BEYOND TECHNOCRACY: NEW ROUTES FOR CITIZEN INVOLVEMENT IN SOCIAL RISK ASSESSMENT

Sheldon Krimsky
Tufts University

Over the past decade and a half, several pieces of Federal legislation established an initial framework for improving public access to information and public input into Federal regulatory policy. Of special significance in this regard are the National Environmental Policy Act [NEPA] (1969), the Freedom of Information Act (1974), amendments to the Administrative Procedure Act (1966), and the Federal Advisory Committee Act (1972). NEPA requires that governmental agencies avail themselves of commentary from various sectors of society on their policies before final decisions are made. The Freedom of Information Act and the Executive Department's requirements for "government in the sunshine" have made further contributions to an open process of decision-making, where the evidence, justification and procedural issues are available for public review. The Administrative Procedure Act requires that the opinions, policy statements, rules, and procedures of Federal agencies be a matter of public record. Under the Federal Advisory Committee Act, the deliberations and reports of Federal advisory committees are open to public review.

Despite these reforms and others in the rule-making process, in the access to information and in the format of open hearings, public skepticism over the soundness of governmental decisions has not waned; it may even be rising. The aforementioned reforms have themselves contributed to broadening the avenues for dissent. With greater accessibility to information, dissenting parties have the opportunity to present their cases more effectively.

Recent Federal policies involving the site of the Seabrook Nuclear power facility, off-shore oil drilling on Georges Bank, the Three Mile Island incident, the landing of the SST at New York's JFK Airport, and the NIH guidelines regulating the production of and work with recombinant DNA molecules have been met with widespread criticism--and in some cases, mass protest. These actions and others like them begin to place in doubt the degree to which governmental decisions that seek to balance the risks and benefits of a technology have been successful in gaining the public confidence. Some may argue that increasing democracy results in less efficient and costly decision-making. Nevertheless, the primary good of democratic process is not the optimization of efficiency, but the promotion of fairness and objectivity. Furthermore, from a pragmatic standpoint, narrowly-drawn decision processes which fail to take account of the full potential of citizen participation may, in the long run, be quite costly in the event of mounting opposition.

The attainment of public confidence in Federal regulatory decisions on the impacts of risk-bearing technologies is of paramount importance. When public confidence begins to erode, it is time to re-examine the conventional systems of decision-making and to test appropriate modifications. One of the relevant considerations is the degree and form of citizen involvement. Can we improve public confidence by providing citizens better access to the decision process? When can we say that we have achieved optimum participation? If we liken the participation process to due process in our legal proceedings, then its justness must be judged independently of the outcome. However, the analogy falls short in places. Whereas the onus of proof is clear in our system of jurisprudence, in decisions where social risk-taking is at stake, the burden of proof may depend on where the balance of political power lies.

This paper examines some new developments in citizen participation for technological decisions involving highly specialized areas of knowledge. It discusses the role of non-experts on technical advisory committees of risk assessment panels. The form and legitimacy of citizen involvement is addressed through a set of general principles. The paper emphasizes the desirability of improving access to the decision-making process for those segments of society which endure special risks, but are unorganized, lack technical expertise, or are relatively powerless.

FORMS OF PARTICIPATION

In considering meaningful and effective forms of public participation in technological decisions, it is useful to start with an examination of the determinants that distinguish alternative models. The type of public involvement should, in some sense, match the nature of the problem. Three factors are important in this regard: the entrance points into the decision process; the structural form of participation; and the types of citizens who participate. The following table illustrates some cardinal elements within these categories.

ACTIVE VS. REACTIVE PARTICIPATION

Most opportunities for public participation in social risk assessment restrict citizens to playing a reactive role in decisions. Accordingly, che public responds to a proposal or a set of guidelines or regulations after it has been drawn up by technical committees. The open hearing is the conventional vehicle for this mode of public input, as is the solicitation of responses to regula-

Table 1

Modalities of Citizen Participation

I. Entrance Points for Citizen Involvement

- a. Definition of the Problem
- b. Data Collection and Analysis
- c. Risk Assessment
- d. Technical Alternatives/Solutions
- e. Policy Implications
- f. Policy Alternatives
- g. Resolution: Choice of Policy

II. Form of Citizen Involvement

a. Hearings	f. Review Board
b. Task Force	g. Science Court
c. Advisory Board	h. Citizen Court
d. Referendum	i. Pre-hearings for Major Constituencies
e. Mediation/Arbitration	

III. Types of Citizens Involved

- a. Disinterested Laypersons
- b. Laypersons with a Vested Interest
- c. Technically Sophisticated but Disinterested Parties
- d. Technically Sophisticated and Interested Parties
- e. Representatives of Constituencies Most Impacted by the Decision
- f. Members of Public Interest Groups

tions published in the Federal Register. This passive mode of participation has drawn criticism because fundamental issues have already been factored into the decision by the time the public is asked to react. Within this reactive mode, the permitted changes are usually marginal. To achieve the full benefits of participation by citizens, early access routes to the decision-making process should be developed, possibly even at the stage where the problem is defined.

The Environmental Impact Statement (EIS) process is a case in point. By the time an EIS is introduced to the public for comments, the salient issues have already been developed. Active participation by the public would include its involvement in the scoping session for the EIS. It is in this early period that the impact parameters are established and the boundaries of discourse set.

ADVISORY PANEL

This format for public involvement permits citizens to participate at the highest levels of policy-making. It responds to the criticism that the narrow interests of technical experts dominate the decision-making process. But it should not be seen as a substitute for the public hearing where a broader involvement from public constituencies is possible. An example of such a panel is the Recombinant DNA Advisory Committee, chartered by the Secretary of HEW in 1974, to advise the Director of the National Institutes of Health on the regulation of genetic research. Another model in the area of research involving human subjects is the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research (Yesley, 1978). The limitation of such bodies is that the lay members are at a disadvantage with respect to the scientific and technological issues. In such situations, there is a need for interpreting technical language to intelligent lay representatives. Public members should be in a position to reach decisions based upon arguments they hear from different technical experts. In addition, the lay members may offer expertise in procedural areas or broaden the scope of social impacts addressed.

SCIENCE COURT

Modeled on a legal adversary proceeding, the Science Court would establish a panel of distinguished scientists, presumably disinterested in the issue under consideration. This panel would listen to testimony orchestrated by two opposing teams of "scientific lawyers." The outcome of such a proceeding would be a ruling by the scientific judges on the factual situation with respect to the risks and benefits in question. Although the concept of the Science Court has been discussed in science policy circles for six years, it has not been put to a test. The assumptions underlying its successful operation are that factual claims and value judgements can be separated in a controversy involving the risks of a given technology. Moreover, the model assumes that the public policy makers need only have the relevant factual information provided by the scientific experts to deliver a rational decision on the appropriate course of action (Kantrowitz, 1975; 1977).

The Science Court does address several important problems in decisions over risk assessment. It embodies the notion of the disinterested, astute technical generalist. It also incorporates the skills of scientists who are specialists in an area of research or technology other than the one in question. It recognizes that an adversary proceeding (i.e., getting the best minds to address each side of the question) is the most promising means of drawing out into the open all the hidden assumptions and speculative hypotheses passing for ineluctable truth. As a vehicle through which the public can obtain a better grasp of the nature of a controversy, it is much superior to a public hearing.

However, the Science Court concept is built upon some tenuous assumptions. It does not promote broad public participation, but draws heavily on the idea that "scientists know best" regarding the issues related to the conceptualization of risk and the selection of relevant evidence (Nelkin, 1977). In cases where there is significant disagreement among the scientific experts, public confidence may not be secured by appealing to yet another subset of that community of elites.

CITIZEN PANEL

This form of participation has been used with some degree of success for setting policies or resolving disputes involving differential impacts on selected communities. Where complex scientific and technological questions are at issue which require in-depth study, local public officials may designate a citizen panel as an advisory body. As distinguished from a Science Court or technical advisory board, this group is selected to represent diverse sectors of the community--and therefore to promote public confidence, when a narrower selection of scientists might not be successful in achieving the same objectives (Krimsky, 1978a). Another asset of this model is that it brings opposing views into a negotiating framework.

There are some serious limitations in having a panel composed exclusively of laypersons review a technical problem. The issues may be too complex for nontechnical persons to understand. The time it might take the lay citizenry to become well versed in the issues could be prohibitive, given their work schedules. Also, laypersons may be more vulnerable to persuasion by exaggerated claims, especially when they are made by scientists or technical persons, than individuals who are trained in a technical discipline.

ARBITRATION/MEDIATION

The American Arbitration Association has supported the use of arbitration and mediation techniques for resolving intractable disputes of an environmental nature. The principal idea behind this strategy is to adapt a procedure that has been successful in labor negotiations and business conflicts. Since environmental controversies involve many constituencies, the design of arbitration or mediation modes must incorporate multilateral negotiations (Susskind, 1978). The advantage of such negotiating mechanisms is that those constituencies which are recognized as important segments of the impacted population will be treated on par with other parties, including public agency heads. However, for the powerless and unrepresented, arbitration offers no entry points into the decision-making process. Thus, while it may not broaden participation of the citizenry, it may deepen the quality of participation for some well-established groups in the community. In addition, arbitration may help to remove the impasse between formidable opponents.

INFORMAL HEARINGS & GRIPE SESSIONS

The public hearing has become a great American institution. But many people have been frustrated by its limitations. First, it is an imposing atmosphere--threatening to those who have not achieved a certain level of competence in public speaking. Second, the citizen is at considerable disadvantage with respect to the decision authority. It is the latter party who controls the timing and can shape the nature of the questioning. Third, there is no opportunity for citizens to engage the decision-makers in a dialogue where issues can be pursued in greater depth and in less formality . The pre-hearing (or post-hearing) is designed to augment important agency proceedings where informal procedures can permit representatives of key constituencies to have special access to the decision authority.

A post-hearing was used effectively by HEW Secretary Joseph A. Califano after a public hearing was held in September 1978 on revised guidelines for recombinant DNA research. Outspoken critics of the proposed guidelines were brought together with HEW and NIH agency personnel to express their concerns about procedural and safety issues. The setting was informal and conducive to in-depth discussion between citizen advocates and public agency officials. One of the results of that session was a broadening of the public members on the HEW-NIH Recombinant DNA Advisory Committee.

SOME SUCCESSES AND FAILURES IN PRESENT EFFORTS AT PUBLIC PARTICIPATION

The grounds for broad public participation in policy decisions involving the risks and benefits of technology are similar to those which have been cited for urban revitalization programs, water quality planning, or transportation planning. They fall into three areas: justice, knowledge, and pragmatism.

It is a simple matter of justice that those who are the prime targets of technologies' adverse effects have some representation in the decision that weighs risks against benefits. Too often the most vulnerable groups in our society are burdened with additional risks which they did not choose.

Richer resources of ideas and perspectives on troublesome problems are gained by soliciting help from diverse constituencies. Even in cases where the issues are highly technical and specialized, broadening the range of inputs into decision-making invariably adds some special dimension to the process. The experience of laboratory technicians is quite different from that of scientists; consequently, they are likely to have unique insights into the actual safety operations of a laboratory. Policies that address the spraying of insecticides on crops can benefit from listening to migrant farm workers. They, after all, are among the ones at greatest risk and can offer valuable personal knowledge about exposure that could be complementary to the knowledge of the toxicologist. The personal experiences of workers at risk can often provide the earliest advanced warning that something is amiss. If we examine the case histories of how asbestos, vinyl chloride and the soil fumigant DBCP were discovered to cause occupational disease, they show that workers were among the first to understand the relationships between chemical exposure and morbidity (Epstein, 1978).

The third justification for public participation is a pragmatic one. It is desirable that policy decisions on technological risk achieve public confidence. By broadening the opportunities for public participation, the likelihood for improving public confidence is surely higher than where such decisions are the work of narrowly-defined interests (Carroll, 1971).[1]

The areas which illustrate failures or limitations in present efforts at public participation in technology policy include (1) entrance points, (2) vehicles for participation, and (3) who participates. Several examples of the entrance points are listed in Table 1.

ENTRANCE POINTS

For meaningful participation, the public must have access to the decision-making process in the early stages, when it can make a difference. Once the problem is defined, and the questions set, a decision-making body may exhibit considerable inertia in returning to a more fundamental examination of the issue.

One rationale for scheduling public input late in the process is that the determination of policy is separate and independent of the scientific and technological analysis which precedes it. This rationale is severely limited in the following respect: it is very unusual for a clear demarcation to exist between technical issues and policy issues with regard to the assessment of risk. Consequently, restricting public input to the later stages of such a decision results in giving policy-making authority to a group of technical experts, thereby limiting the alternatives of the final outcome.

In the early stages of the recombinant DNA debate, scientists acted as if they were providing only technical knowledge to the National Institutes of Health. A careful analysis of the role of scientific decision-making in that period reveals that many policy decisions were being made, highlighted by the way that the problem of risk was initially defined (Krimsky, 1978b). Had there been broader participation by diverse sectors of the scientific community, environmental groups, bioethicists, and ecologists, certain issues would not have been factored out of the DNA discussion at the outset--such issues as the relationship between recombinant DNA research and genetic engineering, the impact of the new technology on the physical environment, and the desirability of long-term epidemiological studies.

We also face the prospect that diversifying participation on technical advisory bodies can delay new advances in biomedical science. More interests and perspectives involved in the assessment of risks and benefits could slow down the process. Pluralism can translate into a go-slow attitude when it comes to introducing new technologies.

VEHICLES FOR PARTICIPATION

Little attention has been given to creating effective modes for citizen involvement in public policy decisions involving science and technology. Our experience with the passive-reactive mode of participation reveals a high risk of public cynicism accompanied by a lack of public confidence. Without participatory vehicles for becoming educated about a technological innovation, the public is likely to oversimplify the issues and respond in a polarized manner. In the recombinant DNA episode, wherever citizens were engaged in what was primarily a reactive type of participation, and were basically uninformed about this highly specialized area of knowledge, the consequent polarized choices were: calling for a ban on the research, or acting uncritically by placing public trust in the scientists.

As an overall objective, the vehicle for public participation should be chosen so as to optimize the attainment of public confidence. That is to be distinguished from a call for an efficient outcome. Four factors that can help insure public confidence are accountability, openness, objectivity, and awareness of the social good. Accountability means knowing who is responsible for the decision and understanding the avenues for review, modification and reversal. Openness refers to the degree to which (1) the public, on its own initiative, can learn the reasons why certain decisions are made, (2) meetings are held in the open, and (3) all the factors which play a role in the decision are open to examination by the public.

Objectivity in the decision-making process implies that the decision-making body or individual does not enter the process with a bias that selects out information and resists rational argument. Where objectivity is difficult to achieve because any single individual has special interests, pluralistic bodies are clearly preferable to single-interest decision-makers. Finally, the forms of decision analysis and policy determination should instill in the public the confidence that the social good is being sought. To this end, there must be an unambiguous statement about how the instruments of science and technology will be used, especially when public funds are the source of support.

Another factor to consider in the choice of a vehicle for participation is whether the impacts of a policy are differential (substantially affect some distinct population or community more than others) or uniform. Recent trends in decisions involving the siting of a facility suggest some type of partnership model between the Federal government and the community in question. This could mean two types of participatory processes--one at the Federal level and one at the local level. To insure an element of justice and secure public confidence in the decisions, safeguards must be built into the process to avoid a partnership of elites. Diverse groups in the community, especially those who would bear disproportionately more risk, should be effectively represented.

Special difficulties arise when local communities wish to have veto power over Federal siting decisions, or wish to impose more restrictive regulations for achieving greater margins of safety than those issued by the Federal government. A balance must be found between the rights of communities to decide the level of risk they are willing to tolerate and the interests and needs of the larger society. More than a dozen states and local communities held hearings on local proposals for regulating recombinant DNA research. These hearings are a concrete expression that review of Federal regulations is an appropriate role for them to play in response to concerns by their local constituencies. In these communities, Federal preemption was viewed as a serious infringement on the authority of these states and local municipalities to promote public health and safety.

In the summer of 1976, the Cambridge (Massachusetts) City Council was faced with a controversy over the construction of a physical containment facility to be used for moderate risk recombinant DNA research. The Council, recognizing the complexity of the issues, called for a study panel. The City Manager avoided selecting a panel of distinguished scientists, since--in his view--these scientists were already in disagreement over the interpretation of the potential hazards of the research to the community. The Manager chose a board of citizens to investigate the public health hazards of the new techniques for gene splicing developed by molecular biologists. The Cambridge Experimentation Review Board (CERB) functioned like a citizen court, and proved to be a reasonably good representation of community interests. Its purpose was to hear the arguments first-hand from the scientists in dispute and decide what recommendations to make to the City Council. The achievements of this process became evident when the CERB issued its report. The confidence felt toward this citizen review board was high among elected officials and the general public. While not everyone agreed with the outcome, even those most polarized on the issues believed that the members of the citizens' panel had no vested interests in the outcome of the decision, and that the overriding concern of this body was the public safety in the community. The process was interpreted as a fair one in the context of the issues and the circumstances of the debate.

Clearly, there were limits on the ability of CERB members to reach deep technical insights or to understand the subtle nuances in the NIH regulations. But on broad policy questions, such as the need for risk assessment, public accountability of local institutions, enforcement, and the concerns over the unregulated sectors, such a citizen board can be effective.

WHO PARTICIPATES?

Next to the issue of how much participation, the question of who participates is the most perplexing. If we are considering a reactive mode of participation exclusively, e.g., a public hearing or solicited comments on a proposed regulation, then the response to the question of who participates is: anyone who wishes to. But when we enter into participatory modes that make citizen input a more integral part of the decision-making process, other determinations must be made. What factors should guide such selectivity?

The powerful forces in society have always found means of getting their point across. There is a natural advantage to participation by individuals and organizations which possess economic resources. But it is the powerless and unorganized in society who have difficulty gaining entry into the decision-making process, even at the reactive level. Consider, for example, chemical workers who do not have environmental health experts at their disposal; non-unionized migrant farmworkers who have no direct representation in pesticide hearings; non-organized laboratory technicians working with biological agents. Present efforts are not successful in insuring participation by groups that are asked to bear the greatest human risk in a decision. The open hearing by itself is insufficient because these sectors of society lack organization, resources for technical assistance, or political influence.

In decisions regarding who participates, special consideration should be given to the particular population groups that are most severely at risk. Risk is interpreted to mean adverse effects on health and well-being. The fact that positive benefits are likely to accrue to a larger population from the decision, should not override the importance of the minority at risk. Representation in decision-making should be skewed in favor of those who must bear the greatest risks.

The inclusion into the decision process of laypersons with an alternative perspective or who are representative of a particular population group does not insure that their role will be effective. Public representatives are generally at a disadvantage with respect to the technical members of policy boards or advisory bodies. This is true whether it is the consumer representatives on Health Systems Agencies sitting with the providers, the public members on Institutional Review Boards, or the community advocates on Institutional Biosafety Committees. These individuals interact with scientists or technically trained medical persons. Consequently, their effectiveness depends on an ability to learn quickly, break through the technical jargon, and their refusal to be intimidated by titles and letters. When filling such slots for public representation, it is incumbent on the agency head to select individuals that are credible and effective spokespersons with a good potential for technical learning.

SOME CAVEATS FOR PUBLIC PARTICIPATION IN TECHNOLOGICAL DECISIONS INVOLVING RISKS AND BENEFITS

I have argued that serious attention given to citizen involvement in technology assessment is in the interest of social equity and achieving broad public confidence in public policy. Some sectors of government--especially agencies which deal with policy matters of broad application--have made some efforts to incorporate diverse viewpoints in their rule-making. When technological decisions are linked closely to current developments in science, that is, when the determination of risk involves highly technical information, scientific nomenclature, and what some have called esoteric knowledge, the propensity to encourage citizen participation has been weak, even when the risks to some groups have been clearly ascertained (Krimsky, 1979). The following recommendations take account of decisions involving such highly complex technical issues.[2]

PUBLIC PARTICIPATION MUST MAKE A REAL DIFFERENCE

Efforts toward involving citizens in decision-making must get beyond the reactive phase. It should take on more than pro forma significance. Where citizens obtain access to the decision-making process, it should be at points where they can make a difference in the outcome. This will help to reverse the public's disillusionment about the relevance of its input to the setting of policy.

PARTICIPATION SHOULD BROADEN OPTIONS--NOT NARROW THEM

The idea behind integrating more diverse interests into the decision-making process is to widen the scope of possibilities: to capitalize on the imagination of many different minds, with many different experiences and perspectives. The options should include fundamental changes, and not simply minor adjustments of pre-formed policy. On many occasions, citizens severely at risk are not afforded the opportunity to offer input at a point where significant changes might still be made.

WEIGHTED INPUT PRINCIPLE

Those individuals, communities or regions which are asked to bear the greatest risk from a decision on whether to implement a new technology should have a weighted input into the decision-making process. The risks in question are interpreted as real or potential hazards to the health and well-being of individuals. Where no special consideration is afforded the greatest risk bearers, the tendency is for their interests to be overridden by larger numbers of people who accrue benefits but bear little risk. The weighted input principle is advanced to effect greater justice in the deliberation of impacts. The principle has a counterpart in John Rawls' Theory of Justice, where it is argued that in a society of unequal distributions, decisions should not make the least advantaged worse off (Rawls, 1971).

How can the weighted input principle be used to guide public policy? First, it must be possible to identify a population that is particularly vulnerable--in terms of hazards to health and well-being--to the impacts of a technology. Second, a determination should be made on how the impacted population can have access to the decision-making process, such as whether there are existing organizations that represent them. If not, other means should be explored to determine how their interests can be represented. Third, the forms of participation should enable citizens to effectively advocate their interests. For technically difficult subject matter, scientific expertise should be available to high risk groups. Thus, the interests of asbestos workers cannot be fully realized in hearings on exposure levels, unless the workers have scientific personnel at their disposal.

Two forms of participation can be useful in achieving the objectives of the weighted input principle. The pre-hearing or post-hearing permits a more informal atmosphere for citizens to put their case before agency officials. Formal hearings can often inhibit creative exchanges between decision authorities and parties affected by the rule-making. For issues where extensive analysis and prolonged study are required, the advisory panel is another means through which representation of vulnerable populations can be achieved.

LOCAL OPTIONS

When a technology selectively impacts a community, such that its residents bear special risks, then maximizing local options for regulation is consistent with the "weighted input principle." Where the issue of Federal preemption is being considered, the burden of proof should be on government. Increasingly, cities and towns want to share in the decision-making authority with the Federal government when differential risks are at stake. Local communities have passed their own ordinances for the transport of hazardous materials through neighborhood streets, despite the fact that Federal regulations were issued by the Department of Transportation. Similarly, several cities and towns passed ordinances regulating genetic engineering after Federal guidelines were promulgated.

PRE-CONDITIONS FOR EFFECTIVE USE OF CITIZENS ON ADVISORY BOARDS

If current trends continue we can expect to see a growth in lay member representation on technical-scientific advisory bodies and policy-making boards both at the national and local levels.

For over a decade, the precedents have been mounting. Institutional Review Boards (IRBs), initiated by the Public Health Service in 1966, consist of lay members, scientists and medical personnel who review research protocols involving human subjects (Gray, 1975; 1978). The National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, established by Congress in 1974, set a new standard for citizen involvement in science policy (Lappe, 1978). Medical experts and lay consumers of health care serve together on Health System Agencies (HSAs) as mandated under the National Health Planning and Resource Development Act of 1974. Also in that year, the Secretary of Health,Education and Welfare chartered the Recombinant DNA Advisory Committee (RAC), which presently consists of twenty-five members, about one third of whom are non-scientists with backgrounds in law, ethics and environmental policy.

When scientists and non-scientists serve together on advisory bodies like the RAC and the IRBs, lay participants face formidable obstacles. How can the public members make reasoned choices when faced with highly specialized and esoteric knowledge? The problems are similar but are expressed differently when the advisory body in question is constituted exclusively by lay members, as in the case of the Cambridge Experimentation Review Board (established by the Cambridge City Council to evaluate the potential public health risks of recombinant DNA research).

Effective and meaningful participation by well-informed non-scientists in decisions involving the analysis of scientific information is not easy to achieve. There are many factors which can inhibit a working relationship between scientists and laypersons. Nevertheless, there are some conditions which, if satisfied, can reduce the likelihood that participation of lay citizens in technical decisions will become a form of tokenism.

ACCESS TO TECHNICAL KNOWLEDGE

Approaches must be sought for translating technical information and scientific nomenclature for the non-specialist. Consideration should be given to utilizing a scientific liaison advisor (SLA) for the public members on advisory bodies. The function of such an advisor is to find ways of presenting technical arguments related to risks in modalities useful to the lay members of such boards. The SLA would presumably be skilled in the use of special models, analogies, representations, and the like, for educationg the non-specialist. The goal of the educational process is to demystify the scientific arguments to the public members, while at the same time raising the technical competence of the non-scientist.

This idea was tried in a limited way by the Cambridge Experimentation Review Board (CERB) during its deliberations on the public health risks of a P3 containment facility for recombinant DNA research. CERB had a technical advisor on its staff who had some expertise in the biological sciences. Unfortunately, the education of the Cambridge citizens was quite limited for the role they were asked to play, and no effort was made to set up some educational program prior to their meeting with the scientists. Each CERB member was responsible for his/her own education of the scientific techniques under review. As a result, there were substantial differences in the level of understanding among members of the citizens' committee (Krimsky, 1978a).

CONDUCIVE ATMOSPHERE FOR SCIENTIFIC CRITICS

For lay people to be effective participants on advisory bodies that deal with adverse technological impacts, they must have the opportunity to hear opposing arguments. To achieve this outcome, the atmosphere must be suitable for members of the scientific community to express unpopular concerns. If a curtain of fear blocks such expression, then the lay members will be at a considerable disadvantage, for they need scientists to interpret the data and translate the technical vernacular (Holman & Dutton, 1978: 1531).

When advisory boards contain a mix of scientists and non-scientists, efforts should be made to select scientists who express diverse views on the subject matter. In this manner, the public members will hear a wide range of ideas and approaches to the problem.

CHOICE OF PUBLIC MEMBERS

If the trend of mixing scientific experts and public representatives on advisory bodies continues, greater attention must be given to the choice of public members. To improve the public confidence in such choices, the head of a regulatory agency (or other agency of government) could request nominations of individuals from the important constituencies involved with the issue in question. In this way, there can be assurance that the interests of key populations are represented in the policy process--that is, if the agency director actually selects advisors from the list of suggested names.

SPECIAL MECHANISMS FOR POLICY INPUT FROM DIFFERENTIALLY IMPACTED AREAS OR GROUPS

When Federal policy selects out certain target areas as the recipients of technologies with potentially adverse impacts, mechanisms should be available for those areas to weigh the impacts and satisfy themselves of the safety standards. Local or regional hearings have an advantage over those centered in the nation's capital. Promotion of public debates, educational forums, and local citizen review boards prior to a polarization of views can be useful to all parties.

EPA and FDA have demonstrated that regional hearings can be conducive to broadening citizen input into policy decisions. However, citizen participation cannot be reduced to the hearing process. Where significant hazards are at stake, other measures must work in concert with the public hearing.

INSURING THAT CITIZENS HAVE A FULL RANGE OF OPTIONS TO ADDRESS TECHNOLOGICAL IMPACTS

The value of having public representation on advisory bodies or technical review boards can be subverted if a very narrow range of options is available. One can expect that lay representation would broaden the outlook on a technological assessment to include social impacts. But if the process is restricted to the rules established by the technocratic sector of society, then there may be little gain in having lay people represent the broader issues.

When the Recombinant DNA Advisory Committee was expanded to include a greater proportion of public members, the charge to the Committee remained the same. The RAC continued to focus its attention on the issues of laboratory safety. No provision was made to redraft the original charge. Thus, even with one-third of its members unaffiliated with scientific research, the RAC has continued to avoid broader issues such as: genetic engineering, biohazards associated with non-recombinant DNA work, or the industrial exploitation of the new genetic techniques.

If we wish to achieve the full benefit of mixing lay citizens and scientists on policy boards, then the boundaries of discourse should reflect the concerns of non-technical participants. Otherwise, the lay citizens, following the lead set by the scientific experts, will have little or no opportunity to offer a critical re-examination of the basic problem.

CONCLUSION

The paper has examined the transformation in thinking that is taking place with regard to the role of citizen involvement in the assessment of potentially hazardous technologies. What was once visualized as the exclusive and legitimate responsibility of society's scientific elites is now being viewed along more pluralistic models of decision-making. This is a sign of a growing recognition that the assessment of risks and benefits cannot be carried out on purely technical grounds because values are embedded in the process from the very outset. Attempts to divide the functions of analysis into technical and policy components has a tendency to narrow policy options prior to public review.

Traditional channels of public participation, such as court action, lobbying, and public hearings, while important, are limited in what they can achieve (Coates, 1975). One of the ways to improve public confidence in decisions where adverse technological impacts are being assessed is to establish advisory bodies to governmental agencies that represent broad societal interests. The weighted input principle would give special access to the decision-making process for those groups that are likely to bear the greatest risks from a technology. In this regard, greater attention should be given to the intensity and distribution of adverse impacts and less to the aggregate weighting of risks and benefits. Local communities are prepared to convene their own panels to study the impacts of major technological innovations. This is a reflection of a growing distrust of large, impersonal bureaucracies, as well as a recognition of the profound impact of technology.

As risk assessment draws upon a base of knowledge that is highly specialized and complex (the situation that is illustrated in the recombinant DNA controversy), it becomes more difficult for non-specialists to participate in the decision-making process. However, the involvement of the non-specialist is an integral part of that process if we are seeking broad public confidence in such decisions. Otherwise, as science and technology become increasingly insulated from the public, the citizenry becomes dependent on expert affinity groups whose members benefit from the technological instruments that only they can understand. The experiences of both the recombinant DNA affair and the system of institutional review boards for experiments with human subjects show clearly that the public has a legitimate interest in the formation of science and technology policy. Moreover, as technical decisions behind policy choices become more difficult for the public to comprehend, that is a signal for planners and policy makers to place additional weight on public understanding and participation.

NOTES

1. The term "participatory technology" refers to the mechanisms by which society can achieve a greater sense of confidence and control over technological decisions (Carroll, 1971).

2. These ideas were presented in embryonic form at the National Conference on Citizen Participation, held in Washington, D.C., September 28-October 1, 1978 (Langton, 1979).

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