 1991: Robertson 116). Robertson also opposed a community veto of transportation of wastes through its region, as "contrary to accepted practice and law" (FEARO 1991: Robertson 120; also FEARO 1990: Assoc. P. Eng. Sask. vol. 5: 7).

II. THE DISPOSAL OF NUCLEAR FUEL WASTE

Attitudes Towards Disposal of Used Fuel Wastes: Intervenors

The technology for the disposal concept developed by AECL was supported as safe by the pro-nuclear intervenors. As one stated, "I firmly believe that AECL's eventually accepted method of disposal for nuclear wastes will be the safest in North America, and will certainly rank among the safest in the world, if not ~~the~~ safest" (FEARO 1990: Stanik vol. 5:112). Another stressed that ". . . the proposed scheme for underground disposal provides complete protection for mankind and the environment . . . " (FEARO 1990: Steed vol. 3: 1; see also AMPCO vol. 1; FEARO 1991: Hester 97-99).

Aside from more technical comments made on the disposal concept itself (and such comments were of course made by both pro- and anti-nuclear intervenors as well as by those who were interested only in technical details), the most common objection to the concept from the pro-nuclear intervenors was that the waste should not be irretrievable.

The reason for this argument was the future economic value of the used fuel, which could be recovered and reprocessed when the economics are favourable: "We will look pretty silly in the eyes of the rest of this energy-hungry world to be literally sitting on a colossal source of energy, and be unable to utilize its 'unburned' plutonium and uranium. Irretrievable disposal is a luxury we cannot afford" (FEARO 1990: Steed vol. 3: 1). Similarly, Hester argued that ". . . we should be extremely reluctant to dispose of the whole of the nuclear waste in a way which does not permit of reclaim. Barely 2% of the energy inherent in the CANDU irradiated fuel has been used. And there is little doubt that we will be using breeder reactors eventually which will be able to utilize uranium - 238 for power generation" (FEARO 1991: Hester 99; see also FEARO 1990: Jamieson and Lloyd, vol. 3: 172). The waste may be dangerous, but it is also useful and potentially valuable.

Several intervenors noted that the nuclear industry is, and has been, acting in a responsible manner by managing the wastes safely on reactor sites, and by designing a method of disposing of the wastes that will isolate them from humans and the environment. The utilities and the industry, broadly speaking, have assumed this responsibility and will carry out the disposal when a repository is opened.

Ethic of Responsibility for Nuclear Waste: Intervenors

The responsibility to manage nuclear wastes is held by those who generate electricity with nuclear power; this responsibility is held collectively by all of society, since it is all of society on whose behalf electricity has been generated with the technology and who have benefitted from related economic activities. As Rouben and Smith pointed out,

2

PM-1 3 1/2"x4" PHOTOGRAPHIC MICROCOPY TARGET
NBS 1010a ANSI/ISO #2 EQUIVALENT

PRECISIONSM RESOLUTION TARGETS

We believe that the permanent disposal of used nuclear fuel is necessary, and that to do so now is indicative of our responsibility to manage the wastes we have generated in deriving the benefits of nuclear power (FEARO 1990: Rouben and Smith vol. 1 last p. of sub.).

The issues of both spatial and generational equity were raised by one intervenor, who noted that neither principle obliged a particular sector of today's society to accept most of the responsibility for the wastes. "With regard to spatial equity, there is a widespread assumption in the [anti-nuclear intervenors'] submissions that there should be a close balance between the benefits and risks from any technology for the communities affected. This is completely contrary to our society as it now exists: what we try to achieve is some rough overall balance" (FEARO 1991: Robertson 120). Robertson also noted that since it is to be expected that future generations will also benefit, directly or indirectly, from nuclear power, it is not inappropriate that they share the burden of waste management (FEARO 1991: Robertson 119).

The point was also made by several intervenors that the responsibility to find an acceptable method for the disposal of nuclear fuel wastes is in addition to the responsibility to store the wastes safely, which is already assumed by the utilities. Hydro-Quebec stated that it "clearly accepts its responsibility for managing irradiated nuclear fuel with full regard for the protection of the environment, of its plant personnel and of the public at large" (FEARO 1991: Hydro-Quebec 36). R. Steed noted that "it is important to bear in mind the care with which radioactive wastes are already handled today, in comparison with non radioactive hazardous substances . . . " (FEARO 1990: Steed vol. 3: 2).

III. THE RELATION BETWEEN THE EXPERT AND THE PUBLIC

The Role of the Expert: Intervenors

The credible knowledge sought by the pro-nuclear intervenors is gained through a specialist's rational evaluation of accurate, objective data. As the Association of Professional Engineers of Saskatchewan pointed out, the layperson is not equipped to achieve this kind of knowledge: "only a small fraction of the public in Canada has the academic background and knowledge to independently evaluate the waste management concepts for nuclear fuel waste management systems" (FEARO 1990: Assc. P.Eng. Sask. vol. 5: 9). The expert's ability to meet these conditions confers competence and accountability, which are of paramount importance to experts and professional managers who make decisions on behalf of the public.

A particular relationship of experts and managers to the general public was suggested by most of the pro-nuclear submissions, and was most explicitly defined by the Association of Professional Engineers of Saskatchewan.

Professional engineers were servicing the public of Saskatchewan before the Engineering Profession Act of 1930 first granted the privilege of self-regulation. By maintaining high entrance standards to the profession, and by enforcing the code of ethics, Professional Engineers have supervised the investment of many billions of dollars to improve the standard of living, safety and welfare of the citizens of this province. Saskatchewan Professional Engineers are convinced that continued rigorous enforcement of these high standards is essential to ensure the continued safety and welfare of the public. . . . An engineer is required to act at all times with candor and fairness when engaged as an expert and give, to the best of his or her ability and knowledge, an honest opinion based on adequate study of the matter in hand. Further, it is the ethical responsibility of every Professional Engineer to regard all aspects of the physical and economic well being of the public as his or her first responsibility (FEARO 1990: P. Eng. Sask; 5: 7-8).

The Role of the Expert: Theoretical Context

Because credible knowledge is grounded in a trained interpretation of data, expertise is accorded an authoritative position in a society dependent on increasingly complex technology. This expertise is offered in the spirit of service to the public, who do not have the advantage of such specialized knowledge. On a large scale, it has been observed that Ontario Hydro, an institutionalized body of expertise, assumes a sort of de facto equation of its public funding and public service mandate with representation of the public interest (Salter and Slaco 1981: 90).

The term "the public" is used widely in risk perception and risk management literature to denote those who are not experts. Although these terms ignore variations in the orientation of different expert specialities, they are probably accurate enough in their reference to practitioners of the physical sciences and engineers, who share the basic scientific paradigm of reality; distinctions among non-scientists, whether uneducated or highly educated in a non-scientific field, are not acknowledged in this context.

A useful definition and role of the expert, the professional, appears in the Guidelines of the Canadian Council of Professional Engineers:

A profession is a learned calling which requires advanced knowledge, understanding, and abilities gained from intensive and specialized education, training, and practical experience. Members of a profession limit their activities to their areas of knowledge and experience, doing so out of commitment to serve and protect the public. . . . Professions tend to be characterized by high levels of

organization and regulation(Canadian Engineering Qualifications Board 1992: 18).

The professional must first earn, and then strictly maintain and uphold, the position of influence accorded by accredited expertise. The professional's relationship with the public is framed as a "social contract between the profession and the public . . .[which] requires that the profession make an operational public statement of the goals its practioners intend to pursue in the service of the public" (Lind et al. 1991: 26), and which is assumed to be accepted by the public:

Adherence to a code of ethics ensures an adequate standard of competence and conduct based on a relationship of responsibility and trust between the profession and the public But the highest obligation of a profession is to society, which it serves: the members of a profession shall protect the interests of society in the areas of the profession's specialized expertise. This obligation rises above all others when there are conflicting responsibilities (Lind et al. 1991: 26).

Although they earn their status in gaining their credentials, professionals are to be motivated not by a desire to enhance their status, but by their duty to serve the public; in return, public respect for the authority of expertise is assumed. The influence of expertise is confined to its defined field and experts in one field will respect the expertise of the professional in other fields. All members of society contribute their own expertise to the common good in the service of the shared goal of material progress and increased wealth: the basic context is thus the differentiation of function and gradations of status within a society unified by its allegiance to a common set of social values and goals. Pro-nuclear intervenors and theorists in that worldview do not characterize themselves as an elite, but they do explicitly

distinguish their contribution to society as being based on specialized knowledge and competence, from the knowledge and competence of the lay public which does not qualify for decision making on technical issues.

One expert undertaking carried out on behalf of society is risk management, which follows from expert risk assessment. Shrader-Frechette explains that "after [the] three tasks of hazard analysis are completed, regulators and lawmakers begin the process of risk management, ensuring that the actual risk exposure conforms to the standards of acceptability already determined by assessors" (Shrader-Frechette 1991: 55). Risk management systems generally consist of several components, including monitoring, research, standard setting, legislation, regulation, inspection, enforcement, emergency response, and ongoing system re-evaluation (Cutter 1993: 60). There are many accounts of the technical and administrative aspects of risk management, but the fundamental task of weighing and balancing the risks of a technology against its benefits is common to all - taking a risk means, in essence, a calculated striving for a desired goal, taking account of the desirability of the goal, the magnitude of possible costs and dangers and the likelihood of their occurrence. Risk management writers stress that no activity is risk-free, and 'zero risk' or 'zero tolerance' is viewed as being an impractical, unaffordable and undesirable goal.

In Canada, the Joint Committee on Health & Safety of the Royal Society of Canada and the Canadian Academy of Engineering has prepared a document entitled Health and Safety Policies: Guiding Principles for Risk Management that discusses underlying principles that guide risk management as a professional task. The introduction of

this document states that:

The guiding principles presented in this report are directed at decision makers in government, industry and other institutions responsible for the promotion of safety. The engineering and management of human safety is a widespread activity in our society that includes much government activity, legislative and administrative, concerned with promulgation of regulations to protect and enhance the health and safety of the public (Joint Committee 1993: i).

The three guiding principles are as follows:

- Risks shall be managed to maximize the total expected net benefit to society
- The safety benefit to be promoted is quality-adjusted life-expectancy
- Decisions for the public in regard to health and safety must be open and apply acrosss the complete range of hazards to life and health (Joint Committee 1993: i-ii).

The 'quality-adjusted life expectancy' is described in another work as "the single, aggregated social indicator that may be used as an objective function when policy or projects are to be selected in the public interest" (Lind et al. 1991: 56). Another such indicator that is useful, because it reflects quality of life and well-being and is available and reasonably reliable and accurate, is the real gross national product per person (Lind et al. 1991: iii, 56).

The quantitative, economic and utilitarian terms in which risk management is defined and carried out are deliberately sought, in part as a result of the philosophical alignment of its practitioners, and in part for ease of building a workable methodology. In a sense these are one, as reducing risk and safety criteria to quantitative measures ensures the accurate analysis that is necessary to identify, compare and allocate resources to manage risks to health. "It is the first duty of those who manage risks to

see that lives are saved efficiently, not to merely create a perception of safety" (Joint Committee 1993: 12).

Uniform quantitative measures are an important means of keeping the policy-making eye on the essential task of all public safety efforts ("to make lives long and healthy . . . If the objective were not this, then what else might it be? Lind et al. 1991: 20), since many elements distract legislators from serving the public interest: the media, "misperception of hazards, sensationalism, vociferous interest groups and faulty indicators" (Lind et al. 1991: 3).

Acceptability of the Disposal Concept and Public Education: Intervenors

A certain characterization of the public is implied by the value of authority and knowledge and the responsibility of the professional to the public. The professional not only serves the public, but also protects it. The public is that part of society which lacks expertise in a certain field, and must turn to experts in that field for guidance. This also applies in some measure to professionals in other fields, who will defer to relevant expertise. The complementary relationship between the professional's duty to the public and the public's respect for, and trust in, the professional reflects and compounds the expert's sense that those who lack proper knowledge and the means to achieve it will be unable to assess the evidence properly and are vulnerable to being misled. Hence the pro-nuclear intervenor's concern, noted above, that panel members are unfamiliar with nuclear power and are thus 'susceptible to prejudice'.

Non-experts' misconceptions of the facts are often presented as being understandable, in light of their lack of training and inability to interpret the evidence. Many

intervenors sought to describe and correct these 'faulty perceptions' (FEARO 1991: Hester 98-99; Robertson 115-122; Sutherland 72-76; Steed 46-48). K.D. Hester suggested that the units of measurement used in the analysis of radiation levels may lead people to believe that amounts and concentrations are greater than they are (FEARO 1991: Hester 98). Wardrop Engineering urged that information given to the public be kept in context:

From technical, economic and social perspectives, the issues of nuclear waste management are very complex. They also tend to elicit emotional opinions and reactions from a wide variety of people. Unfortunately, information quoted out of context can be very misleading to the public as well as the whole review process (FEARO 1990: Wardrop vol. 1 rec. 4).

The uninformed opinions of the lay public are not of great value, but the public may learn enough about a subject to form an opinion and understand information about the technology and the review. The pro-nuclear intervenors are aware that the non-expert will have some difficulty with this process, and most of them emphasize the need to educate the public to assist them in making a decision:

A University of Calgary poll in February 1990 indicated that many Canadians do not even have a basic understanding of some elementary scientific principles. This further underscores the need that, to achieve rudimentary understanding of concepts for storage/disposal of nuclear wastes, a substantial education effort will be needed to translate scientific complexities using terminology that can be understood by the majority of the population. Only with this information can the public make a personal evaluation of the safety of the proposed concepts (FEARO 1990: Assoc. P. Eng. Sask. vol. 5:7; Wardrop vol. 1 rec. 1).

The provision of information to assist members of the public in understanding technical concepts and forming a personal opinion, rather than actually participating in the formulation of policy, was a strong theme of the pro-

nuclear submissions. There were almost no references to the possibility of active involvement of the public in decision making on this inherently technical issue. No explicit consideration was given to allowing members of the public to participate in making a decision on the acceptability of the concept.

In fact, as we have seen, pro-nuclear intervenors devoted considerable effort to explaining why the concerns of the lay public were not relevant to this review and should be excluded from consideration. As noted above, pro-nuclear intervenors' loyalty was to objective fact and to the protection of the public interest, which are carefully distinguished from uninformed lay opinions and beliefs. Public acceptability, in itself, was seen by many pro-nuclear intervenors not as the expression of approval by members of the public, but as a technical quality that can be determined by an expert who considers all the factors that affect public health and well-being. The CNA submission specified that "whether or not the concept proposed by AECL is acceptable" means "can an acceptable set of safety and environmental criteria be met and what should these criteria be" (FEARO 1990: CNA vol. 1 p. 2 of sub.). R. Steed presented as essential public services the expert's assessment of the technology, as well as the task of identifying and addressing the issues of relevance to the public:

Specifically, addressing the scope of the Environmental Assessment, we submit that it should carefully and thoughtfully inquire into the concept of disposal of spent fuel, including transportation of the fuel to the disposal site, to satisfy the informed, reasonable layman, beyond all reasonable doubt, that this concept, including transportation, is viable, and "safe". It is further submitted that the public must be appraised of the work already done at Whiteshell and the Underground Research Laboratory, in layman's language, so that it can appreciate that its

concerns have been given very thorough attention, and completely addressed (FEARO 1990: Steed vol. 3: 2).

Expert decision making is legitimated by its public service function, and by the fact that it assures a better decision for the public than would be possible with uninformed laypersons. It is the professional's responsibility, for which he or she is well trained, to carry out technical assessments and advise on decisions on behalf of the public. Merely reflecting public opinion is an abdication of the professional's responsibility, similar to "succumbing to political pressures" (FEARO 1990: Rouben and Smith vol. 1 p. 2 of sub.).

Pro-nuclear intervenors appeared to agree that public opinion, while not a valid basis for a decision, is nonetheless a powerful political factor. The public is perceived not as being generally opposed to nuclear power, but as being uninformed and thus vulnerable to a few activists who twist the facts for their own purposes. Sometimes interest-group and public opinion constitutes an unwarranted obstacle to the implementation of rational decisions and good policy. M. Feraday referred to the "deliberate scare tactics by anti-nuclear groups, some of which either do not know the facts and/or do not wish to be concerned with them. These tactics resulted in unwarranted expenditures of tens of millions of dollars per life saved per year" (FEARO 1990: Feraday, vol. 1 p. 4 of sub.). Another argued that "irrational fears must be somewhat discounted, particularly those so stridently enunciated by special interest groups dedicated to shutting down nuclear power generation . . ." (FEARO 1990: Steed vol. 3: 2). Robertson stated that it is widely agreed by those in the nuclear waste management field that "safe d'sposal of the wastes is possible with the existing technologies but

gaining public acceptance for the proposed solution is much more difficult" (FEARO 1991: Robertson 121).

For a few pro-nuclear intervenors, "acceptability" suggested the requirement of acceptance of the concept by the public, and this is a much more problematic issue than its determination by experts. The precise manner in which the public could be involved was unclear, in several references to unspecified 'involvement' of the public (FEARO 1990: Rouben and Smith vol. 1 p. 2 of sub.; see also Ampco vol. 1 p. 2 of sub.). It was argued that the necessity for public acceptability of the disposal concept increased the need for public education on the relevant technical matters, to enable the public to decide on such acceptability. Jamieson and Boyd pose the question:

. . . the question of "acceptability" poses, we submit, many difficulties. Acceptable to whom? If to the total public, how will its acceptance (or not) be determined? Will the "public" (or the subset of the public that must decide whether or not the concept is "acceptable") be properly and objectively informed of all of the key factors in determining the "safety" of the concept? In this regard we endorse the concerns expressed by our Toronto colleagues about the importance of the public information process (FEARO 1990: Jamieson and Boyd vol. 3:172).

In addition to providing information to assist the public in making a personal assessment of the disposal concept, then, several intervenors stressed the importance of ensuring that members of the public were able to evaluate the evidence and material provided throughout this review. Educating and communicating with the public are responsibilities that should be assumed by the review process, since public opinion is becoming increasingly important, as Rouben and Smith of the Toronto Branch of the Canadian Nuclear Society stressed:

The success in achieving public concurrence with the

EIS results is entirely dependent upon the manner in which the final and interim findings are released, and the extent to which the general public, particularly those communities most likely to be associated with the facility, is involved. In failing to maintain an effective means of communication with the public, or by succumbing to political pressures to stress or to ignore certain facts, the environmental review process may simply become a process mired in bureaucracy and devoid of public faith. Scientists and engineers are beginning to realize that resolution of the nuclear waste disposal issue will be accomplished by public opinion and not by an accepted value for groundwater flow in granite (FEARO 1990: Rouben and Smith vol. 1 p. 2 of sub.).

Public opinion loomed somewhat for some of these intervenors, as it threatens to obscure or obstruct the proper focus of the review. Informing, educating and communicating with the public in a more open and transparent process is an important step in helping to move the public onto the proper territory so they are able to judge the acceptability of the concept in terms that are relevant and understand expert commentary. If the public are to be included, as it appears is preferable, they must be educated about the issue. Rouben and Smith concluded their submission with the caution that:

The ability to convince the public that the disposal concept is sound, and that permanent disposal of used nuclear fuel should be implemented, is of paramount importance (FEARO 1990: Rouben and Smith vol. 1 p. 5 of sub.).

The essential criterion remained that the review maintain the proper definitions of the issue and of credible knowledge. Public acceptability was acknowledged as important, however, and it is not members of the public per se who are excluded, but uninformed and irrelevant opinion. As M. Faraday expressed it, "scientifically correct information from any source should be considered as legitimate input to assess the viability and safety of an endeavour being proposed by a proponent" (FEARO 1990:

Feraday vol. 1 p. 3 of sub.).

Providing the public with accurate information will resolve the difficulty many non-experts have with issues that are outside of the Panel's terms of reference, as the facts clearly demonstrate the advantages of nuclear technology. The public's apparent aversion to risk, particularly to large, complex technologies like nuclear power, is attributed to concerns about reactor safety and environmental damage: the key to public acceptability therefore lies in scrupulously objective scientific and technical information demonstrating the safety of reactors and the disposal concept, and the benefits of and the need for nuclear power. Convincing the public that the disposal concept is sound thus becomes a matter of, and the purpose of, an effective education and information effort.

Acceptability of the Disposal Concept and Public Education: Theoretical Context

Theorists and researchers on risk management and decision making on technical subjects make explicit many of the positions of the pro-nuclear intervenors. Grounded in a conception of reality as objective fact, they distinguish reality from public opinion, and establish criteria for defining the public good or the public interest, which may also be distinguished from public opinion. The expert, as noted earlier, is qualified by his or her accreditation in a particular field to make assessments and decisions in that field, to advance the public good and protect it. This framework separates the public from decisions on its interests, and assigns that function to experts.

Dorothy Howell states that "only with scientific literacy can perceptions come closer to reality and public demands approach real needs, now and as projected into that future

promised by gathering momentum in the scientific revolution" (Howell 1992: xvi). Real needs are determined, as is the way they may be met, by those who are scientifically literate. In determining risk management policy, public opinion is explicitly irrelevant. As Lind et al. state,

The public perception of risk should be recognized as an irrelevant factor. Suppose that the public perceives hazard x as particularly lethal, although it is not. Any policy that reflects such perception, and consumes resources beyond diminished returns to reduce this risk, is not in the public interest because there exists another allocation of resources that saves more lives. The concern is with real lives, not perceived ones (Lind 1991: 20).

Elsewhere Lind et al. state that though legislators are committed to serving the public interest they are often unable to do so, because various members of the lay public, with their various perceptions and agendas, "dominate public discourse on such matters" (Lind et al. 1991: 3). Lind et al. recognize the implications of their position, and state that "it is necessary at the outset to deal with the basic question of how to justify pursuing a goal that may disagree with strongly held opinions of the client. How does a professional serve the public interest even if there is widespread misunderstanding of the essential issues?" (Lind et al. 1991: 26). Lewis devotes his entire chapter "The Politics of Risk" to a discussion of the declining level of education among the American public, and suggests, with Lind et al., that the "anti-technology forces" take advantage of the public's lack of technical knowledge to generate fear of, and opposition to, technology (Lewis 1990: 42-49).

Many scientists observe that the combination of rapid progress made by science and technology and declining education levels among the general public leaves a large

gap in understanding of much of what drives modern society. Bolker quotes the president of Ciba-Geigy as explaining that "as chemistry has advanced, we've left a lot of people behind in the dark - alone with their fear, afraid of what they don't understand" (Bolker 1986: 19). It is often in the public perception of nuclear power and the disposal of nuclear waste that fear of the unknown and a heightened sense of the danger of complex technology are seen to be most strongly operative. Lewis states that:

Much of the argument against nuclear power has risk aversion as its basis The most exaggerated current fear is probably that associated with the storage of high-level nuclear waste, with deep roots in the unfamiliarity of radiation (Lewis 1990: 24, 31).

Some writers acknowledge that the scientific illiteracy of many members of the public, in rendering them unqualified to participate in decisions on technology, disenfranchises them from major policy decisions. Howell's book focusses on this issue, and concludes, as did the pro-nuclear intervenor, that education and information are the answer:

In the rush to realize the promises of the scientific revolution, this country has effectively disenfranchised an electorate suffering the ravages of scientific illiteracy. . . . Acknowledging effective disenfranchisement is the first step toward reenfranchisement. The requisite second step is practical scientific literacy throughout society (Howell 1992: xv).

Many writers on risk issues stress the need for public education. Education programs and the provision of information on specific issues address not only the public's fear of nuclear power, but also their inability to understand, contribute to, and have confidence in experts' decisions on technical matters. Lind et al., having acknowledged that the public's perception of risks and of technology is irrelevant and cannot be equated with the public interest, recommend a transparent process that

allows concerned individuals to monitor risk levels (Lind et al. 1991: 25). The determination of the public acceptability of a risk remains a professional responsibility.

Regaining The Public's Confidence: Intervenor

With trained experts working to achieve the best possible decision for the public, and assuming an informed and educated public able to form its own opinions and understand an open process that allows some public contribution, experts and decision makers interpret the decline in the public trust in them as an increased suspicion of technology and fear of its risks, as well as a response to a perceived decline in their professional integrity: they haven't been living up to expectations. The corrective is thus to emphasize the education of the public in science and technology, and to provide accurate information on particular issues as they are under debate. It is also important to reassert the strict standards by which expertise is accredited, carefully observe procedures to verify facts and perform technical or environmental evaluation and make the best decisions on behalf of all of society.

To ensure a high standard of credibility in presenting the facts, therefore, pro-nuclear intervenors recommended that the credentials of those who assist in reviewing the concept should be described (FEARO 1990: vol. 1), and that the public should be assured that the best science, the best expertise and the best and most advanced technology are brought to bear on this issue (FEARO 1990: Rouben and Smith vol 1 p. 5 of sub.).

Public acceptance of the disposal concept, and ultimately of nuclear power, was thought to hinge on the ability of

experts to assure people of the safety of the concept and the quality of expertise and training of the professionals who design and operate nuclear facilities. The CNA stressed "the urgent need to provide public assurance that nuclear fuel is being, and can continue to be, safely managed." (FEARO 1990: CNA Vol. 1 p. 4 of sub.). The Ampco submission stated that "Ampco believes that public acceptance of nuclear generation depends in part on satisfying legitimate concerns regarding the operating safety of nuclear plants and long term disposal of nuclear fuel waste" (FEARO 1990: Ampco vol. 1 p. 2 of sub.).

SUMMARY OF PRO-NUCLEAR POSITION

Vision of the Ideal Social Order

The central motivating value of the pro-nuclear intervenors' position was that of economic growth to drive the improvement in material conditions so needed in the world. The application of science and technology to utilize natural resources and manage the environment are prime factors in the achievement of this goal. Those individuals who are expert in specialized fields have decision-making authority, which their professional accreditation entitles and obliges them to exercise in the best interests of society.

Perception of the Present Order

The present social and political system embodies the dominant values of Western institutions; the pro-nuclear intervenors were, broadly speaking, defenders rather than critics of the status quo. The differentiation in society among individuals with specialized skills and knowledge is reflected in differentiation in status, authority and reward.

Pro-nuclear intervenors' "we" continues to include opponents to nuclear power within their broad social umbrella, as differences and pluralities in one social system. Difference is confined to technical issues and explained by misunderstanding, or treated as social or political deviance. It unites the complete range of social activities in a common striving for economic growth and material wealth, and thus under a common obligation to assume a share of the costs of those benefits. It is based on the assumption that individual efforts, economic and institutional activity are contributed on behalf of the whole and are understood and appreciated as such by the whole: they are thus assumed to represent the interests of the whole. Status differences are expected with specialized functions, and do not diminish the unity of society.

Fundamental Principles

The fundamental principles of the pro-nuclear intervenors were in the tradition of humanism, ". . . any philosophy which recognizes the value or dignity of man and makes him the measure of all things. . . ." Humanism "exalted man's capacity to form his world, to vary it, and to better it absolutely" (Encyc. of Philosophy 1967: vol 4: 69-70). This is an anthropocentric philosophy, in its confidence in the rightness of human goals of progress and in the ability of human ingenuity and technology to enable man to transcend the limits imposed by nature. In the industrialized worldview, this confidence in the progress of human society is, as we have seen, intimately tied to science and technology. Adas explains that from the early days of industrialization, "the capacity to master the natural world through scientific investigation and the application of machine power was a vital source of the optimism regarding the human condition" (Adas 1989: 212).

These ideas come together to form a unified social philosophy.

This worldview is also, however, one that has broken from an older type of anthropocentrism, in which all of nature was created for humanity and participates in the same cosmic purpose to which humanity is central: the pro-nuclear intervenors' natural environment consists of amoral, purely physical matter in a law-bound mechanism that can and should be manipulated and utilized.

This is an individualist worldview, in which knowledge is gained through trained, rational apprehension of objective phenomena; essentially, through objective scientific knowledge of a mechanistic and law-bound physical environment. Sensory perception, subjective emotion and anecdotal information are not only undependable and distorting, but can lead the individual to be swayed by charismatic persuasion and superstition. Scientific and economic rationality constitute the knowledge and the means of evaluating it that legitimize the pro-nuclear intervenors' position and the dominant paradigm. Credentials in scientific and related expertise are influential in determining social status, and values and beliefs that fall outside of the range of science are subordinate.

Human goals, aspirations and limits, not those imposed by nature, form the social context. The accepted standard of achievement is the present human and technological capability, and it is through the improvement of these capabilities that further progress is realized.

Decision Making Process

Pro-nuclear intervenors' essential loyalty was to an

objective reality and mechanistic physical environment: the organizing principle of the decision making process is objective fact. Important knowledge about this world is learned, through a rationality that is also learned, and the best decisions are based on a competent knowledge of this reality: expert advice is required by the very nature of the issue involved. The level of competence required is achieved, particularly in highly technical matters, only through intensive, specialized study. Those who do not have the education and training that confer competence in a particular field are assumed to be insufficiently informed to contribute to a decision in that field. In order to make the best decisions for society, therefore, the decision manager has an obligation to ensure that the relevant expertise is included, and uninformed and irrelevant opinion is excluded. The obligation of the expert is to be accountable to the public, and to protect and act in the best interest of the public.

The general public, a large proportion of which may be people without any technical expertise or specialized academic training, is assumed to share the desire for the best possible decisions and to recognize that the best way to get them is through expert advice. Society deserves to have the benefit of appropriate expert advice on all decisions.

The pro-nuclear conception of reality and nature necessitates the authoritative influence of an accredited expert, and precludes an influential role for the layperson in making the most competent decision for the benefit of all of society. This loyalty to objective reality supersedes the ideal value of public participation, and shifts the emphasis in democratic principle to representative functions.

Credibility and Trust

Credibility is credentials: expertise and relevant experience must be earned, and imply accountability to the public and a duty to act in the best interests of the public. It is assumed that the visible fulfillment of these conditions instills and confirms trust among the recipients and beneficiaries of the professional expertise.

The recent decline of public confidence in expertise and decision makers is attributed to a decline in the image of professional accountability. Experts disagree, and the public get confused; decisions are shown to have been based on faulty models, projections do not prove true. The assumption is that the public shares the scientists' conviction that the most credible knowledge is the most accurate and objective data evaluated by an expert. What the public seeks, the pro-nuclear intervenors argued, is decisions that are in fact based on the most credible knowledge - they need assurance that the science is sound, the technology is the best, and the experts are world class.

CHAPTER 5

ASSUMPTIONS UNDERLYING THE ANTI-NUCLEAR INTERVENORS' POSITION

I. VIEW OF EXISTING POLICY AND DECISION MAKING CONTEXT

The Broader Context: Intervenor

If there was one core belief that defines the anti-nuclear intervenors' opposition to nuclear power and shapes the specific concerns and demands about the disposal of high-level waste, it was that nuclear power is essentially and exclusively a commercial venture. All parties involved in advocating its use are therefore motivated by the need to make a profit; governments have supported the industry with public money and maintain a commitment to the investment of capital in the technology and the industry, through favourable policy, legal and financial arrangements. The primary beneficiary of this commercial enterprise has been the industry - particularly AECL, whose business is seen primarily as expanding the market for reactors and securing the position of the industry.

The official position - taken to be that AECL is a public agency providing the means by which electricity and economic activity are generated for Canadians, and that nuclear power itself is a public service - was rejected as a rhetorical justification for the contribution of public funds to an unpopular industry. The fundamental dynamic appeared to be that of a dangerous technology opposed by the public, being funded by government with public money to enhance industrial profit. Government and industry are thus complicit in the exercise of overruling public preference in favour of industrial profit; government policy-making is designed to enhance the commercial

position of the nuclear industry.

The restriction of the panel's terms of reference to a narrow set of technical issues was seen as a systematic exclusion of public concerns that might expose the frankly commercial orientation of the review. It protects certain aspects of the technology and the industry from public comment. The Atikokan Environmental Action Committee was representative in its view:

Surely we can only discuss a concept for disposing of such wastes in the context of a larger discussion that addresses whether or not we should be looking at other disposal options, whether we should be reducing the amounts of waste, and if we should stop producing the wastes altogether! This broader discussion is long overdue; however, it is contrary to the interests of the nuclear industry, so it cannot be allowed (FEARO 1990: Temiskaming vol. 2: 112).

This exclusion of the public from decision making and the public's concerns from the decision framework, in order to sustain the industry, results in a process and a body of policy that lack public assent and political legitimacy. In a democracy, failure to include the public is seen as a violation of fundamental principle. In addition, several intervenors mentioned that although official inquiries (the Porter Inquiry and the Report of the Standing Committee on Environment and Forestry that resulted in The Eleventh Hour report) recommended that a moratorium be called on nuclear power pending public agreement on waste, this recommendation has been ignored by governments (FEARO 1990: Golden/Red Lake vol. 2: 19; Atikokan vol. 2: 36).

The Evangelism and Social Action Council of the Conference of Manitoba and Northwestern Ontario - The United Church of Canada summarized the situation this way:

The civilian nuclear industry has developed in a climate of secrecy, largely isolated from unfriendly public scrutiny. Protected from the Freedom of

Information Act, the Canadian nuclear industry is funded by the public purse, subject to control by a federal regulatory agency, yet operates effectively shielded from public view. The legitimacy of such an industry, one that controls not only the generation of information but also its release, is at best suspect (FEARO 1990: Evangelism and Social Action vol. 5: 177).

This perspective, of a government-industry alliance to advance the commercial prospects of an industry, shaped the perception of government and industry efforts at public education as advertising or even as propaganda, as the manipulation of public opinion to favour a commercial product (FEARO 1990: Evangelism and Social Action vol. 5: 177). The ambiguous position of AECL was noted frequently, as its activities as national and international marketer of CANDU reactors are in a conflict of interest with its role as government research agency, conducting studies on the safety of its own proposed technology. As the National Action Committee for the Status of Women argued, "We are faced with the fact that the agency charged with promotion of the nuclear industry is the same agency that is doing the research. It is analagous to the tobacco industry doing research on the health effects of smoking" (FEARO 1990: NAC vol. 5: 121; see also Evangelism and Social Action vol. 5: 167; Temiskaming vol. 5: 112-113).

The Perspective on Nuclear Waste: Intervenors

The intervenors' views of the concept of the disposal of high-level nuclear waste were set in the broader position on nuclear policy. Many intervenors cited the official rationale for the urgent need to approve the permanent disposal of wastes deep underground as an ethical concern to relieve future generations of the burden of caring for our wastes. This is consistent with the official position on AECL as a public agency delivering a service to all

society, with the burden appropriately placed on today's society, and likely the province of Ontario, as the major beneficiary of the technology.

These 'official' arguments were rejected as rhetorical covers for industrial profit. Many intervenors described both the perceived rush to approve a disposal concept and the commitment to deep geological disposal as a desire by industry to get the wastes as far as possible from public view, and thus remove a political obstacle to the expansion of the industry:

. . . nuclear waste disposal has been one of the main public policy impediments to the continued development of nuclear power. This is true both in Canada and abroad.

The nuclear industry would like this barrier removed so as to rejuvenate a sagging . . . record of reactor sales and nuclear development, especially in the export market" (FEARO 1990: NAC vol. 5: 123).

Another group argued that: "AECL claims that burying nuclear fuel waste in the Canadian Shield will relieve future generations of the burden of looking after the waste. Contrary to the position of AECL of unburdening future generations, we see this concept as unburdening the producers of the waste of a very large problem" (FEARO 1990: Golden/Red Lake vol. 2: 24). Temiskaming Environmental Action Committee claimed that "AECL is the developer, promoter and primary marketing agency of nuclear power in Canada. Should no effective disposal method be developed, AECL stands to be a big loser" (FEARO 1990: Temiskaming vol 2: 133); and Atikokan Citizens for Nuclear Responsibility argued that "the concept of underground disposal is wrong. It is a short sighted, risky, weak solution, conceived under pressure, to save face and to justify nuclear expansion" (FEARO 1990: Atikokan vol. 2: 32).

This opinion was strengthened by AECL's assurances that the current methods of above-ground storage are safe for many decades. Many intervenors suspected that the intent of AECL and the government is to open a commercial repository for international used fuel wastes, in part as an extension of the international marketing of reactors. The Golden/Red Lake Environment Group stated that:

It is our view that acceptance of the deep disposal concept would make it possible for Canada to become an International High-Level Nuclear Waste Dump Site.

AECL has a vested interest in developing this concept. The incentive for other countries to purchase Candu reactors would be increased if the supplier agreed to relieve them of the problem of disposal of waste fuel (FEARO 1990: Golden/Red Lake vol. 2: 27; see also Sask Env'l Soc. vol. 5: 38; Nishnawbe vol. 5: 104; Concerned Citizens of Manitoba vol. 5: 108).

Many anti-nuclear intervenors also believed that the waste will be imposed on communities in Northern Ontario who lack the economic and electoral power to resist, taking a different perspective than the pro-nuclear intervenors did on the social context in which spatial equity is determined. The Saskatchewan Environmental Society explained that "we have too much experience in Canada of depressed regions which, out of desperation, gladly accept dubious development opportunities which would not be welcomed by a community which saw other options for building economic prosperity" (FEARO 1990: Sask. Env'l. Soc. vol. 5: 40).

The Golden/Red Lake Environmental Group explained that: "As Northerners, we resent the regional chauvinism aimed at the North by large urban centres. . . . the economic dynamics make it hard for small communities such as those in Northern Ontario to reject potential economic benefits on

environmental grounds"(FEARO 1990: Golden/Red Lake vol. 2: 21, 23). Another group said that:

I cannot see what can possibly be ethical about taking an extremely hazardous by-product of a process which exists primarily for the benefit of one area, in this case, the urban, industrialized south, and forcing another area, the north, to accept the disbenefits in the form of long-term risks. The major criteria for the north being targetted is not our Canadian Shield, but rather our political impotence (FEARO 1990: Temsikaming vol 2: 113; see also Northwatch vol. 2: 94).

Many of these communities argued that they do not receive the benefits of nuclear power, which accrue either to "the South" or even more selectively to those directly involved with the industry. The Nishnawbe-Aski Nation submission noted that most of their communities do not even have electricity (FEARO 1990: Nishnawbe-Aski vol. 5: 99). The concept of a unified society that shares the benefits and the costs of nuclear power was dismissed in favour of an analysis of society in which economic inequities split the population into elites - spatial, political or economic - and the rest, the general public. The overall context was one of commercial profitability, elite control of political and economic power, the domination and relative powerlessness of the general public, and the domination of rural and remote regions by commercial, industrial, and political centres.

The Broader Context and the Perspective on Nuclear Waste: Theoretical Context

There are three themes underlying this broad perspective on nuclear policy: the fact that the industry is a commercial, profit-making venture; the fact that the public has been excluded from energy and nuclear policy decisions, resulting in an illegitimate process that produces illegitimate policy; and, underlying these, an implicit

critique of the ideology of economic growth as motivated by the need and desire to improve the welfare of the general public, and as actually succeeding in this goal.

The observation that the nuclear industry is driven mainly by the need to make a profit becomes a criticism through an environmentalist interpretation of the dominant paradigm's definitive tenet that economic growth improves the living conditions of all members of society and that modern capitalist-industrial societies are uniquely able to produce this material affluence for their members. To environmentalists the nuclear industry embodies the dominant paradigm, which "equates material growth with development which, in turn, is regarded as a prerequisite for human happiness and prosperity, claiming that any drop in this growth rate must inevitably result in stagnation, mass unemployment and distress." (Taylor 1992: 26)

It is the fundamental logic and value of economic growth and its inherently environmentally damaging action that receive the bulk of the criticism from environmentalists. Environmentalists explain the destructive actions and influences of capitalist economics on social relations and social justice and on the environment. The environmental and social effects are interrelated: a founding assertion of Murray Bookchin's social ecology is "that the very notion of man's domination of nature stems from man's domination of man" (Bookchin 1980: 15). This is not an easy position to argue: Jonathon Porritt states that ecologists are "up against materialism, the deeply ingrained belief that the pursuit of material wealth is an end in itself, and that there can be no salvation or meaning to life except through material fulfillment" (Porritt 1984: 107).

To environmentalists, the pursuit of material wealth and the reduction of all things to economic rationality are destroying the natural environment and demeaning human nature: Bookchin claims that "modern society - our profit-oriented bourgeois society - tends to exacerbate humanity's conflict with nature in a more critical fashion than pre-industrial societies in the past" (Bookchin 1980: 41). "By repressing feelings, sentiment, intuition," Jonathon Porritt argues, "we have ended up with an incomplete, degraded and horribly aggressive image of human nature; by denying the creativity and 'transcendent aspirations' of people, we have become dependent upon a sick caricature of reason and science" (Porritt 1984: 107). In a major critique of capitalist economics, Narindar Singh argues:

. . . in so far as the giant corporations of today actually require a continuous introduction of seemingly new products, by and large not meant to satisfy any genuine human needs, economic planning in a real sense simply does not exist under capitalism . . . irrespective of who owns the means of 'production', single-minded pursuit of technological sophistication and 'growth' must perforce entail increasing inequalities and thus a further intensification of the assaults on ecology (Singh 1989: 59-60).

Most environmentalists and "green" theorists, economists and politicians do not advocate a total repudiation of material sufficiency, however. In fact a certain standard of living is considered a basic human right, and capitalist industrialism is criticized because it creates great wealth for some and poverty and dependency for many. Vandana Shiva states that "the industrial revolution converted economics from the prudent management of resources for sustenance and basic needs satisfaction into a process of commodity production for profit maximization" (Shiva 1991: 50). Heilbroner notes the "tendency of the growth process to generate both wealth and misery

simultaneous'y as part of the workings of the accumulation process itself" (Heilbroner 1992: 40), and Kenneth Boulding states that "the dynamics of capitalist societies produce too great disparities in the ownership of capital, especially equity capital, and in the net worths of the individuals or among families in the society" (Boulding 1978: 12). Langdon Winner explains that despite the early promise of industrialism that goods previously available only to the wealthy could be produced for everyone, it soon appeared that:

the fruits of the machine were unevenly distributed, [and] also that the entire material and institutional system of the new society was organized in ways that favored the interests of some but not others. This fact, it became clear, was of political as well as economic significance, for power within the state was obviously linked to concentrations of industrial wealth. The notion that scientific and technical advance would be uniformly beneficial for the populace as a whole and a reliable aid to self-government soon became the target of a sustained attack . . . (Winner 1992: 3).

Rees argues further that economic growth serves to insulate policy makers from dealing with these tendencies to inequity, and simultaneously protects the privilege of the elite and provides a rationale for the drive to further growth: ". . . in capitalist states, governments depend on the constantly increasing size of the national economic pie to ensure that the poorer classes receive a sufficient share of national wealth to survive. Growth relieves the pressure for redistributive policies" (Rees 1990: 125). Spretnak and Capra note that one of the German Greens' greatest challenges will be "the redistribution of wealth. Today's world economy is based on past configurations of power, perpetuating class structures and a grossly unequal distribution of wealth within national economies , as well as exploitation of Third World countries by rich,

industrialized nations (Spretnak and Capra 1986: 101).

Salter and Slaco point out, in the context of reviews of technological installations, that the jobs associated with these do not always go to local residents (Salter and Slaco 1981: 75); the 'economic benefits' of such installations may not always accrue to those regions or their residents.

Environmentalists thus argue for a radically different conception of material sufficiency and principles of economics and distribution. Porritt says that "Green economics is all about sustainability and social justice: finding and sustaining such means of creating wealth as will allow us to meet the genuine needs of all people without damaging our fragile biosphere" (Porritt 1984: 126). Murray Bookchin explains that

By "material abundance" we do not mean the wasteful, mindless "affluence" based on false needs, the subtle coercion of advertising, and the substitution of mere objects - commodities - for genuine human relations, self-reflection, and self-development. We refer to a sufficiency in food, shelter, clothing and basic comforts of life with a minimum of toil that will permit everyone in society - not a specialized elite - to directly manage social affairs (Bookchin 1980: 41).

The argument is, therefore, that capitalism is not providing a reasonable level of affluence for everyone in society, and also that it is inequitable by its very nature: capitalism is criticized for its ideology of being necessary for generating material sufficiency for the general population. Heilbroner points out that there have been many pre-scientific societies that were able to produce a surplus of goods that exceeded the requirements of material life (Heilbroner 1982: 36). While capitalism does provide material affluence, therefore, it is not the only social organization that has done, or can do that; it

does not do it in an equitable manner; and it does it through the sacrifice of other important social values. Many ecological writers propose alternatives for the present and future that would provide an equitable, respectable standard of living for everyone without damaging the environment (Porritt 1984; Bookchin 1980; Gordon and Suzuki, 1990; Singh, 1989; Martin, 1985; Robinson, Francis, Legge and Lerner, 1990; Spretnak and Capra 1986, Trainer, 1991). The radicalism of these writers is grounded in their assertion that social activity in and treatment of the natural environment springs from cultural beliefs about the essential identity of nature and humanity and the proper relation between the two, and is expressed in their prescriptions for changed attitudes and social institutions to reorient people to new relations with nature and each other.

As capitalist economics is described as a social system comprising social relations and relations to the environment, technology is also seen as more than a politically neutral means of accomplishing an end. Technology is, as it is also for supporters of nuclear power, an integral part of capitalist development and the ethos of progress. Langdon Winner describes technology as "forms of life", and says that "the construction of a technical system that involves human beings as operating parts brings a reconstruction of social roles and relationships" (Winner 1986: 11). "The theory of technological politics," Winner says, "draws attention to the momentum of large-scale sociotechnical systems, to the response of modern societies to certain technological imperatives, and to the ways human ends are powerfully transformed as they are adapted to technical means" (Winner 1986: 21). Winner describes two ways in which technology can have political content, both deriving from the

assumption that technologies order our social world. First are the technologies that structure, deliberately or incidentally, the way people do things - he cites transportation infrastructure, communications technology, and even the features on machines as falling into this category (Winner 1986: 22 - 29).

The other category is that of "inherently political technologies", in which "the adoption of a given technical system unavoidably brings with it conditions for human relationships that have a distinctive political cast - for example, centralized or decentralized, egalitarian or inegalitarian, repressive or liberating" (Winner 1986: 29). Compounding these factors are large-scale social changes that are put in place to support technology's operations in society. John Fielder notes that

. . . we tend to overlook the requirements of technology. Institutions, procedures, processes, laws, customs, ideas, and attitudes have been changed and reshaped to accommodate technology. In order to enjoy the products of technology, we have had to create the social, political, and ideological conditions for its development (Fielder 1986: 106).

Environmentalists thus stress the sociological effects of technology when describing the technologies that are congenial with the kind of society they would like to build. 'Soft technology', or the 'soft energy path', is a concept of technology based on renewable energy with smaller scale, less centralized organization (Morrison 1980: 275). Winner quotes Amory Lovins, a major proponent of the soft energy path, as stressing the consideration of "centrism, vulnerability, technocracy, repression, alienation" (Winner 1986: 53).

Devall and Sessions list seven principles for questioning technology, on the assumption that "we need technology which is compatible with the growth of autonomous, self-

determining individuals in non-hierarchical communities. We need principles that will help us escape the trap of technocratic society, where technology is the central institution." Among these questions are: "Is this device or system of the sort that can be immediately understood by nonexperts?" and "Does this device or system enhance the individuality of persons or does it lead to bureaucratic hierarchies?" (Devall and Sessions 1985: 35)

The question of the control of technology that develops as increasingly complex technologies require the conceptualization, design, assessment, implementation and management of specialized expertise has become a central issue in the debate on the inherently political nature of technology. As Carol Gould asks,

If the knowledge of [high] technology is one of the main prerequisites for the ability to control or direct it, then how can one speak of democratizing such control? The choices seem to be either turning everyone into scientists and engineers or abandoning expertise and permitting everyone, whether knowledgeable or not, to make decisions, thereby losing the benefits of technological development. This poses the apparent dilemma of technocratic versus democratic control of technology (Gould 1988: 275 - 276).

The apparent paradox between the use of advanced technology and democratic principle is explored by many academics, with the focus often on the implications for democracy of the use of expertise to determine major social policy on the use of technology (Winner 1992; Shrader-Frechette 1991; Morone and Woodhouse 1989). Richard Sclove asserts that

An engaged citizenry must become critically involved with the choice, governance, and even design of technological artifacts and practices. Citizens must furthermore grow committed to adopting only technologies that are compatible with preserving or strengthening their society's democratic nature. Or else - like hapless daytime victims of our own midnight cabals - we can have no democracy, or none worthy of the name (Sclove 1992: 139-140).

The quintessentially 'inherently political' technology is nuclear power, and the charge of technocracy is central to its opponents' position. Morone and Woodhouse discuss the reasons for the decline in public support for nuclear energy, and consider the question of whether large-scale technology is incompatible with democracy. They conclude that "more democracy in the 1960s rather than less would have gone a long way toward making the nuclear technology of the 1980s more palatable" but do believe that it is not beyond the capacity of democracy to control social policy on the use of nuclear power in the future (Morone and Woodhouse 1989: 140).

Others disagree with that conclusion, largely for deeper reasons of social relations and opposition to the type of management that is necessary to operate such a complex technology, which holds such a great threat of damage to human health and the environment. Charles Perrow analyzes the characteristics of nuclear power as a technological system, and concludes that it is inherently prone to catastrophic accidents: "There will be more system accidents; according to my analysis, there have to be. . . . There is no organizational structure that we would or should tolerate that could prevent it" (Perrow 1984: 348). Murray Bookchin and other environmentalists resist the domination of society by experts through the dependence on complex technology: "We should raise the vision of a people's technology - the passive, simple, decentralized solar, wind, and food-producing technologies that the individual can understand, control, maintain, and even build." (Bookchin 1980: 52).

Technology is understood not only to structure a society in a certain way, but also to be part of the larger economic system that favours the accumulation of wealth by an elite

rather than the general public. In her study of modern technology, Ursula Franklin distinguishes between divisible and indivisible benefits, and divisible and indivisible costs. Indivisible benefits are those that accrue to all of society - clean air, safe roads - and institutions that developed to deliver other common benefits, like courts and education systems. Divisible benefits, on the other hand, are those that are received selectively by certain individuals or groups. Indivisible costs would be what economists call 'externalities', those costs that all of society must bear collectively, like air pollution or acid rain. Franklin explains:

. . . there is historically the notion that citizens surrendered some of their individual autonomy (and some of their money) to the state for the protection and advancement of the "common good" - that is, indivisible benefits.

Technology has changed this notion about the obligations of a government to its citizens. The public infrastructures that made the development and spread of technology possible have become more and more frequently roads to divisible benefits (Franklin 1990: 70).

Industrial development is perceived as being undertaken for the private profit of an elite group, and the appropriation of large amounts of public money and other resources (land, water) is seen as legitimized through the claim that such investments are necessary for the improvement of all of society. The core values of the dominant paradigm, that is, are viewed as a mask for the pursuit of private gain; industrial and economic growth are thereby de-linked from the public good, and economic growth shifts from the creator of affluence for all to the creator of major social and economic inequities. With respect to the implication that the private pursuit of material gain is somehow indecent without a covering of social duty, it is interesting to note that Roger Hutchinson, in his study of

the assumptions underlying the arguments for and against the Mackenzie Valley pipeline, observed that "no one explicitly defended the consumer society" (Hutchinson 1992: 103).

Theorists of environmental politics describe how governments defined the public interest as economic development, which permitted the overriding of common law concerns of individual entitlement by industrial concerns. Schrecker describes

. . . the pattern in which, as applications of the common law to conflicts involving economically important natural resources were recognized as inimical to economic development, governments sought to redefine them as involving a public dimension as well as the competing claims of private resource users (Schrecker 1992: 86).

Schrecker argues that "[r]egulation and discretionary enforcement in the environmental field have both reflected identification of the public interest with industrial and commercial growth" and warns against "the facile assumption that governments necessarily act in the public interest. . . the public interest is whatever the government of the day says it is" (Schrecker 1991: 91, 104). As Hoberg (1991), Lyon (1992) and Schrecker (1992) describe, governments are increasingly perceived as systematically protecting the interests of industry and throwing the weight of the public behind their actions. The interests of industry now appear to diverge from, even conflict with, the public interest. George Hoberg notes that "the traditional public philosophy that assigned the role of representing the public interest to the state. . . has been challenged" (Hoberg 1991: 9). Political scientist Vaughan Lyon describes the inception of political parties in Canada as "loosely structured factions representing the dominant classes and held together by patronage. . . at no time during the course of our evolution from autocratic to

representative government were political institutions specifically designed to support the new system and reflect democratic values" (Lyon 1992: 128).

The very existence of the environmental movement, as measurement by opinion polls of a 'paradigm shift' of the public, is evidence that the dominant values of the professional are not shared by all of the public. Sewell documented the environmental value systems of professional and the public and found them fundamentally different (Sewell 1972). Franklin states that ". . . we have lost the institution of government in terms of responsibility and accountability to the people. We now have nothing but a bunch of managers, who run the country to make it safe for technology" (Franklin 1990: 120).

In this perspective on economic development and technological progress, the view of technological risk assessment is a very politicized one. Charles Perrow states that ". . . the risk-acceptance position is the one that favors private business and industry, and the risk-averse position would harm it. . . . Why should not the public be averse to risks run for the benefit of industry and at the cost of workers and communities?" (Perrow 1982: 299).

There are three avenues of research and theory on the public, non-expert view of technological risk. One is the field of risk perception, usually a branch of psychology carried out through surveys. A second is the largely philosophical critique of technical risk analysis and its assumptions of value-neutrality. The third, risk communication, has evolved from and continues the conclusions of the first two.

Risk perception as the focus of research began with the publication of a paper by Chauncey Starr that endeavoured to learn why the public's perception of risks of large-scale, complex technologies was out of proportion to the actual risks as determined actuarially and projected by risk assessment. Using quantitative measures of the cost relative to the social benefit of an activity, Starr found that people will tolerate risks from voluntary activities that are up to 1000 times greater than those from involuntary activities (Starr 1969).

Following from this research, Paul Slovic, Baruch Fischhof and Sarah Lichtenstein studied the use of 'heuristics', ". . . a set of mental strategies that people employ in order to make sense out of an uncertain world" (Slovic et al. 1982: 143) This research essentially tested people's intuitive perceptions against statistical probabilities, and found not only that these heuristics often lead to "large and persistent biases with serious implications for risk assessment" (Slovic et al. 1982: 143), but that experts are also subject to inaccuracies through the use of heuristics (Kahneman et al. 1982: 507).

Slovic et al. also described, using questionnaire data, the ways in which non-experts' risk judgements differ from annual rates of death from a selection of technologies and activities. From this they concluded that to the public, risk is not synonymous with death rates but includes other considerations such as "familiarity, control, catastrophic potential, equity and level of knowledge" (Slovic 1987: 283). A grid developed by Slovic et al. plots a range of risks according to two factors, unknown and dread risks, and places nuclear power in a corner by itself, high on both those factors (Slovic 1987: 282).

More recently, emphasis has been given to the rationality and legitimacy of public perceptions of technological risk, which incorporate a broader range of qualitative and value-laden considerations than the technical approach to risk assessment does (Slovic 1990: 14). Salter and Slaco express the often-made point that quantitative analyses must simply leave out many important impacts of technology that cannot be quantified (Salter and Slaco 1981: 166). The public acceptance of a risk is seen to depend in large measure on the public's confidence in risk management (Slovic 1991: 1606), which places trust in institutions in a key role.

Other studies have shown that through the complex components of risk perceptions and the dynamic social process through which they are developed (Kasperson et al. 1988), negative images become associated with a technology such as nuclear power or a nuclear waste repository that then become associated with the locations of these technologies, resulting in "stigma" and potentially damaging economic impacts on these areas (Slovic, Layman, Kraus, Flynn, Chalmers and Gesell 1991). These insights are assisted by the inclusion of Douglas's cultural theory of risk, which stresses the importance of cultural identity, social relations and political strategy in risk issues.

The second major approach to the public perceptions of risk is that taken by philosophers, such as Shrader-Frechette, whose analysis of technical risk assessment finds many persistent value biases embedded in the process itself: risk evaluation and management, she states, "are irreducibly political" (Shrader-Frechette 1991: 218). She describes advocates of value-neutral, technical risk assessment as "naive positivists" and discusses three types of values

that often occur in risk assessment: bias values, which occur "whenever researchers deliberately misinterpret or omit data, so as to serve their own purposes" (Shrader-Frechette and McCoy 1993: 83); contextual values, which are personal, social, cultural, or philosophical emphases that often get included in risk judgements; and constitutive or methodological values, which are inevitably a part of deciding on a methodological rule (Shrader-Frechette 1991: 40; Shrader-Frechette and McCoy 1993: 82-84). Shrader-Frechette questions whether the goal of entirely value-neutral risk assessment is itself a useful one, since including values in discussion offers the possibility of criticizing the values that have crept into the assessment (Shrader-Frechette 1991: 44).

Conrad Brunk points out that many of the key concepts used in risk analysis are value-laden, including "harm," "magnitude" (of harm), "probability," "exposure," and "safe" (Brunk 1993: 3). Other 'biases' have been discovered in the scientific assessment of risk. Kraus, Malmfors and Slovic have documented, in their "Intuitive Toxicology: Expert and Lay Judgments of Chemical Risks" that fundamental professional assumptions and values play a significant role in toxicologists' assessment of a risk. Kraus et al. found that toxicologists differ widely on their perception of the validity of extrapolating to humans the results of animal and bacterial studies, a methodology that is "the backbone of their science." An 'affiliation bias' was also found: "toxicologists working for industry see chemicals as more benign than do their counterparts in academia and government" (Kraus et al. 1991: 229).

Experts' perception and assessment of risk appears to be more value-laden than is acknowledged. To the non-expert public, it is a frankly loaded concept that incorporates

far more than statistical probabilities of premature death operating within an assumed framework of the desirability of economic activity and technological development. The perspective of the anti-nuclear intervenors illustrates that benefits, too, are not a natural category; a benefit is a result or effect (of a technology, for example) that is desirable for, or enhances the conditions essential to, a certain worldview. In this context a benefit is a strategic advantage to one worldview, and could be a political threat to the other. The growth produced by nuclear power, for example, is not a central value for the anti-nuclear intervenors, is in any case not seen to be received by many outside the industry, and is seen as being the source of the problem, not a benefit. As Jerry Mander claims, "still worse than the failure of this society would be its success" (Mander 1991: 382).

William Leiss's analytical approach to the perception of different activities and technologies often classified as 'risks' emphasizes the importance of understanding that 'benefits' are perceived and interpreted through an individual's value system just as risks are, and must be included in an examination of the perception of the activity. In one type of risk/benefit tradeoff, the benefits of an activity (such as smoking) form the framework that defines the activity for the participant, and the risks are downplayed. Leiss's second type of risk/benefit tradeoff, in which the risks are focussed on and the benefits are downplayed, involves large-scale technologies, especially nuclear energy. Leiss states that in these cases the benefits "are counted largely in economic terms" and may seem 'remote' from the everyday lives of individuals. The "diminution of perceived benefits also may be a function of the feeling of 'powerlessness' in relation to those technologies" (Leiss

1989: 183).

Perceptions of risks and benefits are determined through value systems, and this leads to the third aspect of risk perception, risk communication. Education campaigns that "attempt to shift the intuitive net benefits calculations" may be attempts to change values more than provide knowledge for forming opinions. Seeking an "attitudinal shift . . . on behalf of a controversial technology" constitutes a 'strategic objective' which must be openly declared if such efforts are not to appear manipulative (Leiss 1989: 185).

The model of risk communication recommended by the pro-nuclear intervenors is a 'top-down' model in which experts provide information to the public. This is based in the conviction that there is a clearly definable set of objective facts on the subject that must be known before one may form a rational position on the issue, and that as the public does not understand these facts its perception of the risk is faulty or incomplete. This conception does not see a need for two-way communication, in which both sides learn and adjust their positions, and may be appropriate in attempts to alert the public to dangers to their health (such as smoking-cessation or AIDS awareness campaigns) or emergency instructions. It is regarded by many researchers as not suitable to conflicts over technology or other policy disputes, as it is incompatible with a belief that the public's views are legitimate and should be incorporated into an eventual decision or policy.

These models emphasize the relevance of scientific and technical information, to the diminishment or even exclusion of other important and relevant information, such as political philosophy, the political implications of

decision processes, non-technical components in human-environment relations. Information on such subjects is rarely considered relevant to the resolution of risk conflicts. As Pidgeon et al. explain, "The one-way model of risk communication has been the target of much criticism, in particular on the grounds that by assuming an altruistic communicator it implicitly devalues the perspectives and knowledge of the risk bearers, and well as glossing over the political aspects to many of the risk conflicts in society" (Pidgeon et al. 1992: 44-45).

These approaches are increasingly non-viable politically, and simply don't work. Leiss says that

When private industry, government, and quasi-public industries attempt to change public attitudes about controversial technologies, and especially when they choose media advertising campaigns for this purpose, they run the risk of being perceived as seeking to "manipulate" public opinion (Leiss 1989: 184).

Cannell and Otway argue that it is "crucial to pin down the elusive distinction between informing people about risks and persuading them to adopt particular attitudes to them" (Cannell and Otway 1988: 528). "The first is the (largely professional) task of ensuring that the public is adequately informed about risks. The second is the (essentially political) task of resolving conflicts of interest and aspiration about how technology should progress, what risks are acceptable and to whom they should accrue (or in other words, what kind of technological society people want to live in)" (Cannell and Otway 1988: 521).

Baruch Fischhof cautions that public education programs that aim to "give the public the facts" or to "sell the public the facts" are not likely to succeed. Of the 'give the public the facts' strategy, he says "The underlying

assumption in this strategy is that if people only knew as much as the experts, they would see things the same way. . . Inundating the public with information ignores the possibility of legitimate differences between the public and the experts. . . . " (Fischhof 1990: 448). The premise of the 'sell the public the facts' strategy is "that the public needs persuasion, not education. Often these efforts follow the failure of an information campaign to win public acceptance of a technology. This approach implies an underlying disrespect for the public, which frequently leads to heavy-handed implementation - in effect, repeating more loudly messages that the public has not accepted before" (Fischhof 1990: 448).

Dorothy Nelkin reports that information programs that are intended to generate greater agreement with the scientific position - often on the assumption that science, which is seen as rational and objective, may be a means of depoliticizing public issues (Nelkin 1977: 189-190) - actually reinforce politicization, especially in cases involving disagreement among experts (Nelkin 1979: 56). In fact, in cases of conflict among experts, people tended to trust the experts who supported their position; the quality of expert advice was less important than trust in authority, the economic or employment context of the controversy, and the intensity of local concern (Nelkin 1977: 200, 202).

II. ASSERTION OF ETHICAL PRINCIPLES

Public Participation: Intervenors

Anti-nuclear intervenors worked from the fundamental assumption that the public's right to participate in important decisions is a 'given' - a democratic right, not a privilege. In contradiction to the pro-nuclear

intervenors' contention that participation was contingent on accreditation and that political representation of non-scientific public opinion constitutes 'caving in' to pressure, anti-nuclear intervenors believed that representing public opinion was the right and appropriate operation of democratic principle. The Northwatch submission listed a series of principles that are "fundamental to public decision making processes," including Fairness ("all citizens should have an equal opportunity to participate in the decisions which affect them and the environment. This principle implies an obligation on the part of the initiators to create favourable conditions for all interested parties to become involved"), Openness, Mutual respect, Consideration of and sensitivity to cultural, minority and worldview differences, Flexibility, and Commitment (FEARO 1990: Northwatch vol. 2: 89-90).

Most anti-nuclear intervenors did not express gratitude for the opportunity to speak, but rather indignation that these opportunities had been so difficult to get and were often not meaningful. The short notice given of the hearings, the difficulty of obtaining funding and the prohibition against legal counsel were invariably noted as inexcusable obstructions of the public's right to make meaningful contributions to important decisions. The Evangelism and Social Action Council observed that "the necessity for public input into decision making is widely recognized yet rarely are the public consulted" (FEARO 1990: Evangelism and Social Action vol 5: 177). The Temiskaming Environmental Action Committee said that:

Although AECL claims there is no rush to site a facility, there seems to be a panic to get these scoping sessions over with. Mail arrives stating we have a few weeks in which to apply for funding, to make up our minds where and when we will speak. The

short time lines, dismal funding and general confusion about locations and dates have caused many people to want nothing to do with this process. . . . The public seems to be the least important component in the process (FEARO 1990: Temiskaming vol. 2:111; see also NAC vol. 5: 120; Whitefish River vol. 2: 127; Northwatch vol. 2: 92; Golden/Red lake vol. 2: 18).

The intervenors' contention was that the present body of nuclear policy is invalid, as it was developed without public participation and consent. As Environment North said, "One other function of public participation in these hearings is to legitimize the entire assessment procedure, to place a stamp of democracy on a process which is not necessarily all that democratic" (FEARO 1990: Env't North vol. 2: 2).

Public Participation: Theoretical Context

The intervenors' emphasis on the importance of public participation in decision making, and on legitimacy as derived from popular support, is consistent with the preference in the environmental paradigm for participatory political structures in an egalitarian, non-hierarchical society. Hierarchical structures in which experts are influential are opposed almost by definition (Cotgrove 1982: 27).

Many environmentalists' opposition to nuclear power and other large-scale complex technologies involves their opposition to the dominant role the use of these technologies gives to experts in society. They favour soft or 'appropriate' technologies in part because they are less damaging to the environment, but also because these technologies are more accessible to average citizens, and allow citizens greater and more meaningful participation in social policy decisions. In their paper describing a sustainable society, Robinson et al.

. . . assert as a principle that the ability of all

persons to participate in decision making about things that affect their lives, the lives of others and the world around them is a necessary consideration in the design and creation of all socio-political structures and institutions (Robinson et al. 1990: 45).

Robinson et al. also reflect the intervenors' preference for an egalitarian society that does not create the economic inequities which leave northern communities vulnerable to being 'bought off' or bribed to accept nuclear wastes:

Responsible participation in decision making requires freedom from extreme want and from vulnerability to economic coercion, as well as the positive ability to participate creatively and self-directedly in the political and economic system through which much social interaction and decision making takes place (Robinson et al. 1990: 45).

The sustainable society Robinson et al. describe echoes the intervenors' sense that public participation in decision making is a serious responsibility. In an egalitarian society decisions would not be delegated to professionals to such an extent as in a hierarchical society, so public participation is genuine - it provides input that is required for decision making, and is not a superficial formality. The frequency with which more time to prepare a proper case for presentation to the panel was demanded suggests that they recognized the importance of salience - how clearly people have thought about an issue and how much consideration has gone into an opinion - to a constructive discussion. The concern for being properly informed on an issue may be related to the importance the individual or group places on the participation of the public in decision making; in effect, how seriously they take it, and see it as being taken by authorities. Bookchin explains that he hopes for

. . . a revolution which will produce politically independent communities whose boundaries and populations will be defined by a new ecological

consciousness; communities whose inhabitants will determine for themselves within the framework of this new consciousness the nature and level of their technologies, the forms taken by their social structures, world views, life styles, expressive arts, and all the other aspects of their daily lives (Bookchin 1980: 45).

These principles of public participation in decision making and of power residing ultimately in the people are also, the intervenors remind us, central to democratic theory. The basic democratic values (that democracy is "a system of government designed to reflect the will of the people as a whole rather than the will of an individual or of a small elite" (Van Loon and Whittington 1971: 108) are, publicly, respected by all parties: the debate takes place over whether the representative system we have serves this democratic principle or whether a more direct style of participatory democracy is needed.

The notion of a crisis in legitimacy and the consequent need for greater public participation is a central theme of environmentalism and environmental politics. The pervasiveness of high technology in industrial society places a strain on the practice of democracy, as we have seen. Many theorists analyze the effect of the expert domination of technological decisions on reducing the public's ability to exercise its democratic right, and describe the ethical imperative of increased public participation. Gould's analysis of the principles of democracy lead her to conclude that "technology seems to be controlled by only a small minority, whereas it affects everyone" (Gould 1988: 263). Shrader-Frechette argues that "public consent to, and control over, risk evaluation and management are not the prerogatives of the rich, but the rights of all" (Shrader-Frechette 1991: 217).

Shrader-Frechette and McCoy stress the "primacy of public, democratic control of conservation decisions." Respecting the public's risk concerns by minimizing public risk "is one way to locate power with the people. It is also one way to make policymaking both more democratic and more sensitive to the ethical dimensions of environmental impacts." Shrader-Frechette and McCoy rest their sense of the obligation to provide public participation in decision making in Jeffersonian democracy: "the only safe locus of power in a democracy is the people" (Shrader-Frechette and McCoy 1993: 169).

These theorists recognize that this approach may result in a conflict between a technically correct decision and public preference, and raises again the fundamental dilemma of democracy in a technological society: if public opinion opposes the experts' best advice, does democracy require that public opinion prevail? Shrader-Frechette and McCoy argue that "the public may make bad decisions, but this defect is not grounds for denying persons' rights to self-determination" (Shrader-Frechette and McCoy 1993: 168). Shrader-Frechette and McCoy feel that 'this defect' is preferable to the domination of decision making by experts, and can be corrected through public education and information.

Other theorists argue that public decisions that conflict with experts' are less 'bad' than based on other, non-technical concerns that are equally valid. Brunk says that "there is no way to argue persuasively that these non-expert risk attitudes are less 'rational' than those embodied in the expert 'science' of risk analysis. It is an alternative rationality, with deep roots in widely held philosophical and religious perspectives" (Brunk 1993: 6).

Some academics conclude, as already noted, that the benefits of technology are great enough that a reconciliation of high technology and democratic control should, and can, be developed (Morone and Woodhouse 1989). Others take their analyses beyond the argument that present democratic principle is betrayed by present technological decision making and that public participation is necessary to fulfill that promise, to an argument of what promise democracy ought to hold and what further principles must be acknowledged in order to ensure that decision making on technology can be compatible with democratic principle. Fielder explains that

Liberal democracy is an attempt to adapt . . . 'pure democracy' (all of the people governing themselves in all public matters all of the time) to the realities of a modern industrial state. . . . The combination of institutionalized technological inertia and citizen ignorance seems to exclude all but a small minority from genuine participation in public policy debates . . . [Benjamin] Barber believes that liberal democracy undermines citizenship, turning citizens into mere voters with only periodic opportunities to exercise their choices on representatives or bond issues. He proposes "strong democracy," in which all of the citizens govern in some public matters some of the time (Fielder 1992: 108).

Gould argues for an 'extended' democracy:

When the concepts of freedom and equality are properly understood, what follows from them is the requirement for the extension of democracy beyond the political sphere to social and economic life; and that in all of these spheres, the form of decision making should be participatory to the extent feasible . . . (Gould 1988: 25).

Ethic of Responsibility for Nuclear Waste: Intervenor

The intervenors' arguments on the actual disposal of nuclear waste combine to form a rough ethical position that those who produce it should dispose of it. Two variants of this ethic were expressed, built on the criticisms we have

already seen: one is based on the philosophical opposition to economic growth or the rejection of the notion that it benefits everyone, the other on the assertion that the whole basis of decision making on nuclear energy policy is illegitimate.

The first variant accepts, in principle, the official equation that accepting benefits implies the acceptance of costs, but denies that it applies to the acceptance by Northern Ontario of wastes produced in and by Southern Ontario, or acceptance by the general public of wastes produced by AECL for AECL. This argument rests on the claim that the regions in question do not receive the benefits of nuclear power, that the present political and nuclear policy situation does not constitute spatial or 'sectoral' equity; in effect, the wastes are not produced on their behalf. It is based on the rejection of the identification of economic growth with the common good, and thus of any responsibility for disposal of the associated wastes. Said one group, "environmental awareness world-wide has taught us that ultimately the most effective, the only way to ensure environmental responsibility is to make the producers of waste deal with it themselves. Those who benefit most must also accept the most responsibility for the waste" FEARO 1990: Golden/Red Lake vol 2: 29; see also Evangelism and Social Action Council vol. 5: 175; Nishnawbe-Aski vol. 5: 99).

The entire burden of benefits and costs was placed with industry. This argument was extended to the conviction that AECL is in fact attempting to shirk what is clearly its own responsibility, by passing the wastes on to others; the proposal to bury the wastes in Northern Ontario is " . . . dismissing the responsible community from its actions" (FEARO 1990: Northwatch vol. 2: 94).

The other strain of this ethic argues that the 'share the benefits, share the costs' logic doesn't apply because the public was not allowed to participate in the decision to pursue deep geological disposal, or even in the decision to use nuclear power as a means of generating electricity. Atikokan Citizens for Nuclear Responsibility argued that "the public has no functional means of influencing nuclear power expansion and therefore no public control on the amount of ongoing nuclear waste to be produced." They went on to ask "should the mere act of using electricity make us responsible for accepting wastes locally? Do we have any real means of electing how the electricity we use will be generated in the first place?" (FEARO 1990: Atikokan vol. 2: 38-39; see also NAC vol. 5: 120; Whitefish River vol. 2: 129).

These arguments rejecting a general social responsibility for nuclear fuel wastes were part of the broader contention that nuclear policy in general, having been formed without public participation and assent, is not legitimate and cannot form the basis of further policy. The debate must return to a legitimate process for establishing energy and nuclear policy, and only then proceed to responsibility for wastes.

This leads to the intervenors' almost unanimous assertion that the narrow scope of the Terms of Reference for this review, with its explicit exclusion of certain issues, does not permit discussion of aspects of nuclear power that do in fact bear directly on the assignment of responsibility for nuclear wastes. Anti-nuclear intervenors, situated within the general framework of environmental politics, saw this restriction of terms as a political strategy to prevent public debate on issues that cannot bear public

scrutiny. These issues - including general energy policy, the further production of nuclear fuel wastes, and the association of nuclear power and the international trade of nuclear technology with nuclear weapons - are those that intervenors considered essential to debate before public consent to the operation of nuclear power can be given, and this is in turn required for the acceptance of responsibility to manage the wastes. As one group warned, "Citizens will very likely refuse to accept nuclear waste disposal when waste production issues are evaded in hearings such as these and remain beyond public control" (FEARO 1990: Atikokan vol. 2: 40).

Nature and Science: Intervenors

Criticism was also levelled at the use of science, in part for its sanctioning of the narrow, technical definition of the nuclear waste issue. The reduction of the issue to one of physical safety, as measured quantitatively and reflected in government standards, and the technical logic that dismisses concerns about moral, political and spiritual values, appeared as a lens that serves as a filter. The aboriginal groups were particularly adamant on this point, stating that while science may be correct on the facts, not everything can be reduced to scientific rationalism. The Council of the Whitefish River First Nation argued that:

This review places emphasis on scientific, technical and procedural rationality and we are not arguing that high-level nuclear waste does not deserve this approach. However we would like to remind everybody that life and peoples are not limited to only scientific and technical applications.

Your facts and knowledge are presently inadequate unless they can be accompanied by the wisdom of experience that Aboriginal peoples' historical continuity and relationship with the land can provide you.

. . . We want our issues and concerns to be served by this process, but this cannot be

accomplished in your structure and processes as they presently stand. You must be prepared to look at our philosophy, culture and value system and integrate it into your review to meet our needs (FEARO 1990: Whitefish River vol. 2: 130, 131).

Other groups explicitly challenged the experts' authority by virtue of the importance of scientific knowledge. The National Action Committee on the Status of Women argued that :

. . . while people generally may not take the time to understand the minutiae of mathematical equations and models used to convince us of the safety of nuclear power and nuclear waste disposal, we can certainly understand the larger human questions to which the "wisdom of the body" pertains - we may all be experts in that field, if we so choose. And if the "wisdom of the body" is given equal time, it seems likely that the result would be a total ban on nuclear power (FEARO 1990: NAC vol. 5: 140).

The NAC submission continued,

That is why nuclear proponents have a vested interest in ensuring that people remain mystified by the intricacies and details of nuclear technology (FEARO 1990: NAC vol. 5: 140).

The computer modelling of natural systems, rather than empirical and experimental results of scientific research, was considered insufficient and relying on it was arrogant and overconfident. Scepticism was frequently expressed that science could 'predict nature' with enough accuracy to assure safe operation of a repository in the long term: "Predicting natural phenomena is dangerous and imprudent. Predicting how nature will function for millions of years is just plain folly. . . Science cannot predict nature" (FEARO 1990: Concerned Citizens vol. 5: 107-108; see also Atikokan vol. 2: 35; Temiskaming vol. 2: 115; Sask. Env'l Soc. vol. 5: 39; NAC vol. 5: 151; Evangelism and Social Action vol. 5: 168).

Several intervenors, including both aboriginal groups whose testimony was studied, were explicit about the spiritual essence and meaning of nature, and the obligation of human society to adopt a role of stewardship rather than exploitation that grows out of a recognition of the intrinsic value of nature. As one group said about the possible siting of a repository in Northern Ontario, "The thought of burying the most deadly poison known to us deep in the heart of what we consider sacred is intolerable" (FEARO 1990: Golden/Red Lake vol. 2: 26). Concerned Citizens of Manitoba asked: "Why does it have to be put into the middle of one the earth's most delicate and beautiful regions?" (FEARO 1990: Concerned Citizens vol. 5: 106). The Evangelism and Social Action Council explained the theological basis of their argument:

For hundreds of years Christian theology has been misused to justify escalating exploitation and domination of the earth and its resources. This history of wanton exploitation in pursuit of progress is now culminating in environmental crises of unimagined proportions: rivers poisoned; rain made toxic; forests, fauna, atmosphere and ultimately people, destroyed. Slowly, out of necessity, this old theology is giving way to a renewed theology of stewardship. Careful analysis of biblical scripture is leading the United Church of Canada to a faith more firmly based on justice, and on respect for the interdependence of humanity and the rest of creation - a theology of nurturing rather than subjugation (FEARO 1990 Evangelism and Social Action vol. 5: 165).

The opposition to science was partly an expression of the belief that science is an implicit threat to nature, in physical terms and terms of the cultural relation to the land that is possible.

The aboriginal groups discussed the importance of the daily interactions with the land that make up their culture and their spiritual lives (FEARO 1990: Nishnawbe-Aski vol. 5:

97; Whitefish River vol. 2: 131). Although many intervenors mentioned the difficulties of carrying out an environmental review of a concept without a specific environment to consider, the aboriginal groups also alluded to their essential cultural relations with their particular landscape. They expressed the impossibility of considering 'the environment' in the abstract as a collection of physical conditions and natural resources, as Western industrial culture is more likely to do, and urged the Panel to visit their communities to experience personally the culture of the people.

In order to begin to appreciate the nature of our communities and the potential impacts development of AECL's concept could have, we support the suggestions of other First Nations organizations regarding the need to visit some of the potentially affected communities. . . .

The Panel should very specifically guide the proponent to produce a detailed impact analysis that describes the effects of implementation of the concept on the land base needed for healthy Native communities, the health of our community members, our economies, including employment considerations, the wildlife and plants which we harvest and use in our traditional lifestyles, and our spiritual, cultural and heritage values (FEARO 1990: Nishnawbe-Aski vol. 5: 100-101).

Nature and Science: Theoretical Context

According to Cotgrove's profile, the core values of the environmental paradigm are, in addition to non-materialism, that the "natural environment is intrinsically valued," and "harmony with nature" (Cotgrove 1982: 27). Whereas the dominant paradigm holds that nature is valued as a resource, that it is either neutral or hostile and should be dominated and controlled, and that confidence is placed in science and technology, the environmental paradigm holds that nature is benign, delicately balanced and limited, and that there are limits to science.

Science represents Western society's attempts to harness and exploit nature, the impulses that have led to environmental destruction. Shiva explains that her book grew out of her questioning of progress, science, and development, which threaten the survival of nature, described in very organic, empathetic terms:

The death of nature is central to this survival. The earth is rapidly dying: her forests are dying, her soils are dying, her waters are dying, her air is dying. Tropical forests, the creators of the world's climate, the cradle of the world's vegetational wealth, are being bull-dozed, ruined or submerged (Shiva 1991: 49; see also Gordon and Suzuki 1990; Sadler and Jacob 1990).

That the social order defined by the complex of science, technology, capitalist economics and industrial development has brought the natural environment to a crisis of pollution, climate change, habitat destruction and loss of species diversity is the founding assertion of radical environmentalism of all stripes. For many environmentalists this destruction, its threat to the survival of human and other life, and the urgent need to understand and change the deeply embedded beliefs and attitudes that led to such destruction, is the *raison d'être* of environmentalism. An integral aspect of this needed change is a radically new definition of nature and how humans and human society ought to relate to it. Nature is usually described as an organism rather than a mechanism, as constituted by many complex interrelated and interdependent networks of living systems, as operating on its own rhythms and cycles rather than subject to physical laws, as plentiful and benign, sometimes as powerful, and always deserving of respect. The domination, control, improvement and management of nature are contrary to the ethic of environmentalism, regardless of the possibility of achieving them. Instead, humans' dependence on the natural

environment is emphasized, along with the necessity of protecting what sustains life and the recognition that nature is limited and finite.

Environmentalism is an alternative social order, a paradigm that takes its conceptual origins from the understanding that the way in which humans define the environment and get their living from it structures political institutions, social relations, and patterns perceptions and thoughts, all of which determine human impacts on the environment: nature is a political and cultural artifact. Some writers, however, particularly deep ecologists and aboriginals, go beyond this understanding and refer to the intrinsic value of nature and a deeper philosophical or spiritual dimension of nature with which humans can communicate. Deep ecology stresses the necessity of wilderness, both for the development of human maturity and as "the habitat of other beings which have a right to live and blossom for themselves" (Devall and Sessions 1985: 111). Devall and Sessions explain that experiencing wilderness is, from a deep ecology perspective:

a process of 1) developing a sense of place, 2) redefining the heroic person from conquerer of the land to the person fully experiencing the natural place, 3) cultivating the virtues of modesty and humility, 4) realizing how the mountains and rivers, fish and bears are continuing their own actualizing processes (Devall and Sessions 1985: 110).

In a more radical and frankly political position is the Earth First! movement, whose biocentrism perceives not industrialism but civilization itself as the problem. Earth First!ers envision a world in which everything is wilderness, and would like to see people living in tribal hunter-gatherer and shifting-agriculture societies (Manes 1990: 237, 240).

In contrast, aboriginal people have a more religious perspective of nature and humans' relation to it. As Jerry Mander explains:

. . . resistance to resource development is expressed as an effort to protect "Mother Earth." It is not only American Indians who use the phrase. So do Aborigines of the Australian desert, natives of the Pacific islands, Indians of the Ecuadorian jungles, Inuit from Arctic Canada; in fact, I have yet to find a native group that does not speak of the planet as "mother." And they all mean it literally. Plants, animals, all life as we know it is nurtured at her breast. We have germinated within her, we are part of her, we burst into life from her, and we dissolve back into her to become new life (Mander 1991: 211).

The land is sacred to aboriginals, as traditional livelihoods on the land and traditional beliefs maintain cultural integrity and impart a deep meaning to life.

Mander quotes a Shoshone Indian as saying that

. . . to disconnect from the land is unthinkable to Indians. The land is everything. It's the source of our existence. It's where the ancestors' spirits live. It is not a commodity that can be bought or sold, and to rip it open to mine it is deeply sacrilegious to all Indian people. . . . Indian people die if they are removed from the land (Mander 1991: 223).

Within the environmentalist worldview, greater knowledge about nature leads to a deeper understanding and respect for it. In fact, Richards argues that "local natural history is often 'good science'; that is, it makes a worthwhile contribution to the global stock of knowledge concerning plants and animals" (Richards 1993: 144). The proper use of knowledge about nature is not to increase in human control over it, so that more resources and products can be extracted from it. Science is thus resented for taking an essentially unethical approach to nature. Many attribute environmental destruction directly to the mechanistic view of nature established by science in the seventeenth century, and defend the quality of knowledge

about nature held in traditional societies. Shiva states that "the scientific revolution in Europe transformed nature from terra mater into a machine and a source of raw material: with this transformation it removed all ethical constraints against its violation and exploitation" (Shiva 1991: 50; See also Merchant 1990, Devall and Sessions 1985, Porritt 1984).

Recently a critique of many of the dominant assumptions of the physical nature of the environment, which have led to the mismanagement and destruction of the environment, has come from geographers, biologists and ecologists. Stability, or equilibrium, a key concept in the scientific-economic view of nature, has been described as a cultural myth. Timmerman describes several variants of 'myths of equilibrium', and points out that the entire dynamics of an ecosystem can be changed through the imposition of an inappropriate model of equilibrium (Timmerman 1986: 437, 433). The cod fishery in Canada is one such case; in another, Donald Worster describes in detail the failure of the early scientific-management efforts to control predators in the United States (Worster 1977: 258-290).

Kenneth Hewitt, in his volume of essays on natural hazards that are critical of the dominant approach, describes the "myth of ordinary life" in which extreme events are defined as hazards.

The ongoing conditions that provide the setting for disaster are inferred to be 'stable', 'orderly', and predictable', or at least sufficiently so to be called 'managed' and even 'planned'. . . Everyday life thus comes to appear as a 'frictionless' process, readily poured into whatever mold technology and the certainties of nature require. . . [These assumptions about predictability] lead to that dangerous transfer of the notion of 'predictability' as a feature of scientific method, to the partial and scientistic notion of **predicting society**, which is tantamount to

controlling it. This is not the stuff of scientific enquiry but technocratic wishful thinking, a rhetoric that sees society as running smoothly only when fully predicted and managed by its 'experts' (Hewitt 1983: 22-23).

These critical perspectives 'deconstruct' the dominant view and describe its observed reality as selected reality, as ideology necessary for the legitimacy of a social order. In fact the biological appropriateness of the very concept of equilibrium is coming under challenge. Shrader-Frechette and McCoy, for example, describe the ambiguity, inconsistency and imprecision of the central concepts of 'community' and 'stability' in ecology that hamper that science's predictive power (Shrader-Frechette and McCoy 1993: 11 - 79). Other researchers, using computer models of crab populations, have found that "instability and change are the rule for these animals rather than the exception" (Yoon 1994: A9). As one scientist said about the crab studies, "If this is really what real populations are like, it presents a big difficulty in analyzing and predicting how they're going to behave. It makes things even harder than they were before" (Yoon 1994: A9).

Rees criticizes the standard assumptions through which natural resources are incorporated into economic models as stock resources: "Contrary to the assumptions of theory," he says, "there is no equilibrium of any sort in the material relationship between the economy and the environment" (Rees 1990: 126). Economic theories that assume a closed system, "a self-sustaining circular flow between production and consumption" ignore the second law of thermodynamics, according to which energy and matter in a closed system are "continuously and irrevocably degraded to the unavailable state": modern economies thus actually consume their own resource base (Rees 1990: 124-126).

Milbrath notes a related irony, central to the message of environmentalism, in the scientific assumption of "biogeochemical stability" and its necessity for social order. "Our power to perturb is now so great, our numbers so vast, and our foresight so lacking, that there is a serious danger of driving biogeochemical systems into oscillation or chaos. It is incoherent to strive for order in economic systems while simultaneously perturbing ecological systems into disorder" (Milbrath 1994: 120).

Science comes under criticism for establishing a narrow and incomplete model of the natural environment, and for a style of rationality that can lead to only partial, and hence distorted, knowledge and understanding. Whitehead explains that science developed from physics, whose ". . . concepts are very unsuited to biology; and set for it an insoluble problem of matter and life and organism, with which biologists are now wrestling. . . this scientific field of thought is now, in the twentieth century, too narrow for the concrete facts which are before it for analysis." (Whitehead 1925: 41 and 66). Science was, and is, however, very powerful for a limited range of subjects; "if only you ignored everything which refused to come into line, your powers of explanation were unlimited" (Whitehead 1925: 101).

Scientific rationality creates a dichotomy between humanity and nature, and between emotion and logic, between fact and value. Whitehead says that

Science is concerned with the general conditions which are observed to regulate physical phenomena; whereas religion is wholly wrapped up in the contemplation of moral and aesthetic values. On the one side there is the law of gravitation, and on the other the contemplation of the beauty of holiness. What one side sees, the other misses; and vice versa (Whitehead 1925: 185).

Shrader-Frechette and McCoy recognize this duality in rationality, distinguishing scientific rationality - "based primarily on using scientific theory . . . to assess the probability associated with various competing hypotheses and their consequences" - from ethical rationality - "based on using ethical theory and norms (about rights, duties and ideals) to assess the moral goodness or badness associated with alternative actions and their consequences" (Shrader-Frechette and McCoy 1993: 150 - 151). They argue that ecological decision making should consist of both scientific and ethical rationalities, and that in some cases of environmental decision making, ethical rationality is more appropriate (Shrader-Frechette and McCoy 1993: 151 and 191 - 193).

The dominance of scientific rationality in the dichotomous conception of rationality has also marginalized environmentalist, traditional and aboriginal spirituality and spiritual relations with the land. Walter and Dorothy Schwartz express a common environmental tenet: science is not wrong, but partial. "Its shortcoming is in what it omits. That omitted area is what we mean by spiritual. . . . The spiritual is not identified with any actual religion, nor confined to religious sentiment; it includes the intuitive, the non-measurable, the aesthetic, the caring and the loving" (Schwartz 1991: 104). These aspects of reality are valid and important, environmentalists argue, and have been central in protests against the scientific worldview from the time of the Romantic poets. "The romantic revival was a protest on behalf of the organic view of nature, and also a protest against the exclusion of value from the essence of matter of fact. . . . The romantic reaction was a protest on behalf of value" (Whitehead 1925: 94). Environmentalists argue that an entire important realm of human concern and type of

interaction among humans and between humans and the environment is invisible, and thus trivial, to science and the worldview associated with it.

Values are also cultural, determined, in part, and held collectively, in contrast to the cost-benefit calculations made by individuals in the scientific view of credible knowledge. The individualist ontology has been challenged by an alternative that conceives of humans as inherently social, and hence values culture as the very identity of people rather than an add-on to supposedly universal economic motivations, and gives greater credence to traditional and collective knowledge. Reus-Smit outlines the alternative ontology:

First, individuals are inherently social in a strong sense of the word, that is, their identities, interests and actions are constituted by the social world in which they live. Culture . . . has . . . an ontological aspect, assigning reality to actors and actions, to means and ends; and it has a significatory aspect, endowing actor and action, means and ends, with meaning and legitimacy. Second, it follows that individuals are not autonomous sources of their own conception of the good. . . . Finally, society is best thought of as a complex of human practices and intersubjective meanings embedded in, and constitutive of, layered institutional norms, rules and principles. While exchange relations are clearly an important dimension of human interaction, they do not constitute the totality of social life (Reus-Smit 1993: 21, 22).

The rationality of social values and beliefs about nature, risk and how people should relate to nature is validated by this definition of human nature. Humanism, the philosophy of scientific progress and the dominance of human reason that rejects other sources of power, such as God, supernatural forces, or nature, is in turn rejected by environmentalism as the logic justifying technological progress and increased control over nature: "Absolute faith in our ability to control our own destiny is a dangerous

fallacy" (Ehrenfield 1991: 45). In addition to science's narrow and partial definition of reality, which has subordinated and excluded other kinds of rationality and knowledge, therefore, environmentalists criticize science and technology and the general philosophical outlook of humanism for violating their first principles that nature is intrinsically valuable and that humanity should respect and live in harmony with it, and for driving industrial expansion. Nature is by definition too complex, too intricately interconnected and too variable to be completely understood by science, let alone modelled and predicted. Robinson et al. express the common environmental sentiment that

. . . humanity does not understand much about the complex sets of interactions and processes of the biophysical world around us. That is, a significant degree of ignorance about the external world is characteristic of the human condition. This suggests a basic caution is in order when interfering with natural processes (Robinson et al. 1990:38).

"Even if the reductionist assumptions were correct" say Gordon and Suzuki, "it is the height of arrogance to think we are approaching a level of knowledge that enables us to manage a natural resource" (Gordon and Suzuki 1990: 52).

III. DEMANDS AND ETHICS RELATED TO THE PRESENT REVIEW

Public Participation and Inclusion of Broader Range of Issues: Intervenors

The anti-nuclear intervenors' major demand for this review was that meaningful public participation be included and that public concerns be recognized as grounded in reason and often in cherished official political principle. This means that the practical conditions of proper notice and equitable funding should be provided, so that intervenors can prepare their cases to their satisfaction. The full

range of relevant issues must be discussed, so that a 'contract' establishing the basis of the responsibility for nuclear waste can be worked out. Indeed, though public participation was considered a necessary provision as a fundamental principle of democracy, anti-nuclear intervenors called for increased involvement of the public as a means of ensuring that non-technical concerns were addressed in the review. Concerned Citizens of Manitoba observed that "operating within this Accept or Reject framework does not address the problem. Any conclusions that do not allow for the expansion of Canada's nuclear industry will not be tolerated under the present terms of reference" (FEARO 1990: Concerned Citizens vol. 5: 107).

They also asserted that:

The concept of disposing of nuclear waste cannot be discussed within the terms of reference drawn up for this review. These parameters are so narrow that the real problem which will continue to face Canadians for thousands of generations to come is not addressed. It is the high-level waste itself which should be focused on in these hearings. This single idea that AECL has come up with doesn't provide any solutions. It is the continued production of these wastes which must be carefully examined, and the people of Canada should have the right to decide whether this irresponsible and dangerous method of generating power should continue. (FEARO 1990: Concerned Citizens vol 5: 105).

The National Action Committee on the Status of Women submission argued that:

. . . the terms of reference for this review are too narrow. They are designed to focus on the specific issue of long-term management of nuclear fuel waste. Yet the decisions and actions which evolve from the review have implications which go far beyond the terms of reference as they are currently stated. NAC feels that in order to carry out a legitimate review process, the terms of reference must be expanded to cover these implications. Related to this point, NAC representatives do not consider it legitimate to separate nuclear fuel waste management from the other aspects of the nuclear fuel chain, and feel this distinction to be false (FEARO 1990: NAC vol. 5: 123;

2: 18, 23; Atikokan vol. 2: 38; Northwatch vol. 2: 89, 90, 91; Whitefish River vol. 2: 129, 131-2; Sask. Env'l Soc. vol. 5: 38; Nishnawbe-Aski vol. 5: 101; Evangelism and Social Action vol. 5: 166, 180).

According to the rough ethic of the responsibility for the management of nuclear fuel waste expressed by the anti-nuclear intervenors, within the framework adopted by the proponent neither Northern Ontario nor the public generally has any obligation to take responsibility. It was on behalf of the industry that government formulated and implemented nuclear energy policy, and these groups must take full responsibility for the wastes.

On the other hand, several intervenors took the stance that if society is to be asked to assume responsibility for these wastes, that responsibility would be taken seriously: far from routinely approving the industry's process, the public would take over the matter and establish clear terms on which nuclear waste would be produced and disposed of. If society in general is to be considered to have generated its electricity with nuclear power, society in general is now committed to acknowledging the full implications of this practice and undertaking an assessment of the rationale of continuing to produce nuclear wastes:

The fact remains, however, that we do have nuclear waste and it won't go away. And because we, as women, and as citizens, care about our health, and the health of the next generations, because we care about life and about the Earth, we want the production of nuclear waste to be stopped, and that which exists to be guarded safely, so that it will not contaminate water and ecosystems. Because we care, we try, in honest and caring ways, to take responsibility for a situation which we did not create (FEARO 1990: NAC vol. 5: 124, 141-2; see also Sask. Env'l Soc. vol. 5: 37; Evangelism and Social Action vol. 5: 165).

Public Participation and Inclusion of Broader Range of Issues: Theoretical Context

Theorists of decision making on technology contest the legitimacy and viability of traditional expert-led processes, in which experts and managers make decisions and mediate disputes on behalf of a public assumed to be ill-informed on technical issues, on the assumption that technical risk analysis and assessment define the issue and determine the right course of action. This approach has been described as the 'welfare model' of public participation, "in which risks are defined as problems to be dealt with, mainly by experts. It is assumed that if a problem is solved by a respected scientific opinion, this will enhance the legitimacy of public authorities. And it is assumed that adequate information will contribute to consensus" (Nelkin 1979: 60). As noted, Nelkin has found that neither information programs nor the use of technical expertise increased public agreement with scientists' positions, or decreased polarization in a technical controversy.

In fact expertise is often employed in order to avoid dealing with public opinion. Nelkin states that "developers seek expertise to legitimize their plans and they use their command of technical knowledge to justify their autonomy. They assume that special technical competence is a reason to preclude outside public (or 'democratic') control." She concludes that conflict in judgements about public priorities or levels of acceptable risk "is bound to be reflected in a biased use of technical knowledge, in which the value of scientific work depends less on its merits than on its utility" (Nelkin 1977: 202-3).

Perrow observes that "the public is [not] granted the

dignity of being able legitimately to dissent from the experts. The gap between the public and the expert must be narrowed or closed, but always by moving the ill-informed public over to the well-informed expert" (Perrow 1980: 298). In the case of the present urgency to determine responsibility for nuclear waste in the absence of a general public acceptance of the technology itself, Brunk notes that the risk management decision was imposed on society 'after the fact': this results in a justified feeling of distrust from betrayal (Brunk 1993: 7). This case is one of the distribution of risk: who will accept the waste - complicated by who has received, and values, the benefits? In these cases the appropriate process is not risk calculation but negotiation, because "the issue now is consent" (Brunk 1993: 7).

Shrader-Frechette advocates the use of negotiation between communities and industry or developers when some cooperation is possible. In more contentious situations she suggests a process she calls adversary assessment, which would involve presentations by scientists on the technical issues themselves and by social scientists and humanists on "evaluative points of view," with the final decision made through a representative democratic process rather than by experts (Shrader-Frechette 1991: 206 - 216).

Gould believes it is both necessary and feasible to increase democratic control of technology through a process like workers' self-management, whereby all the workers would make decisions on technology to be adopted and implemented, based on information provided by experts (Gould 1988: 276 - 277).

A participatory type of decision process is advocated in part on the political principle of ensuring democratic

rights to self-determination and partly on the ethical and, increasingly, politically practical premise that valid concerns of the public should be included in decisions on technology and the environment. An equitable, legitimate and successful decision-making process must therefore be based on a risk communication process that hears, validates and accommodates public concerns: in some cases the risk communication becomes the decision making and risk management process. To these theorists, risk communication is a two-way exercise that is integral to a participatory process by which risk disputes are resolved and decisions on technology and the environment are made.

Brunk states that "risk communication is the two-way process of determining the 'actual risk' as well as managing it" (Brunk 1993: 3). Brunk and Leiss argue that one-way 'risk information' approaches based on technical risk analyses fail to capture and address people's legitimate value concerns. According to Brunk, "a risk assessment is . . . only as reliable as it is successful in assessing the probabilities of harm to the actual values that lay people see 'at risk' by a technology or social practice . . . a 'risk' is understood as the probability of harm to some value. What is 'at risk' is always some value or set of values" (Brunk 1993: 3). One-way, top-down types of risk communication fail because they are based on values 'at risk' that are not those of concern to the public.

Leiss's analysis of the ethics of risk communication in matters of public policy and technology includes public control over the final decision. He concludes that a fair risk communication strategy in cases in which a proponent seeks to "shift the intuitive net benefits (or risk/benefits tradeoff) calculation that is made by other interest groups and many members of the public at large"

(Leiss 1989: 184) ought to express openly the proponent's interest in changing the public's perception of the technology. This "is certainly a case of 'letting the chips fall where they may'": the proponent should be prepared to lose. "In the end, the majority among the public might decide to opt for rigorous energy conservation measures, entailing profound lifestyle changes, in order to reduce the perceived risks associated with energy-use technologies of all sorts, including nuclear power" (Leiss 1989: 185).

With reference to a possible inquiry on nuclear energy, Patterson states:

If an inquiry is to be held, it must be held in such a way that its role in the overall decision-making process is clear and vital, and that its outcome is not a foregone conclusion. Henceforth, in particular, if the authorities are wise, they will ensure that any proposal for a major civil nuclear facility be formulated to take account of the need to obtain an explicit public consensus in its favour. If such a procedure be time-consuming, so be it. If it be expensive, so be it. If it indeed be decided against the facility, so be it. No other approach will satisfy society (Patterson 1980: 240).

Concern for Future Generations: Intervenors

The final major concern of an 'ethical' nature derived from the anti-nuclear intervenors' testimony is the overriding concern for future generations. The emphasis of this concern differs from the official desire to relieve future generations of the burden of managing our wastes: anti-nuclear intervenors felt that it is important to secure for future generations the flexibility to change management procedures, to implement new technologies they may discover, to recover the wastes if a use is discovered for them, or to monitor, prevent or repair the problems or leaks that these intervenors are confident will occur.

Many intervenors pointed out that problems will likely occur long after the generation that has designed and constructed a waste repository is gone, and the effects and damages will be experienced by those who had no say in the production of the wastes or the manner in which they were managed. To commit them to our technology for managing the wastes is unethical:

AECL argues that the irretrievable disposal is attractive on the premise of "not burdening future generations", however the reverse consideration could be more than equally argued: that imposing the waste on future generations is in itself an onerous and lethal burden; and the more difficult monitoring and remedial measures are made by remote locations, or "out of sight - out of mind" attitudes, the greater the handicap future generations will suffer in dealing with any and all adverse consequences of the buried waste (FEARO 1990: Northwatch vol. 2: 94; see also Golden/Red Lake vol. 2: 24; Atikokan vol. 2: 34; Sask. Env'l Soc. vol. 5: 40-41; Concerned Citizens vol. 5: 108; NAC vol. 5: 152).

Control over technology is a central theme, as it is in the more general debate over the social implications of large-scale technology. Any attempt to extend a commitment to our technology through many future generations, particularly when the health of people and their environment may be threatened by the technology, is to be expressly guarded against: "we are not relieving them of a burden, we are complicating the one we've already created for them" (FEARO 1990: Concerned Citizens vol. 5: 110).

Many intervenors argued that the maximization of the control future generations may exercise over a repository should be a primary consideration; alternatives to deep geological disposal, such as the continuation of above-ground storage for as long as it is safe, or until society reaches a stronger consensus on disposal, should therefore be examined. There was suspicion that irretrievable burial is preferred by the industry not because it fulfills any

ethical obligation to future generations, but because it removes the waste as far as possible from the present generation of opponents of the nuclear industry.

Concern for Future Generations: Theoretical Context

Within the politics of environmentalism, small-scale "appropriate" technology that can be understood and managed by the community is preferable to large-scale complex technology that requires expert management. This is partly to avoid the social relations of dominance and dependence that are fostered by large-scale, complex technologies; as we have seen, a complex technology that requires expert control suggests an incompatibility with democracy. Long-term commitments to one type of technology (with the expert-elite control this may imply) may be avoided with more flexibility in the technology, which helps ensure that future generations inherit a social and institutional system that they can participate in, change and adapt. Robinson et al. include as a "key characteristic of sustainability" that "we cannot, and don't want to, guarantee persistence of any particular system in perpetuity. We want to preserve the capacity of the system to change" (Robinson et al. 1990: 44).

With their sensitivity to the political nature of technology, environmentalists recognize that long-term commitments to technology entrench a long-term commitment to that technology's implicit human-environment relation. Such a long-term commitment diminishes the possibilities for conceiving of alternative social orders and ways of interacting with the environment, for the present and the future.

David Collingridge also argues for flexibility in technology, from the perspective of technology planning.

He begins from the recognition of the "huge disparity between our technical competence and our understanding of how the fruits of this competence affect human society which has given rise to the widespread hostility to technology . . . technology often performs the way originally intended, but also proves to have unanticipated social consequences which are not welcome" (Collingridge 1980: 15-16).

The first option for avoiding these unwanted consequences is to develop better forecasting, to enable planners to foresee such consequences and design the technology to avoid them; Collingridge argues, however, that "the prediction of social effects with such confidence demands a vastly greater appreciation of the interplay between society and technology than is presently possessed. I doubt that our understanding will ever reach such a sophisticated level. . . ." (Collingridge 1980: 19). It is in this context that he defines technology planning as 'decision making under ignorance', and puts forward the argument that "the essence of controlling technology is not in forecasting its social consequences, but in retaining the ability to change a technology, even when it is fully developed and diffused, so that any unwanted social consequences it may prove to have can be eliminated or ameliorated" (Collingridge 1980: 20-21). Building in the capacity for future generations to monitor, repair or change the technology to meet their own needs is fundamental to avoiding social problems.

Another formulation of this issue is presented by Philip Frankenfield, who uses a "scheme of Lockian common patrimony . . . to argue that forebears are morally obligated to leave future generations a world as controllable and as affordable as ours for experts and

laypeople, despite potentially increasing complexity, ungovernability, and cost of environmental hazards and an increasing pace of change" (Frankenfield 1993: 32).

Frankenfield argues that while we cannot know the preferences of future generations, we may assume some common needs and dislikes: one is the dislike of death, disease, anxiety, and costs of time and money. Another is the dislike of "increased technocracy or dependence upon experts for life, health and the certainty of this" (Frankenfield 1993: 34). These principles oblige the present generation to refrain from the installation of technologies that may present a serious threat to the health of future generations, who are not able to consent to their use and the risks they entail, and/or that involve a long-term commitment to dependence on experts.

Frankenfield suggests that it is the commitment of future generations to a level of technocracy greater than we would accept ourselves that should be avoided; but this assumes a general assent to present levels of dependence on expertise. Many environmentalists oppose the influence and power that experts now have, and hence oppose the continuation of technologies that require such expert management. In arguing against the implementation of complex technology that future generations will be unable to control and adapt as they see fit, environmentalists are extending their anti-technocracy argument for the present into the future.

SUMMARY OF ANTI-NUCLEAR POSITION

Vision of the Ideal Social Order

Community and spiritual values, cultural knowledge, and respect for the proper limits of human influence within

nature are aspired to. We should work toward a more egalitarian, participatory society and harmony with the natural environment, not domination of the public by elites and exploitation of nature for financial profit.

Perception of the Present Order

The anti-nuclear position is critical of the present social and political order, as of the value system underlying it. The pro-nuclear intervenors' unified but internally differentiated society is the anti-nuclear intervenors' stratified society of economic, political and geographical inequities, in which economic and political elites dominate decision making to their own advantage. The large body of the public is disempowered and effectively disenfranchized, excluded from meaningful participation in decision making on important social issues, such as technology and society's use of and relation to the environment. Economically disadvantaged groups, those in rural or remote regions, aboriginal groups and the environment itself are marginalized. The relation that emerges is one of dominance and dependence, not of different functions performed in the interests of the whole. Professionals appear, at best, in a relation of paternalism to the rest of society; at worst, as exercising power and control by virtue of the institutionalization of their dominant ideology.

The professional and the expert, as described by pro-nuclear intervenors, are not the equivalent of Berger and Luckmann's simple specialization of knowledge and roles in society. What environmentalists perceive and oppose in expertise is a more complex 'subuniverse' whose values are not broadly representative, but that is an extension of the dominant social order and functions to enforce compliance with it.

To anti-nuclear intervenors, the ideal society is internally differentiated, by role and function as by cultural diversity, but this differentiation is not seen as leading properly or inevitably to gradations in wealth and power, nor is it seen as determining participation in decisions on issues of general social and political concern. Anti-nuclear intervenors emphasized their divergence from the ideal of economic growth and the exploitation of nature; elite interests are very different from those of the public.

These intervenors were explicit that expert-determined policy and actions do not represent their interests, but are carried out by elites who maximize the values of growth in the name of the public. The anti-nuclear intervenors' "we" is thus much more restrictive than that of the pro-nuclear intervenors, applying within a community of shared values and social alignment rather than an entire society. Professional decision making is not a representative executive function but the imposition of a dominant elite's value system on the rest of the public. This constitutes a violation of democratic principle and renders policy thus made illegitimate.

In making these distinctions anti-nuclear intervenors are asserting their separateness from the dominant society, their status as political dissenters. They are not party to dominant values, conceptions of benefits or responsibility for costs.

Fundamental Principles

Principles of humanity as essentially social and living in harmony with nature form the defining framework of the anti-nuclear, environmental worldview. Nature is an organism that has inherent value independent of human

perceptions of its utility: it defines its own set of limits and conditions, and its complex interrelations are beyond the complete understanding of humans. Full and detailed empirical knowledge of nature, which deepens understanding and respect, is desirable and authoritative, but the abstract modelling and prediction of entire complex natural systems represents the presumptuous efforts of humans to control what we should defer to, and is in any case doomed to failure: sufficient certainty can never be attained. Unsuccessful attempts to engineer modifications to natural systems are not just problems with execution, but are likely also conceptually wrong.

Nature is not completely separable from personal and social values, and humans' practical, cultural and spiritual relations to it are complex. Scientific and economic rationality is, to environmentalists, narrow and partial, excluding values and pretending to be value-neutral itself, and is intolerant of emotional, spiritual, and cultural aspects of knowledge that environmentalists consider to be valid and essential. Anti-nuclear intervenors made their own values clear: their case rests on fundamental political principles of democracy and justice. Simple ethical positions override the desire for, even given the physical possibility of achieving, progress or greater wealth at the expense of the environment or people. It is not for humans to dominate: the social relations that are engendered by man's confidence in his ability to control are ethically wrong.

Decision Making Process

The organizing principle for the anti-nuclear position's decision making process is public participation, for the representation of public values in policy. The fundamental right to participate in social decision making is claimed

as democratic principle, but it also gains credibility within a conception of reality in which laypeople's values have integrity as knowledge and are not dismissed in favour of specific technical expertise. Cultural values are very important factors in any social decision, perhaps particularly in decisions affecting the use and the condition of the environment. As they reject the conception of a material environment that fits into a universal, objective standard of rational knowledge, anti-nuclear intervenors believe the 'best' decision for society can only be the one that best represents and is supported by a majority of the public.

In addition to the principle that public values, in general, should be reflected in policy, it may be even more urgent to protect that principle and exercise it in practice when decisions on the environment are involved. Decisions on fundamental questions of the social relation to the environment cannot be left to traditional decision makers, when elites and decision makers do not share public values and concerns about the environment and implement policy that does not reflect public values.

Anti-nuclear intervenors did not accept the primacy of objective fact that permits the overruling of the public by the expert, and rejected the representative logic that supports expert decision making as a democratic process. The primary principle of process to anti-nuclear intervenors is public assent and support, which narrow technical data alone cannot invalidate, though public opposition invalidates a decision taken on other grounds.

Credibility and Trust

For anti-nuclear intervenors, who were suspicious of the claims of science and opposed to many of the efforts of

technology, credibility is not in better and more objective data. More and better science is not compelling for those to whom science can by definition comprehend only a partial view of reality. The source of the trust or lack thereof lies in a completely different set of values.

Confidence in science, technology and the rightness of human progress declines as values shift to the environmental paradigm. Anti-nuclear intervenors were less confident than pro-nuclear intervenors that science can tell us what we need to know and is value-free, and they disapproved of much of what technology can accomplish. In this process the practitioners of these fields also lose their authoritative status.

Anti-nuclear intervenors appeared not to doubt that scientists and decision makers are competent at what they are trained to do as much as they doubted that they are working towards acceptable goals. Objectives have diverged: experts are seen to be carrying out their tasks competently enough, but to be doing it in the pursuit of invalid goals in the service of a discredited social and political order. Thus, while to pro-nuclear intervenors an individual's previous association with industry may mean simply that he knows what he is talking about, to anti-nuclear intervenors it is likely to taint that individual with the suspicion of bias and vested interests.

The trust of the anti-nuclear intervenors is gained through shared loyalty to common values, a demonstrated conviction of ethical principle and, perhaps most importantly, a demonstrated independence from economic and elite interests.

CHAPTER 6

AFTER SCOPING: THE REVIEW PROCESS

After the scoping meetings, the environmental assessment panel issued its Final Guidelines for the Preparation of and Environmental Impact Statement on the Nuclear Fuel Waste Management and Disposal Concept, detailing the issues the proponent, AECL, should address in its EIS. In these Guidelines the panel emphasized the social impacts of a possible disposal facility, as provided for in the Terms of Reference as "social, economic and environmental implications of a possible nuclear fuel waste management facility" (FEARO ToR 4). Under section 8, "Impacts," the panel stated that:

The potential social, economic and environmental impacts of the implementation of a disposal facility and of the contents of a disposal vault on humans, human communities, the work site and the natural environment should be described and discussed in detail. . . . The proponent should consider the different viewpoints when presenting its EIS, particularly the viewpoints of aboriginal peoples and the viewpoints of other public groups that have a significant potential of being impacted. . . .

Ethical and moral perspectives, along with various social issues, as evidenced by presentations to the Panel at the scoping meetings, are as important as scientific, technical and economic considerations. The proponent should investigate how relatively narrow and focused considerations of a scientific, technical or economic nature should be viewed in the much broader context of ethical, moral and social considerations (EARP Panel 1992: viii).

In the Introduction, the Guidelines refer to the concept of spatial equity, in stating that:

Various public groups in Canada, such as residents of northern communities, aboriginal peoples, people living near possible transport corridors, etc. may have different viewpoints on many aspects of the concept. The proponent should consider these different viewpoints when presenting its EIS,

particularly the viewpoints of public groups that have a greater potential of being impacted as a result of concept implementation (EARP Panel 1992: 2).

The panel also encouraged the proponent "to present its EIS in the clearest terms possible, and to use language, where possible, that can be readily understood by the public. . . . the EIS should begin with a summary of the document and its findings that is easily understood by the general public. . . . The summary should be prepared for wide distribution as a document separate from the EIS (EARP Panel 1992: 2).

Interpretation of the Dynamics of the Nuclear Conflict

The panel of this review is proceeding according to the process and terms set out in its mandate. It is here that the panel and I go our separate ways, as I take the liberty of stepping outside political reality and exploring the conditions necessary for an improved process, a cooperative, constructive one that could reduce misunderstandings and politicized tensions, and that would be equitable and ethical. With an understanding of the contrasting values, knowledge and rationality of the two paradigms and how they shape the opposing positions on nuclear power, and of the politicized values that are more specifically a product of the conflict between the two sides, what could be done to bring about a more constructive debate? Are there any common principles that might help establish the goals of such a debate? I discuss the possibilities for such a process in the next chapter: first, the principles for determining the directions for proceeding need to be explicit.

The first conclusion derived from a detailed study of the underlying philosophical assumptions of the pro- and anti-

nuclear positions is that both are mature social paradigms. They are internally coherent and logically consistent, anchored to the physical environment by socially constructed definitions of nature that are consistent with and supportive of their respective social orders. As such, both paradigms are equally legitimate and deserving of respect. The contrasting positions on nuclear power are derived from and supported by the underlying cultural values, and are thus equally defensible.

The paradigms are also different and separate: their arguments are not symmetrical, but are embedded in separate cultural assumptions, social values and styles of rationality, and do not refute each other. The assumptions of the one side, when expressed explicitly, are for the most part the complete opposite or obverse of those of the other side. It is the separateness of the two positions and their underlying worldviews that is striking, and suggests that the nuclear conflict is not the competition of interest groups within a unified pluralistic society, but the confrontation of two cultures within one society.

Second, although these are, in the abstract, equivalent socially constructed realities, the policy process belongs to the institutionalized social order, and does not support or include alternatives. The two sides are not functioning as equal contestants bringing their divergent values and assumptions to bear on a policy dilemma that is external to them both. The dominant paradigm's mechanistic vision of the natural environment, its scientific and economic rationality of quantification and pragmatism, its values of human progress and mastery of nature, its hierarchy, market, and expert-dominated decision making are all actually in use in industrialized societies throughout the world. Its quantitative cost-benefit style of technology

assessment is the standard method employed in decisions on technology, its economic and instrumental valuing of the natural environment prevails in the market, its scientific-expert conception of credibility structures managerial as well as political priorities and decision making, its logic of economic advantage and its pursuit of technological progress shape people's livelihoods and dominate society and culture in the industrialized world.

Decision making criteria were a central concern to both sides in the scoping hearings. It was extremely important to the pro-nuclear intervenors that a decision should be made by experts, according to scientific and economic criteria. Pro-nuclear intervenors were no happier than anti-nuclear intervenors were with the prospect of seeing major policy decisions made by people whose social values and goals they do not share. The expert - lay relation of the pro-nuclear intervenors' world, however, does produce a group of people who make decisions on behalf of the collectivity and another, larger, group of people who live with decisions made on their behalf.

The values, ideals and processes of the dominant paradigm are extended through the material world to channel, control and constrain the aspirations and behaviour of all members of society, whether committed or opposed to those values. The anti-nuclear movement arose in opposition to these very values and processes, as nuclear power was seen as not only a potent symbol of industrial society but also as a crucial element in its continued development. The environmental paradigm consolidated its opposition to industrialism and nuclear power through its evolution within the framework of industrialism's institutional structure. In response, the supporters of nuclear power can use their institutional advantage to marginalize and exclude opponents, and resist

calls for more a open process, through closed decision making legitimated by scientific rationalism and economic imperatives.

The decision making process must therefore be seen as a crucial element in the evolution of the anti-nuclear position itself, and, in reaction to it, of the pro-nuclear position. This process creates pressures that opponents of nuclear power resist and react against, and this resistance and reaction are incorporated into the shape of the opposition to nuclear technology, illustrating how perceptions of technological risk become politicized symbols of general social conflict and dissent.

The terms of reference of the EARP review on the disposal of nuclear fuel waste continue this procedural alignment with the pro-nuclear dominant paradigm, and are thus themselves a deeply significant aspect of the anti-nuclear intervenors' position on the intentions of this review. The terms of the review do not capture or accommodate the philosophical assumptions of the anti-nuclear intervenors; their values, knowledge, rationality and expertise are deemed irrelevant to the issue and the review.

Finally, while the substance of each position rested on underlying values of its own broader worldview, many submissions were not presented to the panel entirely in those terms. Each position, in composite, consisted partly of positive argument in support of its own elements and values, and partly of defence and argument against the opposing position: each position was framed in part as a response to the opposing position.

Several issues were given an emphasis that was out of proportion to the emphasis given other issues of importance

in the conflict between the two sides on nuclear power. While a preferred style of social decision making is logically inherent in each worldview, the profile given to that issue by the intervenors was disproportionate to the profile given to that issue in the researchers' paradigms, and was exaggerated in response to challenges from the other position.

The pro-nuclear intervenors, for example, spent more effort defending their credibility and the technical nature of the issue against what they described as the 'irrationality' of the anti-nuclear position than would seem necessary to describe the subjects they believe AECL's EIS ought to address; their emphasis on the need to exclude opponents of nuclear power and non-expert laypeople with utopian visions of society was not necessary at all. Anti-nuclear intervenors presented not only the 'pure' core values or philosophy of environmentalism or case against nuclear power but also an argument against nuclear supporters' argument and a sharp criticism of their social goals and policy process.

The polarization between the two perspectives is becoming identified with the essence of the issue, as it structures the way each side defines itself and as the issue becomes more firmly identified with these particular two ways of interpreting the nuclear issue. It is beginning to shape the way the issue is defined and perhaps preclude other possibilities for looking at the issue. The subject of concern for both sides has become the conflict between them, which has taken on a life of its own and become self-referential and self-perpetuating.

While the core values of the two paradigms are starting points, lenses and filters, therefore, they are also static

and ideal: it would be simplistic to believe that this conflict is merely the manifestation of difference and misunderstanding. The intervenors on each side of this debate were very aware of the opposing position and the challenge it posed to their own, and each position showed a familiarity with the central points of the opposing position. But few intervenors seemed aware of, or impressed by, the deeply rooted values that underlay the position they opposed or the commitment to principle of the opposing intervenors. Participants' positions were interpreted by the opposing side as cynical attempts to protect vested interests or advance a subversive project. The characterization of the opposing argument that each side has incorporated into its own position is superficial and misunderstood: each side is thus criticizing a position it neither understands nor respects.

In addition, the social roles of expert/professional, as used in the pro-nuclear worldview, do not exist in the anti-nuclear worldview; likewise, the environmentalists' 'citizen participant' does not really have a counterpart in the pro-nuclear social order. Those involved in the nuclear conflict do not recognize the legitimacy of the roles played by their opponents or their demands for proper process; the whole function of these roles has little credibility for those in the other worldview. This mismatch in the social roles dedicated to decision making generates further misunderstanding and friction.

In their article on the social amplification of risk, Kasperson et al. emphasize that peoples' perceptions, though mental constructions that are partially collectively developed, interact with a complex array of events and social actions and reactions:

risk events interact with psychological, social, and

cultural processes in ways that can heighten or attenuate public perceptions of risk and related risk behavior. Behavior patterns, in turn, generate secondary social or economic consequences but may act also to increase or decrease the physical risk itself. Secondary effects trigger demands for additional institutional responses and protective actions The social structures and processes of risk experience, the resulting repercussions on individual and group perceptions, and the effects of these responses on community, society, and the economy compose a general phenomenon that we term the social amplification of risk (Kasperson et al. 1988 178-179).

If we wished to take the long view, we might note that both sides in the nuclear debate appear to fit the pattern of socially constructed realities struggling for legitimacy and getting caught in "incoherence across paradigms," and that this conflict is an example of what societies do as values and worldviews shift and social transitions occur. The social order that is institutionalized has control and will use the available means to maintain it; other strategies are available to the challenging alternative. Legitimacy and control are the stakes sought by all participants, and the strategizing is not confined to one side.

As the dominant paradigm loses credibility and struggles to retain control as well as legitimacy, the prevailing vision of the future appears less inevitable: progress towards industrialist social goals as 'natural' is challenged by the alternative as destructive, and in fact contrary to nature. To environmentalists, further progress towards industrialist social goals is resisted as it deepens the commitment of society to the dominant human-environment relation and diminish possibilities for conceiving of alternatives.

Evaluation of Principles Underlying Present Process

The long view is not usually taken by those living in the societies in conflict, however, and it is not one that is helpful if reducing social tension is an objective. It seems necessary to get inside the conflict and to take a position on it. Given the emphasis in the foregoing analysis on understanding and equity, this effort should be based on principles to which both sides feel some loyalty, to ensure that the result is greater equity rather than a different sort of inequity carried out by the other side. Fortunately, there are some common principles that point to the adjustment of internal inconsistencies in process, and some structural explanations that can help guide this process. In some cases, it amounts to calling the dominant side on its own principles.

First, the dominant paradigm attempts to maintain and extend its predominance not by force or other control but by authority, by legitimating its application within many cultures through its claim to universal relevance, or value-neutrality. It claims, that is, to stand outside constructed realities with a special claim to "objective" knowledge that is universally relevant and superior to other traditions that are more frankly cultural. This reification of the social order is, as Berger and Luckmann explained, a typical process in the institutionalization of a socially constructed order. As such, its objectivity does not cross cultures, and in the context of this conflict has been discredited by philosophers and scientists.

"Objective" scientific knowledge is inevitably embedded in particular value positions, and the concept of objective data as the basis of credible knowledge is in any case one that belongs to the dominant paradigm as a social order.

The dominant paradigm's tendency to view social traits and cultural values as superficial and changeable, relative to its own basic definitions of human nature which it perceives to be biologically innate, appears, ironically, to be a deeply held cultural position.

The counterpart to the privileging of "objective" scientific knowledge is the marginalizing of other kinds of knowledge. The predominant definition of the nuclear waste issue as one of technical performance has allowed the pro-nuclear intervenors to dismiss anti-nuclear arguments as disorganized misunderstandings of science and irrational fears, and anti-nuclear intervenors as uninformed and not competent to participate. The opposition to nuclear power is actually, however, a coherent articulation of a cultural and political position, to which scientific and technical arguments are irrelevant. The pro-nuclear criticism of the opposition to nuclear power is not sound.

Second, the democratic principles of the legal equality of all members of society, their rights to participate in decision making and the representativeness of government are central tenets both of environmentalism and of Canada's official political ideology, indeed that of most Western industrial nations, and provides a common philosophical ground for judging political practice. Direct participatory democracy is, of course, recognized as unwieldy and impracticable in a large and complex society, and is approximated through the representation of the public by elected officials and, by inference, the institutions they administer. The legitimacy of the entire political system is in its representation of the public, or in public assent for decisions. If the representativeness of the decision makers and the policy they implement breaks down, the legitimacy of the representatives, the policy, or

the entire system may come into question.

The link from an unrepresentative decision making process back to its broader political context calls into question the democratic legitimacy of the whole political order. What the predominant decision making values, methods and processes have in fact represented is the political and industrial elite, and these interests are different from, perhaps even opposed to, those of the public. The history of closed decision making on nuclear power issues and of decision making that focusses on narrow technical concerns suggests that nuclear policy making has violated the basic tenets of democracy in systematically excluding public concerns and denying the validity and relevance of public values and opinions.

In Greverus's perspective, the dominant environmental orientation has been privileged, not only creating a landscape that is alienating to many, but also cutting off access to the decisions on the ordering of the landscape. At the very least, this suggests the need for a different process that considers the concerns of the public and represents them in decisions.

The implementation of a decision making process that is more representative and inclusive of the public would simultaneously constitute the meeting of major environmentalist demands and enhance government and institutional credibility. This is the argument of the anti-nuclear intervenors, who have demanded that governments, in effect, fulfill their own democratic obligations in adopting a more inclusive decision making process: once it is acknowledged that public values differ from 'official' ones, the elite is bound by its own principles to be more inclusive.

A more inclusive process would also, however, entail governments' willingness to lose control of the issue, since it implies the willingness of the dominant institutions to place democratic principle before economic and corporate interests. Governments' allegiances to the public and to corporate-industrial interests are coming into conflict as these interests and values diverge; as it becomes increasingly difficult to satisfy the interests of the business sector and represent the public with the same policy, the public legitimacy of unrepresentative policy and process comes to rest on ideological justifications that subtly alter the very meaning of democracy.

The bridge between democracy and expert decision making on technology has been the assumption that expert decision making represents the public interest and is thus publicly acceptable, and its correlative, the assumed tacit 'contract' by which the public give professionals this decision making authority. As we have seen, this position, which conflates 'on behalf of' and 'represents', is supported by a particular concept of reality and knowledge that supersedes other democratic priorities, and excludes the uninformed public not only from participation in decision making but also from determining what the public interest is. This gap between the public interest and public opinion, and between public acceptability and public acceptance, underlies the belief expressed by pro-nuclear intervenors that policy that addresses public concerns or reflects public opinion is not the proper functioning of representative democracy but rather the cowardly or self-interested capitulation to political pressure.

Opposition to expert representation of the public, linking democracy and technological decision making, begins from the recognition that many industrial technologies are not

socially neutral means of improving the material well-being of society, but carry an inherent bias towards particular kinds of social ideals and relations that have a profound impact on the fundamental shape and direction of society. Decisions on the use of technology therefore incorporate decisions on basic social questions that should be, on principle, accessible to the public through democratic process, a principle that becomes more urgent as expert decision making appears in fact not to represent the public.

Governments' need to use and to legitimate unrepresentative policy making processes in order to protect economic interests from public opposition erodes the legitimacy of the policy, of the sponsoring institutions, and ultimately, as the anti-nuclear intervenors have shown, of the whole social order itself. It also results in procedural strategies that complicate and perpetuate conflict rather than resolve it. As the anti-nuclear intervenors pointed out, this review of nuclear fuel waste disposal is proceeding in the absence of public debate and agreement on the use of nuclear power itself: broad public consent to proceed on the matter is lacking. A wider-ranging forum for discussion of energy policy and nuclear issues, as suggested at the creation of this review, is still under discussion and has not yet materialized; certainly it had not when the scoping meetings of this review were held. The social value and nuclear policy concerns of the anti-nuclear intervenors have never been given an open forum for discussion and they are not to be considered in this review, but the focus of the review tacitly assumes agreement on them. There is therefore no agreement on nuclear policy that could serve as a basis for discussion of the responsibilities for nuclear waste.

Principles for an Improved Process

As governments and institutions lose representative authority in decision making, the public is demanding direct participation, or representation of its expressed interests by a new type of social association or group, as the essential criterion for legitimate policy decisions. The decision making process thus needs to be changed, but change is also required in the larger political and policy structure that manifests itself in decision processes, to give some credibility to decisions and policy.

In exploring the possibilities for a more ethical process, I start with a few fundamentals, imperatives that have been voiced before and remain valid. First, this is a political conflict, in which the social vision of two worldviews is at issue, and not a simple matter of technical assessment. Therefore, a wide-ranging review of nuclear energy policy and related issues must be held, to provide the stable foundation for a review of nuclear waste disposal that an ethical process should have.

As a corollary and extension of this first observation, we may note once again that the "environment" means different things, and encompasses a different range of concerns, within the two worldviews in conflict over nuclear power. It is clearly for both sides a cultural construct that serves and supports the larger social order, and is a visible expression of that order. It is for both sides, and according to cultural geographers it must be for all societies, a defining and integral element of the social order; decisions on the environment are a key to decisions on the general social order.

To return to Jackson's contention - "the collective character of the landscape is one thing that all

generations and all points of view have agreed upon" (Jackson 1984: 8) - the concentration of environmental decision making in the hands of an unrepresentative elite is a violation of the essentially collective nature of the environment as a cultural artefact and element in social reality. Denying access to the full range of political implications embedded in the environment is an expression of frank cultural dominance and a betrayal of democratic principle. The appropriation by an elite of decisions on the manner in which society will relate to the environment and will use and act on it is a profoundly political measure that blocks or undermines the cultural integrity of subordinate or alternative social orders.

Once the environment is recognized as more than a collection of physical characteristics and biological materials that support life, its political relevance becomes more than the provision of an adequate supply of an adequate quality of those materials. The concept and process of an "environmental review" must therefore be adapted to accommodate the concerns that all participants consider relevant to the issue. Enfranchized citizens in a democracy must have the right to participate in more decisions on the environment than whether a technological installation will cause physical harm to them or their local landscape. Participation and the giving of explicit assent to policy and actions that have a bearing on the environment and people's relation to it should be seen as inherent in, or an extension of, the political participation promised by democracy.

It is important to specify that, although the process needs to be changed to accommodate subordinate viewpoints and concessions are asked of the dominant side, that side too must be respected and represented in any equitable process.

Perhaps the most crucial factor is that scientific expertise is required in the evaluation and operation of technology, and that the importance of competence and accountability must be acknowledged. Risk analysis and risk management remain important undertakings; the question is within what social framework these will operate.

Second, this review ought to be participatory, inviting and needing the input of the interested public from scoping through a decision. Third, following from the first two points, the terms through the entire course of the review should be structured to accommodate and require substantial input from all participants, and both major 'sides' from concept through to decision making and adoption of a solution. To do otherwise is to use public participation to seek legitimacy for one side, in terms that do not threaten its position and interests. Dorothy Nelkin lists five questions that help in the search for a process that is acceptable to cynical opposition groups:

- How are the boundaries of the problem defined?
- Who participates in the experiment?
- Who conducts the procedure?
- What is the distribution of technical expertise?
- Is there really a choice? (Nelkin 1979: 60)

Achieving agreement on a review structured on the principles raised in Nelkin's questions will clearly be a key obstacle to be overcome. The different groups, as we have seen, have different ideas of what public participation ought, ideally, to be. In their study of public inquiries in Canada, Salter and Slaco noted that in some reviews the proponents of projects may be more inclined to use public involvement in order to get an idea of the level of public tolerance for impacts, and what and how much would need to be offered to offset those impacts.

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The public, on the other hand, was more likely to see its involvement in hearings for technical assessment as a demand for power sharing (Salter and Slaco 1981 166-169). Clearly the two worldviews' perceptions of the fundamental nature of social policy making and of public participation in it are at odds: they will need to be aligned in the exercise of designing a process that is satisfactory to all participants. Agreement on the definition of the issue and the subjects to be discussed would also need to be reached. Meeting these conditions would require a great deal of work. They amount to the willingness of, in this case, the dominant pro-nuclear party to relinquish control over the agenda.

To continue the focus in this paper on the subtle, embedded conditions that privilege certain values, information and knowledge and marginalize others, in the following section I ask what are the possibilities of compromise, commonality, or accommodation between these two social groups, and how can they be most enlarged and enhanced? Can a process simultaneously acknowledge the legitimacy of both value systems and reduce the tension of the politicized positions so that a more cooperative and productive process can take place? What conditions of the terms of discussion are most congenial to such a process and most likely to produce it?

To address these questions I have used the intervenors' submissions to the scoping sessions and retained their focus on nuclear waste management; in effect, I have used the scoping hearings as a separate review to help determine how the nuclear waste issue could best be approached. The assumption is that the most constructive debate is the one in which both sides have equal status, equal input, and equal relevance to the issues under discussion.

CHAPTER 7

A NEW PROCESS: ENHANCING POSSIBILITIES FOR ACCOMMODATION

In this chapter I analyze the foundations and dynamics of the conflict over nuclear power, and of the conditions under which potential commonalities could be enhanced and optimized. The overall goal is to achieve an equitable process and reduce the misunderstandings and 'cross-cultural' communication problems that plague the "debate" on nuclear energy so that discussions can proceed from a common understanding of the issues. The ultimate, and idealistic, goal of such a process would be the negotiation of a compromise or common position on nuclear power in Canada that respected both sides' visions of society and relations with the environment, and arrived at a renewed and widely acceptable process for policy making.

The basis of this conflict is clearly the difference in worldview of the major parties involved, but much of its contentiousness derives from a lack of understanding of these differences and the strong undercurrent of political rivalry. Clarifying the principles under discussion and the misunderstandings on them may at least allow participants to clarify the areas of disagreement and begin a more level-headed negotiation on them. This goal assumes that the resolution of this issue is properly the province of social debate, and that there is no solution which is inherently preferable.

This analysis steps back from supporting or advocating one side or the other and insists on the deprivileging of one side over the other. It thus assumes a willingness of participants to be similarly depoliticized and adopt as a common goal the primacy of a constructive, equitable debate

that is not fraught with layers of misunderstandings, challenges and defenses. The previous analysis, however, has suggested, in part, that these layers of defensive responses to perceived threats are not simple mistakes that have led the parties astray from the agreement they both desire: they serve the political purpose of legitimation of the broader social orders that hold or seek control. The assumption of the general desire for equitable social decision making, instead of a process that maximizes the advantage of one's own side, is unrealistic, and it is not really expected that participants will embrace their opponents' ideals, once they understand them, and rapidly reach some consensual compromise between the two value systems. It is recognized, however, that the alternative to developing a more equitable conceptualization of this conflict and process for addressing it is the perpetuation of the contentiousness, an escalation of the politicization, and continuing paralysis on the matter itself.

Nelkin argues that consensus in many social disputes over technology is not possible. While an optimum process cannot be generalized, the provision of certain conditions "will allow dissenting groups to express their concerns and to communicate effectively with administrative agencies . . . [and] . . . may reduce public mistrust and hostility toward political and administrative institutions in order to at least allow detente" (Nelkin 1979 64). These conditions are "a 'formula' that gives due weight to social and political factors; appropriate involvement of affected interests; an unbiased management; a fair distribution of expertise; and a real margin of choice" (Nelkin 1979 64).

In this analysis I do not attempt to select a formal process style, with the following qualifications. As

discussed in the previous section, based on the understanding that as values shift the traditional and present process is not only inequitable and undemocratic but has in fact contributed to the hostility and contentiousness of the conflict, the analysis begins from some founding assumptions, derived from Nelkin's conditions and applied to the nuclear conflict. The process should be participatory, the participants should come to the process as equals, and no values, of either side, should be privileged or marginalized by the definition of the issue of the terms of the process. The final decision should remain to be determined by the participants.

In addition, some procedural features of a process do have a bearing on the productivity of a review. "Real participation," as Salter and Slaco observed, is not easily achieved when relations between parties are adversarial. They suggest that a cooperative process demands "a series of informal, and, wherever possible, private meetings" (Salter and Slaco 1981 180). They also noted that in the Porter Inquiry on Electric Power Planning in Ontario, the "real" inquiry "centred in the give-and-take discussions that took place through many forums" (Salter and Slaco 1981 88). As we have noted, Shrader-Frechette finds that situations in which there is some possibility of cooperation allow for negotiation between parties (Shrader-Frechette 1991: 206-216). A cooperative situation in which participants may discuss and negotiate with each other may be the best one for finding some real and persisting agreement on this issue. Discovering the conditions most amenable to cooperation, to set the stage for negotiation, is thus an important goal in determining the most appropriate terms of a review of nuclear waste disposal.

The tasks of this analysis are the adjustment of conditions

to those that are congenial to an equitable, cooperative process, designed with an understanding of the values of both sides so that there is sufficient "room" for the unconstrained negotiation of positions on both sides. In addition, it seeks areas of convergence that may already exist or may be enlarged on so that cooperation on a shared objective becomes possible, once misconceptions and defensiveness are cleared away. What principles, values, or goals do the participants share, that may bring them together in seeking a resolution to this conflict? Clearing away misconceptions and defensiveness so that areas of agreement and disagreement may be clarified for constructive negotiation is the first, and by no means simple, step that is addressed here in the distinction between 'core values' and 'politicized positions'.

I have explored which conditions would be most conducive to reducing politicized polarization in the conflict and building on seven "areas of convergence" I have identified that seem to be amenable to negotiation: working from an analysis of the context in which the conflict was sustained, I attempted to determine which conditions would best maximize the areas of convergence that seemed theoretically possible and facilitate the negotiation of more detailed or creative resolutions. This is not an attempt to predict where attitudes may converge in the future or make a blueprint for engineering attitudes in the present, or to minimize the very real differences in values that produce a genuinely difficult conflict on the disposal of nuclear waste. It does not discover any ground that is broad enough to support a workable compromise position. The convergence that does exist, however, represents an opportunity to achieve some agreement on goals and solutions, and hence cooperation, and any degree of this is preferable to almost total opposition in which

success for one side must come at the expense of the other.

The Structural Assumptions of this Analysis

The Role of Core Underlying Values

Reducing the adversarial nature of this dispute and focussing on principles or objectives that all participants may share is the key in this exercise. Setting out the areas on which agreement between the two sides already exists, or may exist, is a necessary first step in creating a situation of cooperation from which further productive discussions may develop. It has already been noted that a review of nuclear waste disposal should properly build on a prior agreement on the role of nuclear energy policy in society; in the absence of that agreement the 'unfinished business' of the broader social values is not only unavailable as a foundation for directing discussions on nuclear waste disposal, but actively obstructs these discussions. The values that shape positions on nuclear energy policy must be dealt with for ethical reasons in themselves, and also so that the pressing matter of nuclear waste disposal may be resolved.

In the absence of such agreement in practice I have dealt with the underlying values in principle in such a way that they are, for the moment, less contentious and may provide some common ground for proceeding: I have asserted that all participants' fundamental underlying values, as expressed by intervenors to the scoping hearings, are legitimate and should be understood and respected by all participants. Neither value system is to be selected as more legitimate and neither is to be marginalized.

I have used the device of 'fixing' the underlying assumptions of both sides to define the values that should

be respected. A composite set of values can be made up that includes both sets, more or less by simply merging the two. This is possible largely in the sense that the paradigms themselves do not preclude it; because they are not, in most of their theoretical features, incompatible. For instance, material sufficiency, the use of and dependence on the natural environment to supply material needs, and trading have been essential and valued in human societies; but they have also been balanced and shaped by cultural contexts and philosophies of nature that gave them meaning. And while scientific rationalism is essential for discovering certain kinds of knowledge about the world and the state of the environment, social values and cultural knowledge require a more subjective and collective kind of knowledge.

This is explicitly a device pressed into service in the effort to make the most of an opportunity to review the management of nuclear waste, not to preclude the necessity of holding an open debate on nuclear energy policy: indeed, the areas of convergence discussed here could be applied to a review of nuclear policy. This device should also not be pushed too far: the worldviews are different, even contrasting, and the objective is not to wrestle their values into one composite value system or to attempt to direct the course of future value change. The objective is to recognize that in many respects the two value systems are not mutually exclusive but could be complementary, with each outlook seen as one half of a whole system.

The assertion that basic social values should be respected is grounded in the recognition that the major participants in this conflict are representatives of two worldviews that have coherence and integrity in their own right. It would be inappropriate, and futile, to attempt to mediate deeply

held values: such an approach could threaten values that should be respected, encourage the perception that the 'best' values or those most persuasively argued are to be selected, and would derail the more concrete focus of the review. In the artificial context of this analysis the simple adoption of core values expressed by both sides will stand for the preliminary stage in which basic terms are discussed and agreed by both sides.

The inclusion and validation of all core values is a necessity for building on more concrete areas of convergence, and constitutes an essential pre-condition for the subsequent exclusion of value issues from active debate, as required by the precept that it is unethical and pointless to negotiate core values and the recognition that a mandate that is too broad is unmanageable. A fair, constructive debate can proceed only from a premise that is not itself in dispute, and dispute is no longer necessary when respect is assured and exclusion not permitted. Participants may then align their views of the common goals towards which they are all working within the process as the inclusion of all values, since the only concession required of each side in the adoption of the two sets of values is that of exclusivity. The exercise thus shifts from efforts to discredit and marginalize the opposition's social values to a common effort to find a solution to the problem at hand that respects all values and violates none.

This approach assumes the education of each party of the philosophical assumptions, and justifications, of the other, in order to bridge Milbrath's "incoherence across paradigms" (Milbrath 1994: 117). A crucial first step, therefore, is the mutual learning about both sides' values and the logic by which they are justified and form a coherent worldview. This might take the form of prepared

reading material and then discussions to familiarize all participants about their opponents' views. A close look at their own values and their underlying assumptions can also provide participants with a valuable perspective on what is ethical and 'true', and serves as a prelude to the continued learning and provision of information and education relevant to the issues of concern to both sides. Without such an improved understanding, in a spirit of respect and recognition as a precondition for further discussions, it is pointless to proceed to the next step of a process that accommodates the values of both sides.

Once it is accepted, a set of theoretically compatible values can form a foundation for discussion that can be acceptable to all participants, from which areas of convergence on more concrete issues can be derived. It can form the theoretical 'shared ground' that is essential for any cooperative discussions: it also constitutes the more or less formal recognition that value positions are legitimate, thus making them present and accessible as essential elements to be considered in the future evaluation of possible decisions. The negotiation of solutions is carried out on the understanding that as all of these values are legitimate, none should be violated. The accommodation of the values in the composite set thus serves as a central criterion for the acceptability of solutions proposed.

As discussed earlier, this perspective on the core values and their important role in an improved process assumes a process that can acknowledge and accommodate the complete composite set of values through the process to a solution or decision, or participants' efforts and goodwill are betrayed. Asking participants to respect core values is futile if the process marginalizes certain values and

concerns. The undertaking must be conceptually consistent if it is to be an honest attempt to accomplish its stated goals; the conditions of the review must accommodate and protect all core values.

The Role of Politicized Positions

A set of compatible values that are not up for discussion forms an essential and - relatively - non-contentious foundation for discussions on other matters. While an important condition for a constructive debate on concrete issues may be the assertion that values are different but equally legitimate, and that intervenors' values will not be subject to pressure for change or compromise, outlining the elements of the debate that should remain intact is only one aspect in conceptualizing the structure of the conflict and how it should be approached. It is clearly desirable that something in this conflict be subject to mediation and change.

As we have seen, the two worldviews in this conflict have different relations in theory and in practice. In the actual, politicized conflict over nuclear power that has pitted the two value systems against each other, each side claims exclusivity, attempts to discredit and displace the values of the other, and attributes motives of political strategizing to its opponent. The sentiment among many of the intervenors at the scoping hearings seemed to be that a 'victory' consists of the defeat and exclusion of the opposing side's concerns and objectives. This attempt to claim exclusivity poses a threat to the credibility and viability of the opposing side.

The core underlying values that define the two value systems in themselves are relatively constant, and distinct from the politicized positions that have developed in the

actual social conflict. The politicized positions are context-dependent: they develop in response to the social and political conditions in which the conflict has evolved and are used strategically in the conflict, often in defense of core values that have been threatened or marginalized. These conditions are partly the escalating rhetoric of the ongoing conflict, and partly the material structures of process, accessibility to decision making on issues, the definition of the relevant aspects of an issue, and the admissibility of knowledge about an issue. Change in the politicized positions is dependent on changes in those conditions: acknowledging the legitimacy of both sets of core values and their validity as relevant factors in decision making, suggested as the foundation for discussion, is an important first change in these conditions that could begin to reduce the conflict.

Resolving the conflict over nuclear power will involve more than a manipulation of ideas or the construction of a composite position that might overlap enough with the two polarized positions that it would be acceptable to both. Many positions have developed in, may even have been produced by, the social context that has for many years defined the nuclear power issue and the debate over it. An analysis of the relation between elements in the two positions and the social dynamic is necessary, as is an analysis of what conditions would facilitate the changes that are desired in this conflict.

Though the politicized attitudes that have escalated through the history of the nuclear conflict may not have the same inviolability as the core values do, they are not trivial and there is no assurance that they will be easily mediated. The strategic importance of some politicized positions may make them indispensable to some committed

intervenors, and others will simply not want to compromise; certainly a strategic position on one side will not shift unless there is perceived to be a real concession from the other or certain key conditions change.

AREAS OF POSSIBLE ACCOMMODATION BETWEEN PRO- AND ANTI-NUCLEAR POSITIONS

This section begins with the composite set of core values that form the common foundation for discussion, and derives from them a set of seven "points of convergence" on issues that are more properly matters of debate within this review, respects in which values of the two positions may be common. These points are not the essential core values that are acknowledged but not debated, but the 'politicized' positions that need to be negotiated. The first two points are aspects of fundamental principles that are central to the specific concerns expressed about the nuclear debate. Many of these overlap each other, as they are different angles on the same underlying values. In particular, ii) on knowledge is paralleled, in a more political sense, by iii), on expertise. These statements have been structured to capture the sense in which, or the degree to which, they might be acceptable to both sides, and as such are undoubtedly incomplete and unacceptable to either side without qualification. They are intended to serve not as end points but as starting points for discussion of differences in values and the possibilities for compromise.

The analysis explores the direction discussions on issues of immediate concern to the review could take to accommodate core values, and the broader conditions that would best enhance and support any theoretical convergence.

The objective was to maximize complementarity and convergence, partly by respecting core values and avoiding forcing issues of intractable difference, and partly by examining what real changes in conditions could open the most space for the two sides to find agreement.

Summary of Underlying Assumptions of the Two Outlooks

Pro-Nuclear

Nature is material resources that are bound by physical laws, and should be managed wisely for greatest long-term human utility

Knowledge is objective, fact-based and verifiable, value-neutral; achieved by specialized expertise, a primary and indispensable element in major policy decisions

Economic growth and material progress permit the improvement of the human condition and are the essential good for all of society; their achievement is a moral duty

Anti-Nuclear

Nature is an organism, or complex web of life, and has intrinsic value. It forms humans' physical, cultural and spiritual context. Nature is limited and fragile, and humans should live in harmony with it.

Knowledge is contextual, subjective and cultural, rooted in value assumptions: public concerns and values are crucial components of major policy decisions, and participation and political access to

decisions are fundamental tenets of democracy

Economic activities and material progress should be guided and balanced by other social and moral values

Points of Convergence

- i. It is desirable to be in a strong economic position; governments and institutions have an obligation to manage public money responsibly.
- ii. Credible knowledge is empirical, a product of close observation and experience.
- iii. Experts and specialized knowledge are influential within the scope of their fields; participants in decision making have a responsibility to be informed.
- iv. Public acceptance legitimates policy decisions.
- v. Those who produce the waste, or benefit from its production, should take responsibility for its disposal.
- vi. Future generations should not be burdened with the management of our waste.
- vii. Humans depend on the natural environment for survival: risks to the environment and human health should be evaluated in detail so they can be avoided or minimized.

Analysis of Agreement, Difference and Potential for
Commonality

- i. It is desirable to be in a strong economic position; government and institutions have an obligation to manage public money responsibly.

Pro-Nuclear Position Interpretation Achieving an advantageous economic position is a very strong focus of the pro-nuclear intervenors' pro-growth values, as a lack of economic strength is seen as the source of much of the world's misery; and poor health, social injustice and environmental degradation are understood to be the consequence of economic weakness and improved by economic growth. Economic activity is driven by the need to generate social affluence and improve living conditions, and in turn drives progress and the improvement of social conditions; it benefits all members of society. Many pro-nuclear intervenors believe that if we need a nuclear fuel waste repository for ourselves and can provide income and employment for Canadians by opening it to other countries, we should not pass up the opportunity.

Technical experts insist that the reduction of risk beyond a reasonable level literally costs more than it is worth: the money must come from somewhere, and may have been diverted from, or could have been allocated to, a project that could save more lives. When public money is distributed the net benefit to society must be considered.

Anti-Nuclear Position Interpretation A comfortable standard of living is important, as is the ability to improve one's financial situation and get employment that brings a measure of economic autonomy and self respect. To many environmentalists a certain standard of material and

economic sufficiency is a basic human right. Thus equitable distribution of social wealth is a basic ethical obligation, and the accumulation of excess private or corporate wealth is disapproved. Purely economic values, perceived as the ongoing pursuit of wealth, do not supersede other values and are not, by themselves, a sufficient basis for important decisions. In fact freedom from economic hardship is important precisely because it frees people from having to subordinate other activities and values to making money. Basic domestic economic ethics are strong - you can't have what you can't afford, and it is irresponsible to overspend on one thing so that other important things cannot be done. For environmentalist, anti-nuclear intervenors, the pursuit of financial gain through an activity that is already unacceptable is a travesty. Making money on evil deepens the evil: a commercial repository, and perhaps 'compensation' for hosting a repository, falls into this category.

Differences What appears to some decision makers as environmentalists' blindness to the costs of demands for increased regulation, stricter standards and lower emission levels may be a measure of their lack of integration with mainstream society and their lack of identification with decision makers and purse holders. They may not feel part of the same society and share responsibility for common problems; many environmentalists believe that industrialists, with their overriding concern with economic performance, do not share or understand the concerns of the general public.

Potential for Commonality Within certain limits and in certain contexts, improving economic conditions is a common goal. Material benefits could be valued by environmentalists when they are not so diffuse as to be

abstract or illusory, or appear to be purely financial and accrue to an elite: residents of a proposed host community would want to see genuine employment possibilities, for example, for a long enough period that the community does not undergo a short 'boom and bust' cycle. Environmental intervenors are sensitive to the possibility that the relatively weak economic situation of a community places it in a disadvantageous position, vulnerable to being 'bought off', to accepting something a community with a stronger economy could afford to reject.

Acknowledging the validity of non-economic values, to prevent economic rationality from encroaching on other values, would bring the values of both worldviews into balance as criteria for consideration. Imposing a corporate sort of economic rationality for policy decisions that involve personal, community and environmental values may inspire a backlash against economic values. Being careful to respect and make efforts to accommodate values other than economic ones may begin to assure the public that some cooperation and accommodation are possible.

Any economic benefits or compensation offered may be more readily accepted if they are equitably distributed, and are compatible with, or even advance, non-economic values. Economic benefits should not violate or conflict with non-economic values, or place people in the position of having to make a direct tradeoff between economic benefits and other values.

- ii. **Credible knowledge is empirical, a product of close observation and experience**

Pro-Nuclear Position Interpretation The knowledge of this worldview is that of science; the world to be known is

an amoral material mechanism and set of physical phenomena distinct and separate from human nature. Thus the knowledge that is important and credible is knowledge that is objective - that which is external to the mind, or "does not belong to the consciousness or the perceiving or thinking subject but what is presented to this" (OED).

The individual gains trustworthy knowledge through the systematic and disciplined observation of phenomena. To this core of the definition of knowledge science adds objectivity, verifiability and quantifiability - observation that leads to credible knowledge is systematic and analytic, independent of social pressures and values, and free of emotion and subjective impressions. Some of these aspects of knowledge follow from, and are made necessary by, the variable and undependable nature of human sensory perception, and the fact that the laws of nature may be obscure and imperceptible to normal human perception. The weight of credible knowledge is therefore often located outside primary human perception - in instruments, measurements, quantitative data manipulated according to mathematical procedures, and careful application of scientific method.

Science has a fundamental faith in the necessity and appropriateness of breaking subjects into component parts and studying phenomena in detailed isolation, and in the dependability of quantitative and, more recently, computerized models of natural systems and predictions of their future behaviour. Science seeks universal principles and laws in a quantitative, abstract model of the world; it is associated with the values of managing and 'improving' nature for the progress of human society.

The fundamental assumption is that the essential objective

reality exists under all the social and subjective interpretation and projection, which must be stripped away. Essential and extraneous or information must be distinguished if definitive knowledge about a subject is to be attained, and scientists endeavour to keep their personal values and subjective impressions to a minimum in their professional work. Science involves the separation of fact from value, the definition of issues in terms of what is objective and what is subjective, and the designation of issues to a particular discipline and field of expertise. The essential data and process to apply to the analysis of an issue must be identified.

Anti-Nuclear Position Interpretation A core value of environmentalism is that the natural world is, variously and among other specific interpretations, an organism, a complex web of life in which human life and culture evolved and to which it remains closely linked, and infused with spirit and related to the human spirit. To environmentalist intervenors objective fact, though it may contribute something important about the physical mechanisms of natural processes, is only partial knowledge. Values are no less "real" than facts are. Personal experience and feeling, knowledge that is subjective - that is "belonging to, . . . due to, the consciousness or thinking or perceiving subject" (OED) - are important ways of gaining an otherwise unattainable depth of knowledge about a world to which humans can relate in different ways. Respectful observation, experience and learning from nature are highly valued pursuits of knowledge, from which important lessons for humanity can be derived. The knowledge that is relevant to a society is integrated with its values and its social order, not rootless and isolated from its human context. People, especially elders and other respected members of the community, are thus the

repository of important knowledge.

The environmentalist intervenors conceive of knowledge as more synthetic and holistic than analytic; they are less likely to separate objective, factual knowledge from subjective value perceptions, and do not necessarily rank fact higher than value. To them such separation is not desirable, as value issues are implied in the actual implementation of any decision on nuclear waste disposal, and is equally not possible, as certain cultural values are embedded in scientific rationality and technical assessment. The particular and the experienced, the meaning and the social relations, are of interest in this worldview. The non-scientific approach to knowledge contributes many different kinds of knowledge towards a position or an opinion, and is thus less concerned with making clear distinctions between facts and subjective experience: these distinctions often get blurred.

Differences Strict scientific rationality carefully and deliberately confines knowledge to objective, verified fact to learn about a material, external world, while environmentalists have a more inclusive concept of credible knowledge that combines facts with subjective elements like cultural values, experience and feelings to know a world that interweaves matter and spirit. Environmentalists want to engage the faculties that science subordinates, and value the knowledge gained by those faculties, which science considers peripheral or even distorting. The argument, therefore, is a complex one over the nature of the knowable world, the validity of emotion, values and subjective perception, and the sufficiency of objective fact in arriving at credible knowledge about something.

Environmentalists' dispute with scientific approaches to

knowledge may range from an acceptance of traditional, non-scientific kinds of knowledge to a more studied and political anti-science. Either way, they are not satisfied with the sufficiency of objective data and the abstract claims of science and technology, and may disapprove of many of their aims and methods. Some of the incompatibility is a product of mutual misunderstanding and reactions to perceived threats. Part of the difficulty scientists have with the lay perception of risk and technology, for example, seems to derive from scientists' own perception of lay attitudes as random misunderstandings - attempts at scientific assessments without the proper background - made within their own value system, instead of grounded in a very different set of values and beliefs that has its own internal logic. Lay attitudes to technology may thus be dismissed by scientists as silly, wrong, or subversive.

Scientists also, through their own efforts to distinguish fact from hearsay or hypothesis, dismiss knowledge simply from personal experience as not credible - if it cannot be verified, or was not reached through proper scientific process, it cannot be counted as knowledge.

Environmentalists interpret this dismissal of their important knowledge as a lack of respect for their fundamental values and a direct threat, and respond with a politicized perception of experts as directly aligned with industry and government. Facts become constrictive, oppressive, and susceptible to manipulation, instead of vital knowledge about the world.

The different concepts of credible, trustworthy knowledge shape correspondingly different concepts of the basis for credibility of, and trust in, individuals. While pro-nuclear intervenors stress their institutional credentials,

explicitly regardless of their own personal values, anti-nuclear intervenors are more likely to emphasize the gaining of trust through experience with an individual and his or her values, aside from, or at least in addition to, impersonal credentials. Each side has been seeking its own kind of credibility in individuals on the other side, and attempting to establish its credibility on its own terms among individuals on the other side - this cross-cultural communication problem has resulted in much distrust and suspicion.

Potential for Commonality In recent years science's focus on verifiable facts and its exclusive claim on credible knowledge have begun to break down, as the values embedded in science itself have been acknowledged and it has been more widely agreed that while science is attuned to certain aspects of objective reality, it simply has nothing to say about other aspects of reality. The emerging position is that science has been at fault not for being embedded in a particular social order and value system but for claiming that it is not, and for, in the process, subordinating other value and cultural concerns to the 'objective' scientific and economic facts that are in fact its own culture.

Values are known through non-scientific means, but are not less important than facts. Many scientists have a growing respect for the deep empirical knowledge of the natural environment that is possessed by many indigenous cultures, for example. This could easily bring together a Native elder and a professional biologist, who from their different perspectives know and respect the environment. Both sides respect concrete and extensive knowledge about a subject, and individuals who have spent years in careful study and observation of a subject and have accumulated

knowledge and experience. Concentrating on the kind of knowledge shared by both groups - empirical rather than analytical or computer-modelled projection - could include both groups in discussion and establish some common ground to build on.

If values and objective fact were acknowledged as equally valid, important and necessary components of balanced knowledge about the world, technical expertise and public concerns would be in more even balance and equally available to be respected as legitimate. This does not mean they are the same thing or can tell us the same things about the world, only that a policy decision needs both components to be complete and legitimate. Introducing subjective impressions and values into pure scientific research remains a flaw, and violates a core value: science must retain its criteria of credibility for its own enterprise. The knowledge produced from that research, however, is information to be used in decision making, not the decision itself. Intervenors from both sides could acknowledge that specialized expert knowledge is a necessary component in good decision making, just as physical mechanism is part of our knowledge about something, and that formulating a complete policy position requires a debate of the value implications of various technical options. Scientific knowledge would thus become important input to a broader decision making process, rather than constituting the decision itself, moving from a leading to an associative role. This suggests, of course, the presence of a prior and continuing broader social agreement on the validity of the policy or project that science is to advise on.

Both sides have been caught in the confusion of technical arguments made to support value positions, which an

acknowledgement of the validity of value concerns could begin to resolve. Values are embedded in technical assessments made of ostensibly purely technical issues, and environmentalists have been criticized for attempting to use technical data they do not understand in order to make what are clearly value positions and for pressing for unreasonable controls on minimal technical risks. If technical terms were no longer the only legitimate terms in which to make an argument about the desirability of nuclear power and the acceptability of the waste disposal concept, value positions could be defined explicitly in more appropriate terms without being bad science, and science could make its contribution without carrying disguised value judgements. This might also relieve the need to express opposition to technology in technical terms, addressed through extreme and costly regulation.

- iii. **Experts and specialized knowledge are influential within the scope of their fields; participants in decision making have a responsibility to be informed.**

These statements are about competence, its definition, application, credibility, and limits and obligations, and overlap heavily with the subject of knowledge discussed above. In principle, both sides respect competence, expect that decisions on matters of specialization will incorporate the best expert advice, and demand accountability of experts in influential positions. Both sides also asserted that participants should be 'informed', that individuals or groups who have not devoted sufficient time and effort to the subject under consideration should not be involved in decision making.

There seem to be three components to this principle and the

disagreement over its interpretation and observation. The first stems from the scientific and the non-scientific styles of rationality and the development of a credible opinion on a subject; the second concerns the determination of which are the essential issues to be debated in the conflict - which in turn defines the expertise and the cognitive slant that will dominate; and the third is the more political struggle between representatives of each side, who attempt to define the other out of contention.

Pro-Nuclear Position Interpretation One of the strongest features of the pro-nuclear intervenors' submissions was their insistence that only those with the appropriate credentials in relevant fields should contribute a formal opinion on the subject. The fundamental ethic is that decisions on certain specialized, particularly technical, matters, require expert advice, and that expertise in a specialized field is required for a contribution to a decision in that field. The knowledge itself is complex, requiring specialized education, and the cognitive tools for interpreting the knowledge are specific and learned. There is an identification of the issue with its expertise, and a social responsibility of experts for decisions on matters within their field. Professional associations feel this responsibility very strongly, and license and regulate their members to ensure the protection of the public - hence also the protection of the integrity and authority of the profession and its practitioners. Competence is earned in terms of valued knowledge and institutions - technical expertise accredited by professional bodies. Being 'informed' is thus a matter of having the appropriate credentials in the field defined as relevant.

The issue of nuclear waste disposal is, to pro-nuclear

intervenors, clearly one that requires the advice of specialized experts. Most of them argued that it was, particularly in the context of the EARP review, almost exclusively a technical issue, capable of being assessed in isolation from social values and policy issues. To them arguments by the public on social policy were irrelevant and costly distractions from the real issue. Non-experts' concern with social policy as it related to the use of nuclear power suggested a lack of understanding of the relevant knowledge, confusion of emotional issues with scientific fact, and a desire to twist emotionally loaded issues to accomplish political ends.

Anti-Nuclear Position Interpretation Environmentalist intervenors agreed with the principle that deep and extensive knowledge is required to reach the best possible decision on a subject - taking into account their interpretation of knowledge, which insists on the inclusion of values and gives more weight to the wisdom and personal experience of a respected member of the community than to an unknown accredited expert in computer modelling. Their main claim was that they are informed, on the issues they consider central to nuclear policy: a wider range of concerns than technical ones are directly relevant to the nuclear waste disposal question, and expertise on these issues of social values is also required for a good decision. Technical expertise as commonly employed in decision making is seen as giving an arm's-length sanction to decisions already made by government or industry elites, in order to override public opinion. To environmentalists, competence and credibility are earned in terms of individual values and trustworthiness, confirmed by the trust of the community and demonstration of personal integrity and loyalty to shared values.

On the matter of being informed, anti-nuclear intervenors agreed with the principle that participants in decision making must be informed, arguing that they needed proper time and resources to develop a credible case for their position. They claimed, however, that the review process was structured to prevent them from doing so. Once again the dispute centres on the definition of relevant information, with implicit agreement that uninformed and unprepared intervenors are not credible.

Differences The two important points of contention derive from the principle that participants should be informed: what are the definitive issues on which participants should be informed, and what kind of knowledge constitutes being informed. The principle that participants ought to be informed is being conflated with the dispute over which issues are relevant: not salience, but control of the agenda, is at issue.

The anti-nuclear intervenors interpret the pro-nuclear intervenors' insistence on applying exactly the right knowledge and expertise to achieve the best decision for the public in an important technical matter as staking out exclusive ownership of territory in a matter of central political and economic importance, and attempting to gain control of the agenda. In this sense the experts appear to work for the elite, who are seen as supporting nuclear power for their own profit. The pro-nuclear intervenors see the environmentalists' insistence on being involved as meddling with subject matter they know nothing about and for which they show no respect.

As discussed in the section on knowledge, in addition to the value assumptions that are implicit in scientific technology assessment, pro-nuclear intervenors made many

explicitly value-based arguments on behalf of nuclear power and the acceptability of the waste disposal concept. These values were not supported by the intervenors' technical expertise, simply related to them; however, these intervenors seemed to use their technical credentials to legitimize their inclusion of value issues in a technical review.

Potential for Commonality Anti-nuclear intervenors will likely continue to resent technical and scientific experts and challenge the validity of expertise in general, as long as these experts' fields continue to define the nuclear power issue. Including 'expertise' from other traditions, such as Aborigines and environmentalists, would improve representativeness, but the logical extensions of that step are significant. First, it could be done successfully only if the knowledge valued in non-scientific traditions is also perceived as legitimate. Second, broadening the definition of credible knowledge to include non-scientific knowledge broadens the definition of the issue; non-scientists fully informed on cultural, political and social policy issues will not necessarily come to the conclusions that scientists do.

The two groups share a strong tradition of respecting the opinion of members of society who know most about something - a better decision will be reached if those most knowledgeable are consulted - and agree also, with qualifications, that those who participate in decision making should be informed on the issues. In addition, there seems to be agreement that decisions on certain matters require the input of an expert in that field - efforts to repair environmental damage, for example, will be successful only if the damage is accurately identified and the appropriate remedial measures employed. Respect

for expertise and for the complexity of some subjects is not at issue here, except for the very polarized. Competence is sanctioned as an important principle by both sides, as long as it remains in its appropriate role. It is when experts and expertise deny the credibility and relevance of other traditions' knowledge and concerns about a subject that they are resented.

An objective in finding commonality on the use of expertise might be to consolidate agreement around the value of detailed and extensive knowledge of a subject, and respect for the complexity of subjects that require expertise and the competence of those who possess it. In practice, to protect the integrity of scientific and technical expertise while diminishing the perception that expertise is simply a layer of elite decision makers and managers, it might help to clearly link the application of relevant expertise to particular technically complex questions or tasks that have the assent of the public. This expertise will need to function within a broader framework of social decision making, however, to establish among environmentalists and other members of the non-expert public the belief that professionals do work for all of society, as they profess to do, and not just the elites: they will need to be seen as helping to implement decisions approved by the general public instead of effectively being the decision makers. That, in turn, depends on the admission of value issues and public concerns into the debate.

With respect to the responsibility of decision makers to be informed, aside from the question of deciding formally what issues are relevant for participants to comment on, providing all participants with equal and adequate resources for preparing their cases to the Panel would ensure that all intervenors may become well informed on the

issues that concern them and avoid the perception that a prior determination has been made of the relative importance of technical and non-technical perspectives.

iv. Public Acceptance Legitimizes Policy Decisions

Pro-Nuclear Position Interpretation The pro-nuclear intervenors accept the political principle of democracy, but are comfortable with the provision that only those who are "informed" should be allowed to participate in making decisions on matters of expertise, which follows from the definition of some issues as purely technical and others as political. The professional's obligation to protect the public good involves the responsibility to make decisions in the best interests of the public, on behalf of the public - to represent the public in matters of relevant professional expertise. The public is assumed to share the desire to achieve such a 'good' decision and thus to delegate such matters to professionals in the interests of good decision making, and to accept decisions made in this way on its behalf. Public acceptance thus melds with public acceptability, which has clearer criteria and can be determined by experts. If the experts have properly taken care of public acceptability, a tacit ratification is assumed that translates as public acceptance.

Anti-Nuclear Position Interpretation The environmentalist intervenors stressed that genuine democracy should involve greater actual participation of the public, and that many decisions defined by experts as being technical matters are also matters of social policy and as such are political and of legitimate concern to all. The public has a right to be involved in decision making, and decisions made by elite or special-interest groups are not legitimate. Public participation in decision making is essential for the development of legitimate and

authoritative policy, which reflects the values of the public and not just technical and economic standards. Thus the public ought not only to declare its acceptance explicitly, but also to define the criteria of acceptability.

Differences The pro-nuclear position's particular definition of rationality and credible knowledge and of the essential nature of an issue are built on an objective reality that is known through training, and converge to define a specific group of people who are qualified to participate in decisions on that issue. The anti-nuclear position, in contrast, is more likely to hold that a decision is made right by the assent of the public, not by an assessment of technical or economic feasibility, and that the right to participation would in any case supersede the value of any possible "objectively right" decision imposed.

This is a highly political issue, involving different conceptions of what democracy ought to be and how well the present system achieves that ideal. It pits representative democracy as a practical and legitimate process against a more participatory democracy in which many citizens do not wish to have decisions made on their behalf by members of an elite. The non-expert public appears to hold different values about nature and technology than experts do: a representative process without agreement on basic values begins to look like elite dominance, and certainly suggests that policy made by decision makers may not reflect the public's concerns.

There will be strong disagreement over what kind of participation the public ought to have. Environmentalists talk of 'meaningful' participation, and take seriously the

responsibility to be informed; they mean participation in or at least contribution to the decision making itself. Those in the dominant paradigm might agree that the public ought to be able to contribute to the process, but would maintain that decisions would still be made by experts, professionals and governments.

Potential for Commonality There is a strong case for including the public in decision making to some degree; democratic philosophy itself guarantees the public some involvement. Decision processes may be in a period of transition to more participatory and less closed decision making styles, particularly on environmental matters. The belief that policy should reflect public concerns incorporates an acceptance that a decision made by experts and managers on behalf of the public is very different from one made by the public, and that non-technical concerns are both legitimate and relevant to technological policy decisions. Values and the democratic principle of public participation should be protected from being subsumed into professionals' responsibility to act and give advice in the public interest. These values should retain their independent identities, integrity, and realm of operation.

Innovative processes will need to be devised for reaching large numbers of the population, as will principles and mechanisms of integrating input from such processes back into decision processes, and balancing expert and lay opinion on technical matters. A genuine willingness to open the process would diminish the perception that the requirement to be informed on a narrow technical conception of an issue is merely a device for excluding the unwelcome opinions of a suspicious public, subject to the need for expert advice on complex matters. For their part, interested members of the public will need to develop ways

of being involved that fit within financial and practical limits, and of including people who are informed on the issues and can make a constructive contribution. Greater involvement could improve the public's understanding of the financial and operational constraints that decision makers contend with, enhance the development of shared understanding and goals, and produce policy and decisions that have more legitimacy and greater public support. More importantly, public participation in decisions is increasingly seen as a necessary precondition to the public sharing of costs and responsibility associated with a major social undertaking, such as nuclear power.

- v. Those who produce the waste, or benefit from its production, should take responsibility for its disposal.

Pro-Nuclear Position Interpretation For the pro-nuclear side, this is an ethic by which this society and this generation take responsibility for the consequences of their own actions, and which ensures that those who have not benefitted (those in provinces without nuclear energy, for example, and future generations) are not saddled with waste they had no role in producing. It is based on an inclusive vision of society, in which economic activity is almost by definition a good thing for all members of society. "Those who produce, or benefit from the production of" nuclear waste is thus all of present society living in a jurisdiction that receives nuclear-generated electricity or related economic activity, and all of society should share the costs of waste management.

This interpretation of the responsible position is aligned with a confidence in the technology of nuclear power and in

the value of its benefits. Willingness to accept a share of responsibility for the disposal of nuclear wastes implies a confidence in the viability of nuclear power technology, which itself offers assurance that the wastes from the production of electricity with nuclear power can be managed responsibly.

Anti-Nuclear Position Interpretation For anti-nuclear intervenors, assigning responsibility for the waste to those who produced it or benefitted from its production is more an exclusive than an inclusive formula. The decision to proceed with nuclear power and the benefits of its operation are seen to belong not to everyone but more narrowly to economic and political elites, and to the industry itself. Thus the general public - or, variously, residents of economically disadvantaged Northern Ontario, Native communities with no electricity service, or those who did not approve of the use of nuclear power to generate electricity in the first place - does not share any responsibility to dispose of the waste.

For environmentalist intervenors, a genuinely responsible attitude to the disposal of nuclear waste is set in contrast to the approval of the generating technology, and is defined as acceptance of responsibility contingent on a commitment that no more wastes would be produced and that decisions made include consideration of the public's concerns.

Differences There are several fundamental issues encapsulated in this one ethic, most centrally the basic conception of the technology itself and hence the meaning of the disposal of its wastes. The terms on which some environmentalists were willing to accept responsibility for disposing of nuclear wastes would be completely

unacceptable to industry and supporters of nuclear power. Those terms seemed to be that nuclear power itself should be acknowledged as a terrible mistake whose costs and risks are enormous and whose benefits are debatable and selective; the acceptance of responsibility for the wastes would mean the end of that energy technology and the cessation of continued waste production. Accepting responsibility for an ongoing process that facilitates the continuation of the technology is seen to be a distinctly irresponsible act that sanctions the perpetuation of the damage. When the central issue at stake is the continuation of the technology, accepting in principle or categorically refusing responsibility for the wastes becomes the main bargaining point.

The "burden of the wastes" may also be perceived differently, depending on the interpretation of the value of economic activity and of the natural environment. Aside from different perceptions of risk and of the natural environment, different cultural patterns of getting a livelihood from the land change the weighing of a physical risk to the environment. If a resource is depleted, for example, an industry changes suppliers or moves its operations and continues its activities - it retains its identity and may even improve its economic position. An Aboriginal community, on the other hand, may interact with the land in such a way that the depletion of a resource, the contamination of a river or the driving out of wildlife constitutes a major cultural crisis. Certain physical changes to the environment thus actually present markedly different threats to different cultural systems. The failure to perceive the importance of the loss of something derives from, of course, a prior failure to understand its value.

Potential for Commonality The kernel of agreement on the acceptance of responsibility for the wastes remains the 'formula' - that receipt of benefits ought to imply a share of the costs - but the interpretation and application of this formula are contentious and the ground of agreement may be narrower than for other issues. Willingness to accept responsibility for something depends, of course, on what that responsibility entails. For environmentalists and those who suspect they may be asked to host a repository, the nature of the burden could be more important than the benefits received. Clarifying definitions, concerns and objectives may allow some progress in discussion, as financial costs borne by the whole country will not be the concern of the communities in the regions where the waste is disposed - there will be values and features in the present community that need to be identified and protected. Some confidence that there is understanding of and respect for the different conceptions of the burden involved, and the context in which they would constitute a burden, might facilitate arrangements that could mitigate burdens that are particularly onerous or destructive. Such arrangements might include routing of transportation and its infrastructure, timing of transportation to and construction and operation of a facility, or avoidance of certain sensitive or culturally valued regions. The 'benefits' side of the tradeoff can more easily be established when the burden it is to offset is known.

A deeper understanding of the legitimate differences in the valuing of benefits could locate some area for agreement. Some convergence on the value of a healthy economy, and its value in relation to other community values, and on different cultural valuations of economic benefits might advance discussions on which groups have received,

benefitted from and valued the 'products' of nuclear power. Environmentalists might consider, for example, what stake they, their communities and their employment may have in the continuation of the nuclear industry, how they could be affected by a closing down of all industry-related activities, and how important is a stable domestic energy source. To be credible to environmentalists, discussions on this matter would have to be free of 'advertising' by proponents: the question would then be what credible person could provide the necessary information.

Assignment of public responsibility for costs and burdens will not be possible without inclusion of the public in decisions establishing policy on the matter. Some real movement on the inclusion of the public will be essential if the public is to be asked to accept these costs.

Beyond the discussion of 'internal' arrangements by participants willing to consider different options, the whole issue of responsibility may be one of the most difficult and contentious in the nuclear waste debate. It contains within it the pivotal question of whether accepting responsibility for the wastes is a matter of putting a stop to the production of more wastes, or of putting in place a safe management process for managing the end-stage of the nuclear energy cycle. It is here that the need for a broad social debate on energy policy and the use of nuclear energy is most pressing, and the absence of it most obstructive to progress on nuclear waste management. Environmentalists can be expected to use the strategic potential of the relation of responsibility for nuclear waste to approval of nuclear energy, in order to force attention onto the unresolved status of nuclear policy.

- vi. Future generations should not be burdened with the management of our waste.

Pro-Nuclear Position Interpretation To the pro-nuclear intervenors, this ethic drives the search for a waste disposal technology. It acknowledges that the present generation has produced wastes that will remain toxic for many hundreds of years, and that it has a responsibility to bear most of the costs of managing that waste and for ensuring that it will not endanger humans and the environment in the future. Although they generally approved of the proposed disposal concept, many pro-nuclear intervenors argued that the wastes should be retrievable in the future, should economic factors or technological improvements make that desirable.

Anti-Nuclear Position Interpretation Anti-nuclear intervenors were intent not so much to deny the pro-nuclear interpretation of this ethic as to add another dimension to it. They were concerned that a technology designed today to avoid placing responsibility for the waste on future generations would also remove the possibility that future generations might exercise some control over the waste disposal technology, whether simply to monitor and repair problems or to retrieve the waste for another use. This concern may be derived from a greater scepticism about the social consequences of technology and the confidence that can be placed in it; ensuring that future generations would not be bound by our technology, or presumably to any technology and its managers, is an important concern of environmentalist intervenors. There is also, implicitly, a resistance to the entrenchment of the commitment to nuclear power and to the dominant human-environment relation that it facilitates.

Differences Many environmentalist intervenors expressed some cynicism about the stated ethical responsibility of this generation to manage its own wastes, and suspected that it is a cover for the industry's desire to remove the public relations problem of nuclear waste from the public mind and thus improve the market for nuclear technology, and perhaps create a commercial repository for international wastes. This cynicism about the actual ethical intentions of the industry may originate in the unfavourable perceptions many environmentalists have of the value of economic activity and powerful social and economic institutions. For pro-nuclear intervenors, safe nuclear waste disposal is a responsible act that solves a major difficulty in a good technology, protects the future of an industry and ensures an adequate energy supply for the future. For environmentalists, on the other hand, it must be the regretted remediation of an admitted error and dangerous practice - a concession to harsh reality that should not sanction further waste production and should not be turned into a commercial venture.

Potential for Commonality If agreement is reached that disposal is to be carried out, clarification of intentions for future generations may lead to agreement on the control future generations have over a disposal technology. The two interpretations of the obligation to future generations need not undermine each other and the technology may be able to accommodate both concerns. The different emphases on retrievability - pro-nuclear intervenors wish to accommodate the possibilities of a higher economic value of nuclear fuel waste and future technological improvements, and anti-nuclear intervenors wish to ensure that future generations are not bound by our technology - also agree that future retrievability of the wastes should be built into the design of the disposal technology. Moreover, the

reasons are not incompatible, so implementing that feature in the technology would not give one side an advantage that could be opposed by the other.

With respect to the cynicism of the anti-nuclear intervenors about the 'real' motives of the industry in establishing a nuclear waste repository, willingness of the proponent and the pro-nuclear intervenors to investigate how increased control of the technology might be given to future generations could help improve relations and actually lead to a concrete agreement on this issue that would satisfy both sides. Likewise, willingness to discuss and negotiate the desirability of a commercial repository could help reduce such 'politicized' cynicism about the actual intentions of the industry in claiming to be motivated by ethical principle.

vii. Humans depend on the natural environment for survival: risks to the environment and human health should be evaluated in detail so they can be avoided or minimized

Pro-Nuclear Position Interpretation In the dominant worldview, humans control nature, but it is understood that natural resources are the basis of all human life and the economy. This is the central notion of sustainable development: we must adopt ways of doing business that do not deplete the environment, so that development and economic growth are viable and sustainable activities.

Pro-nuclear intervenors are concerned that credible research should lead to the establishment of safe and reasonable standards and levels, and that the public and regulators recognize that a certain acceptable standard is

genuinely safe. Further efforts to reduce a risk below a certain level not only cost more than can be justified but may introduce even greater risk. Efforts to reduce physical risk levels in response to public concerns that are grounded in value conflicts, instead of in actual risk, fail to address the real problem and may divert funds from other projects. This is a matter of a quantitative, objective measure of physical risk to health or the environment, and a tolerance of risk levels that are measurable but not harmful, and that may in fact be smaller than naturally occurring levels. It also reflects a concern for economic costs, for the fact that money is contributed by all citizens and must come from somewhere, perhaps other worthwhile projects, and that its use should be justified.

Anti-Nuclear Position Interpretation The environmentalist conception of human dependence on the environment is a philosophical relation derived from a moral interpretation of a physical relationship, and involves proscriptions against human attempts to dominate and control. This dependence is also an interdependence, as humans are seen as an integral part of a natural system that they have an obligation to respect, and extends to a spiritual connectedness to nature. The insistence that physical dependence on nature entails a social obligation to respect the limits and integrity of natural systems also stands, however, as a block to the development of social relations of hierarchy and domination.

Non-scientists and environmentalists are often more concerned with the consequences of a risk than with its probability, no matter how small; with contaminants that are man-made, rather than naturally occurring; and with risks that are imposed, particularly by industrial

activities that already lack credibility. Here again is the incorporation of facts with other values, such as the lack of faith in the honesty of regulators or in the ability of science and technology to detect and contain contaminants, in the formation of a general attitude. Sometimes this can be a matter of contamination by principle rather than by measurable quantity of a toxic substance. The anti-nuclear intervenors hold a different sense of the natural environment, and may fear for and grieve for the loss or damage of a particular landscape, even if the damage is not scientifically significant. And some physical effects might present an actual threat to a certain way of living on the land, but remain genuinely insignificant to others.

Differences The differences between the dominant and environmental worldviews on the natural environment, with respect to what it 'actually' is and how humans and society should relate to it, are considerable, despite the convergence on the physical dependence on resources, and are as well politically loaded. A culture's credibility, legitimacy and practical ability to sustain itself as it is constituted are dependent on the credibility and the continued physical feasibility of its particular way of defining the environment and deriving from that a way of behaving in the environment. The divergence on this value underlies many other environmental disputes, including that over logging, and the wider environmental context is likely to ensure that the issue remains contentious.

The gap between the two positions on this matter is the one risk researchers have noted between expert risk assessment and lay risk perception. The crux of the matter is the incorporation of non-scientific cultural values, social relations and other non-technical issues into a perception

of the acceptability of a technology, versus the more mechanistic, quantifiable conception of physical risk posed by a technology, relative to the risk posed by other technologies, that is congenial to a scientific worldview.

Each group's interpretation of the other is couched in its own terms and projects assumptions that are not in the other position. Anti-nuclear intervenors, believing that nuclear power is, for a whole constellation of reasons, uniquely dangerous, assume that supporters of nuclear energy are simply willing to tolerate that high risk, and impose it on others, because it offers attractive financial and political benefits. Pro-nuclear intervenors, who in fact perceive nuclear power as posing a relatively low physical risk with which they are quite comfortable, assume that opponents of nuclear power are either overly anxious about science they do not understand or are using the threat of danger to accomplish purely political ends.

Potential for Commonality The statement that risks to the environment and human health should be evaluated so they can be eliminated or minimized probably goes too far for many pro-nuclear intervenors and not far enough for anti-nuclear intervenors. The difference is not only a matter of degree, however, but derives meaning from the complex of underlying values about such issues as the environment and style of rationality. Nevertheless, in agreement is reached to dispose of the waste, ensuring that a disposal method is safe over many years for human health and the environment would be a common goal. Competent evaluation of physical and environmental risks from technology is essential - it is important to know how many people will be affected, and in what way, or what the environmental impact may be, as a result of a technology, regardless of how favourably received it may be. Risk

assessment must remain as an area of qualified competence, within a framework of publicly accepted technological options and actions on the environment.

Identifying accident and contamination possibilities and the need to reduce them to some minimum could serve as the basis for discussions on what this means to both sides, how their concerns could be addressed, and how monitoring and compliance would be carried out. Expertise would be required to achieve this objective, of course, and it is in this type of function that expertise might be least controversial, clearly acting in support of goals determined by the general public in a separate policy process.

Conditions Required to Facilitate Constructive Debate and
Suggestions for Building on Potential for Commonality: a
Compilation

Conditions that Facilitate
Constructive and Equitable
Debate

i) It is desirable to be in a
strong economic position;
governments and institutions
have an obligation to manage
public money responsibly

acknowledge validity of non-
economic values

ensure that economic
rationality and values do not
encroach on other values

encourage a sense of
responsibility among public
for the costs of regulating
physical risks of technology
by increasing public
participation in decisions on
technology; and by recognizing
validity of non-technical
concerns about technology, to
remove need to express all
concerns in terms of technical
risk to be minimized

Possibilities for Building
Commonality on Nuclear Waste
Disposal Issue

focus on importance of
reasonable level of material
affluence as a common value

ensure that economic benefits
described or offered do not
conflict with, or force a
trade-off with, non-economic
values

ensure that a community's
economic weakness is not
exploited with offer of
economic incentives that may
violate or undermine other
values or benefits

focus on economic benefits
that converge with, or could
enhance, non-economic values

Conditions that Facilitate
Constructive and Equitable
Debate

ii) Credible knowledge is
empirical, a product of close
observation and experience

acknowledge validity of non-
scientific rationality and
knowledge, within their
spheres

science should function within
a broader framework of social
consensus, serve as a support
to social policy

Possibilities for Building
Commonality on Nuclear Waste
Disposal Issue

emphasize knowledge and styles
of rationality common to both
groups - observation and
experience

stress science and expertise
as necessary components in
research, monitoring, and safe
and effective implementation
of technology

clarify which areas require
input of scientific expertise,
and which are matters of
broader social value and
policy

point out matters of
importance and relevance to
review that are of non-
scientific and non-technical
nature

Conditions that Facilitate
Constructive and Equitable
Debate

iii) Experts and specialized knowledge are influential within the scope of their fields; participants have an obligation to be informed

expertise should operate within broader agreement on social policy, assist in implementation of policy, to be, and be seen to be, a public service

expertise should be seen as directed to specialized needs and applications rather than existing as a generalized body of policy makers and managers

Possibilities for Building
Commonality on Nuclear Waste
Disposal Issue

focus on competence, accountability and expert advice as a service

certain issues require expert advice

request specific advice of those with extensive knowledge on important scientific and non-scientific matters, including technical and scientific experts, community leaders and elders

where possible link expert contributions to particular questions or tasks

participants should be provided with equal information, time and other resources to prepare submissions

Conditions that Facilitate
Constructive and Equitable
Debate

iii) cont'd **Experts and specialized knowledge are influential within the scope of their fields; participants have an obligation to be informed**

iv) **Public acceptance legitimizes policy decisions**

legitimate policy incorporates what public has genuinely accepted: decision making terms and process should accommodate values and knowledge of public participants, and should have flexibility to allow public preference to be reflected in final policy

public's right to meaningful participation should be protected from being overtaken by experts' responsibility to public good

Possibilities for Building
Commonality on Nuclear Waste
Disposal Issue

participants should be informed on their issues, be prepared to explain their positions in appropriate terms

reach people to involve and inform them so they can contribute what they believe is important to the debate and decision

determine how to balance opposing or incompatible claims and concerns from science and non-science, and how to represent these in a decision, so that final policy may reflect both position accepted by public and technical competence

Conditions that Facilitate
Constructive and Equitable
Debate

v) Those who produce the waste, or benefit from its production, should take responsibility for its disposal

public assumption of responsibility for costs and burdens of nuclear waste disposal is contingent on public assent to nuclear policy, participation in decisions on nuclear power and waste disposal

Possibilities for Building
Commonality of Nuclear Waste
Issue

ensure involvement of public in defining waste disposal issue; permit and encourage potentially involved communities to define matters of concern

clarify different conceptions of the burden, costs, and benefits of managing the waste

consolidate understanding of what is valued and potentially at risk from disposal installation; examine how these could be avoided or mitigated, and how benefits offered could compensate for or offset threat or loss

Conditions that Facilitate
Constructive and Equitable
Debate

vi) Future generations should
not be burdened with the
management of our waste

forum for broad debate on
energy policy could reduce
cynicism about this official
ethical principle as
motivation for nuclear waste
disposal

open discussion of the
commercial considerations of
waste disposal, and
negotiation of possible uses
of and technical adjustments
to the technology, would
permit more constructive and
cooperative debate and give
credibility to review exercise

Possibilities for Building
Commonality on Nuclear Waste
Disposal Issue

discuss possibility of
adapting technology to
facilitate future retrieval of
waste

clarify objectives and
rationales for preferring
retrievability, to ensure
compatibility

encourage discussion of
probability and desirability
of future commercial
repository

Conditions that Facilitate
Constructive and Equitable
Debate

vii) Humans depend on the natural environment for survival: risks to the environment and human health should be evaluated in detail so they can be avoided or minimized

broad social policy agreement necessary on disposal of waste, for technical details to operate within and support

Possibilities for Building
Commonality on Nuclear Waste
Disposal Issue

focus on shared sense that safety of any installation is crucial

clarify standard of safety and environmental integrity to be enforced (categories of risks, environmental parameters to be considered, elements to be monitored and to what specifications)

enlist appropriate expertise to ensure proper implementation of designated tasks

CHAPTER 8

CONCLUSION

It is an inescapable observation, from the analysis of the intervenors' positions and the analysis of areas of possible accommodation, that one side in this conflict is clearly caught in an outsider position while the other is strongly identified with the power centre in society and with the terms of the EARP review. The process is aligned with and congenial to the values and objectives of one side, and ill-suited and constraining to those of the other: suggested improvements in conditions include a disproportionate number of concessions to the side that has been marginalized. In terms of the active influences in the conflict over nuclear power, the decision- and policy-making process itself has to be seen as a major and definitive contributing factor.

I have focussed my attention on the conditions and process that could, in an ideal world, give both sides in this conflict fair and equitable treatment in an environmental review. The broader conditions I have assumed for the possible areas of accommodation may turn out to be necessary conditions for the kinds of progress I have suggested. Working backwards, it must be questioned whether achieving agreement on certain issues would be possible without an acknowledgement that both sets of underlying values are legitimate and should be respected, and whether that step in turn would be possible without an acknowledgement that value issues per se are valid components of decisions on nuclear waste decisions.

If agreement can be reached that disposal of the wastes should proceed, the manner of its disposal may not be so

difficult to negotiate. Both sides in this dispute are concerned that any disposal method and facility that is established must be as safe as possible, for the environment and human health in the near and long terms, and that public money not be wasted to achieve this goal.

It may prove to be a major challenge, however, to reach explicit agreement that the waste should be disposed of. The complex group of issues embedded in the notion of assigning or distributing responsibility for managing the wastes could paralyze efforts to move on to practical considerations of disposal. Even more difficult is the very real possibility that environmentalists may refuse to negotiate anything that leads to the disposal of the waste without the explicit termination of the continued use of nuclear power, even though they would very much like to see the wastes safely removed from the face of the earth, because any type of disposal would have the effect of sanctioning nuclear power and the production of more waste. Almost any disposal option, with almost any concessions, would constitute the only victory that matters for the industry and the crucial loss that could not be mitigated for environmentalists.

For this reason very committed environmentalists may believe that the only position that can be taken is the steadfast opposition to any kind of disposal. The difference between one manner of disposing and another is of much less significance than the difference between sanctioning or blocking the continuation of nuclear power. If the requirement is that a concept for disposing of the wastes be approved, some environmentalists would probably refuse to be part of such negotiations on the shape of something they oppose categorically, in any form. The absence in this issue of any shared overall or final goal,

which could be kept in sight as negotiations proceed on details, complicates resolution. The lack of agreement on nuclear energy policy that has been perpetuated by the absence of a satisfactory public review of the subject threatens to obstruct progress on the matter of nuclear waste disposal, and thus perpetuate the contentiousness of that matter as well.

Is there any condition, in the absence of a complete review of nuclear policy, that could be attached to approval of a disposal concept or method that would satisfy environmentalists' concern with the generating technology itself? Is there any way in which approval can be given for a disposal concept that will not have, in time, the effect of sanctioning the continuation of the industry, and thus favour in that essential matter the pro-nuclear values? Perceiving the essence of the issue and the conflict as they do, environmentalists may reject efforts in a review to legitimate underlying values and then disengage from them as the focus moves to details of actual disposal; agreeing to discuss possible compromises on the actual form of the disposal implies agreement that it should take place, a concession they may refuse to make.

The political dynamic that drives this conflict is a testament to the central importance to both sides of social relations, of cultural independence and access to decisions of the direction and the future of society. It is a testament as well to the implications for social relations of technology and of the environment: policy on these areas is a matter of integral cultural and political concern. The major irritant is technology, which is opposed on several related fronts. First, technology is itself inherently political, and the increasing commitment to the use of technology in society brings an increased dependence

on technical frameworks and expertise in decision making, which pulls the political approach to decisions on technology away from the social values prevalent in the non-expert public. This results in decisions that do not represent public values and opinion, and a violation of basic democratic principle.

Second, the use of technology and the economic development that it serves are blamed for environmental destruction that has reached crisis proportions throughout the entire world. The protection of the environment is the protection of clean and sufficient natural resources for humans and other life forms, as well as the protection of the integrity of a fundamental element of culture. These charges against technology coalesce perfectly to form a coherent social critique that integrates political and social philosophy with environmental philosophy, in a struggle for an emerging alternative order against a discredited opponent. This conflict is more than interest group competition in a pluralistic society; it is a cultural contest that will not be resolved through the processes currently in use.

The conflict over the disposal of nuclear fuel wastes is essentially one of the fulfillment of democratic principle in the face of a challenge of unusual magnitude and scope. If the basic principles of democracy are not met, how is the obligation to accept responsibility for nuclear waste determined? In what terms is the provision of democratic rights assessed, in what terms is the duty to share social costs assigned, and how closely should such rights and obligations be linked? The location of a possible nuclear waste repository was not the pivotal issue in the scoping hearings in this review; the pivotal issue was the terms in which the obligation to accept a share of responsibility

for nuclear waste should be established.

As constructed social realities, both worldviews are equivalent and legitimate: the relativism invoked by the acknowledgement that reality is socially constructed places both on the same level as possible social orders. It also denies any ground for external criticism and evaluation, recasting all criticism as value judgement. The loyalty to democracy of the two worldviews in conflict over nuclear power, however, permits the use of democratic principles as a standard for the evaluation of political achievement and a guide for the formulation of improved processes.

The non-representativeness of technological decision making undermines the democratic legitimacy of the dominant order, which appears as more intent on protecting its own interests by marginalizing subordinate and alternative values than on ensuring that these alternative values are democratically represented in political decisions. The increasing prominence of technology is thus placing democracy itself in crisis, as it brings the institutional base of society into conflict with democratic principle. Opponents are contesting the right of elites to appropriate the public's right to participate in the determination of the future of society, in order to take society in a direction not everyone wants to go in. They are asking, in essence, whose society is this? Whose environment is this?

The emergence of an alternative social order in a democracy places the dominance of the established institutional order in conflict with the democratic principles that give it legitimacy. It is quite clear, however, that if a society is to retain democratic legitimacy, elite control cannot be maintained when elite interests are not representative of public opinion, particularly when elite interests are seen

to be directly contrary to public opinion. The essence of democracy is the willingness to lose: the proponents of technology appear to be in no mood to make concessions, let alone lose; but they may be unable to extricate themselves from the complicated struggle for public representation that they have created for themselves unless they acknowledge that democratic legitimacy has its own set of rules and obligations.

Some scholars believe that technology is valuable enough that a means must be found to make it more democratic, so that it continues to be politically viable. Others are convinced that the implications of large-scale, complex technology for democracy and for the integrity of the environment are so destructive that society must choose to use 'soft' technologies instead: the entrenchment of a commitment to a technical-commercial social order must be blocked. In opposing nuclear power on behalf of the natural environment as a cultural referent and as a physical habitat, environmentalists are bringing technology and the environment into direct opposition as emblems of contesting worldviews. Social order, technology and the environment are the mutually interconnected main elements at issue in the conflict between the industrial and the environmental worldviews.

The environment itself is a latent but pervasive element in the opposition to nuclear technology on fundamental political principle. Rather than being completely irrelevant to people unless their local area is directly affected, the environment is a foundational and integral social construct that supports the rest of the social order and legitimates the relation a social order has with external world. What the dominant, industrial social order wants to do with the environment is use technology to

control and exploit it for the material progress of society; environmentalists want to see the environment as an organism that contains humans, and to interact with it in a more respectful and spiritual manner that is violated by the use of technology.

The implications for geography and geographers of this very political depiction of the conflict over nuclear power and the disposal of nuclear fuel wastes are quite clearly that the meaning of "environmental review" must be broadened to include the political concerns implicit in different ideas of the environment itself. An environmental review should be flexible enough to accommodate the concerns of the groups involved in any given dispute, and an additional area of research, on cultural attitudes to and uses of the environment, should be a part of the design of every environmental review. In this way environmental assessment may become a tool of democracy, rather than of partisanship.

In time one or the other of these worldviews may emerge as clearly predominant, or a new social order may evolve, through a collective and dialectical process that responds to and interprets social and natural events. It is not the role of environmental assessment to prejudge or predetermine the eventual course of this process. Based on an understanding of the culturally and politically vital character of the environment, however, it does seem to be the appropriate role of environmental assessment to accommodate the range of values of concern to those involved in a dispute over the use of the environment, and continue to adapt to the changing profile of society to ensure an honest and equitable forum for the resolution of environmental disputes.

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