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The Social and Ethical Aspects of Nuclear Waste

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Nuclear waste management seems to exist in a perpetual state of crises. For 50 years the nuclear states of the world have fought, and generally lost, the battle to deal with the nuclear waste problem. Worldwide, there is a growing acknowledgement within industry and government that social and ethical issues are just as important as technical issues when developing safe programs for nuclear waste management. This paper is a review of some of the outstanding social and ethical issues that are influencing discussions on nuclear waste management around the world.

Social Equity in Nuclear Waste Management

There are many ways that nuclear waste management has the potential to be socially inequitable: burdening certain groups of society with more than their fair share of risks and costs. The following sections outline salient social themes that have emerged as the nuclear nations in the world attempt to deal with nuclear waste.

Nuclear Stigma

According to work by Slovic, Layman, and Flynn (1993, p. 64) nuclear waste can be regarded as the top neighbor from hell, ranking higher than oil refineries, chemical plants, garbage dumps and even nuclear power stations as the most undesirable facility to live beside.

The aversion to things nuclear, including nuclear waste, is often referred to as nuclear stigma and it has a number of possible effects: economic, social, political, cultural and psychological. With regard to the last of these, while there may be a case to state that the people of nuclear host communities are active in the construction of a positive nuclear identity, it is apparent that some members of the public are concerned about the mental stress of living close to a nuclear site (or the prospect of the same) (Dunlap, Rosa, Baxter & Mitchell, 1993; Edelstein, 1988). In such circumstances, if nuclear waste managers are to take social issues seriously then maybe they should consider the ideas brought out by the likes of Lois Wilson (2000, p. 87), and Wendy Oser and Molly Young Brown (1996) who suggest professional counseling in some form should be provided to local individuals or groups. Kristen Shrader-Frechette (1993) suggests also that giving citizens funding for education and health might alleviate this problem, as might delegating authority to monitor stress to the community itself. This would allow local

people to have some degree of self-help capacity over their own psychological and stress problems.

Another type of stigma that may rear its head in the siting of radioactive waste facilities is that associated with moral stigma. Easterling and Kunreuther (1995, p. 137) indicate that the moral qualms that people feel toward nuclear weapons seem to have generalized to civilian nuclear power. And thence, to anything nuclear, such as the radioactive waste left over from nuclear weapons and nuclear power production. In this case, if a nuclear waste management facility goes against the morals of individuals, it is not only politically problematic, giving rise to resistance, but ethically problematic, asking people to live with a facility they find morally objectionable. As far as these people are concerned, it is flippant for nuclear waste facility planners to derail weapons/waste connections by indicating that they are only involved in the rear-end of the nuclear cycle, when so much of the waste was produced for military purposes.

Nuclear stigma has also been identified as having identifiably negative economic consequences. New industries may be reluctant to set up near nuclear waste facilities in fear that their products will suffer negative nuclear stereotyping (Great Britain, Parliament, House of Lords, Select Committee on Science and Technology, 1999, p. 43).

In the states of Nevada and Texas, for example, pre-emptive concerns were expressed regarding the reputations of the tourist and cattle industries when sites in these states were considered for nuclear waste facilities proposed by the U.S. Department of Energy (Brody & Fleishman, 1993, p. 117; Slovic & Flynn, 1991; Easterling & Kunreuther, 1993). Similarly agricultural communities in eastern Washington state were concerned that the establishment of a nuclear repository at Hanford would be seen as leading to the contamination of fruits and wines grown in the area, thereby causing a decline in the economy (Easterling & Kunreuther, 1995, p. 137).

It must also be noted that while some community members might welcome an influx of industrial activity into their local area, desperate to "attract any kind of economic growth" (Rosa, Dunlap, & Kraft, 1993, p. 303), others may fear that such an influx may lead to "increased crime, increased cost of living," property devaluation and disruption of their livelihood (Nuclear Energy Agency, Radioactive Waste Management Committee, 2003).

There has been some indication that what stresses the public most about nuclear power and radioactive waste is the possibility of an accident (Rosa et al., 1993; Easterling & Kunreuther, 1995). This is confounded by the suspicion that the managers of radioactive waste will be secretive with

regard to the public dissemination of information about accidents (Flynn, Slovic, Mertz & Toma, 1990).

Nuclear Oases

Radioactive waste is an intensely local issue. The waste has to be located somewhere, whether it is stored or disposed of, and some communities are going to live nearer to this spot than others.

Once upon a time, when the dangers of nuclear activities were not generally well-known, it was usually the case that certain nuclear host communities were very positive about their status. Living in a pre-nuclear stigma era, many host communities felt they were partaking in a beneficial and advanced technological industry that brought jobs and services to their area. Since the late 1960s however, this unfettered optimism has been battered by the changing economics of nuclear power and faltering tolerance of anything nuclear.

In some nations, the United States and the United Kingdom amongst them, the nuclear industry is suffering a slow but observable decline. Nuclear host sites and their adjacent communities, however, might be labeled as *nuclear oases*; a term the U.K. social scientist Andrew Blowers uses to denote places of lively nuclear activity in a world gradually deserting the industry (Blowers, Lowry & Solomon, 1991). According to Blowers (1999), nuclear oases are peripheral communities, in so far as they tend to be remote, economically and politically marginal and environmentally degraded. Examples of such communities, suggests Blowers, might include Sellafield in England, Hanford in the United States, Dounreay in Scotland, and Cap de la Hague in France.

These localized nuclear communities, Blowers (1999) intimates, exist as sites of intense interest for the nuclear industry, the last strongholds of economic and technical survival against a changing world. Generally, though, and despite the nuclear interest, nuclear oases are sometimes sites of neglect as far as national economy and public profile is concerned. Burdened with remoteness, marginality and powerlessness and previous environmental degradation the above named communities exhibit "a relatively stable locational pattern as a declining industry is resisted in all but the nuclear oases" (Blowers, 1999, p.242).

Blowers' idea of nuclear oases is supported by American social science work on nuclear waste. For example, the social scientists Douglas Easterling and Howard Kunreuther (1995) have observed that traditionally there are lower levels of resistance and protest to new nuclear facilities in regions of strong nuclear presence where the residents may be dependent upon the jobs that

the nuclear industry brings. Through such common dependence, a community spirit of defensiveness against anti-nuclear protest becomes inscribed in the minds of much of the local people (Blowers, 1999).

Of course, not all people living in nuclear oases may be there because they work for the nuclear industry, and some within the industry may themselves be quite critical of it. This has prompted some to note that nuclear host communities exhibit certain schism with regard to nuclear resistance. As well as schisms within the community, it is quite probable that individuals and family units may exhibit schisms of resistance and non-resistance. When social scientist Brian Wynne (1996) was studying the communities around Sellafield in the United Kingdom, for example, he found that Cumbrian farmers not far from Sellafield:

recognized their own indirect and sometimes direct social dependency upon the Plant—not only neighbors, but also close relatives of the hill farmers worked there. Thus, underlying and bounding their expressed mistrust of the authorities and experts, there was a counter-veiling deep sense of social solidarity and dependency—social identification with material kinship, friendship, and community networks which needed to believe that Sellafield was well controlled and its surrounding experts credible. (p. 37)

Wynne doesn't believe such schisms represent an inability to decide upon the ultimate goodness or badness of the nuclear plant but as a considered strategy to tread between various allegiances and experiences (p. 43).

According to Buclet and Bouzidi (2003), who studied nuclear host communities in France, the presence of nuclear oasis communities strongly familiarized to nuclear power does not give rise to more gentle resistance to nuclear waste issues. However, it should be noted that this resistance in the French case is not necessarily community-based but involves the actions of activist groups from metropolitan centers away from the nuclear host communities. In their book *The International Politics of Nuclear Waste*, Blowers, Lowry and Solomon (1991) also acknowledged such a phenomenon in the United Kingdom and the United States, as does Sjölander (2003) in the case of one of Sweden's proposed nuclear host communities. If such examples are to be trusted, then we should predict that all nuclear waste host communities are liable to garner increasing help and attention from formally organized protest groups and informally organized urban sympathizers.

Regional Justice

If nuclear facilities happen to be clustered in particular parts of a nation then

radioactive waste can become a regional phenomenon, thereby giving rise to issues of regional environmental justice (or geographical equity, as some writers like to call it (Gowda & Easterling, 2000)). This issue has been brought to light by a number of writers in a number of countries. Lois Wilson (2000), in regard to Canada, points out, for instance, regional injustices whereby the south produces nuclear waste while the north is focused as the future repository of it. She cannot offer any process to resolve this injustice but merely asks what is the best way to address "equitable distribution of costs, risks and benefits among regions" (p. 3).

Easterling and Kunreuther (1995, p. 35) also point out that an unequal relationship of regions is something keenly felt by western states in the United States. Eastern states, which have a greater population and a greater electricity use, have historically looked west when they are searching for sites for the long-term management of the waste. Anti-nuclear waste sentiment in the western states of Nevada and Utah has given rise to cries of regional injustice when it comes to the planned nuclear waste facilities at Yucca Mountain (Dunlap, Rosa, Baxter & Mitchell, 1993) and Skull Valley (Fahys, 2003). The governors of these states have repeated the complaint that they do not produce nuclear waste, so therefore they should not have to store it for those who do (Gerrard, 1996).

The Promise of Employment

If nuclear communities and nuclear regions are economically depressed and sometimes financially stricken then perhaps they should be quite pleased to host a radioactive waste facility since it may well offer up new employment opportunities. Atomic Energy of Canada Limited (AECL), for example, makes the point that when construction of the Canadian Shield disposal facility starts, "jobs will be created" (as quoted in Wilson, 2000, p. 40). The International Atomic Energy Agency (IAEA) is also on record as saying that employment opportunities associated with nuclear facilities can foster community acceptance of the facility (International Atomic Energy Agency, 2003).

The immediate response from those who receive such advice, as Wilson (2000) notes, is to question exactly who will get these jobs. Will it be local people pooled from the surrounding community, or will the jobs go to imported skilled workers from different regions of the country? If the latter is more probable than the former, then any social impact analysis must be critical of the claim that long-term waste management facilities decrease local unemployment.

What also has to be assessed is the variation of the grades and qualities of

work available to the local workers compared to the imported workers. The local workers, if unskilled in the nuclear industry, are more liable to be given the low-paid jobs and, if Shrader-Frechette's (2001) research is to be trusted, they also may be far more likely involved in non-unionized, low-profile, dangerous work for which they are under-prepared and underpaid with respect to the risks. For these reasons, it has sometimes been expressed that the promise of jobs is not sufficient to garner community acceptance of nuclear waste (Great Britain, Parliament, House of Lords, Select Committee on Science and Technology, 1999, p. 43).

Coercion and Consent

In the case of nuclear waste planning, it is an accepted belief within social science circles that a facility that imposes risks on a community should be built only if the members of that community give their consent (Gowda & Easterling, 2000). But an important issue that emerges involves the way that a potential nuclear host community may be pressured into offering up their consent.

Many prospective facilities have come across stiff opposition when proposed by governmental or private bodies. Despite this, though, the resources and funds that nuclear resistance groups are able to muster compared to the nuclear industry and government is very small. Governments and business can inject funds into their side of the proposal to produce advertisements, campaigns, education projects, and so forth, all aimed at fostering a public opinion conducive to their plans. If consent is given within such an atmosphere of often subtle but perfectly legal coercion, then what is the ethical status of the facility?

Normally we would regard all players in technology and environment debates as rational and well-informed actors capable of making up their own minds. For instance, if a radioactive waste facility was planned in a disused metro station in central New York or London and then opposed by the local people, we'd regard the people as being quite rational and informed. But as Blowers and Shrader-Frechette have illustrated, the communities subjected to waste facility plans (and the workers who are promised jobs in these facilities) may be regarded as peripheralized communities and economically-disadvantaged workers, unable to access all the information they need, unable to access independent points of view, and unable to fully judge the economic benefits versus the radiological risk.

All this gives rise to what Shrader-Frechette (1991) and Wigley (Wigley & Shrader-Frechette, 1994) would call the *consent dilemma*: wherein the siting of nuclear waste facilities and the employing of nuclear waste workers

requires the consent of those who are put at risk; yet those most able to give free, informed consent are usually unwilling to do so, and those least able to validly consent are often willing to do so because they are unaware of the dangers.

These problems then beg us to ask the following questions with regards to siting nuclear waste facilities.

- * What is an adequate level of information and understanding for people to make a decision?

- * Do all stakeholders have equal access to adequate information and assistance in understanding?

- * Who should be in charge of ensuring adequate and equally-accessed information and understanding?

Compensation

One way of dealing with many of the issues noted above is to enact some form of retributive justice, typically compensation, for the people and communities affected. This path in itself is fraught with problems. Kleindorfer et al. (1988), for example, have produced evidence that some people do not believe any amount of compensation makes up for living next to a radioactive waste site.

Shrader-Frechette (1993, p. 204) warns that the use of compensation confuses and upsets any notion of pure consent. Although many people would acknowledge we live in a complex political world where consent always has to be negotiated, the problem is that the disparities in negotiating strength might arise purely through well-financed interests employing misinformation and propaganda, something that has to be countered if the act of compensation is to be processed in an open and fair way.

As an example of nuclear waste financial compensation in action, consider the town of Eurojoki in Finland whose council accepted over 6 million Euros from the waste production and management company Posiva to site a repository near their community. The Eurojoki council did not put the question to referendum amongst its community members but used a Posiva-conducted poll (Posiva Oy, 1999)—that indicated 59% of the community might accept the repository—to make a decision on behalf of the community. This high level of acceptance, 59%, in Eurojoki may have been because the town was already host to two nuclear reactors and so the community members involved in these nuclear operations could have been quite accustomed to the risk of happily clawing economic benefits from the

handling of nuclear materials. However, according to Jorma Jantunen, a critic of the Eurojoki nuclear project, Posiva was bombarding the community with an advertising campaign, served not to inform the community members about the project but to get them to be positive about it (Nuclear Energy Agency, Radioactive Waste Management Committee, 2002).

Alternatively, if Blowers (1999) is right, the community members of Eurojoki may be so economically dependent on the nuclear industry that they feel unable to resist further nuclear operations in fear of industry's declining future. Added to this, if we put store in the writings of Blowers (1999), Shrader-Frechette (1991), Dunion (2003), and others, it may be that community members not actively involved in current nuclear operations may have been socialized to accept the industry's view of the risks and benefits without having the intellectual and financial resources to assess and challenge these received views. When financial compensation is introduced in a form such as that offered by Posiva, it is likely that some will perceive the process as being somewhat morally corrupt (Oughton, Bay, Forsberg, Hunt, Kaiser & Littlewood, 2003, p. 35).

Gender and Risk Sensitivity

A general feminist critique would posit that a lot of environmental and technology policy is biased towards male interests and perpetuates a patriarchal society (Buckingham-Hatfield, 2000; Everts, 1998). As a possible example of the gendered nature of radioactive waste, the report to the 3rd COWAM Seminar (*History and some facts to Wellenberg*, 2002) indicates that only 41% of women polled in a potential repository site accepted the idea of a nuclear waste repository in their area compared to 52% of males. Other commentators, like Gregory and Satterfield (2002), have noted that woman have a greater degree of sensitivity to risk in various hazardous environmental projects. Undoubtedly, there are a myriad of reasons for such situations: the sensitivity of women as a social group to environmental issues due to their self-perceived social roles, the sensitivity of men as a social group to technical issues due to their jobs, the higher expectations within men that economic benefits will actually help them and their families compared to a lower expectation among women for the same thing.

Indigenous Issues

Many countries with historical settler-populations have laws maintaining the land rights and personal rights of indigenous communities. Some of these countries, for instance, the United States, Canada, and Australia, have nuclear waste. In these countries it often happens that nuclear waste

facilities are proposed in remote areas occupied by a high proportion of indigenous people or near to indigenous reservations. An added concern is that these communities are often peripheralized and economically disadvantaged (Fowler, Hamby, Rusco, & Rusco, 1990). This is a recipe for deep social injustice based not only on regionalism and economic inequality but on ethnic issues as well. For instance, Lois Wilson (2000) in Canada noted that one representative of the Canadian indigenous community in a preliminary hearing said that he:

represents fifty First Nation communities, inhabiting two-thirds of the Ontario land mass. Thirty-five of these communities do not have road access, twenty-five are not connected to the electric power grid, and none use nuclear power. (p. 16)

In Canada, the responsible authorities have now at least recognized the necessity to incorporate indigenous concerns into radioactive waste management (Nuclear Energy Agency, Radioactive Waste Management Committee, 2003). Amongst the cited concerns of indigenous groups within targeted sites are the issues of maintaining access to water and land resources, protecting the quality of these resources, health and safety against accidents and pollution, protecting important historical and cultural sites, and sustaining and enhancing cultural and economic opportunities for community members.

NIMBYism

Negative public reactions to radioactive waste facilities are often construed as an operation of the NIMBY (Not-In-My-Back-Yard) syndrome. NIMBYism, under this interpretation, is the emotive, reactionary impulse of local citizens to a project they would probably agree with were it placed somewhere else. Some, like Rosa, Dunlap, and Kraft (1993), feel that such NIMBYism may just be the predictable result of the alienation that people feel to national decision-making processes, a natural response to their resignation that their views will not ever be considered.

According to some research, the whole concept of NIMBYism has little explanatory power when used to interpret the politics of managing and siting radioactive waste facilities. The NIMBY concept predicts that those people physically closest to any planned facility should be those most objecting to it, but when Krannich, Little, and Cramer (1993) studied the phenomenon as applied to the Yucca Mountain repository in Nevada they found that opposition and concern are strongest in the communities farthest from Yucca Mountain.

Another theme that the faltering NIMBY concept predicts is that the arguments of opponents will be emotionally driven by fear and dread and that they will be lacking in technical sophistication. But according to Kraft and Clary (1993), who were studying repository-siting meetings, only 14% of those members of the public testifying made declarations of this kind. Emotive themes were present for only a relatively small number of those making statements; the vast majority did not appeal to emotionalism.

Kraft and Clary also repeat the idea forged by numerous previous studies that a great amount of public testimony from non-expert individuals and groups is of comparable technical sophistication to that of the experts (Martin, 1996).

After reviewing the way public acceptance of a facility is either forthcoming or not within various affected communities across the United States, Rosa et al. (1993) come to the conclusion that resistance to nuclear waste is so widespread that it does not conform to NIMBYism at all but to NIABYism: Not In Anyone's Backyard (p. 318).

Although NIMBYism is denounced by many project planners as the irrational knee-jerk reaction of technically unsophisticated locals acting out of self-interest, if we trust the research outlined above, it seems as though the quick and indiscriminate labeling of resistance as NIMBYism is but the knee-jerk reaction of politically unsophisticated project planners who themselves are reacting under self-interest. A number of works, like for instance that of Rabe (1994), Dunion (2003), and McAvoy (1999), would confirm this view.

Lack of Public Understanding

One of the concerns that arises from the side of the nuclear industry regarding nuclear waste management is that the public does not fully understand the technical issues at hand. This makes it impossible for the nuclear industry to garner full public acceptance of their plans.

This perceived public deficit of knowledge gives rise to what Alan Irwin and Brian Wynne label the *public ignorance* model of citizen participation. If only the public can be rescued from their ignorance, this model suggests, they would be freed of their irrational dread associated with nuclear operations. The public ignorance model, which advocates a form of public participation based upon education, has its roots in the presumption held by many scientists and technologists that the reason people do not fully trust the scientifically-proven point of view is because the public don't fully understand it. For example, Sundqvist (2002) says:

There is a widely held image, in the rhetoric of decision makers, of lay people as uninformed, ignorant and fearful of the unknown. This image suggests that if the level of information is raised, lay people will accept the proposals from decision makers. (p. 14)

Rosa et al. (1993) echo this point with regard to the 50 years of nuclear facility siting in the United States:

The nuclear sub-government, then as now, was guided by the unshakeable belief that increased public understanding—the knowledge fix—would translate into support for nuclear technologies. All that was required was thoughtful public relations to convert the dull, scientific knowledge into interesting, convincing public knowledge. (p.77)

Susana Hornig Priest (Hornig Priest, Bonfadelli & Rusanen, 2003), drawing from her social studies of biotechnology, points out that any determined effort to use public relations to educate the public about controversial science and technology is prone to backfiring. Rosa et al. (1993, p. 315) have found that the same thing happens when the nuclear industry starts up campaigns aimed at using the media to disseminate information.

Transportation Issues

Within and outside of the industry, the transport of nuclear waste has been perceived as inherently riskier than its storage or disposal. The risk of such accidents has driven some writers to declare that waste transport should be regarded as the last resort (Nuclear Guardianship Project, 2002).

According to studies by Slovic et al. (1993), somewhere between 70% and 80% of people questioned in Nevada and California were convinced that railway and highway accidents were going to occur on route to any operating nuclear waste facility. The public perception of transportation as being a problem arises in part from the acknowledged dangers emerging from industry watchdogs, the media, and the industry itself. For instance, the Association of Electronic Journalists declares that “from 1971 to 1998, there were 1,936 accidents and incidents involving radioactive materials transport” (*Nuclear Shipping Accidents: Rare but Regular* , 2002) .

When forecasting the transport problems of the proposed Yucca Mountain repository in Nevada, the U.S. Department of Energy (DOE) predicted there will be 100 accidents over the lifetime of the project (the State of Nevada predicts 400 accidents during the same period) (Wile & Cox, 2002). Most of these accidents would result in no, or negligible, harm to human health and the environment. However, Wile and Cox used published DOE figures to

study what that agency calls a “moderate” accident. Wile and Cox concluded that under such an event:

- * A small number of first responders may be fatally affected.
- * Around 200 to 1,200 latent fatal cancers of nearby citizens would eventuate.
- * Nearly 600 million dollars would be needed to clean up the contaminated area over a 14 month period.

In the event of a transport accident it is fairly certain that local fire, police, and ambulance services might be among the first upon the scene. An ethical issue that must be investigated here is whether all the emergency personnel from the local communities that line the proposed routes of the transported radioactive waste should be trained in some way to deal with accidents that may involve that waste. If so, this will have ramifications concerning the security and financial regimes under which such training might be given.

Some people have argued that the transportation of waste is so dangerous that it should not be undertaken. The Nevada-based Citizen Alert group, for instance, points out that transportation massively increases all the risks associated with radioactive waste handling (*High level radioactive waste transportation factsheet* , 2000) . Physical, or *passive*, security, for instance, at stationary sites involves much more robust physical protection from human interference and natural disaster since the strength of buildings and earthworks that house stationary waste is greater than that achievable with mobile wastes. Nevada’s Nuclear Waste Project Office confirm this when they declare that if transport casks were designed to protect the waste to the same degree as stationary facilities, they’d be too heavy to be transported (Nevada Nuclear Waste Project Office, 1999).

When it comes to *active* security, mobile radioactive waste cannot favorably compare to the stationary waste either, since the former does not have the police presence, and the emergency personnel, that regularly accompanies the latter. The Nuclear Information and Resource Service (NIRS) (Mariotte, 1998) also points out that mobile radioactive waste is more vulnerable to external factors than stationary waste since, as safe as we can get the transportation system, external factors (such as drunken drivers, weather extremes, traffic emergencies—all of which have caused accidents in radioactive transport in the past) cannot be eliminated.

Another important issue regarding transport of radioactive waste is whether the route should be openly declared. To discuss this particular issue necessitates an engagement with the never-ending balancing act of working with security concerns versus fairness/democratic concerns. To minimize the

risk of terrorist action or theft, the usual approach is to keep the routes secret. To maximize the democratic impulse of people to know about threats to their health and their environment, the routes should be declared. This balance may be made more complex by acknowledging that some along the route are more concerned about nuclear stigma affecting property prices than about any health risk or environmental danger. Thus, under the rhetoric of fairness, there may be social pressure (and also political back-up) for the routes to remain unnamed (Gawande & Jenkins Smith, 2001).

Public Participation Issues

Projects to manage nuclear waste involve a series of important and perhaps irreversible decisions. In many nations it is generally thought that these decisions should reflect a certain amount of public involvement (Kraft, Rosa & Dunlap, 1993, p. 11).

Not all people are of the opinion that nuclear waste is an issue worthy of extensive public consultation. Many technocrats believe that when it comes to siting radioactive waste, it is unlikely that everybody can have their desires catered for, but that this situation shouldn't stop the government from making a decision in favor of the interests of the majority (Great Britain, Parliament, House of Lords, Select Committee on Science and Technology, 1999) .

Public participation has come very slowly to nuclear issues. The secrecy of the nuclear industry and its strategic importance regarding security and military affairs has encouraged this. In some nuclear nations this modus operandi of secret operations continues unabated. There has also been the attitude that such complex technical issues should be left to those experts trained in nuclear science and technology management.

In those nations that claim to have strong democratic governments, however, public participation is gradually becoming more extensive and more intensive. The most rudimentary form of public participation is the breaking down of the secrecy barriers just mentioned. This form of public participation involves the D-A-D (Decide – Announce – Defend) approach (Hunt, 2001). Nowadays such an approach is criticized for being more technocratic than democratic, and for being inefficient, socially unjust, and ethically biased. The Radioactive Waste Management Advisory Committee (2001) in the United Kingdom, for instance, has become aware of this and has declared such an approach "inappropriate."

Beyond the D-A-D approach there are a variety of ways to allow the public to enter into the decision-making process, some of which occur earlier or

later along the decision chain with varying efforts to allow public input. For instance, Vári, Reagan-Cirincione, and Mumpower (1994) outline the four ways that public participation has been conceived and used by various nations as they strive to site nuclear facilities:

1. Stakeholders are involved in the project, receiving information, but have no decision-making power (equivalent to the D-A-D approach).
2. Stakeholders are granted the power to review and modify recommendations or decisions.
3. Stakeholders are given the power to make recommendations, although decision-making power is reserved by state or private agencies or institutions.
4. Stakeholders are given direct power to choose a solution or make a decision.

An example of the first way of involving the public, which had been used as the preferred public participation method in the United States up until recent times, is the public hearing. Many heavily criticize this form of public participation, however. For example, Kraft and Clary (1993) say that such participation provides a weak opportunity for real public involvement, lacks two-way channels of communication, and may be usurped by planners to promote the facility they are planning.

Evidence that suggests that maximum community involvement is more effective than minimal community involvement is offered by Carnes, Copenhaver, Sorensen, Soderstrom, Reed, Bjornstad, et al. (1983). They asked a sample of Wisconsin residents whether or not they would oppose a radioactive waste repository built in their state. Initially 26% of respondents indicated they would approve such a repository. Then after being offered accompanying conditions (which included independent monitoring, enhanced community control of the facility, and the power to shut the facility down) the percentage favoring the repository rose to 46%.

Whatever precise path of public participation that a mission-oriented organization might consider adopting, the Swiss-based Expert Group on Disposal Concepts for Radioactive Waste (EKRA), acknowledge there is always the question of how to reconcile different forms of knowledge, levels of rationality, and claims of truth and, at the same time, carry on pluralistic and democratic discussion on the topic of radioactive waste management (EKRA, 2000).

The public participation schemes undertaken by various authorities involved with nuclear waste policy and planning have brought to light a number of

recurring public concerns. These are listed below:

A. What are the exclusion criteria for siting?

People want to know what reasons the authorized body would have to stop a siting (Wilson, 2000, p. 67).

B. Complaints of notification

Despite there sometimes being a lot of press, many people complain they don't know when or where the public consultation process is to be held, and that if they do know, they don't know what the parameters of the meeting are (Wilson, 2000, p. 39).

C. Statements of Uncertainty

People seem to want to have a clear statement of technical and scientific uncertainties up-front. In Canadian public hearings it was found that the public takes the uncertainties far more seriously than the experts, and trust is not built by scientific uncertainties not being stated up-front (Wilson, 2000, p. 37).

The public participation process in the Finnish case also found that there was some public unease about whether experts can claim certainty of their knowledge with regard to the long-term safety of the facility (Nuclear Energy Agency, Radioactive Waste Management Committee, 2002).

D. The right of veto

The right of veto is clearly desired (Flynn, Mertz & Slovic, 1993). But who should it be invested in—the citizenry, the local council, or low- or top-level Government officials? When in the process should it be given—before or after feasibility studies?

Douglas Easterling and Howard Kunreuther (1995, p. 12) offer a method of voluntarism in which a waste management organization proposes to prospective volunteer communities a list of minimum requirements for a facility. The waste managers can then ask the prospective volunteer communities to propose the conditions under which they would allow the facility to be constructed. Under Easterling and Kunreuther's vision of such a system, potential host communities enter into negotiations with the developer only if they are interested and that they can de-select themselves at a future time.

E. The Reliance on Experts

Nuclear experts are only occasionally seen as being neutral. Usually, the public discounts expert evidence because of whom the expert works for (Papinchak & Wingard, 1990). For example, "the international consensus on the concept [of deep geological disposal] comes from proponents of the industry only" (Wilson, 2000, p. 39).

The public often believes that experts have the prevalence of working towards:

- * Making their employers happy (Johnson, 2003; Irwin, Dale & Smith, 1996).
- * Justifying their own earlier judgments (Wynne, 1996; Sismendo, 1996).
- * Legitimizing their own personal value framework (Sundqvist, 2002; National Research Council, Committee on Disposition of High-Level Radioactive Waste Through Geological Isolation, 2001; Slovic et al., 1993, p. 64).

Thomas Rosenberg of the Lovisa movement in Finland found that the EIA process at Eurojoki was steeped in scientific camouflage by the experts involved, alienating the citizenry from the decisions (Nuclear Energy Agency, Radioactive Waste Management Committee, 2002) . According to a moderator within this process, some participants mentioned that due to lack of resources, some people who held suspicions about the proposed plant could not hire their own independent experts to offer independent views.

F. Measuring public attitudes

Lois Wilson (2000) asks, "What method will measure public acceptance? Referendum? Plebiscite? City Council vote?" (p. 43).

G. False participation

According to Wallentinus and Paivo (2001), there have been instances where bodies have sat down to listen to the stakeholders in a succession of meetings in which no effort was made to adjust proposals to the ongoing suggestions of stakeholders. This issue can be expanded to include the often expressed suspicion that much of what constitutes public participation is just public relations (Beder, 1999; Kraft & Clary, 1993), an attempt to manipulate public acceptance into a pre-chosen proposal (or to make the public choose from a range of favored proposals).

H. Trust and trustworthiness

Speakers at hearings and on citizen panels intimate that it is often very difficult to trust the various actors involved in radioactive waste management. For example, in European nations, Eurobarometer found that 29% of the respondents state that they are very worried about the way nuclear waste is handled in their own country and only 10% trust the information provided by the nuclear industry (INRA European Coordination Office, 2002) .

Intergenerational Justice in Nuclear Waste Management

Issues of justice do not cut across only space but also across time. Radioactive waste is long-lived. The waste produced today is going to be around many years after this generation has disappeared. There are a number of ethical problems thrown up as a result of this and they tend to be categorized together in the literature under the rubric of *intergenerational equity*; a phrase meant to convey the fact that there are obligations and rights that the current generation owe to, or project upon, future generations.

Consent

In democratic societies it is often regarded as important to get the agreement of the local people in some way before building a hazardous facility. However, it is impossible to get the consent of future generations of communities that may surround such facilities. With regards to nuclear waste this becomes an intergenerational issue, for the waste remains hazardous from 100 to a million years. Even if the most extensive and intensive public participation, democratic decision-making and stakeholder involvement was all enacted, and even if local consent is given for a nuclear waste management facility to be constructed at this moment in time, this does nothing to allay concern that such processes and such consent decides the future environmental quality of peoples who have not, in any way, approved the facility. In light of this, Nilson (2001) raises a question: how far in the future can we make democratically credible decisions?

Relying on Future Techno-Fixes

While talking about our responsibility to manage our own radioactive waste, Shrader-Frechette (2000) makes the point that:

Of course it may be counter-argued that future persons ought to bear more of the risk and cost of nuclear waste because those future people will be

better prepared to face these technological and economic risks. (p. 773)

Thus, given that society is always advancing and progressing scientifically, technologically and economically, radioactive waste managers shouldn't be in too much of a hurry to invent a solution because any generation that comes after us will provide a better one. Shrader-Frechette's answer to this is:

- * We don't know what the future holds.
- * Economically, demographically, and resource uncertainty may make it more difficult for future generations to solve these problems.
- * Just because they *may* be able to solve the problem better than present generations, this does not mean they *should* solve our problems.

In contrast to Shrader-Frechette, Nilson (2001) sets store in the ability of each generation being able to furnish the next with the skills, resources and means to manage problems that they leave behind. She says that to do that we should make sure the chain of skills remains undiminished. To do that there needs to be a number of processes set in place (such as record maintenance, standardizing a long timescale review process, ensuring traditions of practice are sustained, etc.). Only by actively doing these things in the near-term can we possibly rely on social institutions that are supposed to preserve current experience and knowledge and pass it on to the future generations. The Nuclear Energy Agency (NEA) has also raised similar points (Nuclear Energy Agency, 1995). Critics of this approach, however, might raise the point that this is an apology for the continuation of a nuclear industry.

Social and Political Change

The social and political backgrounds against which radioactive wastes are to be managed are liable to change, perhaps drastically, in both the short-term and long-term life of the waste. Some, like Buser (1997), have noted that our knowledge of the physical environment and our prediction of its stability, while full of lacunae and doubts, are far more impressive than our ability to understand and predict the course of the social and political environment. "Political science fiction" is the phrase Lois Wilson (2000) is driven to use when cogitating about failing institutions and changing social circumstances over the lifetime of radioactive waste.

Writers like Wilson are sensitive to the fact that things are going to change quite unpredictably. It's not only the case that wars will be fought, economic slumps and booms will come and go, but that nations also may rise and fall. And even the concept of a nation may disappear (as some intimate with

regard to globalization (Giddens, 2000)) taking along with it, perhaps, any institutional body charged with maintaining control or a watching brief over nuclear waste.

Given all of this, many have stated that now is the time to solve the problem, now is the time to think of a permanent solution (McCombie, Pentz, Kurzeme & Miller, 2000; McCombie & Chapman, 2002; Säteilyturvakeskus, 1989; Nuclear Energy Agency, 1995; International Nuclear Societies Council, 2002). Whether this is true or not, an important question that must come up is this: is it worthwhile making any predictions for the future of social environment as is done with the physical environment? Some, like Wilson (2000), would say no, since it is merely sooth-saying. The chances of you predicting the right result are very small. Others may say yes, but only if we acknowledge that our predictions are limited to generalities. It is possible, for example, for social scientists to arrive at a range of scenarios for future societies that are helpful in providing overall advice to today's radioactive waste managers. Given that most social science has never been a predictive art, except to those with a distinct utopian agenda, most sociologists would be skeptical of the social and political predictions. However, based on their attempts to delve into the social aspects of other environmental problems (Williams, 1998; Dunlap & Michelson, 2002) , and based upon their attempts to tease out the social aspects within scientific and technological projects (Sismendo, 1996; Mack, 1990), most social scientists would be convinced of the massive importance of social and political issues on the future management of nuclear waste, and they'd probably say that these factors would equal or outweigh many of the technical factors already considered by nuclear waste managers.

Information Upkeep

If future generations are to be able to care for or avoid the radioactive waste facilities that this generation constructs, then some way of communicating the dangers of radioactive waste to these future generations has to be realized. However, any attempt to do this must be cognizant of the changing regimes of information storage. Mainstream manners of conveying information are obviously subject to change over long time periods. Many of the oral traditions and symbolic representations that were standard thousands of years ago are largely lost to or lost on the current generation. Similarly, the documents we produce now relating to the siting of dangerous waste are less likely to survive than the waste itself. The digital revolution may exacerbate this problem according to Ulrike Fink (1993) who points out that data losses may take place even faster due to the rapid progress and subsequent incompatibility of computer systems. Fink offers an example of information loss that she believes is somewhat analogous to what may

happen with regards to nuclear waste:

Everyone knows that Germans are especially tidy and painstaking—but nevertheless, now and then it happens that old pits of abandoned coal mines are just drilled by chance! That means, either the knowledge has got lost during 100 years or the people didn't study the available, existing data—the people were not conscious of the problem. (p. 136)

This case, suggests Ulrike Fink, implies that despite our best record-keeping efforts, it is likely that the information we produce about our radioactive waste activities is probably going to be inaccessible to future generations.

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