Developing a Siting Strategy for a Nuclear Fuel Waste Management Facility

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Nuclear Waste Management Organization

The Nuclear Waste Management Organization (NWMO) was established in 2002 by Ontario Power Generation Inc., Hydro- Québec and New Brunswick Power Corporation in accordance with the *Nuclear Fuel Waste Act* (*NFWA*) to assume responsibility for the long-term management of Canada's used nuclear fuel.

NWMO's first mandate was to study options for the long-term management of used nuclear fuel. On June 14, 2007, the Government of Canada selected the NWMO's recommendation for Adaptive Phased Management (APM). The NWMO now has the mandate to implement the Government's decision.

Technically, Adaptive Phased Management (APM) has as its end-point the isolation and containment of used nuclear fuel in a deep repository constructed in a suitable rock formation. Collaboration, continuous learning and adaptability will underpin our implementation of the plan which will unfold over many decades, subject to extensive oversight and regulatory approvals.

NWMO Social Research

The objective of the social research program is to assist the NWMO, and interested citizens and organizations, in exploring and understanding the social issues and concerns associated with the implementation of Adaptive Phased Management. The program is also intended to support the adoption of appropriate processes and techniques to engage potentially affected citizens in decision-making.

The social research program is intended to be a support to NWMO's ongoing dialogue and collaboration activities, including work to engage potentially affected citizens in near term visioning of the implementation process going forward, long term visioning and the development of decision-making processes to be used into the future The program includes work to learn from the experience of others through examination of case studies and conversation with those involved in similar processes both in Canada and abroad. NWMO's social research is expected to engage a wide variety of specialists and explore a variety of perspectives on key issues of concern. The nature and conduct of this work is expected to change over time, as best practices evolve and as interested citizens and organizations identify the issues of most interest and concern throughout the implementation of Adaptive Phased Management.

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Developing a Siting Strategy for a Nuclear Waste Disposal Facility in Canada

Introduction

Although different policies for radioactive waste management, including nuclear fuel waste (NFW), have developed in different countries, the basic challenge is the same everywhere: finding a method and a place for isolating the radioactive waste from the biosphere. During the last decade, this issue has moved to a new phase where responsible authorities and companies are now facing the task of implementing waste disposal or management strategies. A number of countries (e.g. Canada, Finland, Sweden) are approaching or are in the stage of contemplating or implementing a management approach to isolate NFW. Concurrently, other countries (e.g. Germany, Great Britain, Switzerland) are seeking acceptable places for the disposal of low and intermediate levels of radwaste, as well as interim storage of NFW.

Despite the readiness to make use of technological achievements in order to construct the best available facilities and the creation of incentive packages attached to proposed facilities, various forms of local opposition constitute one of the greatest obstacles to the establishment of nuclear waste facilities.

While a great deal of attention both in the policy arena and in the academic literature is focused on siting controversies, it is imperative to note that increasingly, communities are coming forward to volunteer as hosts to radioactive waste facilities. Benefits to these communities are tangible and sought after. The Municipalities of Oskarshamn and Osthammar in Sweden are good examples of communities vying to host a deep geological repository for spent nuclear fuel. In Canada, the Municipality of Kincardine has emerged as a willing host to a proposed geologic repository for low and intermediate level nuclear waste. The town of Carlsbad, New Mexico is host to a repository for transuranic nuclear waste.

This paper provides a review of elements of facility siting processes by reviewing the current literature produced by social scientists. The goal is to work towards developing a framework within which a facility siting process can be established that is applicable to nuclear fuel waste management in Canada.

The 'Siting Controversy'

Owens (2004) provides an excellent assessment of the 'dominant storyline on siting controversies'. On the basis of examples of siting transport and mineral facilities in the U.K., she maintains that the underlying causes of controversy are not only procedural and are therefore unlikely to be resolved by changing procedures alone. Specifically, the nature of conflicts are not only related to national needs versus local interests, but conflicts are seen as formative in a gradual process of policy learning and change.

Owens characterizes siting controversies as generally following six key dimensions (2004 103-105):

1. There is an alleged public interest or national need for a facility which "has to go somewhere". Often, limitations are imposed based on the facility requirements thus constraining the range of acceptable locations. For example, in Canada a NFW management facility is limited to provinces involved in the nuclear fuel cycle and which have suitable geologic medium (ie. the presence of the Canadian Shield). Further, the need for a facility is articulated in the context of national priorities such as 'Canadian values' and the benefits nationally of nuclear generated electricity. Owens concludes that "the assertion that projects are 'essential' is frequently reiterated *as if* there were full consensus about need. Usually, however, there is not…." (2004 103).

2. There is anxiety expressed about adverse impacts or risks associated with particular projects, often by, though certainly not limited to, communities in the immediate vicinity of the project. The position adopted by these residents is one of resistance. Two subsequent aspects of the locational dilemma emerge. First, the spatial or technical 'fix' in which the aim is to minimize impacts through choice of location or through a variety of mitigation measures central to planning and environmental regulation. Second, the submission of proposals to various forms of assessment. An unfortunate and well documented outcome is often for locally unwanted land uses to be situated in locales that are politically weak and economically depressed.

3. The third and dominant component is that the problem is cast as one of resistance to *local* impacts or risks, so that the conflict embedded in siting controversies can be represented as primarily one of 'national need versus local interests'.

4. A set of formal procedures are instituted in order to allow local people to 'have their say'. A public inquiry or public hearings, such as those conducted as part of the EA process, are primary strategies. For most controversial projects, these processes can take a very long time. In Canada, the Seaborn Panel took nine years and for many participants, the main issue (i.e. the need for nuclear power) was never adequately addressed. Calls to streamline the procedures are subsequently made.

5. The fifth dimension is characterized by the "appeal to a rationalistic tiering system in which generic and local issues are separated and clear national strategies provide the framework within which site specific applications can be considered" (Owens 2004 104).

6. Calls for more inclusive public involvement in planning decisions constitute the final stage of siting controversies despite the fact that this call is inconsistent with proposals for streamlining. Generally, it is assumed that clear national strategies together with engagement with local communities will result in the resolution of conflict.

Owens (2004 105) summarizes the dominant storyline of siting controversies as follows:

> Major projects 'in the public interest' are controversial because their impacts fall disproportionately on local communities; as a result there are high costs and long delays

> in realizing the important benefits of such developments. Salvation lies in adopting a clear strategic framework at the national level, which will cascade down to the local level where individual projects must be accommodated. Since issues of principle will have been decided, decisions about such projects can then be made more quickly and efficiently. Whilst conflict can never be eliminated, inclusive involvement of local communities will forge consensus on what constitutes sustainable development, so that important decisions about the use of land can be made in a less adversarial way.

The characterization by Owens depicts siting essentially as a problem of policy implementation; "universal goods have somehow to be reconciled with the particularities of individual locations" (105). Of particular importance is that siting controversy is not itself seen as integral to political process in which policies are formulated, challenged and modified. Indeed, siting controversies can be seen as important catalysts to policy reformulation (e.g. construction of modern recycling initiatives to replace landfills) and that new initiatives would not have been possible without the controversies.

On the basis of her analysis of two UK siting conflicts and a review of the theoretical literature, Owens (2004) draws three main conclusions. First and most significant, the characterization of controversies in terms of national need versus local interest is inadequate and misleading. The 'national need' is often contested. Further, it falsely implies that issues raised at local inquiries need to remain 'local', and that national and generic concerns can be separated from local issues and be dealt with independently. Indeed, a "wider debate about social purposes has often been crystallized around specific development proposals" (Owens 2004 110). Debates about the role of nuclear energy and about the increasing material basis of modern society are cases in point. Thus, what is a stake in siting controversies is not just the impact on particular geographic communities of pursuing the public good but what in fact the 'public good' should be.

Second, when developments are repeatedly rejected at a local level, it becomes increasingly difficult to defer questions about the nature of growth and development (i.e. nuclear power production). Consequently, new ways have to be found to stem opposition or shifts in policy must be contemplated and acted upon. Clearly, this moves beyond the purview of local geographic communities.

Third, "restricting the scope of local inquiries risks closing one of the most important apertures through which the dominant paradigms have been exposed to critical scrutiny…" (Owens 2004 111). Debate about social purpose should be welcome as policy change emerges out of conflict. Reforms should be less about streamlining conflict and more about ensuring that biases against legitimate objectors are reduced and removed.

Garvin (2001) provides a useful framework that outlines the differences in how knowledge and information is created and used around risky and uncertain issues. Specifically, she examined the different definitions and uses of knowledge and evidence by scientists, policy makers and the public. As shown in the table below, the three groups not only have different sources for their information, but there are also disparities in each group's criteria for legitimizing supporting evidence and dismissing conflicting evidence. This begins to shed light on how a single risky environment or activity or proposal can be interpreted as a different problem by each group.

They each use evidence with slightly different legitimating criteria within their own realm. When that legitimating criteria is applied to other realms, the conflict among groups arises.

The three groups also display differences in how they conceptualize certainty and uncertainty and the way in which they understand complex issues. Scientists appear to follow the rational actor model, using probability to operationalize uncertainty and compartmentalization to deal with complexity. Policy makers adopt a more politically model based on context and evaluating complex issues on a need to know basis, weighing it against the more objective knowledge provided by science. The public's conceptualization of uncertainty seems more straightforward whereby issues are seen in a polarized certain-uncertain manner. This is due, at least in part, the public's view of science as one of many components in the social, cultural, economic and political context (Garvin 2004 452).

Conflicting Analytical Paradigms (Garvin, 2001, p. 452)

	Scientists	**Policy Makers**	**Public**
Origin of evidence	Scientific studies	Availability	Popular sources
Legitimization of supporting evidence	Adherence to scientific method	Political, social and economic implications	Received wisdom
Dismissal of conflicting evidence	Adherence to scientific method	Expediency	"Common sense"
Conceptualization of certainty and uncertainty	Probabilistic	Context specific	Polarized (either certain or uncertain
Understanding of complex issues	Compartmental	"Need to know"	Limited by sources
Resultant knowledge	Specific and Limited	Political, contextual, instrumental	Tacit, experiential, individual
What is done with knowledge	Added to cumulative body of knowledge	Applied to current situation and context only	Added to body of personal experience
Analytical paradigm	*Scientific*	*Political*	*Social*

Facility Siting: Overview

The siting of hazardous facilities is a challenge faced by many nations. With the initiation of a siting process, a familiar chain of events is not uncommon: Developers identify sites on which to build projects, communities may be fearful of the negative effects the projects may have; they are skeptical of the institutions involved because they do not trust them or that they do not see them or their aims as legitimate; communities organize and use political instruments such as protests and coalition building to enhance their political resources to resist the projects; conflict emerges; developers and regulatory agencies find it difficult to deal with community resistance; projects are stalled or cancelled or alternative management measures are sought (Lesbirel and Shaw 1999; Owens 2004; Boholm and Lofsedt 2004).

While we can accept that much siting experience in democratic countries often mirrors the above characterization, there has been a tremendous surge in attention devoted to the "siting problem' by social scientists in the past two decades. This attention has focused on numerous siting case studies from many countries and from many analytical perspectives. It is now accepted that resistance to projects is likely to emerge and that managing that resistance will be difficult but not impossible. In short, we do not have to accept that all siting conflicts will be intractable.

Siting is an inherently political process. Many of the conflicts evident in siting occur due to a divergence in the perceived value of projects to a developer and community interests; the latter referring to geographic communities and communities of interest and identity. Siting almost always involves conflictual relations among a wide range of participants both within and across jurisdictions (Lesbirel and Shaw 1999). Conflict emerges over goals, ideology, motivations, and values; disputes occur over the allocation of the burden and who must bear it, in what ways, though what mechanisms and under what conditions. Siting involves the use of power (i.e. getting groups, individuals and communities to do things that they would otherwise not do) and how that power is manifested and used by different sectors (Petts 2004).

Competing claims over values, motivations and interests are also a characteristic of siting hazardous and risky facilities (Lesbirel and Shaw 1999). Developers develop projects for both private and public interest reasons. Local interests may oppose projects because they believe that the risks are unacceptable (Slovic 1993) or that they do not want to bear the burden of hosting risky projects (Lane and McDonald 2005). Interests with the environmental movement may wish to oppose the facility on a range of environmental, ethical, political or ideological grounds. First Nations may wish to oppose a facility citing land claim and territorial legacies. Regulatory bodies may wish to encourage the siting of facilities but also require strict safety regulations enforced. Indeed, "identifying and developing ways to manage these legitimate claims represent a crucial political and policy challenge" (Lesbirel and Shaw 1999).

There is strong political motivation for dealing with the siting challenge. As Lidskog (2005) observes, despite the conflicts surrounding siting issues and the discrepancy that emerges between and within various organizations and communities, the conflicts share an important similarity; they all need to be solved. Societies need a range of projects for economic and social purposes. This is a legacy and characteristic of our industrial society. The consequence of industrialization generates demands for new projects such as waste facilities. While technology, such as recycling and waste reduction play an increasingly important role to reduce the demand for certain types of facilities, it is not likely to nullify those demands.

Siting is not just a policy problem which starts and ends with the resolution of a specific locational problem (Baxter and Greenlaw 2005; Kuhn and Ballard 1998; Hunold 2002; Lesbirel and Shaw 1999). Due to the nature of hazardous waste facilities, a range of post siting problems can emerge, including changing community dynamics, stigmatization, out migration, spills and leaks, accidents, and decommissioning. Siting is best viewed, therefore as a continuous challenge to private and public decision makers.

Both public and private institutions at different jurisdictional levels are central players in siting processes. States are key players in the management of siting processes, particularly those that

end up in siting gridlock because some projects are required to achieve national social, economic or environmental policy objectives. Government institutions are particularly important because they structure the roles, rules and norms that shape the organization and management of those processes (Lesbirel and Shaw 1999). Independent of the role, the public often views these institutions with distrust or view them as lacking legitimacy and credibility (Rabe 1994). The latter is a critical issue as it is these institutions that are designed to play a major role in the siting process. The imperative of resolving the siting problem has led some nations to institute institutional change aimed at regaining lost trust, legitimacy and credibility.

Another aspect of facility siting relates to equity and fairness. Notions of fairness are contestable and are often defined differently by different actors in the siting process. A utilitarian perspective would suggest that morally correct siting outcomes would be those which brought the greatest utility to the greatest number in society, or those which maximized aggregate social utility. Critics of this interpretation would argue that priority should not be given to ends over means, Rather, egalitarians argue that the rights of individuals should not be sacrificed for some higher purpose. Thus, they would reject hierarchical and market based approaches (Lesbirel and Shaw 1999; Linnerooth and Fitzgerald 1996).

Both outcome and process issues are central to any examination of fairness in siting. Communities may judge siting to be the imposition of a disproportionate burden on them with the majority of benefits accruing outside their community or serving interests to which they are opposed. A significant amount of research has been conducted under the 'environmental justice' heading which demonstrates that noxious facilities tend to be sited in poor, remote, and politically disenfranchised regions and communities (Bullard 1999; Hunold and Young 1998). An alternative explanation posits that facilities are not targeted to these regions but that market dynamics led to certain categories of people (i.e. the poor or members of minorities) moving to those areas after the facilities have been constructed.

The extent to which institutions and socio political processes lead to perceived structural inequalities in siting facilities is also important (the 'processes' perspective). Some observers maintain that some facility siting processes target the poorly educated and economically disadvantaged living in regions with little or no industry because these communities are unable to mount and sustain significant opposition. Moreover, the economic imperative may make them 'willing' to consider hosting a facility while more prosperous and robust communities and regions may be able to thwart the siting attempt. Thus, critics argue that the siting process is unfair and unjust. An alternative perspective maintains that all too often, public institutions responsible for siting make decisions based overly on technical, geological and/or environmental criteria and rarely provide and formal assessment of demographics, health problems and quality of life issues in the community or region (Lesbirel and Shaw 1999). These 'process' arguments suggest that siting processes, which are 'neutral' towards structural inequalities, are unjust because they perpetuate existing, unjust institutions, and socio economic structures and processes (Foster 1998). As Linerrooth and Fitzgerald (1996) conclude: "If a workable and generally accepted siting strategy for hazardous facilities is indeed possible, it will need to grant legitimacy to the different ideas of what is fair. Such a strategy must be tailored to the prevailing political culture, or the relative strengths and patterns of competing ideals of the country involved".

The relationship between compensation and siting is also important; indeed it is a crucial policy instrument in dealing with siting conflict. Where mismatches exist between who gains and who loses, and where communities have veto power, siting proponents will have to redistribute some of their gains to secure a hosting agreement. At the most basic level, communities or regions willing to host a facility must be assured that they will somehow benefit. Strategically and politically, compensation has the potential to increase the benefits or at least lower the costs to a host community or region. It also has the potential to reduce political or other resistance and as such provides a mechanism to attempt to manage the political issue of collective action against projects local communities regard as dangerous, unwanted or risky.

Communities may view the acceptance of compensation as an unacceptable tradeoff for accepting a facility, particularly if the risks and dangers are perceived to be high. Health and safety are usually 'not for sale' and are expected to be protected as a matter of course. Further, some may perceive compensation as bribes and offers of compensation by proponents are often used to shore up arguments for those opposing hazardous projects. In this sense, compensation may have the opposite of the intended effect and in successful siting projects, issues of compensation are addressed late in the process. Jenkins-Smith and Kunreuther (1999) note that with respect to radioactive waste facilities, offers of compensation either do not change the percentage of individuals supporting a repository or even decrease the fraction supporting the facility.

The Open and Closed Siting Approaches

There are two basic approaches to facility siting; the "open" and "closed" approaches. Each approach differs in its commitment to public participation and the sharing of decision-making power between the proponent and local governments and community residents. Armour (1992) characterized siting processes by the structure of their decision-making authority and control. Communities that are able to make their own decisions make siting a voluntary and cooperative process. Proponents that impose a siting decision on a community make siting a conflictive process. Kemp (1992) expanded this decision-making classification of siting methodology into a continuum of two opposing processes; the closed approach or DAD (Decide-Announce-Defend), and the open approach or ECFD (Establish Criteria-Consult-Filter-Decide). The two approaches represent extremes on a continuum of decision-making. However, the continuum suggests that siting methodologies can exhibit characteristics of both open and closed approaches.

The closed approach, relying predominately on a technical perspective, has been, until recently the most prevalent siting process (Kunreuther *et al*. 1993; Boholm and Lofstedt 2004). A major distinguishing characteristic of the approach is that the balance of decision-making power lies with the proponent, which tends to result in a highly conflict-ridden process. The lack of substantive public decision-making power, inherent stages of conflict, and inevitable confrontation mean that few attempts are made to mitigate public distrust. Instead, the closed approach engenders distrust toward facility siting, and the proponent must use defense tactics when dealing with the public (Armour 1992).

Essentially, the closed approach uses a top-down process where environmental data are used to reduce a generalized study area down to a specific site. This progressive narrowing and short

listing of environmental criteria occurs under a logically staged approach (STF 1995). Site environmental qualification is obtained through a process of progressively more comprehensive site data collection with the data being compared to progressively more stringent sets of exclusionary environmental criteria. From a strictly technical perspective, this approach to siting may have merit. Criteria selected are based on the optimal requirements for a hazardous facility to operate safely within strictly defined geologic and biophysical constraints. What is often contentious is selecting the siting criteria. This screening approach was used by the Nuclear Industry Regulatory Executive in the United Kingdom to locate potential disposal sites for high level nuclear fuel waste (Openshaw et al. 1989). It also formed the basis of the selection of Yucca Mountain, Nevada in the United States (Jacob 1990).

The application of the closed approach generally exhibits seven sequential stages:

- goal identification
- project characterizations
- selection of site specific evaluation criteria
- area and site screening
- site assessment and selection
- final detailed design
- announce site decision

Facility siting with a top-down orientation leads to only one outcome - an imposed decision (Armour 1992). Once the facility design has been completed, the site is then announced to the prospective host community. A process of education and defense of the project then begins in order to 'demonstrate' the environmental and technical credibility of the decision.

Closed siting approaches often fail because social and political considerations are not given adequate attention, not because of environmental or technical mistakes. The proponent is the major power holder in developing the environmental assessment and determining the final outcome. Announcement of the site decision after the environmental investigations have been undertaken limits any inclusion of meaningful public participation. Public input may be formally required in the review process, often in an adversarial environment with little or no scope for negotiation. As such, public input is more a cathartic process, leaving the participants feeling that public hearings are intended to placate their concerns (Arnstein 1969). The deficient power sharing, 'ineffective' participation, and an adversarial environment in the closed approach all lead to community opposition. An alternative open siting approach exists that addresses public distrust, supports more robust public involvement, and shares decision-making power.

The open approach has become the emergent siting process. Applications of the open approach attempt to overcome the social and political constraints that lead to conflictive siting problems. Therefore, a basic principle is relied on - only communities that volunteer to investigate a facility are considered as potential hosts. Instead of fighting with communities that do not want the facility, interested communities are supported. The focus is therefore primarily, but not exclusively, on social and political aspects rather than on technical and engineering aspects to find the optimal or "ideal" site. The Canadian federal government's Siting Task Force (STF 1995) followed an open approach for the siting of a low level nuclear fuel waste disposal facility.

Use of an open approach generally exhibits seven sequential stages:

- establish general environmental criteria
- broad public consultation
- invitation to participate
- consultation with interested communities
- site investigations
- referendum
- announce site decision

Communities are able to withdraw from the siting process at any time and for any reason. This 'opt out' principle protects communities from imposed decisions, and reinforces the voluntary and cooperative nature of the approach. Communities opting to remain in a siting process continue to consult with the proponent until a decision is made either 'for' or 'against' hosting the facility. A decision against hosting the facility means that the community is excluded from any further investigations.

Volunteer communities must confirm that they can provide potential sites that meet basic environmental criteria, and the majority of residents must support the project. Support for the facility is determined by a referendum, thus ensuring that local residents effectively hold the balance of decision-making power. Once a final decision is announced the proponent starts a citizen liaison program to ensure the facility operates smoothly.

The use of the voluntary siting approach and the holding of community referenda have occurred in Canada in the communities of Deep River, Ontario, Kincardine, Ontario and Swan Hills Alberta.

Deep River

On January 14th, 1995, the municipality of Deep River Ontario and the Government of Canada agreed to develop a low-level nuclear waste disposal facility. The population at the time of the siting process was about 4 300 (Hunold 2002). The wastes would include radium and uranium by-products from refining operations in nearby towns as well as wastes produced in the Chalk River Laboratories in Deep River. The community of Deep River is heavily dependent on the nuclear industry and over half of the population was employed by the AECL at the time of the siting process. 1998 ballots were cast in the referendum held by the municipality to gain support for the facility. 1439 people were in support of the facility, while 559 people opposed. The voter turn out was 62 percent of the overall population with the overall support of the facility at 72.4 percent (Hunold 2002).

The Siting Process Task Force secretariat was created by the federal government to oversee the siting process. It was reasonably successful in the initial siting phases with respect to social inclusion. Twenty-six interested municipalities sent community liaison groups to facilitate community participation in the initial phases. However, the final town referendum in Deep River only included the immediate municipality. The local community was solely equated with the

local municipality. The secretariat then ceased to regard the community of Deep River as a full partner in the siting decisions believing the cooperative approach to be *too* participatory . Communities downstream from the potential facility were given representation, but were not included in the decision-making process (Hunold 2002). Anti-nuclear groups did not participate in the siting process with any sort of consistency.

Kincardine

In the town of Kincardine, Ontario, 60 percent of the 75 percent of residents who responded to a telephone poll said 'yes' to the development of Canada's first long-term deep geological nuclear waste (LLW and ILW) disposal facility. There was 6208 phone ballots received which was a seventy-two percent voter turnout in a town with a population of 8 319. 71 percent of all households voted in this referendum. If the neutral or 'no response' answers were included as a positive indication of public opinion, the 60 percent acceptance figure increases up to 73 percent, thus leaving only a 27 percent opposition (Wilson 2005).

Those who oppose the siting of the facility claim that the telephone poll was not a formal referendum (Lindgren 2005). It was only a measure to indicate resident approval to the municipal council's decision to site a nuclear waste disposal facility (Wilson 2005). Furthermore, the decision of the municipal council to site the facility in Kincardine is seen as questionable. Many of the municipal council members were either employees of the Bruce Nuclear station themselves or had relatives who were employees or contractors employed by the station. Debates also arose due to the nature of the agreement to site the facility. Compensations payments will be halted by the Ontario Power Generation corporation if Kincardine and the neighbouring communities (Saugeen Shores, Huron-Kinloss, Arron-Elderslie and Brockton) fail to support the construction of the facility.

Swan Hills

In 1984, the town of Swan Hills, Alberta, held a plebiscite to vote on the acceptance of a hazardous waste facility. The town voted 79 percent in favour of the facility, with a 69 percent voter turnout (Rabe 1994). The facility was seen as an example of a successful voluntary siting. However, the referendum did not include input from the Aboriginal communities in the region who opposed the facility (Bradshaw 2003). The community designated with the decision-making capabilities was not necessarily concerned with environmental repercussions from the facility. There are also concerns that the facility is not upholding the terms in which the siting was agreed upon. The facility is only processing a small proportion of Alberta's wastes, and is importing waste from other provinces. Additionally, there are concerns that it may be in violation of Aboriginal Treaty Rights.

Assessments of Siting Approaches

Freudenburg (2004) offers some important observations of siting related to failed US experiences with nuclear repository siting. Specifically, his conclusions emerged following his analysis of efforts to develop a repository for low level radioactive wastes in New York State between 1984 and 1996. He identifies 'sins of commission' and offers lessons for the future.

Three specific problems were evident in New York State:

1. The use of a top-down siting approach, for a variety of reasons, generally leads to siting failure. The application of a technocratically oriented site selection process is specifically singled out. What is referred to here is the use of GIS to screen areas on the basis of numerous criteria to ultimately find the 'optimal location'. While seemingly efficient, the technique is severely constrained by the way in which relevant information is (or is not) considered or excluded from the analysis. Problems continue to emerge as areas not excluded become fewer and are examined more carefully and local citizens may know more about certain characteristics of local sites than will be available to GIS analysts. Local questioning of technical expertise invariably follows.

   The issue is compounded when siting criteria weightings are assigned for many criteria which have inexact measurements. Justification of weights by a siting commission is usually contested setting up a dichotomy between expert and non-expert assessments. Freudenburg concludes that "the simple fact of the matter is that there is no such thing as a 'best scientific combination' of weights" (2004 158). The result is that the siting proponent loses credibility.

2. A second set of problems involves the consideration of a narrow subset of predicable socio-economic concerns. This tendency is most clearly evident in the case of impacts that involve human perceptions and reactions. These impacts, moreover, "tend to be some of the most striking and consistent of all impacts associated with nuclear waste" (Freudenburg 2004 159). Although perhaps difficult to measure, impacts perceived by communities at a variety of scales and interests, are amongst the most important to the success or failure (however measured) in facility siting processes. Freudenburg (2004) goes so far as to contend that of all socio-economic impacts, those generally deemed 'non-credible' (i.e. perceptions of harms, dread etc.) were in fact the most credible and the most ubiquitous not only in New York State, but in all nuclear facility siting processes.

   Two reasons are cited in support of this contention. First, "while changes to physical and biological systems do not occur until a project leads to physical alterations, observational and measurable alterations to the human environment can take place as soon as there are changes in social and economic conditions…"(Freudenburg 2004 161). Second, the evocation of dread in human beings is one of the key properties of nuclear waste (Slovic 1993). This is known and predicable. "Not knowing that essential fact about nuclear wastes is like not knowing their half-lives…" (Erikson *et al* citied in Freudenburg 2004 161).

3. The failure to recognize the siting effort's own effects is a problem evident not just in the New York State case but applies equally to most siting controversies. This consequence clearly follows the dynamics of the interplay between the relevant officials and the affected citizens and communities. As Freudenburg (2004 161) notes, "given the impossibility of demonstrating a true 'technical superiority' for a site, … it should not be difficult to understand the intensity of reactions from citizens who learn that *their*

> backyard is the one that happens to be chosen for an objectionable site". This problem is exacerbated when or if there are indeed other sites that would also suffice. In these situations, emotions run high and frustration develops and conflict between the technically trained personnel and citizens emerges sending the whole process on a downward spiral. The most regrettable action is dismissing citizen concerns as ill-informed or ignorant or invalid. "For a community to have its reality disregarded by a powerful authority is profoundly alienating; it also leaves no common ground on which the community and the authority can stand" (NAS/NRC cited in Freudenburg 2004 162). A reasoned response by the siting authority would be to address the reasons for the citizens' skepticism. This line of action would increase credibility of the siting proponent.
>
> The major lesson here is that impacts are created "not just when people are faced with threats over which they have little effective control, but also when there are *conflicts* over whether a proposed development represents threats, opportunities or both" (Freudenburg 2004 163).

As noted by Freudenburg (2004) the existing body of literature and experience suggests that the intensity of public opposition is a function of three sets of factors. First, nuclear materials clearly do possess the potential to create significant health and environmental effects if they are not properly managed. This problem is compounded by the fact that radioactivity is not detectable through human senses. Sometimes termed *the ambiguity of harm,* the literature on technological hazards suggests that this actually creates higher levels of measurable stress than do known hazards such as flooding or air pollution. The nature of radioactivity also means that the public finds itself dependent on experts to tell them if there is a risk, if they are being exposed, how much exposure and the like (see Beck 1992).

Second, in terms of community characteristics, siting attempts have, at least in the US, tended to focus on areas that do not have a high level of confidence in public officials (e.g. New York State, Yucca Mountain and the legacy of atomic bomb testing). Thus, without an initial level of trust in the siting institutions and agencies, conflict is the inevitable result.

Third, the top down siting approach, while seemingly rational and logical, is inherently likely to generate socio-economic backlashes. Both the siting agency and the involved communities are disadvantaged in the process.

Finally, Freudenburg (2004) concludes optimistically that the literature on siting controversies does point out that citizens often do express a desire for 'the best site' or that a problem of national or regional importance does indeed need to be solved. Citizens "desire a process that is truly equitable, unbiased and fair – particularly in the sense of being fair to the values that are most important to the specific citizens involved" (Freudenburg 2004 165). Scientific or technical training do not provide an inherent advantage in making decisions that combine facts and values.

The Facility Siting Credo addresses the problem of siting facilities that are viewed as beneficial to a region but are perceived as noxious to the community that is asked to host them. The Facility

Siting Credo is a set of principles that local and regional governments may incorporate into their own siting approaches (Kunruether *et al* 1993).

1) *Institute a Broad Based Participatory Process*
Representatives from all affected groups should be invited to participate and be assisted in every stage of the siting process. This should be accomplished through interviews and surveys of key stakeholders, or the use of advisory committees who are given the resources for effective participation. All those who are affected by the siting decision should be able to review the criteria for the site selection. Groups should be allowed to criticize the recommendations of the facility proponent. Stakeholders should be able to make informed decisions about the costs, benefits and risks of a facility siting. A neutral body should ensure that information is shared effectively.

2) *Achieve Agreement that the Status Quo is Unacceptable*
A siting process must begin with the agreement that a facility is needed. The relevant stakeholders also need to know the consequences of doing nothing. Those who advocate the facility need to be precise about the results of a facility not being built.

3) *Seek Consensus*
There must be an established commitment to seek consensus. A serious effort should be made to address all the concerns, values, potential needs and wants of the stakeholders. Expertise should be complemented by local knowledge and should be subjected to public debate. New ways of framing questions and packaging trade-offs should be sought.

4) *Work to Develop Trust*
Lack of trust prevents consensus. There must be recognition of potential sources of mistrust including lack of local support, previous negative experiences, and government/institutional suspicions. Trust can be reestablished by admitting past mistakes and the avoidance of exaggerated claims and promises.

5) *Choose the Solution that Best Addresses the Problem*
A list of alternatives including the no-action alternative with their long and short term implications must be created in non-technical language for public review. Communities are more willing to volunteer to be a host if they perceive their area to be the best based upon technical and risk considerations. The choice of technology should be made with input from the local community.

6) *Guarantee that Stringent Safety Standards Will be Met*
Preventative measures to reduce hazards should be encouraged and the facility should meet health, safety and environmental standards. Interested parties should be able to provide input on any other additional standards that could be met through mitigation (such as facility design changes and substitute technologies). Monitoring and control procedures will involve the local community to minimize risk and maintain standards.

7) *Fully Address all Negative Aspects of the Facility*

When all impacts cannot be mitigated to the satisfaction of affected stakeholders, various forms of compensation can be negotiated. This may include for losses in property values, habitat loss, and the guarantee of service. A written agreement for compensation payments should be created.

8) *Make the Host Community Better Off*
The applicant will create a benefits package for the host community. This will be created so that the community feels better off with the facility than without it. Such benefits would include neighbourhood improvements, reductions in property taxes and promises to site no more locally unwanted land uses.

9) *Use Contingent Agreements*
Contingent Agreements maintain what will be done in case of accidents, interruptions in service, and the emergence of new scientific information on impacts and risks. It will specify the conditions in which a facility will be shut down temporarily or permanently. It will guarantee that contingent promises will be at no cost to those likely to be adversely affected.

10) *Seek Acceptable Sites Through a Voluntary Proces*s
A volunteer siting process is not an irreversible commitment and benefits packages can be issued. A search for volunteer communities will include an open process establishing the need for a facility, a public guarantee that the site selected will meet technical and environmental requirements and a promise that incentives will benefit everyone in the community. The final decision to accept a facility will be subjected to a binding referendum.

11) *Consider a Competitive Siting Process*
A competitive site selection process should be enacted if there are multiple volunteer sites. Potential host communities should be able to propose benefit or incentive packages for later negotiations. The advantage is that no particular community feels singled out to host a community that no other community would want.

12) *Work for Geographic Fairness*
It is inappropriate to locate too many noxious facilities in one community even if they are willing to accept them. Geographic fairness maintains equity and argues for siting several smaller facilities rather than one large one.

13) *Get Realistic Timetables*
A good siting process requires adequate timetables to allow all parties to consider all the options and technical evidence. Opponents have multiple means of slowing or halting the process if them feel excluded from the siting process.

14) *Keep Multiple Options Open at all Times*
It is never a good idea to have only one potential site because communities will feel discriminated against if they are the only place being considered.

According to Kasperson (1999), the difficulties of siting hazardous facilities are attributable to at least six issues. These issues emerge out of the "Facility Siting Credo":

1. *Unclear Need.* Although the need for a facility will be obvious to advocates and sponsors of the facility, it is often not the case for community leaders and various publics who are asked to host a facility. If the need is not clearly established, there is little prospect that a willing host will be found. Establishing need is not straightforward nor should it be taken as immutable. Examples abound where through the discussion of need, significant waste reduction has occurred (hazardous, municipal and nuclear).

2. *Lack of a systems approach.* Siting a facility should not be considered as a single case process, but one that is encapsulated in much broader systems of production.

3. *Risks and Perceptions*. Numerous issues are encapsulated under this heading including expert versus lay perceptions of risk, the qualitative properties of risk associated with nuclear materials (e.g. dread, newness), the voluntary versus involuntary nature of acceptability, the widespread increase of risk of modern society, and the social amplification of risk.

4. *Inequities*. The mismatch between the concentration of risk in the host community and the diffuse distribution of benefits or the imbalance between those who bear the risks and those who benefit from the production of the risk (i.e. northern versus southern Ontario in the case of nuclear electricity).

5. *Social Distrust.* The complexity of risk and equity problems point to the need for high levels of public trust and confidence in the agencies responsible for managing hazardous materials. In many case, the required levels of trust do not exist. Assessing trust and distrust and the sources of responsibility for them is complicated. Kasperson (1999) identifies four dimensions that contribute to or erode social trust:

    a. Commitment. Trust relies on perceptions of uncompromised commitment to a mission or goal (e.g. protection of public health) and the fulfillment of fiduciary obligations. Commitment rests on perceptions of objectivity and fairness in decision processes and the provision of accurate information.
    b. Competence. Trust is gained only when the individual or institution is judged to be reasonably competent over a period of time. Risk managers must demonstrate that they are competent in their mandated area of responsibility
    c. Caring. Perceptions that an individual or institution will act in a way that shows concern for and beneficence to trusting individuals are critical.
    d. Predictability. Consistent violations of expectations nearly always results in distrust. Importantly, predictability does not necessarily involve consistency of behaviour. The latter would require unchanging actions or beliefs, even in the face of contradictory evidence and information.

    Trust is the primary property of social capital that exists in society. It is built over time in the socialization of individuals into the political culture and in their encounter with others

in the political system. Trust exists at different levels of the political system, including at the level of the political community. Patterns of trust in institutions appear to be quite stable over time. Thus, changing levels of distrust over short time frames is extremely difficult and perhaps unrealistic.

6. *Amplification-driven Impacts*. This phenomenon is related to the *social amplification of risk* (Kasperson *et al* 1988). The social processes for depicting and debating risk provide strong signals that the risks may be more serious and difficult to manage than earlier though. In turn, these signals generate more concerns about the proposed facility and eventually alarm and controversy contribute to secondary impacts of the risk (e.g. intra-community conflicts, stigmatization, out migration, and loss of property values). "Facility siting is a prominent example of a case where amplification-driven impacts are the primary risk problem and where, accordingly, extraordinary attention to perception, inequities, trust and social processes generally is required" (Kasperson 1999).

As noted by Kasperson (1999) there are a variety of specific institutional and process mechanisms that can contribute to effective siting outcomes. He terms the recommendations "strategic imperatives".

1. *Establish Need*. Very little can be accomplished in any siting case if the societal need for the facility is not apparent. Assuming that a clear need for the facility can be demonstrated, substantial efforts are required in advance of the siting process to establish a widespread recognition and consensus that the proposed siting is in the public interest. In cases where the voluntary siting process was successful (i.e. Swan Hills, Alberta), extensive discussions commenced well in advance of initiating the siting process. "A social consensus on facility need, is an essential base on which to build" (Kasperson 1999).

2. *Narrow the Risk Debate*. In situations of polarized risk debate that generally characterizes debates about nuclear waste or other 'highly amplified risks', the failure to win consensus that a high level of safety will be achieved is usually fatal. This may lead to 'overbuilding' the safety function if the vantage point of optimizing the siting process is given precedence over optimizing technical safety. Involving the local community in negotiations about the safety and design of the facility is also a way of local empowerment and may help in establishing or reinforcing trust between the proponent and communities. Addition mechanisms may include funding for technical consultants for the community and establishing provisions for the host community to monitor facility performance with the concomitant power to shut down the facility should agreed upon standards be violated.

3. *Assume Trust does not Exist*; *Act to Deserve it*. Many siting processes are initiated under conditions of high social distrust. The conditions under which trust may be recovered or strengthened is difficult to assess. It has been demonstrated that an asymmetry principle appears to prevail for trust in which it is more easily lost than gained and attempts to regain lost trust have generally been unsuccessful. Building a siting process predicated on trust will fail if trust is not present. To overcome the lack of trust or situations of high

public skeptisi, agencies could adopt strategies of power sharing, partnerships, collaboration and negotiations that would allow a host community to proceed with siting that relies less on the judgments of an external agency and more on the community itself. Specific mechanisms can include community participation in all phases of the siting process, support for independent consultants, community review of facility design and safety systems, monitoring facility performance, property value protection and the right to initiate shutdown if health and safety standards are not met.

4. *Maintain a Systems View*. Facility siting does not occur in isolation. The idea here is that strategies be set in place that aim at an equitable sharing of the burden among communities over time. In other words, the need for a facility is set within the larger context of the nuclear fuel cycle rather than approached as an isolated requirement.

5. *Compensate for Irreducible Inequities*. In all siting cases there will be residual risks and uncertainty. A compensation package needs to be negotiated with the host community and region so as to deliver benefits most relevant to local needs and development goals.

6. *Build a Constituency of Support*. A number of major interests must be convinced that they need to be involved and cannot stay in the background of the siting process. A political coalition needs to be created. Kasperson recommends that industry must commit to support of the siting process and assume a leadership role. The political head of the jurisdiction will need to be a firm supporter and a coalition of local officials knowledgeable about and open to the siting process needs to be formed. Effective contacts with local media is essential and dialogues with prospective critics and opponents need to be facilitated.

7. *Adaptive Institutions ands Processes*. Due to the high political volatility involved in facility siting, highly adaptive institutions and approaches are needed. "Siting facilities, it is clear, is not a highly predictive process that can be mounted in the programmed way that many developmental programs can." (Kasperson 1999). The siting 'landscape' is in constant flux; issues changes, participants change over the course of the process, new opponents and proponents may emerge, the debate may link to other agencies and concerns in unpredictable ways, and the path to conflict resolution may often be unclear. As Kasperson notes "Such an institution needs not only high technical expertise but strong capabilities in political diagnosis, communications, constituency building and political analysis. It must be able to work collaboratively with communities and the elected officials and informed leaders that may enter the debate. The siting process may need to be reinvented multiple times over the course of achieving a successful site".

Short and Rosa (2004) analyze siting controversy from the perspective of the role of stakeholders. They base their analysis on the US experience with high level nuclear waste in order to arrive at principles for acceptable and democratically arrived at policies.

It is widely accepted that public involvement is pivotal to the siting of any facility, particularly one related to the management of nuclear waste. Public involvement has been defined as the

inclusion of stakeholders in the decision making process. 'Stakeholder involvement' refers to actors that have a stake in social processes. The principle underlying stakeholder involvement in risk characterization is that "doing so creates 'stakes' in the processes of risk characterization, decision making, implementation of policies, and most importantly, in their acceptability" (Short and Rosa 2004 136). Further, active participation by stakeholders in all phases of facility siting is a necessary condition for success in overcoming problems that are technologically and politically intransigent. A caution, provided by Kasperson (2000), however, is that stakeholders in many conflicts are local activists who have a clearly defined role in the process or a material stake in the outcome. Left out are those who do not know their interests are at stake, whose interests are diffuse, who lack the skills and resources to participate, or who have lost confidence in the political process.

Kasperson (2000) argues that attention needs to be directed to local concerns in order that processes of risk characterization may become more reflective, self-critical and goal driven as opposed to technique driven.

The democratic control of technology presumes an informed citizenry. Studies have found, however, a wide variation in the social distribution of scientifically based information and understanding. Scientists disagree amongst themselves (e.g. the effects of global warming). Public skepticism is magnified over technological decisions that embed scientific uncertainty, such as the case of nuclear waste that must be isolated for thousands of years. The outcome of this is summarized by Short and Rosa (2004 137) as follows:

> Because information and knowledge are critical resources for the exercise of decision making power, the belief that public knowledge based on better communication of science will result in greater consensus among the citizenry has been one of the most persistent beliefs in risk management. In retrospect, it has been one of the most misguided beliefs.

The conclusion from this is that risk communication alone is inadequate for engaging the public in technological choice and facility siting. Risk characterization (which Short and Rosa maintain provide the very conditions framing waste siting decisions), should be an integral part of decision making *at the very beginning of the process*. Further, it must be decision driven, recognize all significant concerns, reflect both analysis and deliberation with appropriate input from interested and affected parties, and be appropriate to the decision (2004 138).

A transition is implied; specifically a historic concern with *risk management* must give way to a more explicit focus on *risk assessment*. This is a significant step in recognizing the public interests at earlier stages in the siting process, beginning with identifying and defining problems and continuing through their analysis, proposed solutions and decisions concerning solutions and management options. Risk characterization thus differs from traditional risk communication in that it focuses on informing the process rather than informing the public (Short and Rosa 2004).

Institutions charged with siting hazardous facilities must cease to attempt to wrestle certainty from uncertainty (Lowenthal 2000 cited in Short and Rosa 2004). Uncertainty will remain in even the best efforts to dispose of nuclear waste. This in turn serves to highlight the debates over moral and ethical considerations. From this emerge notions of fairness and justice, including duties to future generations.

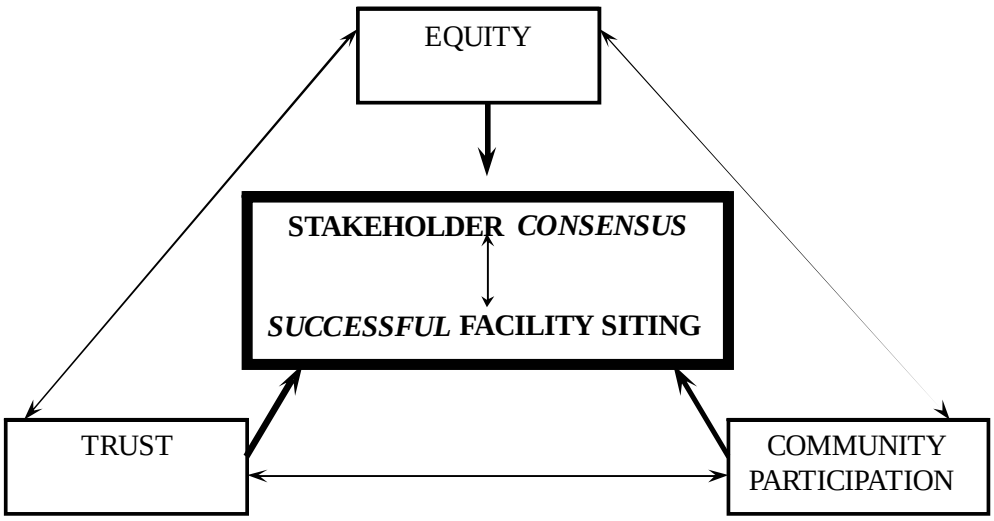
From their review, Short and Rosa (2004) maintain that one of the most promising approaches to siting decisions involves a 'Cooperative Discourse' model of achieving procedural agreement among citizens in communities that must choose between controversial options with regard to risk. Substantive agreement is often hard to reach either by abstract reasoning or empirical fact finding because stakeholders disagree about the conventional criterion of acceptability of costs and benefits, and because uncertainty in undeniable. Nevertheless, agreement in principle that all interested and affected parties should have an equal opportunity to influence the policy decision making process has proven to be successful in generating consensus. In practice, citizen panels work together with local officials, scientists and engineers in an iterative process of deliberation (Short and Rosa 2004 144).

Many studies of risk perception have verified that people have less fear (and perceive the risks as acceptable) of phenomena over which they believe they have control. When carried out properly (i.e. in good faith), broad based public participation offers a measure of control over the *process* of risk characterization. Institutions need to recognize the need for the broadening of legitimate involvement and for the sharing of control.

Three principles are critically assessed by Baxter *et al* (1999) (trust, equity and community participation) on the basis of their applicability to a landfill siting process in Peel (Ontario). Particularly, they explore some of the implications of adhering to recommended siting principles. They note that, though laudable principles for siting, when put into practice they can conflict in ways that can both thwart the effective implementation of the principles themselves as well as contribute to undermining the entire siting process.

Consistent with numerous other studies, Baxter *et al* (1999) note that the recent siting literature marks a shift from a pervious focus on the technical issues of siting (i.e. getting the science right by gathering accurate information on specific criteria) to a focus on procedural principles like development of trust and community participation. Thus, competent siting is presumed to include proper attention to both the technical rigor and procedural issues.

Baxter *et al* (1999) posit a relatively straightforward idealized model for competent and successful siting (reproduced below). Trust, equity and public participation are principles presumed to lead to successful siting since they are mean to reinforce some degree of consensus between stakeholders. The effect of each principle on the others is presumed to be mutually reinforcing.



Idealized model for competent and successf ul facility siting. (Baxter et al, 1999, p. 503)

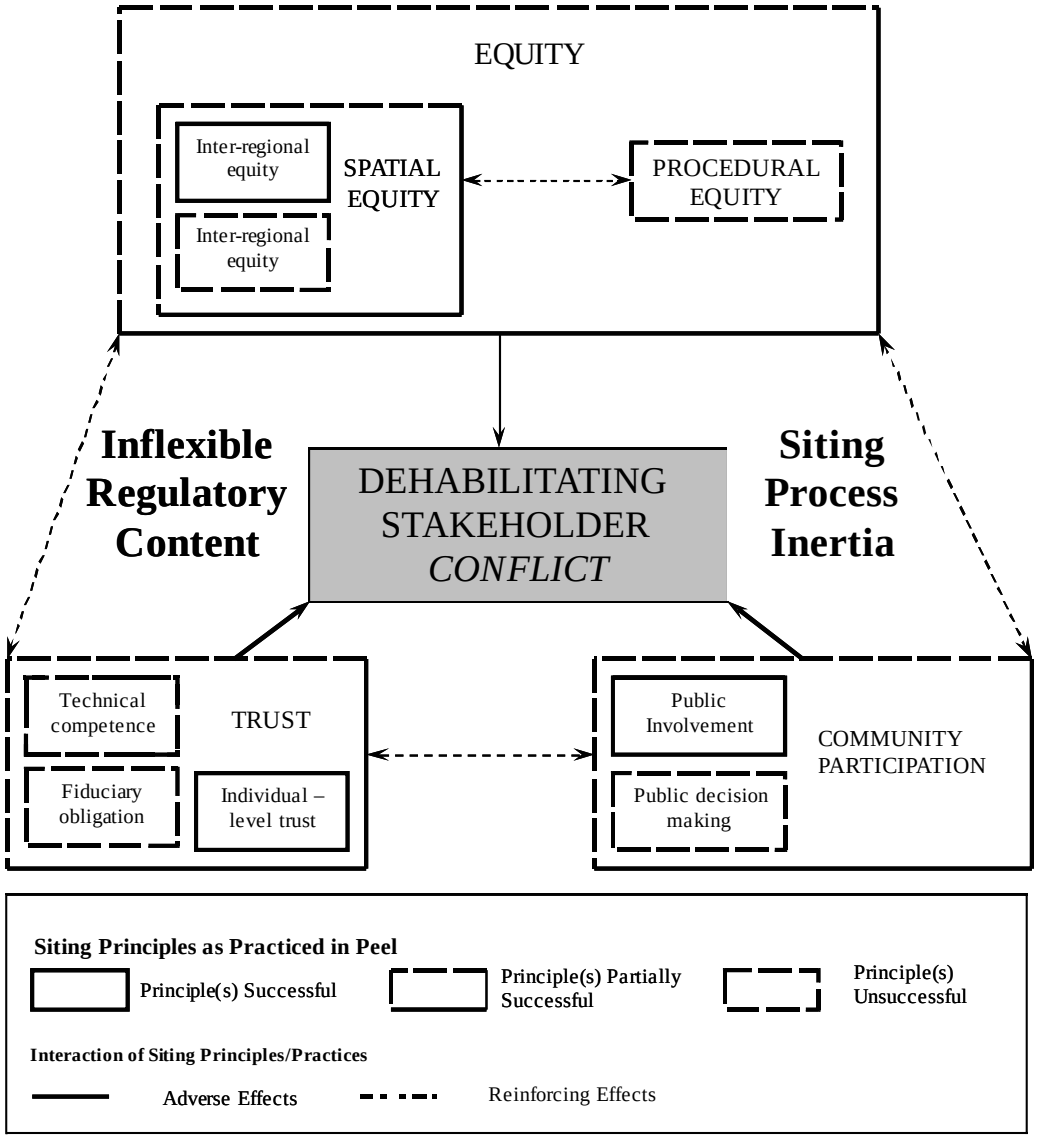
Trust concerns the relationship between key stakeholders including the government, the siting agency and the community hosts. Trust is directly related to public participation so that the latter may foster trust while also satisfying other siting goals. "In this sense, trust may be considered a *principle* of effective siting while public participation is a *practice* for building trust" (Baxter *et al*. 1999 503).

Numerous forms of equity can be included within the siting process. These may include the general tents of environmental equity and justice, and more specific principles of spatial, social and procedural equity.

The necessity for public and community participation in siting processes is well documented. Community participation may be linked to trust and equity in that it allows for the development of fiduciary trust if the public interest is given centrality, which in turn may give residents more procedural control over how siting decisions are made. Most siting processes seem to focus on principles for effective participation by including a variety of elements such as early public involvement, consistent public involvement, provision of intervenor funding, a collaborative as opposed to authoritarian environment, and flexibility (Baxter *et al* 1999). There are, however, specific criteria which address various types of control over the process itself: locational control (freedom to chose whether or not to accept a facility), procedural control (influence on the structure and implementation of the general process), and facility control (need for, size and operating characteristics of a facility). The main challenge with these criteria is that siting managers must relinquish considerable decision making power to the public. As Baxter *et al* (1999) point out, processes which satisfy any or all of these are still few.

On the basis of their review of the Peel siting process, Baxter *et al* (1999) provide an amended version of the figure reproduced above to depict how the principles adversely affected each other when put into practice. 'Stakeholder consensus' and 'successful

facility siting' are replaced with 'stakeholder conflict' and 'unsuccessful siting' as outcomes. Also, many of the relationships between siting principles presumed to be reinforcing are in fact negatively reinforcing. The amended figure also acknowledges the important roles played by the regulatory context and siting inertia in generating and maintaining the conditions for conflict between siting principles. The authors conclude (1999 519): "Inflexibility and the inability or refusal to adapt the process along the way contributed to entrenchment of stakeholder positions and deliberate sabotage of the process".



Principles and Practices (Baxter *et al*1999, p. 511)

Central to the breakdown of the siting process were equity (interregional, intraregional, spatial and procedural) considerations, specifically reluctance to deal directly with equity

issues in dialogues between siting agents and various publics and communities. As the authors note (1999 520), it is not that the various equity issues are "so difficult to understand or that they inevitably conflict, nevertheless they may be difficult to resolve… this resolution needs to happen early, through informed debate about such issues as among the potentially impacted stakeholders". This conclusion reinforces that reached by Armour (1992 32) that "the fundamental issue is not how to persuade the public to accept an unwanted facility but how to structure the process in order to arrive at publicly acceptable solutions".

Public Participation Models and Siting

Public participation may be defined at a general level as the practice of consulting and involving members of the public in agenda setting, decision making, and policy forming activities of organizations or institutions responsible for policy development (Rowe and Frewer 2004). In general, there has been a move away from an elitist model in which expert advice acts as the authoritative source for regulation to one in which citizens have a voice in framing government decisions.

Numerous mechanism exists to enact participation, ranging from those that seek responses from the traditional (e.g. public meetings) to the novel (e.g. consensus conference) and from mechanisms that seek responses from participants acting alone (e.g. surveys) to those involving deliberation between participants acting in groups (e.g. focus groups). Clearly, the public may be involved in many ways. In some cases, the public may participate by being passive recipients of information; in other cases public input may be sought, as in the solicitation of public opinion through questionnaires or focus groups; and in still other cases, there may be active participation of public in the decision making process itself, such as on an advisory committee (Rowe and Frewer 2004).

The majority of public participation models suggest that involvement must occur early in the process, it must be sustained and it must be meaningful (i.e. it must be treated with legitimacy and it must be incorporated into the decision making process.

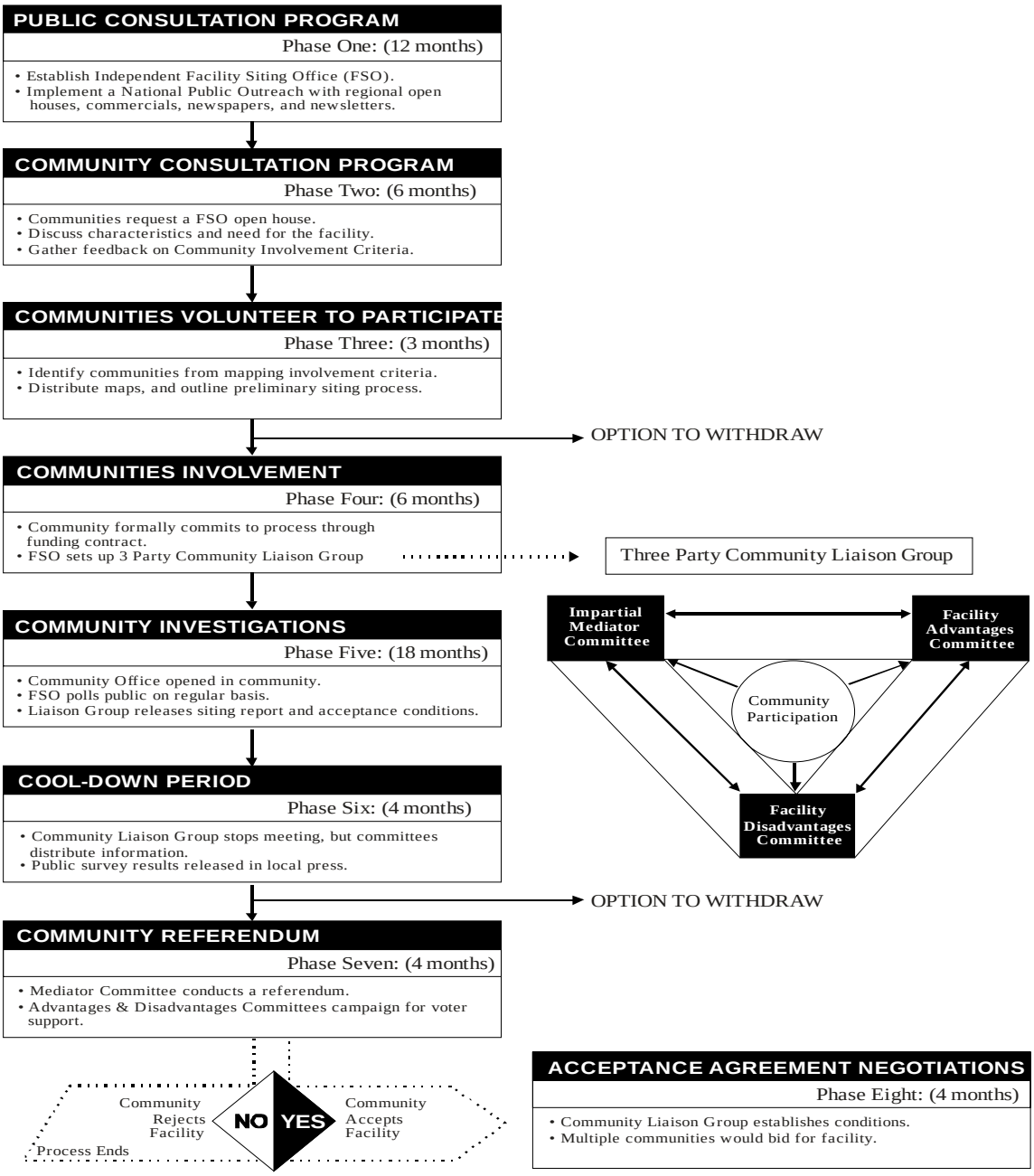
A siting model proposed by Ballard and Kuhn (1996) was designed to incorporate three key characteristics: the use of an open siting approach, the use of siting principles and safeguards, and a three party community liaison group. The basic premise is that for successful siting to occur, a devolution of decision making authority from centralized government agencies and the nuclear industries to local communities is imperative. Secondary features of the model are the principles and safeguards contained within the eight siting phases. These considerations are necessary to help establish trust and commitment while protecting community interests. Siting principles would ensure that only communities that volunteer are considered and that they be equal partners in decision making throughout the process. As well, communities would be guaranteed compensation if they accept the facility and would have meaningful input into the final selection of viable technical options that would most feasibly protect the environment and human health (see Armour 1992; Siting Task Force 1995). The inclusion of siting safeguards is also important to ensure full access to, and disclosure of, information about the technology of nuclear waste disposal and about the process itself. Safeguards, such as those used by the Siting Task Force for

Low-Level Radioactive Waste Management focus attention on community interests through independent review by a local community liaison group, hiring of independent experts, and participant funding (Siting Task Force 1995; Kunreuther *et al* 1993).

A feature of this siting framework is the creation of a three party liaison group comprised of an impartial mediator committee, an advantages committee, and a disadvantages committee. Each committee would be provided with equal funding and be made up of local citizens. Groups either opposed to or supportive of a potential facility would be provided with opportunities to express their concerns in an equitable and open manner. The three party liaison committee is not unlike a judicial process where a case is heard before a judge (impartial mediator committee) who ensures the fair presentation of information. The case is presented to a jury (local citizens) who hear arguments both for and against a proposal (provided by the advantages and disadvantages committees respectively). Budgets for media presentations and expert consultation would be included. The liaison group would also be involved in negotiating and drafting a community acceptance agreement, and managing the referendum.

The entire siting process would be facilitated by a Facility Siting Office. This office would be established to conduct open houses and information meetings, and to set up liaison committees, conduct opinion polls in interested communities, and provide liaison between the community and proponent interests.

Facility Location Model (Ballard and Kuhn 1996 824)



Schneider and Renn (1999) report on a public participation project in Germany in the mid 1990s. A public participation model was used to incorporate public values and arguments into the official planning process related to developing a regional waste management concept and overcoming the NIMBY phenomenon related to facility siting.

The model is premised on the requirement and rules for rational discourse which is defined as "a communications process in which all affected parties resolve a conflict or engage in joint problem solving by a specific set of rules (Schneider and Renn 1999). The rules are as follows:

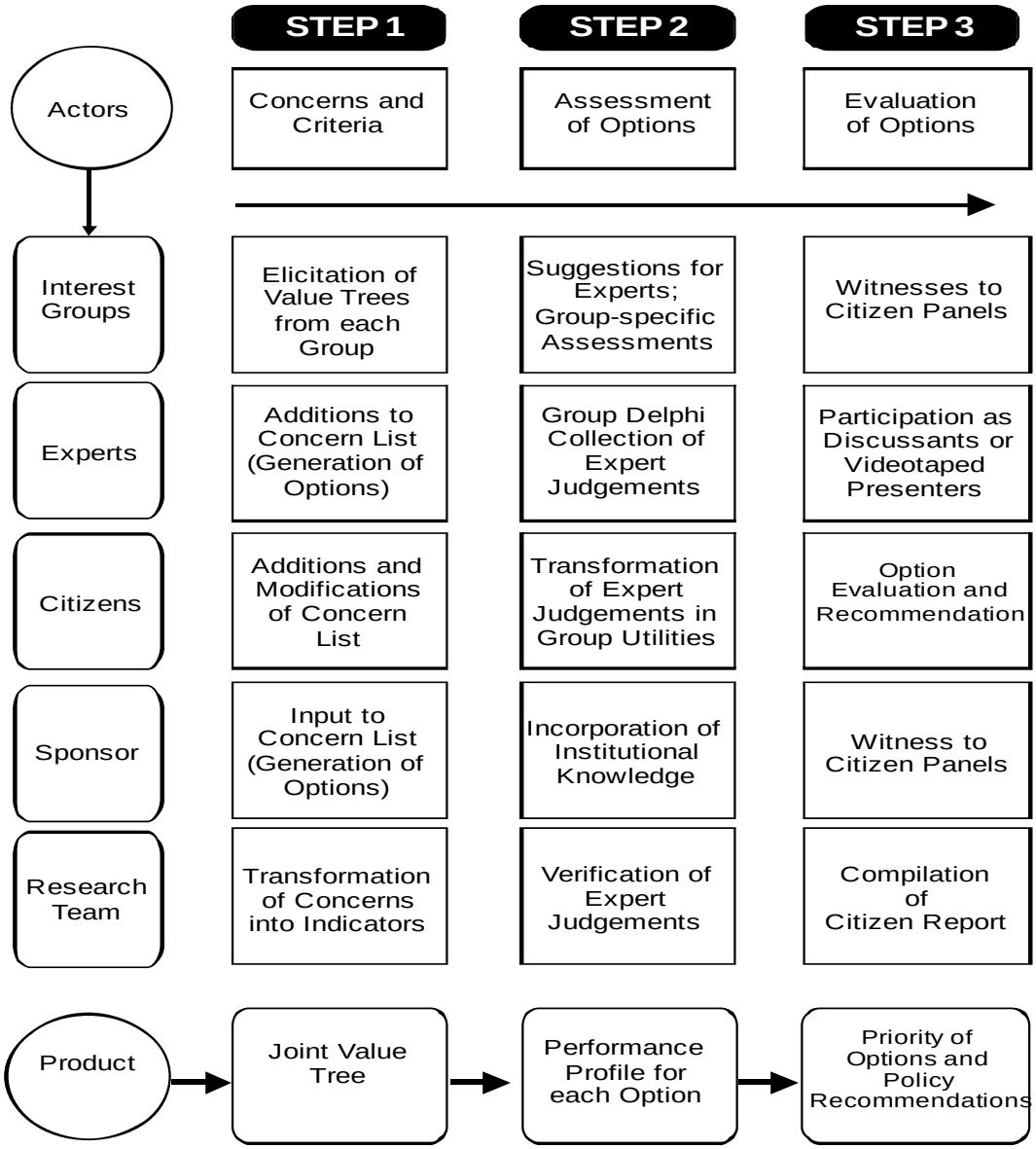
1. *Rule setting*. Consensus amongst participants on the procedure that is to be employed in order to derive the decision (e.g. a majority vote or involvement of a mediator).
2. *Evidence.* Basing factual claims on scientific knowledge and other forms of legitimate knowledge; in the case of scientific dissent all relative camps should be represented.
3. *Argumentation.* Interpreting factual evidence in accordance with the laws of formal logic and argumentative reasoning.
4. *Disclosure of values.* Disclosing of values and preferences for each party thus avoiding hidden agendas and strategic game playing.
5. *Fair bargaining.* Attempt to find a fair solution whenever conflicting values or preferences occur, including compensation or other forms of benefit sharing.

The success or failure of a rational discourse depends on many factors, the most important being sufficient time, openness of results, equal position of all parties, willingness to learn, acceptance of other parties, rationale and the de-moralization of positions and parties (Schneider and Renn 1999).

The model presented below contains three consecutive steps; 1) the elicitation of values, 2) the transformation of the evaluative criteria into indicators and 3) the evaluation of options according to indicators. All three groups (experts, interest groups, citizens) play a role in each step.

Through the application of their model, the authors conclude that the public has something to contribute to the planning process provided that citizens are given a conducive and supportive structure for discourse. They also note that, given the different worlds of expertise (e.g. legal, political, scientific), various forms of input were required. Those most successful tended to be study trips and face to face discussions with experts, a conclusion also reached by Soderberg and Kain (2006).

Model of Cooperative Discourse (Schneider and Renn 1999)

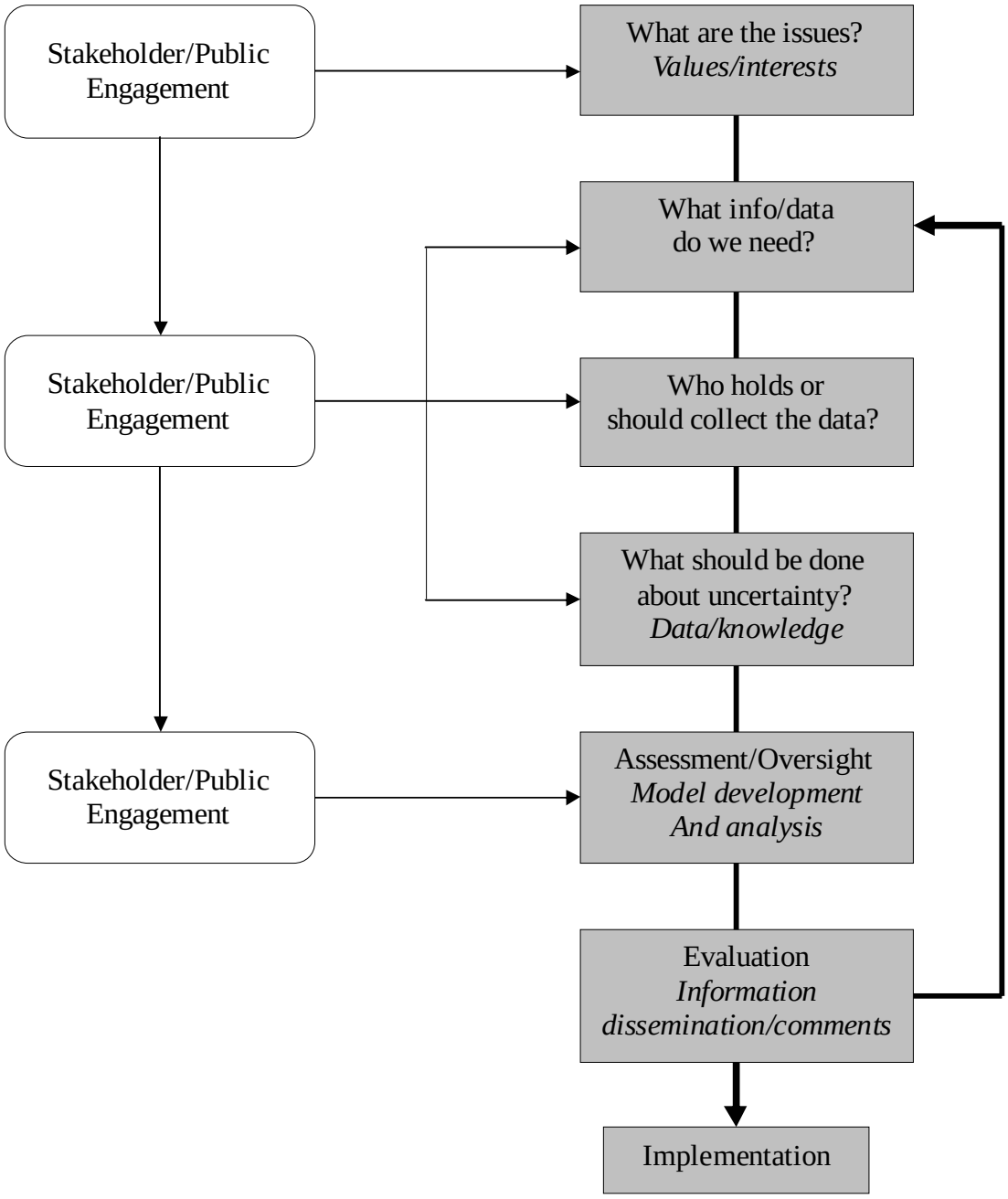


Petts (2001; 2004) used 'analytic-deliberative processes' as a means by which the public can influence risk decisions, including the generation of data and the derivation of acceptable policy options by using evidence from waste management decisions in Britain. Central to Petts' framework are values, a term that is often promoted as all embracing, referring to non expert or non-decision makers' concerns. This characterization, however, often leads to a loss of important distinctions between stakeholders that have 'interests' (financial or regulatory) and peoples' 'values' expressed through their beliefs, attitudes or worldviews.

Many questions still remain over the best means to integrate deliberative processes with conventional scientific or technical elements within existing decision systems. In practice,

decision making frameworks and objectives strongly influence how individuals engage with issues, are able to contribute knowledge and views and influence outcomes. The potential of enhanced public participation in siting processes, including the fundamental questions of the need for waste facilities not merely the appropriateness of a site for a particular facility, has also been addressed extensively. Clearly, it is recognized that effective public engagement presents challenges. It is promoted as a means of challenging what is in the public interest and of enhancing democracy, institutional legitimacy, procedural fairness, social learning, the integration of social values into technical decisions, public trust and confidence in decision makers and decisions, and quality assurance in expert centred decision making. Any of these elements may be conceived as valuable in their own right (Petts 2004)

Practice suggests the need for a clear structure to the participatory process and a decision framework that stresses not only technical information, but also the explicit input of values, insights and tradeoffs. In the model, public perspectives may define or reframe what the process or issues actually are, as well as identify appropriate and optimum solutions. The model stresses a role for the public in attributing the qualities of risk as a process of framing. For example, identifying questions to be answered and data required, agreeing who should obtain the data, understanding or at least recognizing the uncertainty, and engaging in decisions on risk acceptability (Petts 2004; Stern and Fineberg 1996). This in turn should work towards the development of a reciprocal relationship between the public and experts, and crucially, open up the risk decision process sufficiently to admit into the initial framing a wider understanding than merely that of the ‘expert’.



The optimum analytic-deliberative pro cess (adapted from Charnley, 2000 and Royal Commission on Environmental Pollution, 1998) (Petts, 2004, p.119)

The imperative to involve the public meaningfully into siting decisions has essentially become the standard in facility location decision making models. The number and variety of engagement mechanism has expanded enormously in the past two decades as decision

makers increasingly understand the importance of engaging the public and as the public themselves demand an active role in decisions that will affect them and their community. In an excellent review of public engagement mechanisms, Rowe and Frewer (2005), for example, list over 100 techniques that have been employed, primarily in the U.K. and the USA.

Impact and Benefit Agreements (IBAs)

A major challenge in siting facilities is to find a package of compensation benefits so that the host community and region feels that it is better off having the facility than maintaining the status quo. In theory, providing a given region with enough benefits in the form of tax reductions, rebates, improved social services and facilities and employment guarantees, for example, should result in an attractive offer. In practice, there is often considerable opposition. In many cases a facility has to be perceived as being sufficiently safe by enough of the affected public for them even to consider accepting some form of compensation (Jenkins-Smith and Kunreuther 1999, Murdock *et al* 2005).

This section examines compensation in the form of impact benefit agreements and community acceptance agreements that have been agreed to in Canada, primarily with First Nations communities. Also, agreements settled with Deep River (though subsequently invalidated) and Port Hope are summarized. Incorporated in most agreements is some form of empowerment to local communities from the project proponent.

IBAs are premised on the underlying idea that "it is no longer acceptable to develop natural resources in a manner that imposes significant costs at the local level while the benefits are enjoyed elsewhere" (Kennett 1999 1). The main purposes of IBAs are 1) to address the concerns of Aboriginal peoples and local residents about the negative impacts of large scale developments and 2) to provide an opportunity for local residents to access opportunities and benefits associated with the development project. Typically, most IBAs have involved Aboriginal communities and most literature related to IBAs addresses their specific needs and contexts. Three of the most well known IBAs in Canada involve BHP's Ekati diamond mine in the Northwest Territories, Diavik's proposed diamond mine also in the NWT and the Voisey Bay, Labrador development undertaken by Inco (see Table below for a listing of other IBAs in Canada). IBAs have also been used in other jurisdictions such as Australia (O'Faircheallaigh 2000).

Different levels of government, development proponents (typically corporations) and local communities (particularly Aboriginal groups) are the principal players involved in IBAs (Kennett 1999). The proponent will become involved in IBAs when required to do so by government policy or legal statute, but their involvement may also be predicated on the need to address local concerns and circumvent opposition to the project. IBAs also help corporations gain access to a local labour force. From an Aboriginal perspective, IBAs may be seen as beneficial if they address the systemic problems that often plague poor, remote, or northern communities including lack of employment, infrastructure, services and education. The government may also view these agreements positively as an instrument of regional economic development and may actively promote IBAs through policy or legal requirements. However, a number of challenges must be

addressed to realize these benefits including that potential Aboriginal employees must have the requisite skills and interest in wage employment for the development; that there is a need for cross-cultural sensitivity and learning; procedures must be designed to allow Aboriginal businesses to capitalize on available opportunities; and Aboriginal culture and economies must be protected (Kennett 1999).

IBAs will often be negotiated when 1) there is Aboriginal ownership of the land and resources (e.g. land claims or treaties) ; 2) it is required by a land claim agreement (e.g. the Nunavut Land Claims Agreement); 3) it is required by statute or formal government policy (e.g. the Canada Oil and Gas Operations Act) ; 4) ad hoc government policy for the specific development requires an IBA (e.g. the Ekati diamond mine); and 5) case-by-case factors independent of the prevailing policy or legal requirements (e.g. to access the socio-economic benefits) (Kennett 1999). However, problems can frequently arise in any of these circumstances. For instance, O'Reilly (2000) outlines that the federal government had rejected the EA Panel recommendation regarding the need for a completed IBA before the commencement of the project and that Diavik still needed to begin serious negotiations with several Aboriginal governments, yet it was requesting government approval for the diamond mine.

The outcomes of IBAs for Aboriginal communities vary greatly depending on a number of factors. Of particular concern is that if Aboriginal groups do not have land-based legal rights they may not be able to negotiate an IBA that provides a strong set of benefits (O'Reilly 2000). The Aboriginal bargaining position may also be hampered by lack of information, expertise, and financial resources and appropriate regulatory or taxation powers. Further, government policies regarding the provision of information and financial assistance, the resolution of land claims or treaty rights, and the requirement that IBAs be completed prior to project approval also influence the Aboriginal bargaining position (O'Reilly and Eacott 2000; Kennett 1999).

There are confidentiality issues related to negotiated IBAs; they are often considered private agreements between the community and the proponent. This precludes their empirical investigation and also conflicts with the basic tenets of Environmental Assessment (EA) processes. In contrast to the private nature of IBAs, EA processes in Canada are premised on public involvement and transparent decision-making. For projects where both IBAs and EAs are being completed this means that authorities are faced with the challenge of balancing the needs and requirements of both processes. To date, the mechanisms for resolving this tension have yet to be developed.

There are three specific problems of treating IBAs as strictly legal documents (Kennett 1999). Although IBAs are worded like legal, contractual documents the qualified language often utilized (e.g. target numbers or 'best efforts') may mean that it may not be possible to obtain a legal remedy if some specific requirement of the agreement is breached. Additionally, the essence of IBAs is related to the establishment of a successful relationship between the proponent and the other parties involved. It is difficult to coerce these types of relationships through legal sanctions. Also, IBAs move beyond a private contract context in that they often establish regulatory requirements for project approval. Thus, IBAs, although often thought of as private contracts, also involve government and regulatory authorities.

IBAs are case specific agreements; their flexibility is typically touted as being important since this allows them to address the range of concerns important for that particular project and local area. Nevertheless, the most recent trends suggest that Aboriginal peoples are increasing both their involvement and influence in IBAs. Over time these agreements are also becoming more complex and broader in scope. For instance, it is more often the case that recent IBAs contain specific conditions and formal procedures rather than general language and imperatives. While all IBAs address socio-economic impacts of the project, the range of issues covered by such agreements has evolved from a more narrow focus on training, employment and the promotion of contracts with local businesses to include socio-cultural support and protection, cash payments and compensation, environmental protection and procedural provisions related to amendments, conflict resolution, oversight and monitoring (Kennett 1999). In the Australian context, recent IBAs also increasingly involve the creation of joint Aboriginal-developer management committees (O'Faircheallaigh 2000). Of particular concern, is that it has often been the case that implementation and monitoring have not been integral parts of the agreements and that Aboriginal peoples have not been involved in the oversight process. Issues around the inclusion of Traditional Ecological Knowledge in the assessment and monitoring of projects also remain to be addressed (O'Reilly and Eacott 2000).

Examples of Impact Benefit Agreements in Canada	
Newfoundland and Labrador	
2002	Voisey's Bay Project – INCO, Labrador Inuit Association, Innu Nation, governments of Newfoundland and Canada
Quebec	*Quebec*
February 1998	Raglan with Falconbridge – Falconbridge, Makivik Corp.
February 28, 1995	Raglan - Makivik Corp., Qarqalik Landholding Corp of Salluit, Northern Village Corp. of Salluit, Nunaturlik Landholding Corp of Kangiqsujuaq, Northern Village Corp. of Kangiqsuijaq, Societe Miniere Raglan du Quebec Ltee.
February 1998	Raglan with Falconbridge – Falconbridge, Makivik Corp.
1994	Troilus Mine – Mistissini Cree Nation, INMET
Ontario	
May 26, 1987	Dona Lake - Dome Exploration (Canada) Ltd., Osnaburgh Indian Band, Windigo Tribal Council, Government of Canada, Province of Ontario
March 18, 1988	Golden Patricia (1) - St. Joe Canada Inc., Cat Lake, Osnaburgh, Slate Falls Indian Bands, Windigo Tribal Council, Government of Canada, Province of Ontario
August 31, 1992	Musselwhite Agreement – Placer Dome Inc., Cat Lake First Nation, WIndigo Tribal Council, Shigogama First Nations Council, Government of Canada, Province of Ontario
December 17, 1993	Golden Patricia (2) - Lac North America Ltd., Windigo First Nations Council, Cat Lake First Nation, Slate Falls Nation, Province of Ontario
June 21, 2005	Diamond mine, James Bay lowlands - Attawapiskat First Nation, DeBeers
Saskatchewan	
August 31, 1987	Amok Surface Lease - Province off Saskatchewan, Amok Ltd.
December 21, 1987	Cigar Lake Surface Lease - Province of Saskatchewan, Cigar Lake Mining Corp.
June 2, 1988	Cigar Lake Human Resource Development - Province of Saskatchewan, Cigar Lake Mining Corp.
September 10, 1996	Aurum - Mine Government of Saskatchewan, Aurum Mining Corp.
1990s	Surface Lease Agreement and Human Development Agreement – uranium mining companies, Government of Saskatchewan and Canada, Aboriginal organisations (Including Prince Albert Grand Council)
Alberta	
April 1988	Syncrude – Canada, Alberta, Syncrude, Athabasca native Development Corp.
Yukon	

1991	Mt. Hundere - Mt Hundere Joint Venture, Curragh Resources Inc., Government of the Yukon, Corp. Of the Town of Watson Lake, Kaska Dena First Nation
1990s	Brewery Creek – Viceroy Resource Corp, Tr'on dek Hwech'in First Nation
1990s	Mount Nansen Mine – Little Salmon/Carmacks First Nation, BYG Natural Resources
1990s	Kudz Ze Kayah – Cominco Ltd., Ross River Dene
Northwest Territories	
June 18, 1974	Nanisivik – Government of Canada, Mineral Resources International Ltd.
May 1981	Lupin – Government of N.W.T., Echo Bay Mines Ltd.
August 12, 1981	Polaris – Cominco Ltd., Government of N.W.T.
June 18, 1989	Colomac – Neptune Resources Corp. , Dogrib Treaty Council
October 6, 1995	Darnley Bay – Inuvialuit Land Corp. Darnley Bay Resources Ltd.
June 14, 1996	Aber – Inuvialuit Regional Corp., Aber Resources Ltd.
September 17, 1996	Ulu – Echo Bay, Kitikmeot Inuit Assoication
October 22, 1996	BHP Diamonds Project – Government of N.W.T. and BHP Diamonds Inc.
1996	BHP Draft IBA – BHP Diamonds Inc., aboriginal party
Nunavut	
1990s	Diavik – Rio Tinto/Aber Diamond Mines, Yellowknives Dene, Dogrob Treaty 11 Council, North Slave Metis Association
1990s	Meliadine – WMC/Cumberland Comaplex, Nunavut Tungavik Corp., Kivalliq Inuit Association
May 13, 2002	Territorial Parks in the Nunavut Settlement Area - Inuit of the Nunavut Settlement Area, Government of Nunavut

Community Acceptance Agreements

It is becoming the general rule that the siting of new facilities will involve the development of some form of impact and acceptance agreements also called community acceptance agreements. To wit, in dealing with nuclear waste, Kincardine, Deep River and Port Hope all developed such agreements. Prior to these more recent examples, these agreements were quite rare. This section begins by outlining the problems that may ensue when an agreement is not in place, using the example of Carlsbad, New Mexico and then outlines the highlights of the Deep River and Port Hope agreements.

Carlsbad, New Mexico is the host community for the Waste Isolation Pilot Project (WIPP). This is a deep geologic facility for transuranic military waste. Although the facility did not officially open until 1999, the community volunteered to host WIPP in the early 1980s. Leadership in Carlsbad advocated for the facility as a way to provide employment and economic diversity for a community whose main employers – potash mines and oil and gas fields – were on the decline. Although no formal agreement was signed with the community, the facility has indeed provided 1000 highly paid jobs, the majority of which have been filled by the local work force. There have also been some economic spin offs in the form of the development of container technology as well as the provision of contracts for several local businesses. No compensation was initially provided and Carlsbad is not involved in the oversight or monitoring of WIPP. Funds, however, were provided to extensively upgrade several highways in New Mexico and to provide emergency response capacity along the transportation route.

Since no formal agreement is in place Carlsbad has had to negotiate on an ad hoc and continuing basis with the proponent – the Department of Energy (DOE). They have had to depend both on the goodwill of the proponent as well as their ability to leverage public and moral support for their requests. For instance, DOE has decided to accelerate shipments to WIPP and close the

facility is 20 years, rather than 40. In compensation, acceleration payments of approximately $15 million per year have been provided for the community to more rapidly diversify their economy and upgrade infrastructure. However, these funds are subject to yearly US government allocation and are not guaranteed. The mayor therefore regularly makes trips to Washington to advocate on behalf of Carlsbad. Further, although it has secured good employment opportunities for its citizens, this has occurred at DOE's discretion. In retrospect, local authorities have suggested that a negotiated agreement would have provided the community

In contrast to Carlsbad, Community Acceptance Agreements were developed for both Deep River (1995) and Port Hope (2000). In the case of Deep River, if the facility had gone ahead, the Community Agreement in Principle would have been formalized. As with most IBAs, the Deep River agreement was heavily weighted towards providing economic benefits for the community. The agreement would have maintained employment at Atomic Energy Canada Limited and would have contributed towards a host of infrastructure developments including waterfront, business and industrial development, the establishment of a new landfill site, and contribution towards the airport marketing plan and waterway development project. The agreement would have also provided protection against property decline and provided the community with a role in the monitoring of the construction and operation of the facility (Siting Task Force 1995).

Highlights of the Port Hope Legal Agreement

The legal agreement defines the terms agreed to by the Parties - the Municipality of Clarington, the Township of Hope, the Town of Port Hope, and the Government of Canada - for the cleanup and long-term management of the historic wastes in the communities (http://www.llrwmo.org/en/htmauler/pages/Release7_Jun-28-2001.html).

- It sets out the Government of Canada's commitment to proceed with a process aimed at implementing community-defined approaches to the cleanup and long-term management of local historic wastes.

- In each of the municipalities, the Project involves the cleanup of existing low-level radioactive wastes at unlicensed sites throughout the municipalities and, in the Town of Port Hope and Hope (formerly the Town of Port Hope and Hope Township), certain non-radioactive industrial wastes.

- Subject to the results of regulatory processes, these wastes will be consolidated and managed for the long-term in:

  - two new long-term low-level radioactive waste management facilities in the Town of Port Hope and Hope, one at the Pine Street North Extension and, the other at the current Welcome Waste Management Facility; and,

  - a re-engineered long-term low-level radioactive waste management facility at the Port Granby Waste Management Facility in Clarington.

- Signature of the legal agreement initiates a 5-year environmental assessment and regulatory review phase in which the Project will be better defined through public consultation, technical and scientific study, environmental assessment, and regulatory review, including review under the Canadian Environmental Assessment Act and the Nuclear Safety and Control Act.

- Under the terms of the legal agreement, grants of $10 million are to be paid to each of the three municipalities that signed the agreement to assist them in addressing impacts associated with the presence of long-term waste management facilities within their communities.

- A program of property value protection will be established to protect property owners from financial losses relating to the Project on the sale of their property.

- Initially, the proponent for the Project will be the Low-Level Radioactive Waste Management Office (LLRWMO), Canada's agent for the management of historic wastes.

Siting Criteria for a Canadian Nuclear Fuel Waste Disposal Facility

Regardless of the approach taken, some aspects of siting a NFW management facility are entrenched legally (e.g. federal/provincial jurisdiction; requirements as per the CEAA) technologically (e.g. minimum material standards for waste containers; mining standards); biophysically (e.g. geology; presence of mineral or ore bodies); and socio-economically (e.g. distance from a community, presence of provincial parks). Without constraining the siting *process* per se, it is vital that, at least initially, the "constraints" or necessities of siting be identified.

The legal requirements regarding a NFW disposal facility have been detailed in Background Papers prepared on behalf of the NWMO and will not be addressed here (http://www.nwmo.ca). Rather, a brief synopsis of siting variables will be provided based on those articulated in the NWMO Final Report (2005). As depicted in the Tables below, the siting criteria are categorized by process, institutional factors, biophysical parameters, social considerations, economic and technological and engineering criteria. For the NWMO, we present the criteria specified for the geologic disposal option.

Siting Criteria From the NWMO: Study Report, 2005 [deep geologic disposal]

Characteristics	Criteria
Process	• For fairness, focus site selection process within the provinces that are directly involved in the nuclear fuel cycle: Ontario, Quebec, New Brunswick and Saskatchewan. (p. 146) • Seek a willing host community The site would need to address scientific and technical siting factors to ensure protection for present and future generations, other life-forms and the biosphere as a whole into the indefinite future. NWMO proposes that the siting process be designed to: • Be open, inclusive and fair to all parties • Ensure that groups most likely to be affected by the facility and associated transportation are given full opportunity to have their views heard and taken into account, and that they are provided with the forms of assistance they require to present their case effectively; • Include special attention to Aboriginal communities that may be affected; • Be free from conflict of interest, personal gain, or bias among those making the decision and/or formulating recommendations; • Be informed by the best knowledge – in particular the best natural science, the best social science, the best Aboriginal knowledge, and ethics – relevant to making a decision and/or formulating a recommendation; • Be in accord with the precautionary approach, which first seeks to avoid harm and risk of harm. If harm or risk of harm is unavoidable, place the burden of proving that the harm or risk is ethically justified on those making the decision to impose it; • Ensure, in accordance with the doctrine of informed consent, that those who could be exposed to harm or risk of harm (or other losses or limitations) are fully consulted and are willing to accept what is proposed for them; • Take into consideration, in so far as it is possible to do so, the benefits, costs, and risks, of the siting decision, including their physical, biological, social, cultural, and ethical aspects; and • Ensure that those who benefit most from nuclear power (past, present and perhaps future) are bearing the costs and risks of managing spent fuel and other nuclear materials. (p. 40 - 41) **The major components of the siting process will include:** • Initial public engagement, • Discussions and hearings, • Development and application of site screening criteria, • An Environmental Assessment and the preparation of license applications. Each of these major components necessarily includes both public involvement/participation and technical assessment and analysis. (p.306)
Institutional	• During the siting phase, a preliminary conceptual deep geologic repository design would be prepared for each site being evaluated. Design work would be completed for the surface and underground facilities primarily to establish the access, utility and infrastructure requirements. • The end point of the siting phase would be the receipt of a siting license

	and a construction license, the latter giving regulatory approval to begin construction of the deep geologic repository facility on the preferred site. **Canadian Nuclear Safety Commission (CNSC) is responsible for:** • Regulating all activities relating to nuclear materials, equipment and processes within Canada under the Nuclear Safety and Control Act (p.240) • Ensuring, prior to licensing, that environmental effects are carefully reviewed through environmental assessments, as required under the Canadian Assessment Act (p.240) • Obliging the NWMO to obtain licenses for the site preparation, construction, operation, modification, decommissioning, and where applicable, abandonment of disposal/storage facilities (p. 240) • Evaluating the detailed submissions of the applicant; and to facilitate openness and transparency, CNSC makes decisions licensing decisions of major nuclear facilities through a public hearing process (p. 354) **The Government of Canada is responsible for:** • Ensuring that radioactive waste disposal is carried out in a safe, environmentally sound, comprehensive, cost-effective and integrated manner (p.239) Nuclear Fuel Waste Owners (OPG, NB Power Nuclear, Hydro-Quebec, and AECL) are responsible for financing the long-term management approach selected by the government, including costs of designing and siting the approved approach, implementing and decommissioning the facilities. (p.243) **NWMO is:** • Responsible for proposing a nuclear waste management option to the government • Responsible for managing and coordinating the full range of activities related to the long-term management of used nuclear fuel (p.244) • Made up of the producers and owners of nuclear waste (according to the 'polluter pays' principle) • Held accountable for consulting the general public, and in particular aboriginal peoples, on each of the proposed approaches **Provincial Governments and Regulators:** "Some aspects of siting, construction and/or operation of a central used fuel management facility that may be determined to be governed by provincial legislation." (p.243). • For example, Environmental Assessments and Approvals: provincial legislation requiring the assessment of potential environmental effects of an activity, plan or program may apply to certain aspects of NWMO's work (siting?). (p. 243) **Affected Aboriginal Peoples:** The NWMO is committed to engaging with potentially impacted Aboriginal peoples in a way that will lead to a long-term, positive relationship in a manner that respects Aboriginal decision- making processes. (p. 249) • The NWMO is committed to respecting Aboriginal rights, treaties, and land claims.

	• Aboriginal peoples may be affected by implementation decisions and will therefore need to play an important role in any collaborative to determine risk and safety. • Identification of specific roles and active involvement will be subject to discussion and agreement with Aboriginal peoples and communities who may be affected by implementation.
Biophysical	• A deep geological repository would be located in the Canadian Shield at a nominal depth of 500 to 1,000 metres. (p. 21) • Crystalline rock • Sufficient surface area for receipt facilities and associated infrastructure (p.233) • Seismically stable region with low known or projected frequency of high magnitude earthquakes (p. 233) • Low frequency of major groundwater conducting fracture zones, features or faults at repository depth (p.233) • Geotechnically suitable host rock formation at least 200 metres below surface with a preference for a suitable host rock formation between 500 and 1,000 metres below surface for the deep geologic repository (p.233) • Geochemically suitable (e.g., reducing) conditions in groundwater at repository depth (p.233) • Evidence of rock mass homogeneity and stability at repository depth (p. 233) • Low hydraulic gradient and low permeability (p.233) • Diffusion controlled transport of dissolved minerals at repository depth (p.233)
Social	• remote location which would remove the used nuclear fuel from large population centres (as suggested by "many participants") (p.92) Siting Principles: • Respect for life in all its forms, including minimization of harm to human beings and other sentient creatures; • Respect for future generations of human beings, other species, and the biosphere as a whole; • Respect for peoples and cultures; • Justice across groups, regions, and generations; • Fairness to everyone affected and particularly to minorities and marginalized groups; and • Sensitivity to the differences of values and interpretations that different individuals and groups bring to the dialogue (p.231)
Economic	• Absence of known potential economic resources at depth
Technological/Engineering	• Need for transportation containers and the facilities to produce them; processing facilities to load the fuel into transportation containers; production facilities for deep repository containers; processing facilities to transfer the fuel from transportation to deep repository containers; and production facilities for sealing materials (p.138 - 139) • Transportation will require an emergency response plan (p.123) • Mode of transportation would depend upon location of the central facility (p.123) • For the underground facility, a network of horizontal tunnels and rooms would be excavated in stable rock about 500 to 1,000 metres below the

	surface (p.124)

Discussion

Siting facilities is not a highly predictive process that can be mounted in a programmed way. The siting landscape is in constant flux. What is known is that siting processes tend to be highly conflictual and the interpretation of numerous aspects of the nuclear industry, nuclear waste management and risk are multifarious. Siting is a political process required to reconcile numerous conflicting goals and perspectives. What is certain in the siting process is that implementing agencies must be perceived as trustworthy and legitimate. Another certainty in siting processes is that a broad spectrum of interests including the public should be involved at the very start and must continue throughout.

It is also important for the siting agency to reconcile that they are significant agents of change. As we note in an earlier document the actions of siting agencies evoke changes within communities, between communities and within and between regions. Related to this, is that the siting agency needs to cope with myriad issues along the national to local spectrum. Although many authors point out the importance of local involvement in siting processes, larger scale concerns must also be addressed. In other words, failure to address local issues and national issues (and those in between) will result in controversy. Furthermore, siting agencies that are dogmatic in their adherence to a particular strategy are likely to experience greater controversy and dissent than if they are open to policy and procedural changes. Flexibility in siting is paramount.

Numerous public participation models have been developed, such as the model of cooperative discourse (Schneider and Renn 1999) and the analytical deliberative process (Petts 2004), which may prove useful in moving towards the development of a siting strategy. A characteristic of both of these models is that all stakeholders (i.e. interest groups, experts, citizens, sponsors, research teams) contribute to the definition of the issue, how it should be measured, and what the desired outcomes should be. The application of models such as these may prove useful towards initiating a process to initiate a siting process.

In much of the literature reviewed two issues stand out: 1) defining the problem and 2) risk characterization. The latter is important because so much of the discussion around nuclear fuel waste management is set in the context of risk. Therefore, early deliberation by numerous stakeholders on what the risks are (perceived or otherwise) and how they will be characterized prior to the initiation of the siting process can potentially diffuse later siting conflicts. Similarly, a broad based agreement on a specific definition of how the problem should be defined can also even the playing field amongst potentially conflicting stakeholders. Initial focus on these two attributes can potentially provide stakeholders with an early stake in the issue. It may also increase the legitimacy and trust in the lead agency if they are able to relinquish some control regarding what the problem is and parameters upon which it will be defined.

Subsequent to the above, then, and only then, would the conceptualization of an actual siting process occur. Again, this process cannot be rigid, but must be adaptive to changing conditions,

communities, stakeholders, information and the like. Discussions concerning impact benefit agreements or community acceptance agreements could be addressed at this stage as could some of the basic siting parameters such as the biophysical, social and economic criteria.

The actual mechanics of these initial consultations over the definition of the problem, risk characterization and siting process can be guided by any of numerous public participation models such as community advisory committees or citizen juries. Examples from Europe have shown that these methods to have promise in alleviating conflict and empowering citizens, particularly those that focus on experiential learning.

Siting conflict share an important similarity; they all need to be solved. As we also noted, in many siting controversies citizens often express the desire for the 'best site' or that a problem of national importance does indeed need to be solved. What citizens also desire is the ability to ensure that the process, however defined, is truly equitable, unbiased and that they are empowered.

Bibliography

Armour, A.M. 1992 The cooperative process: facility siting the democratic way *Plan Canada* March 29-34

Arnstein, S.R. 1969 A ladder of citizen participation *American Institute of Planning* 5, 216-224

Ballard K.R. and R.G. Kuhn 1996 Developing and testing a facility location model for Canadian nuclear fuel waste *Risk Analysis*, 16, 6, 821-832

Baxter, J.W., J.D. Eyles and S.J. Elliot 1999 From siting principles to siting practices: a case study of discord and trust, equity and community participation *Journal of Environmental Planning and Management* 42, 4, 501-525

Baxter, J. and K. Greenlaw 2005 Explaining perceptions of a technological environmental hazard using comparative analysis *The Canadian Geographer* 49,1, 61-81

Beck, U. *Risk Society: Towards a New Modernity* London: Sage

Boholm, A. and R.E. Lofstedt 2004 Introduction in A. Boholm and R. Lofstedt (eds) *Facility Siting: Risk, Power and Identity in Land Use Planning*, London: Earthscan, xii-xxv

Bradshaw, B. 2003 Questioning the credibility and capacity of community based resource management *The Canadian Geographer* 47, 2, 137-150

Bullard, R. 1999 Dismantling environmental racism in the USA *Local Environment* 4,

Freudenberg, W.R. 2004 Can we learn from failure? Examining US experiences with nuclear repository siting *Journal of Risk Research* 7, 2, 153-169

Garvin, T. 2001 Analytical paradigms: the epistemological distances between scientists, policy makers and the public *Risk Analysis* 21,3, 443-455

Hunold, C. 2002 Canada's low level radioactive waste disposal problem: volunteerism reconsidered *Environmental Politics* 11,2, 49-72

Hunold, C. and I. M Marion Young 1998 Justice, democracy and hazardous siting *Political Studies* XLVI, 82-95

International Atomic Energy Agency 2002 *Institutional Framework for Long Term Management of High Level Waste and/or Spent Nuclear Fuel* IAEA-TECDOC-1323

Jacob, G. 1990 *Site Unseen: The Politics of Siting a Nuclear Waste Repository* Pittsburg: University of Pittsburg Press

Jenkins-Smith, H. and H. Kunreuther 1999 Mitigation and compensation as policy tools for siting: evidence from field survey data, Proceedings, international workshop on challenges and issues in facility siting, Taipei, Taiwan. Earthscan.

Kasperson, R.E. 2000 Risk and the stakeholder express, President's message *Risk Newsletter* 4 Quarter, 3

Kasperson, R.E. 1999 Siting hazardous facilities: searching for effective institutions and processes, Proceedings, international workshop on challenges and issues in facility siting, Taipei, Taiwan. Earthscan.

Kemp, R. 1992 *The Politics of Radioactive Waste Disposal* Manchester: Manchester University Press

Kennett, S. 1999 *Issues and Options for a Policy on Impact and Benefit Agreement for the Northern Territories* Calgary: Canadian Institute of Resource Law

Kuhn, R.G. and K.E. Ballard 1998 Canadian innovations in siting hazardous waste management facilities *Environmental Management* 22, 4, 533-545

Kunreuther H., K. Fitzgeral and T. D. Aarts 1993 Siting noxious facilities: a test of the facility siting credo *Risk Analysis* 13, 3, 301-317

Lane, M.B. and G. McDonald 2005 Community based environmental planning: operational dilemmas, planning principles and possible remedies *Journal of Environmental Planning* 48, 5, 709-731

Lesbirel, S.H. and D. Shaw, 1999 Facility siting: issues and perspectives Proceedings, international workshop on challenges and issues in facility siting, Taipei, Taiwan. Earthscan.

Lidskog, R. 2005 Siting conflicts- democratic perspectives and political implications *Journal of Risk Research* 8, 3, 187-206

Linneroth, B.J. and K.B. Fitzgerald 1996 Conflicting views on fair siting processes: evidence from Austria and the US *Risk: Health, Safety and Environment* 7, 3, 119-134

Murdock, B.S., C. Wiessner and K. Sexton 2005 Sexton Stakeholder participation in voluntary environmental agreements: Analysis of 10 Project XL case studies, *Science, Technology and Human Values* 30, 2, 223-250

Nuclear Waste Management Organization 2005 *Choosing a Way Forward: The Future Management of Canada's Used Nuclear Fuel; Final Study* Toronto: Nuclear Waste Management Organization

O'Faircheallaigh, C. 2000 An Australian perspective on impact and benefit agreements *Northern Perspectives* 25, 4, 12-17

Openshaw, S., S. Carver and J. Fernie 1989 *Britain's Nuclear Waste: Safety and Siting* London: Belhaven Press

O'Reilly, K. 2000 Impact and benefit agreements: tools for sustainable development? *Northern Perspectives* 25, 4

O'Reilly, K. and E. Eacott 2000 Aboriginal peoples and impact and benefit agreements: summary of the report of a national workshop *Northern Perspectives* 25,4

Owens, S. 2004 Siting, sustainable development and social priorities *Journal of Risk Research* 7, 2, 101-114

Petts, J. 2001 Evaluating the effectiveness of deliberative processes: waste management case studies *Journal of Environmental Planning and Management* 44, 2, 207-226

Petts, J. 2004 Barriers to participation and deliberation in risk decisions: evidence from waste management *Journal of Risk Research* 7, 2, 115-133

Rabe, B.G. 1994 *Beyond NIMBY: Hazardous Waste Siting in Canada and the Uni8ted States*, Washington: Brookings Institution

Rosa, E.A. and J.F. Short 2004 The importance of context in siting controversies: the caser of high-level nuclear waste disposal in the US in A. Boholm and R. Lofstedt (eds) *Facility Siting: Risk, Power and Identity in Land Use Planning*, London: Earthscan, 1-20

Rowe, G. and L.J. Frewer 2004 Evaluating public participation exercises: A research agenda, *Science, Technology and Human Values* 29, 4, 512-556

Rowe, G. and L.J. Frewer 2005 A typology of public engagement mechanisms, *Science, Technology and Human Values* 30, 2, 251-290

Schneider, E. and O. Renn 1999 Fairness in public participation: German experiences with a structured public participation process in regional waste management planning. Proceedings, international workshop on challenges and issues in facility siting, Taipei, Taiwan. Earthscan.

Short, J.F. and E.A. Rosa 2004 Some principles for siting controversy decisions: lessons from the US experience with high level nuclear waste *Journal of Risk Research* 7, 2, 135-152

Siting task Force (STF) 1995*Deep River Initial Assessment Report* STF Tech. Bib. No. 413

Slovic P. 1993 The perception of risk *Science* 2362, 280-285

Smith, H.J. and H. Kunreuther 1999 Mitigation and compensation as policy tools for siting potentially hazardous facilities: evidence from field survey data. Proceedings, international workshop on challenges and issues in facility siting, Taipei, Taiwan. Earthscan.

Soderberg, H. and J-H. Kain 2006 Assessments of sustainable waste management alternatives: how to support complex knowledge management *Journal of Environmental Planning and Management* 49, 1, 21-39

Stern, P.C. and H.V. Fineberg (eds) 1996 *Understanding Risk: Informing Decisions in a Democratic Society* Washington: National Academy Press