22. Statement of the DoE at the ministerial conference on acid rain held in Munich, June 1984.
23. DoE, *The Government Reply to the Fourth Report of the Environment Select Committee* (London: HMSO, 1984), p. 3.
24. This was first acknowledged in a statement by L.E. Reed at the presentation of the DoE report *Effects of Airborne Sulphur Compounds on Forests and Freshwaters (Pollution Paper no. 7)* (London: HMSO, 1976), before the 1976 Telemark conference (Norway).
25. DoE, *The United Kingdom Environment 1979: Progress of Pollution Control (Pollution Paper no. 16)* (London: HMSO, 1979), p. 3.
26. CEGB in Select Committee, *Fourth Report, Minutes of Evidence*, p. 18.
27. See, for instance, T. O'Riordan, 'Culture and the environment in Britain,' *Environmental Management*, Vol. 9, no. 2, 1985, pp. 113–20.
28. Speech to the closing session of the Munich conference on acid rain, 27 June 1984.
29. DoE, *Environmental Standards: A Description of United Kingdom Practice (Pollution Paper no. 11)* (London: HMSO, 1977), pp. 7–8.
30. In Park, *Acid Rain*, p. 222.
31. National Environmental Research Council, in Select Committee, *Fourth Report, Minutes of Evidence*, p. 228.
32. The best account of the fascinating early years of the Alkali Inspectorate is undoubtedly R.M. MacLeod, 'The alkali Acts administration, 1863–84: the emergence of the civil scientist,' *Victorian Studies*, Vol. 9, no. 2, 1965, pp. 85–112; for a good case study on the more recent abatement practice, see K. Hawkins, *Environment and Enforcement* (Oxford University Press, 1984).
33. In Royal Commission, *Tenth Report*, p. 45.
34. DoE, *Controlling Pollution: Principles and Prospects – The Government's Reply to the Tenth Report of the Royal Commission on Environmental Pollution (Pollution Paper no. 22)* (London: HMSO, 1984), p. 2.
35. Select Committee, *Fourth Report, Minutes of Evidence*, p. 1; Royal Commission, *Tenth Report*, p. 147; FOE in Select Committee, *Fourth Report, Minutes of Evidence*, p. 39.
36. Royal Commission, *Tenth Report*, 144; FOE, in Select Committee, *Fourth Report, Minutes of Evidence*, pp. 37, 40; Select Committee, *Fourth Report, Minutes of Evidence*, pp. xi, xiii.
37. Select Committee, *Fourth Report, Minutes of Evidence*, p. xx.
38. *Ibid.* p. lii.
39. *Ibid.* p. lxxi.
40. Royal Commission, *Tenth Report*, p. 147.
41. FOE, in Select Committee, *Fourth Report, Minutes of Evidence*, pp. 8, 42, 51.
42. See Fowler *et al.*, 'Rainfall acidity.'
43. It did not help that the Chairman of the royal commission at that time, Professor Sir Richard Southwood, was also chairing the SWAP project.
44. See D. Vogel, *National Styles of Regulation* (Ithaca, NY: Cornell University Press, 1986, pp. 80, 83.
45. J.R. Ravetz, 'Usable knowledge, usable ignorance: incomplete science with policy implications,' in W. Clark and R. Munn (eds) *Sustainable Development of the Biosphere* (Cambridge University Press, 1986).
46. As indeed they did; see House of Commons Select Committee on the European Communities; *First Report: Air Pollution*, 2 vols (London, HMSO, 1988).
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10

Hazardous waste policy, community movements and the politics of Nimby: participatory risk assessment in the USA and Canada

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During the late 1970s and 1980s news reports of oil spills, nuclear disaster at Chernobyl, near-disasters at Three-Mile Island, pesticides in the food chain and DDT damage to wildlife have frightened people around the world (Piller, 1991). The result has been a widespread distrust of industry and a collective fear of all chemical-processing facilities. As the public has become increasingly aware of the extent to which chemicals now pollute the environment, the result has been a new anxiety often described as 'chemophobia'. Polls show that citizens are more concerned about the presence of toxic wastes than any other environmental problem, even though the Environmental Protection Agency maintains that it is not the most severe health threat. Problems such as the ozone hole and the greenhouse effect are said to be much riskier. Such public fear is seen by many experts and commentators to be irrational.

One of the clearest manifestations of this anxiety has come to be called the 'Nimby syndrome'. Much discussed in both the academic and popular presses, Nimby (not in my backyard) is now blamed as a major stumbling block for solving a growing number of environmental problems. As numerous commentators have pointed out, the public formerly accepted everything, but now it seems to oppose just about everything.

Nimby covers a wide range of activities: 'Whether the matter is health, peace of mind, or protection of property values, few Americans (activists or not) care to live beside chemical-waste dumps, airports, petrochemical refineries, nuclear power plants, or other standard features of a modern industrial society' (*ibid.* p. 12). But Nimby is not a term designed to reflect just any opposition. As a theoretical construct, Nimby is a phenomenon based on a specific type of opposition. It is a reflection of a public attitude that seems to be almost self-contradictory – that people feel it is desirable to site a potentially

hazardous type of facility somewhere as long as it is not where they personally live.[1] Nimby, moreover, seems to be spreading to one policy area after another: landfills, prisons, power plants (nuclear or otherwise), industrial parks, housing for the homeless, treatment facilities for drug addicts and hazardous waste facilities (Dear, 1992). Portney (1991, p. 11) gives the following example:

> Nearly everyone seems to agree that more prison space is needed if the criminal justice system is to be able to treat convicted criminals as harshly as the public mood warrants. Yet no one wants a prison in his or her city or town . . . Most people seem to agree that such facilities are a necessary and acceptable result of living in an industrial society.

Community resistance to the siting of risky facilities can now only be described as a 'full-scale public malady', a kind of dysfunctional social 'syndrome' (Portney, 1991, pp. 10–11). Writers speak of 'policy gridlock' and 'policy stalemate'. In the case of hazardous-waste treatment facilities, for example, sitings have virtually ground to a halt during the past decade.

Nimby and hazardous waste

Nowhere has concern about this public 'irrationality' been more prominent than in the political conflicts associated with the siting of hazardous-waste treatment facilities. Such facilities are required to process the large number of industrial and commercial chemical waste products that possess such characteristics as toxicity, reactivity, corrosivity or ignitability. Since the 1970s, Americans have become more aware of and concerned about the growing amounts and types of such hazardous wastes generated by industry and government, especially the military. A study conducted by the Congressional Budget Office, for example, concluded 'that approximately 266 million metric tons of hazardous waste are generated in the United States annually, which amounts to more than one ton per person residing in the country' (Davis, 1993, p. 4).

The production of hazardous industrial by-products is not a new phenomenon. Rather the problem is found in the dramatic increase of such by-products since the end of the second world war, 50 per cent of which are directly attributable to the chemical products industry. The largest share of this increase has resulted from petroleum-based chemical products such as pesticides, plastics, synthetic fabrics, new paints, solvents and wood preservatives. Other important sources of hazardous waste include the paper, fabricated metals and food industries.

A statistical profile of such wastes can inform policy-makers about the 'who', 'where' and 'how much' of such waste production, but conveys little about the actual risks to public health or environmental quality associated with such materials. And it is just this question that has been the source of the problem. Despite concerted attempts to assure the public of the safety of sophisticated treatment facilities, community groups have, by and large, been unwilling to accept the assurances offered by their managers. Especially acute has been the issue of incinerating hazardous materials. Although many argue

that incineration offers the safest – i.e. least risky long-term alternative for disposing of such wastes – it has encountered fierce community opposition. No one wants their community to be the site of the incinerator or a landfill. Activists opposed to hazardous-waste treatment facilities are quite varied in their strategies and objectives. Basic to their efforts, however, are a number of common characteristics: 'Nearly all begin with the frustrated rage and fear of people who perceive themselves as victims and who see their quality of life threatened' (Piller, 1991, p. 12). Highly focused on protecting their home environments, Nimby activists have wasted little time at becoming skilled at petition drives, political lobbying, street confrontations and legal proceedings. If their frustrated rage and anxiety is the most general characteristic that unites these groups, the most specific is their rejection of experts and technocrats as the ultimate arbiters of technological risk and change. Often, in this regard, the zeal of Nimby groups is proselytic and self-righteousness. In fact, some have likened Nimby activists to other moral and religious movements that have gained large followings by advancing what can be described as 'a spiritual critique of medical or scientific teachings and practices'. Piller (*ibid.*) puts it this way: 'Although the link between Nimby groups and right-wing religious movements are otherwise tenuous, they share irreverence for official versions of reality offered by scientists and technocrats.' Indeed, it can be ironically argued that Nimbyism 'is partly a reaction to the effects of the quasi-religious faith in science that emerged in this country following the Second World War'. It represents the contemporary burial of the technological optimism that has long defined the 'American Century'.

Nimby and environmental risk assessment

Nimby is an 'intractable' or 'wicked problem' (Fischer, 1994). All accounts of the phenomenon use such terms as 'recalcitrant', 'undisciplined', 'uncontrollable' and 'unmanageable'. Not only do Nimby groups renounce the government's policy objectives for the use of their own local land but they also fundamentally reject the analyses of the policy analysts who seek to define the problem for them. In this latter respect, the conflict has most often centred around government and industry's use of risk assessment, a major policy analysis technique which has come to dominate environmental policy decision-making (Figure 10.1).

The official response of government and industry to fears accompanying toxic risks has been to submit the dangers to a risk assessment (Wynne, 1987; Fischer, 1990). Formal policy analysis has been used in an attempt 'rationally' to decide the issue by focusing the risk debate on technical factors. Specifically, the purpose has been to shift the political discourse to a search for 'acceptable risk'. The supporters of the modern technoindustrial complex argue that risk must be seen as a mixed phenomenon, always producing both danger and opportunity. Too often, they argue, the debate revolves purely around potential dangers (frequently centring on high-impact accidents with low probability – e.g. nuclear meltdowns or runaway genetic mutations). The approach is

Risk assessment has developed in response to the special decision-making problems associated with technoindustrial society, in particular the array of technological and environmental hazards that have accompanied it. The methodology has not only emerged as a widely approved decision methodology but has also been formally adopted by the Environmental Protection Agency as the basic decision test governing the development and evaluation of all regulations pertinent to the environment.

Risk assessment is specifically employed to evaluate risk resulting from both hazardous technologies and toxic health threats (Covello, 1989). The goal is accurately to predict the health implications of a hazard before or after it exists, and to establish valid safety standards to protect the exposed population. The methodology typically involves four inter-related steps: 1) a process of hazardous identification, e.g. does a waste incinerator emit dioxins or heavy metals?; 2) an assessment of human exposure, e.g. can the various routes of the toxin to the effected population be traced and how much of it enters the human body?; 3) the modelling of the dose-responses, e.g. what is the empirical relationship of the exposures to the chemical under investigation and the frequency of adverse impacts?; and 4) a characterization of the overall risk, e.g. how does the data as a whole provide an overall evaluation of the toxic's implications for human health, most commonly defined in terms of cancer? In an effort to err on the conservative side of safety, risk assessors most often use 'worse-case scenarios'. The overall risk is generally expressed as the probable number of cancers per million people exposed over the course of a standard life expectancy.

Figure 10.1 *Risk assessment*

grounded in the view that technological dangers have been grossly exaggerated, especially by environmentalists with a vested interest in exploiting the public's fears. The result, it is argued, is a high degree of ignorance among the general public about technological risks (Wildavsky, 1988). The classic illustration is the layperson who tends to worry a great deal about the safety of air travel but thinks nothing of driving his or her car to the airport, which statistics demonstrate to be much more dangerous.

The point, then, is to supply the public with more objective (technical) information about the levels of risks themselves. That is, the 'irrationality' of contemporary political arguments is to be countered with rationally demonstrable scientific data. The solution is to provide more information – standardized scientific information – to offset the emotionality plaguing uninformed thinkers, i.e. the proverbial 'man in the street'. Towards this end, risk assessment has been bolstered with a new subspecialty of risk management known as 'risk communication'.

But these risk methodologies have tended not only to heighten the conflict but they have also often become the very sources of contention. The typical conflict involves a government study that shows a very low level of risk and a public – or at least the community groups most directly involved – that is adamantly opposed to accepting the findings. In short, people have remained unswayed by risk assessments and the result has been a near halt in the siting of hazardous waste facilities over the past 15 years. This reluctance to accept such risks – at least after having been shown the outcomes of the analyses – has

compelled environmental officials to label them 'irrational'. Oppositional groups have either rejected the experts altogether, or sought to commission their own analyses. The result has become an impending crisis: in the face of growing mounds of dangerous waste, there is no place to treat or store it.

The critique of risk assessment

Those opposing risk assessment contend that the process – wittingly or unwittingly – biases risk decision processes in favour of the dominant technoindustrial system and its values (Gutin, 1991). Through tacit assumptions that support the industrial status quo, the methodology pre-empts or undercuts the very kinds of discourse about environmental problems that the environmentalists and others seek to interject. Some, in fact, see risk assessment to be a strategy designed to do just that, namely to deflect the environmental movement's ability to rally political support against mounting hazardous risks.

Consider, for example, the argument advanced by Langdon Winner, a leading critic of the methodology. Winner argues that the methodology's analytical emphasis on risk functions to shift inquiry away from traditional concepts such as 'dangers' and 'hazards' to a more subtle and sophisticated exploration of statistical probabilities (Winner, 1986). What otherwise appears to be a fairly obvious link between technological causes and dangerous effects – for instance, the relationship between hazardous chemicals and cancer – tends to be transformed into a question fraught with scientific uncertainties. Whereas a hazard is easily recognized as a danger to health and safety – and thus reasonable people readily agree that something should be done about it – the conceptual transformation of a hazard into a question of risk works to soften and defuse the threat.

Equally problematic is risk assessment's emphasis on expert decision-making. When parties to an environmental decision about technological hazards agree to risk assessment, they commit to the studying, weighing and comparing of the costs and benefits associated with different levels of risk. In doing so they enter into a realm of enormous uncertainties over which there is little chance of a relatively simple, straightforward consensus. Not only are the commonsense assumptions upon which the concern for hazards and dangers normally rely abruptly suspended but any confidence people might have had in their own ability to deal with such hazards also vanishes in favour of excruciatingly detailed inquiries. Furthermore, because the exact nature of this (technological) cause–(environmental) effect relationship is very difficult to 'prove' in the scientific sense of the term, the question of risk always remains open to interpretation. That is to say, the interpretation remains open to the judgements of those who purport to have expertise in the matter.

This over-reliance on experts thus becomes an intellectual barrier to popular participation. Beyond merely underplaying certain kinds of interests and values, the methodology functions to impede the very participatory processes that make the advancement of community interests and values possible. In place of public discourse about what ought to be done, the decision process is

de facto increasingly dominated by the opinions of experts. Experts, rather than the citizens themselves, decide whether or not people will live next to a hazardous waste site. This too has been described as a deliberate technocratic strategy to limit structurally the public's role in issues basic to the advance of technoindustrial society.

The participatory alternative

Essentially, the strategy of risk assessment has been employed to get around what is widely seen to be the ordinary citizen's inability to deal rationally with complex technical problems. As a technocratic strategy, the approach has explicitly sought to circumvent democratic political processes in an effort to avoid citizen participation. But is there an alternative? Many environmentalists argue that the answer is democracy itself; they call for 'environmental democracy' (Kann, 1986; Paehlke, 1990; Thornton, 1991).

Environmental democracy has become a basic component of what has come to be called the 'environmental justice' movement. Activists committed to environmental justice have emerged to challenge the social injustices associated with mainstream environmental policy, particularly as they have pertained to class, race and gender. Opposed to centralized, hierarchical decision-making, whether in government, industry or within the environmental movement itself, the movement has emphasized local participation. Catalysed by the toxic waste problem in particular, it has sought to define and organize environmental struggles in terms of ordinary life – it assumes that *people* are an integral part of what should be understood as the 'environment' (Di Chiro, 1992, p. 96). Basic to the movement has been the forging of new forms of grassroots political organization based on environmental democracy, understood in the words of one writer as 'the right of the public to participate in – even collectively determine – decisions about technology'. The goal is to render obsolete the 'expert' status of government and industry's scientists in order 'to make every citizen conversant at all levels of environmental debate' (Thornton, 1991, p. 15).

For most mainstream economic and political leaders such language is merely ideology. Recent experience, however, has begun to suggest that there is more to the argument than first appears to meet the eye. Two types of evidence now seem to validate – at least provisionally – the environmentalists' emphasis on democracy. One concerns the nature of the siting decision process; the other concerns the emergence of new siting experiences that illustrate the importance of democracy. The first has to do with the failure of risk assessment's attempt to circumvent the political process. Further research into the question of why communities have so adamantly rejected the advice of the experts now offers quite a different perspective. Whereas risk experts have dismissively portrayed the public as incapable of digesting complex technical findings, and thus is left to fall back on irrational fears, writers such as Plough and Krimsky (1987) make clear that such a conclusion misses the nature of the community decision-making process. In their work, they distinguish between two different types of rationality that guide risk assessment, 'technical' and 'cultural' rationality.

'Technical rationality', according to Krimsky and Plough, is a mind-set that puts its faith in empirical evidence and the scientific method, appeals to experts for justifying policy decisions, values logical consistency and universality of findings, and judges non-quantifiable impacts to be irrelevant to political decision-making. 'Cultural rationality', in contrast, tends to emphasize (or at least give equal weight to) the opinions of traditional and peer groups over those of experts, focuses on personal and familiar experiences rather than depersonalized calculations, holds unanticipated consequences to be fully relevant to near-term decision-making, and trusts process over evidence. That is, decisions are judged as much by the social processes through which they are reached as by the outcomes. Beyond probability and risk-benefit ratios, then, public risk perception is shaped by the circumstances under which the risk is identified and publicized, the place of the individual in his or her community and the social values of the community as a whole.

While laypersons tend to be culturally rational in their decision-making processes, few people think or act exclusively in one mode or the other. Such modes typically change with circumstances. Sandman (1986; Chess and Sandman, 1989, p. 20) has demonstrated this with a simple test. He asked experts to imagine themselves in situations in which they were not in control of the circumstances and to think of themselves as fathers rather than as engineers and businessmen. In such situations, the experts were themselves found to abandon the technical rational model of decision-making for the culturally rational mode of the citizen. The conclusion from this work is clear: cultural rationality is only a different kind of knowledge and has to be built into the decision-making process.

From this work we learn that the public decision 'process' is as important as scientific 'evidence', sometimes more so. Citizens react as much to who is talking as they do to what is being said. In this respect they are responding to the possibilities of deception and manipulation often associated with hierarchical decision structures and other asymmetrical communicative relations. Citizens want to know that the decision is reached fairly without bias or deceit. Does the process reflect hidden interests? The answer to such mistrust requires a more open set of communicative relationships.

This brings us to the second type of argument for environmental democracy. If the foregoing discussion suggests that citizens are not so hostile to technical data *per se* – i.e. that they might well be inclined to accept data that is the product of an open and democratic process – such a conclusion appears to be just what new experiences in Canada are demonstrating. In particular, the siting of a hazardous-waste treatment facility in the Canadian province of Alberta has begun to cast a new ray of hope on the Nimby problem. Contrary to the traditional technocratic approaches, this case provides convincing evidence that solutions require more, rather than less, democracy. The most impressive example comes from Alberta. Faced with the Nimby syndrome, the regional government of Alberta sought to address the opposition openly and squarely (Paehlke and Torgerson, 1991; Rabe, 1991; 1992). By establishing an

successfully to site, build and operate the single major new incineration facility in North America in over a decade. Working together, government, industry and local groups in Alberta devised a participatory process in which the conflictual issues of siting were transformed in such a way that all the major stakeholders preferred negotiation to conflict and, through the process, came to believe that they could all reap the benefits of co-operation. Gone were the winners and losers that have typically framed the 'zero-sum' politics of Nimby.

Participation in the project was built into the decision process from the beginning, commencing with a local plebiscite about the acceptability of the siting decision. The regional government then supplied the local community with funds to hire its own experts and consultants and it organized extensive public meetings to discuss with community members and their consultants the nature of the plant and its consequences. Once the site was accepted, the government provided the community with monies to offset the extra burdens incurred by the local infrastructure and for the hiring of its own expert advice.

The community group in Alberta has used the money to establish a local committee to organize seminars and meetings for the community residents regarding hazardous waste treatment. Meeting on a monthly basis, particularly to provide facility managers a source of information regarding community attitudes and ideas, the local committee now also reviews environmental monitoring reports. The reports are translated from technical language into an easily understood format. The government also provides the means for the community to hire a permanent consultant to assist them in monitoring the facility's operations.

Though the Canadian experience might not work everywhere, it has shown that a positive, democratically inspired discourse can help bring about a positive end for the most complex and fear-invoking type of facility. It has lead numerous writers to argue that the Canadian experience shows that long-term oversight arrangements based on greater community involvement, power and risk sharing enhance the likelihood of effectively siting facilities in acceptable locations (Mazmanian and Morell, 1993, p. 28). Contrary to technocratic assumptions, citizen participation can thus prove to be anything but irrational.

Finally, if the local community is to monitor plant operations, the need for some adjustments to the standard hierarchial model of expert advice giving might be anticipated. As already noted in the Canadian example, consultants translate the operational reports from a technical language into a format easily understood by the ordinary citizen and further help grapple with the key issues in the reports. If, however, the community is to become truly involved in such deliberatory processes, one might expect to see this process evolve as something more than an oversight function. And that in fact is what has begun to happen.

Since the beginning of Nimby and the community movement against the siting of toxic wastes, a number of environmentally concerned scientists have begun to experiment with new forms of participatory advice giving, including the possibility of a form of community risk assessment (Chess and Sandman, 1989, p. 20). Such experts emerge to help the community 'understand the significance of new developments, plot strategies, and even take on adversaries directly' (*ibid.*).

Accounts of the Love Canal Homeowners Association's struggles with state and local officials emphasize the work of a cancer researcher who helped the community associations 'to reinterpret government data, develop the capacity to collect additional information, and interpret this information credibly inside and outside the neighborhood' (Edelstein, 1988).

A direct outcome of this Love Canal experience was the formation of a national organization designed to provide just such alternative expertise to other Nimby groups (or 'Niamby', i.e. not in anybody's backyard) across the country. The Citizens Clearinghouse for Hazardous Wastes was started by Lois Gibbs, the Love Canal housewife who had organized the community and extracted major concessions from the State of New York and the federal government (Gibbs, 1982). With only a high-school education and no former experience in such matters, she went on to establish a major Washington-based organization to assist other communities across the country in struggles against toxic wastes. The Citizens Clearinghouse has become a major organization in the environmental social justice movement. Among its various activities, the clearinghouse offers instruction and advice on how to deal with the technical dimensions of the hazardous waste problem, in particular the problem of incineration (Collette, 1987).

Participatory expertise

Underlying such alternative forms of advice giving is the emerging practice of 'participatory research'. Evolving in the context of struggles against environmental hazards in both the community and workplace, participatory research is founded on the efforts of citizens both to broaden their access to the information produced by scientists and to systematize their own 'local knowledge'. It has involved attempts 'to develop cooperative relationships between scientists and citizens, with a view to research that meets people's needs' (Merrifield, 1989, p. 20).

Participatory research is put forward as an effort to gear expert practices to the requirements of democratic empowerment.[2] Rather than providing technical answers designed to bring political discussions to an end, the task is to assist citizens in their efforts to examine their own interersts and to make their own decisions (Hirschhorn, 1979). Beyond merely providing analytical research and empirical data, the expert is conceptualized as a 'facilitator' of public learning and empowerment. As a facilitator, he or she becomes an expert in how people learn, clarify and decide for themselves (Fischer, 1990). This includes coming to grips with the basic languages of public normative argumentation, as well as knowledge about the kinds of environmental and intellectual conditions under which citizens can formulate their own ideas. It involves the creation of institutional and intellectual contexts that help people pose questions and examine technical analyses in their own ordinary (or everyday) languages and decide which issues are important to them.

The practitioners of participatory research point to two important payoffs. First, it identifies very real and important dangers that hide behind the assumptions and generalities buried in the expert's calculations. That is, it brings to

the fore the very problems, especially problematic assumptions, that have been overlooked by standard policy analysts. Second, participation in decision-making helps to build both credibility and acceptance of research findings (Dutton, 1984; Friedmann, 1987), the critical failure facing the contemporary approaches.

To the conventionally trained scientist, both physical and social, the idea of participatory research often sounds outrageously unscientific. In response to this concern, there are at least two replies. First, it is a methodology primarily designed for research problems characterized by a mix of technical and social problems. Scientists concerned with pure research in physics generally have little need to consult the ordinary citizen. Second, where the methodology is used, it is in most ways only the scientific method made more time consuming and perhaps more expensive, at least in the short run. In the next section we briefly examine an example of participatory research in hazardous waste policy.

Risk assessment as lay epidemiology

There is no better example of participatory research than that which took shape in Woburn, Massachusetts in the late 1970s and early 1980s. Although Woburn is scarcely the only experience along these lines, it represents one of the most highly developed illustrations of participatory research to date (Brown, 1990; Brown and Mikkelsen, 1990). In response to the discovery of the presence of toxic wastes, coupled with an inordinately high degree of childhood leukemia, community members in Woburn mobilized themselves to investigate the problem and to challenge state and local authorities with the data they were able to assemble.[3]

The residents of Woburn were shocked in 1979 to learn that construction workers had found more than 180 large barrels of waste materials in an abandoned lot alongside a local river. In reaction to citizens' concerns, the Woburn police department notified the State Department of Environmental Quality Engineering which, after investigation, discovered high levels of carcinogens in several local water wells and ordered them closed. Additional investigation, moreover, revealed that a few years earlier an engineer from the state had detected high concentrations in the same water supplies, although state officials failed to investigate the matter. Local residents further learnt that the city had received complaints about the water – e.g. a foul taste, dishwater discoloration and peculiar odours – and had commissioned a consulting firm to examine the matter, which in turn led to a state investigation. At the time, however, it was thought that the problem stemmed from the interaction of chlorine with other minerals in the water supply. City officials thus ordered a change in the town's chlorination system.

The community's own efforts to come to grips with the problem had, in fact, predated the closing of the wells. Anne Anderson, a local resident whose son had been diagnosed with leukemia, began 'gathering information about other cases by word of mouth and by chance meetings with victims at stores and at the hospital where her son was being treated' (Brown, 1990, p. 79). Given the surprising number of cases that surfaced in the inquiries, she began to speculate about the origins of the leukemia cases; perhaps they had resulted from something in the water supply. She registered her concern with the state agency, but was informed that the agency could not test the water on the basis of citizen requests.

Approximately six months later, the Woburn press reported that the state agency had itself discovered another toxic waste site in the area, but had again decided to withhold information. At this point, a local minister grew sceptical about the state's earlier reports, and suspicious of its lack of interest in further investigation. Together, he and Anderson placed an advertisement in the local paper; they asked fellow citizens with knowledge about other leukemia cases to contact them. Stunned by the feedback, they consulted a local physician and proceeded to plot a map that clustered the cases. Convinced of the significance of the clustering, the physician notified the Center for Disease Control (CDC) of the apparent danger. At the same time, 'the activists spread the word through the press and persuaded the city council . . . to ask the CDC to investigate' (Brown and Mikkelsen, 1990, p. 12). Furthermore, Anderson, Young and about 20 other citizens founded 'For a Clean Environment' (FACE) to mobilize community concern about their findings.

Shortly after the Woburn City Council made a formal request to the CDC, the Massachusetts Department of Public Health submitted a report that took sharp issue with the Anderson–Young leukemia map. According to the department, there was no reason to take the map seriously. Said to show no significant evidence of a cluster, it was dismissed as the work of amateurs. Despite this public setback, the community activists were bolstered by a growing national awareness of toxic hazards in the environment, as well as community efforts in other places. In fact, in the context of this growing climate of concern, Anderson and Young were invited by Senator Edward Kennedy to testify at congressional committee hearings pertaining to the toxic waste problem in the country as a whole.

Eventually, in response to the local physician and the city council, the CDC dispatched a scientific team, in affiliation with the Massachusetts Department of Public Health, to investigate the Woburn complaints. About six months later the researchers submitted a report attesting to the fact that leukemia and kidney cancer in the area were higher than normal. None the less, they concluded the data to be inconclusive. In particular, 'the case-control method failed to find characteristics that differentiated victims from nonvictims. Further, a lack of environmental data for earlier periods was an obstacle to linking disease with the water supply' (Brown, 1990, p. 79). But the families and friends of the victims once again were unwilling to accept the conclusions of the report and began to question the scientific study itself. As one journalist put it, a 'layperson's epidemiology' began to emerge (DiPerna, 1985, p. 106–8).

The first major step towards a more sophisticated lay investigation came when an interested Harvard professor invited Anderson and Young to discuss their findings in a seminar at the university's School of Public Health. Present was

Marvin Zehlen, a biostatistician who became intrigued with the case. In an effort to elicit more conclusive data, Zehlen and a colleague decided to undertake a more detailed investigation of the health problems in Woburn, in particular environmentally related reproductive disorders and birth defects. To do this, the Harvard biostatisticians and the FACE activists officially agreed to team up with one another in what was to become a major epidemiological study. FACE coordinated some 300 volunteers to administer a telephone survey designed to reach 70 per cent of the population; the Harvard scientists, in turn, supplied the volunteers with training on how to conduct the health survey, in particular how to avoid bias in asking questions and recording answers. In the view of Brown and Mikkelsen (1990), the project became a prototype for a popular epidemiological alliance between citizens and scientists.

Altogether, the scientists and citizens assembled research data that included detailed information on 20 cases of childhood leukemia, a careful examination of the Department of Environmental Quality Engineering's data on the regional distribution of water from the wells and the results of the community health survey. The biostatisticians, moreover, conducted a variety of analyses to detect bias in the data. At the end of the research process, the team concluded that leukemia was in fact significantly associated with exposure to the water from the well.

The public distribution of the Harvard/FACE report immediately encountered harsh criticisms from the Center for Disease Control, the Environmental Protection Agency and the American Cancer Society. Even the Harvard Department of Epidemiology took issue with the findings. Many of the criticisms, to be sure, were based on legitimate scientific concerns. For one thing, they pointed out that in such a study there would never be sufficient numbers of each of the numerous defects (Brown, 1990, p. 81). What is more, they showed that their groupings were appropriately based on the chemical literature concerning birth defects. Finally, they argued that if the groupings were in fact incorrect, they would not have uncovered positive statistical correlations.

The harshest criticisms were directed at the very idea of public participation in science. Because of its 'unorthodox methods', the study was said to be biased, and thus invalid. The main complaint was that it relied on a health survey conducted by non-scientific citizen volunteers, who in turn were motivated by community interests. Whereas science is said to be impartial, the research was founded on political goals. For present purposes, however, it is exactly this characteristic that made the case interesting. All things considered, the affected families had through their own efforts confirmed the existence of a leukemia cluster and demonstrated that it was traceable to industrial waste carcinogens that leached into the drinking-water supply. They were able to initiate a series of actions that resulted in a civil law suit against two major corporations, one of which the court judged to have negligently dumped its chemical waste products. The legal case then moved to a subsequent stage in which the plaintiffs were obliged to prove that the chemical wastes were in fact responsible for the leukemia cases. As this part of the process got underway, the judge determined that the jurors had not adequately comprehended the

epidemiological and environmental data crucial to the case and ordered it to be retried. To avoid the possibility of an extremely punitive verdict, the corporation at this point agreed to an out-of-court settlement with the community plaintiffs. In short, the efforts of FACE paid off.

Not only had the case helped to demonstrate nationally that corporations are responsible for dumping toxic wastes and their resultant health effects but it also offered a valuable example of lay detection and communication of risk to scientific experts and government officials. The exercise has been described as a 'prototype' for 'low-cost' epidemiology (Raloff, 1984; Brown and Mikkelsen, 1990). For Brown (1990), such efforts are best referred to as 'popular epidemiology'.

Popular or lay epidemiology provides a sharp contrast to the standard approach. Epidemiology, the first step in an health-related risk assessment, is generally defined as the 'study of the distribution of a disease or a physiological condition in human populations and of the factors that influence their distribution' (Lillienfeld, 1980; Wartenburg, 1989). The data of such a study is typically used to explain the etiology of the condition and to provide preventive public health, and clinical practices to deal with the condition. By contrast, Brown (1990, p. 78) describes 'popular epidemiology' as 'a process in which lay persons gather statistics and other information and also direct and marshall the knowledge and resources of experts in order to understand the epidemiology of disease. It also includes attention to the basic structural features – social and communicative – of both the community and larger society of which it is a part. It is also explicitly political and activist in nature . . . [which] is also a form of risk communication by lay persons to professional audiences, and as such demonstrates that risk communication is indeed an exercise of political power'. In this respect, an increasing number of experiences shows that mobilized communities have succeeded in identifying and communicating hazards and risks in ways that have facilitated significant political, economic and cultural victories. It thus seems fair to conclude that the participatory methodology can play an important role in refocusing the ways that lay citizens, scientific experts and public officials deal with health hazards and risks.

Conclusion

The cases of Alberta and Woburn demonstrate participatory risk assessment to be more than a speculative concept. Alberta makes clear the advantages of participatory forums in policy formulation and programme implementation; Woburn illustrates the ability of a mobilized community to enter the research process itself. Both cases reveal the need for new kinds of relationships between citizens and scientists. The experiences of FACE, moveover, underscore the importance of bringing the 'local knowledge' of the community to the scientific establishment, as well as the need for the scientist to stand in the middle of such processes, rather than above them. Contrary to the conventional wisdom, the experiences also show that citizens are capable of acting intelligently in cases involving complex technological decisions (Di Chiro, 1992). Collaborative research relationships are thus more than academic issues; as the cases illustrate,

they bear directly on the outcomes of the research process itself. Indeed, problem-solving in the case of a problem as intractable as Nimby may literally depend on such collaborative methodological innovation.

But how can participatory risk assessment be brought more directly into environmental policy-making? In so far as risk assessment has mainly developed as a tool for guiding and managing the corporate-bureaucratic state, its methods largely serve top-down policy decision-making processes. Risk policy analysis is thus in many ways built on political and methodological foundations antagonistic to authentic democratic participation. In fact, democratic theorists have commonly dismissed it as technocratic and élitist.

Here we have seen that the discipline's top-down methods are becoming increasingly problematic for a specific class of intractable or 'wicked' problems now confronting state decision-makers, and that this development offers new possibilities for the introduction of participatory methods. Indeed, the two cases show that participatory practices – mainly emerging outside traditional state practices – hold out potential for solving such problems.

Participatory research does not constitute a reconstruction of science *per se*. Rather, it seeks to build in a normative discourse about the social assumptions upon which scientific research rests, social scientific research in particular. Here, as we argued, the scientist has no privileged knowledge or legitimacy. Such assumptions pertain to the nature of society itself, including how we wish to organize it. Science can explore the implications of adopting particular assumptions but it has no privileged methods for choosing among them. In a democratic society these are questions for the citizenry.

In theoretical terms, participatory research can be understood as building in the human emancipatory component associated with participation. Here the perspective of critical social theory, the analytic task of participatory policy analysis can be approached as that of an 'interpretive mediator' between theoretical knowledge and competing practical arguments. Participatory policy analysis, in such a conceptualization, involves first an assessment of a given social problem and an evaluation of the alternative policy solutions in terms of emancipatory criteria, derived from an interaction between analytical frames of reference and the interests and needs of the relevant social actors (Habermas, 1973, p. 33). As a method, participatory policy analysis sets up confrontations between the analytical frameworks of social science and the proposed policy practices, mediated by the actors subject to the policy's manifestations. Such a dialectical exchange can be likened to a 'conversation in which the horizons of both participants [social scientists and citizens] are extended through confrontations with one another' (Dryzek, 1982). The task, in the language of postpositivist epistemology, is to develop a synthesis of social scientific theory and the 'local knowledge' of the community, normative as well as empirical. It is to reshape the interactions among the analysts, citizens and policy-makers as that of a conversation with many voices, adjudicated by the procedural ethics of discourse and deliberation. Seen this way, the social distance between the policy expert and the citizen would be radically reduced; the analyst might simply be

In the age of high technology this is lofty-sounding language. But if we are to take democracy seriously we must confront directly the question of the relation of science to participation. Democracy without citizen participation and discussion is a meaningless concept. If a complex technological society renders such discussion impossible, we must then rethink our commitment either to democracy or technology. Participatory research, as the cases in Alberta and Woburn suggest, offers an innovative approach to this conflict, too often relegated to the realm of either/or. While the conventional argument suggests that citizens need science, the cases above show that science needs an active, informed citizenry.

Finally, for those who argue that decentralized decision-making and citizen participation are basic to a sustainable future, the possibility of participatory research is an important step forward. Basic to the technocratic arguments advanced by the administrators of the large-scale corporate-bureaucratic system is the contention that society is too complex technologically to return to simpler organization forms. While participatory research is no panacea, it surely shows that there is much more room here for exploration than the leaders of the technoindustrial system either recognize or are willing to concede.

Notes

1. Portney (1991, p. 11) gives the following example: 'Nearly everyone seems to agree that more prison space is needed if the criminal justice system is to be able to treat convicted criminals as harshly as the public mood warrants. Yet no one wants a prison in his or her city or town . . . Most people seem to agree that such facilities are a necessary and acceptable result of living in an industrial society.'
2. Participatory policy research is not as unique as it might sound. According to its own theorists, it is in many ways only a more progressive version of a method already well known in the managerial and policy sciences, namely 'action research' (Argyris *et al.*, 1985). Like action research developed after the second world war by the German émigré Kurt Lewin, participatory research is designed as a methodology for integrating social learning and goal-orientated decision-making. Where the former was co-opted by the managerial sciences to serve the rather narrowly defined needs of bureaucratic reform (typically identified as 'participatory management'), participatory research is an effort to carry through action research's earlier commitment to democratic participation (Fernandes and Tandon, 1981; Reason and Rowan, 1981; Kassan and Mustafa, 1982; Merrifield, 1989). Much of the effort to develop this methodology has taken place in the third world, especially among alternative social movements concerned with environmental issues and the use of appropriate technologies.
3. This account of the event in Woburn is drawn from the works of Brown and Mikkelson (1990).
4. The job of the participatory policy analysts, so understood, would be to help citizens obtain an authentic deep understanding of the historical forces that shape their situation. Borrowing from Bernstein (1976, p. 217), we can understand this to mean that 'such theory can only become efficacious – a material force – to the extent that it correctly interprets this situation and initiates self-reflection'. The theoretical task is 'intimately related to the formation of a political consensus among those engaged in strategic action, [but] it does not and cannot play the role of legitimating and justifying what is to be done'. The implication of this, as Habermas (1973, p. 33) explains, is that 'decisions for the political struggle cannot at the outset be justified theoretically and then carried out organizationally'. The only ones who can decide the course of action

those who are conscious of their common interests and possess knowledge of both their circumstances and the predictable consequences – primary and secondary – of the proposed action.

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