

PUBLIC ACCEPTANCE AND NUCLEAR WASTE: DO NEW TECHNOLOGIES MATTER?

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ABSTRACT

It has been several decades since scientific and technical experts first identified geologic disposal as their preferred solution to permanent isolation of high-level radioactive waste (HLW). In the years since, many lessons have emerged from both national and international siting activities. The history of site selection in the United States, in particular, illustrates how the absence of public acceptance--due in no small part to a lack of meaningful involvement by those directly affected by a decision--can effectively stall policy implementation.

Public concerns about waste disposal could significantly diminish the chances for a resurgence of nuclear energy. In spite of a recent mandate by Congress to consider new fuel cycle facilities and reactor types with enhanced safety features, and to examine improved technologies for partitioning and transmuting radionuclides, it remains to be seen whether the introduction of new waste management options will influence public attitudes toward nuclear technologies. A systematic examination of public objections and reactions to nuclear facilities serves to identify patterns or trends related to public acceptance. Stakeholder participation in the process to reexamine partitioning and transmutation as a waste management option is critical, if public acceptance is to be achieved.

INTRODUCTION

The Energy Policy Act of 1992 directs the U.S. Department of Energy (DOE) to accomplish two key programmatic goals by September 30, 1996. The agency is to encourage the completion of standardized advanced nuclear reactor designs by that date, as well as evaluate actinide burning technology to determine its potential for reducing the volume of long-lived fission products (1). Based on the results of the latter study, the DOE is charged with preparing and submitting to Congress a five-year plan for research and development of new technologies for reducing the volume and toxicity of nuclear waste (1).

Partitioning and transmutation (P/T), also known as actinide burning, is a two-step process involving the chemical separation of fission products, actinides, and transuranic elements from a mixed waste stream, bombarding the most toxic radionuclides with neutrons, and transforming them into stable atoms or considerably reducing their half-lives (2). Claims have been made that the incorporation of P/T into the nuclear fuel cycle will have significant benefits regarding public acceptance because: treated waste would be isolated for hundreds rather than thousands of years; the volume of the most toxic waste would be cut dramatically; and the need for long-term storage in geologic repositories would become less imminent (2).

Growing public concerns about radioactive waste as a feature of conventional nuclear technology, declining levels of institutional trust, and a string of aborted siting attempts suggest that those seeking to introduce P/T into the fuel cycle will have to contend with a very low public tolerance of radioactive risk.

Many factors have contributed to shaping current public opinion, but perhaps none as important as the perception by stakeholders--those individuals and groups most directly affected by decisions about radioactive materials--that they have been shut out of the policy making process. Thus, even though no systematic effort to gauge public opinion on the subject of P/T has been undertaken, it is expected that the prospects for public acceptance of this technology are greatly enhanced by stakeholder involvement early in the reasoned debate over risks and benefits.

PUBLIC OPINION AND NUCLEAR TECHNOLOGY

Studies examining public attitudes toward new nuclear technologies are virtually nonexistent; yet a considerable body of social science literature reveals three major themes relating to public attitudes toward nuclear power production and radioactive waste management. The themes--nuclear waste as a reason for opposing nuclear power, issues of trust and confidence, and opposition to facility siting--are relevant to the P/T debate in that each will likely surface in policy deliberations.

Nuclear Waste as the Reason for Opposing Nuclear Power

Concern about waste as a reason for opposition to nuclear power appears to be on the rise. Early studies found that few people opposed nuclear energy, and practically none offered waste disposal as a cause for opposition. By 1990 twenty-two percent of a national sample mentioned nuclear waste first as a disadvantage of nuclear energy; 4% mentioned it second, and 1% third (3).

While public concern over nuclear waste has risen significantly during the last several decades, most Americans remain largely unfamiliar with the origins, volume, and location

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of radioactive waste. Despite that Americans do not appear very well informed about nuclear waste management, many have a very negative perception of radioactive waste, and a significant *percentage*, of those opposing nuclear power are doing so because of perceived problems with nuclear waste disposal.

Issues of Trust and Confidence

Trust in those making nuclear waste decisions is increasingly recognized as a fundamental prerequisite to public acceptance. Accordingly, this theme deals with the dual issues of confidence in technology to solve the waste problem, and confidence in the institutions that have to carry out this task. Supported by the myriad surveys conducted during the 1980s and 1990s, the trend is a significant decline in public trust of science and technology in general, as well as a good deal of variation in the degree of confidence individuals place in institutions and groups who make decisions on their behalf. Scientific experts tend to fare better than legislative bodies or government agencies in commanding public trust.

A recent survey, for example, examined public beliefs about nuclear technology, perceptions about its adequacy, and trust in those who operate nuclear systems. Independent variables included a measure that represented the trust respondents placed in three nuclear groups: nuclear power plant operators, the DOE, and national laboratories. The investigators found statistically significant relationships between trust and perceived risk; that is, the more trusted system operators are, the less the individual perceives the risks to be. They also found that among the public, greatest trust in decisions about waste management goes to university scientists, followed by scientists from national laboratories, national environmental groups, and the Environmental Protection Agency (EPA). The DOE was afforded somewhat lower trust, as were spokespersons for nuclear utilities and chemical companies. The general public perceived nuclear waste policy actors to be aligned in coalitions, with DOE aligned with nuclear utilities and chemical companies, while EPA was loosely associated with national environmental groups. Scientists fell between these two extremes. These results indicate that the general public perceives the DOE as somewhat partisan, and scientists as relatively neutral actors in the nuclear waste policy arena (4).

Siting Nuclear Waste Facilities

In the earliest stages of atomic energy production, there was limited public knowledge about, thus little opposition to the construction of nuclear facilities. In the mid-1970s, however, overwhelming majorities of individuals began to state a greater unwillingness to reside near a nuclear waste repository than any other type of large facility. Recent experience demonstrates that Americans are apparently no more tolerant of residing near a low-level waste disposal site as they are of a *HLW* facility. Stalemates in many of the Low-Level Compact States over site selection, as well as public opposition to the now-defunct NRC "below regulatory concern" guidelines for disposal in municipal landfills, suggest that the public holds strongly negative images of radioactive waste, regardless of classification.

Another feature of the siting issue discussed among opinion analysts is the comparison of attitudes of host and non-host communities. An examination of the groups in proposed host states such as Tennessee, Washington, and Nevada indicates that opposition to locating a facility tends to increase among

those living farther from a proposed site. Two reasons seem to account for the discrepancy. First, some individuals are more familiar, thus usually more comfortable with nuclear technology because of similar facilities already constructed in their communities. Second, those living longer distances from the site perceive themselves shouldering the stigma associated with nuclear waste disposal without receiving financial rewards comparable to those given to the local communities.

In determining what incentives might induce communities to be more receptive toward hosting a temporary or permanent waste storage facility, the establishment of a local committee, empowered to shut down the facility if unsafe, was found to make a majority of respondents in both national and Nevada surveys more favorable toward a high-level waste site (5,6).

Public Acceptance of P/T

Based on existing evidence, there is little to suggest that introducing P/T would produce a significant change in most Americans' attitudes toward nuclear technology. Americans generally do not distinguish between types of radioactive waste, and thus would not likely appreciate that, by treating them, the volume and toxicity of *HLW* might be reduced. It is conceivable that a reduction in waste toxicity might alter some opinions, but the fact that P/T would actually generate large amounts of other kinds of waste would likely offset any gains. Policy makers would still be faced with issues dealing with institutional trust and confidence, and for P/T to make a contribution in this area, it would take years to demonstrate the safety and reliability of the new reactors. In fact, if deployment were to be unsuccessful, confidence in the waste policy process could further erode. Finally, reprocessing would exacerbate the siting problem, since the construction of nuclear facilities in addition to a repository would be required.

STAKEHOLDERS, PUBLIC ACCEPTANCE, AND THE CHANGING POLICY PROCESS

The traditional American public policy and decision making process relied heavily on relatively high levels of popular confidence in institutions and authority. The policy agenda was largely defined by the interaction of organized groups, social, economic, and political elites, as well as technical experts and professionals. This policy community, as shown in Fig. 1, then brought demands for action on the agenda to popularly elected executives and legislatures that formulated policy in the form of decisions, statutes, and regulations.

More often than not, the groups demanding government action offered detailed proposals for deliberation, and were intimately involved in crafting those variations that weighed most heavily in final designs. Because elected representatives (in Congress or the President) or officials appointed by, or accountable to elected representatives (executive agencies exercising delegated power and regulatory agencies) were formally responsible for rendering final policy decisions, popular support for such measures was assumed—even though few citizens were likely to know about, let alone be involved in, agenda setting and policy formulation. Once the basic parameters of policy were set, some form of public hearings typically occurred, there a broader segment of the citizenry had the opportunity to join policy deliberations. The final decision eventually was made, announced, and justified in a system where majorities within institutions ruled. The policy then was delivered to bureaucrats for faithful implementation.

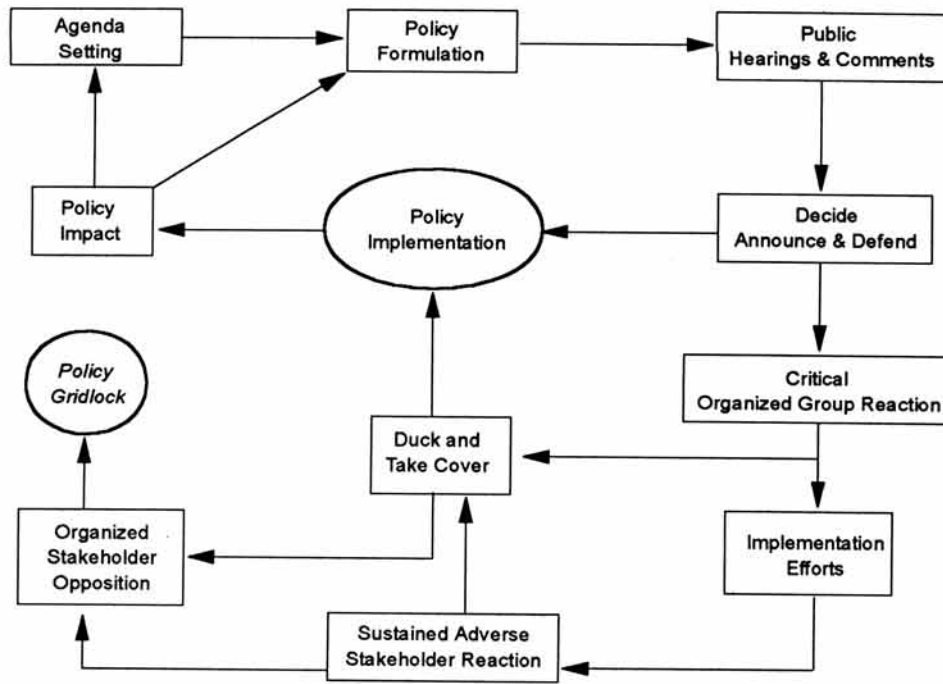


Fig. 1. Policy and decision-making process.

Because the policy had been developed within a democratic and representative framework for which most citizens had respect, acquiescence to implementation was the norm. Those displeased with the policy were expected to avail themselves of the political process rather than to oppose or seek to prevent implementation. And this is largely what happened. As implementation eventually produced its intended and unintended effects, the policy cycle was completed through changes in the policy agenda or reformulation.

As discussed earlier, popular confidence and trust in major institutions has declined over the past quarter century, causing the implementation of public policy to become increasingly problematic. The system now includes a number of complex additional stages, some of which result not in implementation, but in a gridlock that prevents it. Organized groups, unable to create institutional majorities for their policy preference, or to block majority preferences, now use the mass media, the judicial system, and direct protest to delay, undermine, and prevent implementation. This may result in little more than causing policy implementers to "duck and take cover" until the criticism "blows over" and programs proceed. As implementation efforts proceed in the face of group criticisms, some stakeholders--(those who are most directly affected by policy)--many of whom had little or no idea they had a stake until implementation, adversely react in a sustained fashion. Again, if agencies "duck and take cover" and things "blow over," implementation may well proceed with limited delay or negative effect. Several factors, however, now make this unlikely.

First, critical organized national and regional groups, recognizing the value of stakeholder-based opposition, often are willing to share information, connections, and resources. Second, a very small group of stakeholders--even in the face of a large majority of stakeholders supporting government policy--with vigorous leadership, strong motivation, and networking savvy, can organize and sustain opposition. Third, stakeholders can avail themselves of administrative and judicial forums explicitly reformed to protect minority rights; they

also have at their disposal a growing cadre of legal specialists. Fourth, reflecting the decline of trust and confidence in representative institutions, stakeholders frequently now manifest a deep sense of betrayal by a system that generated, from their viewpoint, an unfair, unjust, and burdensome policy at their risk or cost--without their direct knowledge or consent. From this sense of betrayal flows a tendency to distrust implementing authorities and all experts associated with them. Fifth, some policy makers, organized interests, and stakeholder groups tend to assume that the force of the law and authority ought to be sufficient to implement policy, and do not expect to have to work in direct support of implementation. Thus, if implementation is delayed or seriously hindered, their initial reaction is to blame incompetent bureaucrats rather than to engage opposition groups and stakeholders--until it is too late. As a consequence of these factors, then, many of our most important national policies--such as the management and disposal of radioactive waste--are subject to policy implementation gridlock.

Many of those concerned with the process acknowledge the recent shifts in the system that render stakeholders critical to successful policy implementation. Figure 2 presents stakeholders in their new central role and suggests why the analysis which follows places so much emphasis on them. The fundamental assumption of this model is that stakeholders today inevitably are involved in implementation. The idea is to provide for stakeholder involvement that by its nature and timing facilitates rather than inhibits effective policy implementation. Thus, policy and decision making that identifies key stakeholders and their stakes early in the process is important. Insofar as possible the perspective, concerns, and ideas of stakeholders need to be accommodated before policy formulation.

Early stakeholder involvement, it is expected, enhances policy formulation in several ways. It likely broadens the range of alternatives considered, and provides early warnings about the costs and benefits of any given approach from the standpoint of those most likely to support or oppose

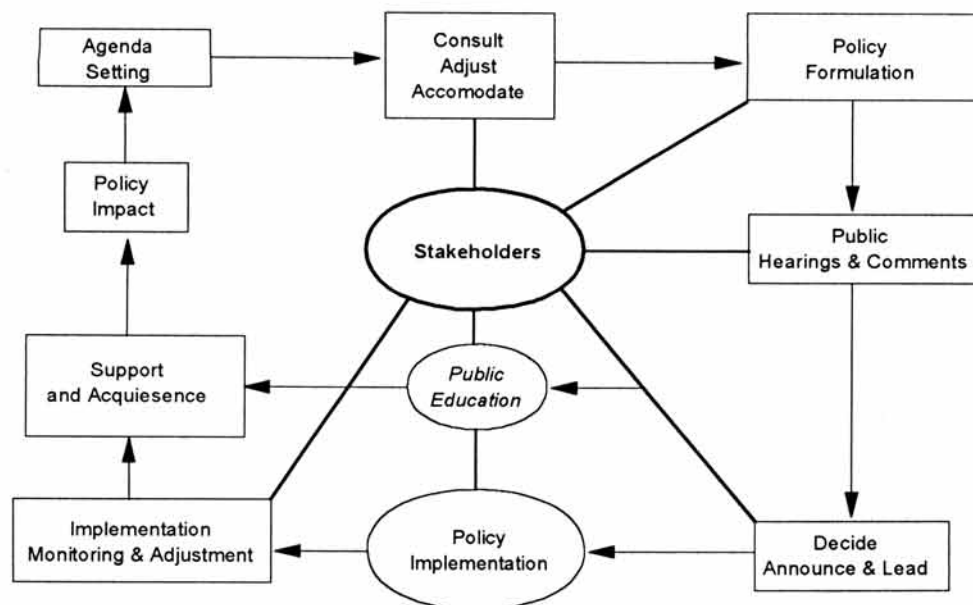


Fig. 2. Stakeholders policy and decision-making process.

implementation later. It also significantly reduces the basis for later claims, by disgruntled stakeholders, that they were denied access to the process at a point when their participation could affect the decision. While this, in and of itself, may not eliminate subsequent opposition, it helps build the kind of record of public accessibility needed to successfully weather later administrative and judicial challenges. Furthermore, early involvement provides those making and implementing decisions with an early warning of where key potential opponents are likely to stand later in the process. Perhaps the most significant result is that a sense of trust and confidence in the process--and thus the policy--should (increase) over time, based on stakeholder experience rather than assurances. This helps to engender a stakeholder "buy in" and "ownership" of the policy that becomes an asset in subsequent stages.

STAKEHOLDERS IN THE P/T PROCESS

An evaluation of P/T, then, requires an understanding of stakeholders' perceptions regarding the technology's positive and negative effects. We speculate how potential stakeholders, in addition to the public at-large, might respond to a decision to move forward with P/T research.

Environmental Interest Groups

The lack of a comprehensive waste management system is a reason frequently posed by environmentalists for halting the generation of nuclear power. For existing waste, most favor permanent disposal, but criticize DOE's repository program; they oppose transporting waste from nuclear utilities to regional or national storage facilities. Another key issue for this group is the fear of nuclear weapons proliferation resulting from the extraction of plutonium from spent fuel for reprocessing.

The time needed for P/T research could possibly be viewed by some as a mechanism to delay repository construction. It is not likely, though, that this group would support a large-scale research endeavor because: any process involving lifting the moratorium on reprocessing would be viewed unfavorably; the introduction of P/T would require shipping

wastes from source reactors to new actinide-burning reactors, thus doing nothing to ameliorate this group's concerns over transportation and nuclear facility siting; and a successful demonstration of P/T technology would significantly weaken this group's argument against continued production of nuclear power.

The Nuclear Industry

The Chernobyl and Three Mile Island accidents have left indelible marks on the nuclear industry. Also contributing to an image problem is the perception that no solution currently exists for disposing of spent fuel. The industry as a whole remains supportive of the geologic disposal concept, and it has borne the financial burden of the repository program. Yet because of programmatic delays, many encourage the construction of MRS-type facilities, and are exploring at-reactor storage.

The Electric Power Research Institute recently issued a report evaluating the concept of transuranic burning using liquid metal reactors (7). It concludes that only modest benefits would accrue by adopting P/T technologies. The costs include: a significant financial commitment; major institutional difficulties; substantial licensing hurdles; and amplified political and public opposition to the overall nuclear power program. If the mass public and political community witness extended delays in the waste disposal program, the already tenuous support for nuclear energy may further dwindle. Furthermore, if public expectations are raised by the promotion of P/T, and the development is not forthcoming, the industry's reputation could be irreparably damaged. Finally, processing the waste does not alleviate the need for a HLW repository.

The Department of Energy

Since the passage of the Nuclear Waste Policy Act in 1982, DOE has received few accolades for its efforts to implement the legislation. The agency has been criticized for its site selection criteria, program delays, and the credibility of its Office of Civilian Radioactive Waste Management has

suffered due to public perception of poor environmental management of DOE's defense facilities. Introducing P/T into the nuclear fuel cycle would likely exacerbate DOE's problems: the agency would have to develop the institutional capacity and restructure its nuclear waste program to accommodate before-disposal processing; DOE would confront reprocessing opponents within the industry as well as the environmental, political, and scientific communities; the regulatory agencies with which DOE must contend--the NRC and EPA--would have to develop new standards for actinide burning; and the introduction of P/T would require siting additional reactors and reprocessing facilities. Nevertheless, proponents of research into new technologies successfully lobbied Congress for funding and the Energy Bill places DOE in charge of that effort.

The Scientific Community

Because evidence suggests that the public places considerable trust in the opinions of experts, the lack of consensus on this issue may contribute to an even more confused public about the risks of radioactive substances. By and large, the scientific community agrees that radioactive waste can be safely isolated in geologic repositories. Scientists are not in agreement about the plausibility of P/T. Critics have argued that P/T would worsen the economics of nuclear power, it does not remove all the long-lived fission products from the waste, and reprocessing waste raises additional problems. Yet competition between national laboratories for funding is likely to occur.

CONCLUSION

There was a time, even in extremely contentious areas, when American decision makers and administrators could reliably depend on widespread public support and acquiescence for implementation, due to popular deference to representative institutions. Today, however, stakeholders are increasingly in a position to promote opposition to implementation and foster the effective withdrawal of popular consent. While the exact nature, degree, timing, and detail of stakeholder involvement will vary from policy-to-policy, the need for greater direct stakeholder involvement at various stages of the process is unmistakable, and should not be dismissed by prudent decision makers. At a minimum, those interested in the promulgation of new policy, or of reformulation of existing policy, need to identify stakeholders, calculate their stakes, and anticipate stakeholder reactions as these are likely to affect popular support and acquiescence later in the process.

Early participation by stakeholders, then, is critical to determine the true prospects for P/T. At this time, it is uncer-

tain whether the introduction of P/T would enhance public acceptance of nuclear technologies, particularly waste disposal. An analysis of public opinion indicates that issues concerning Americans--nuclear waste as a reason for opposing nuclear power, trust and confidence, and opposition to facility siting--are minimally affected by transmuting waste prior to disposal. This is not to say that basic research of P/T technology would not prove beneficial. Yet there needs to be some refinement of the costs and benefits of pursuing this course of action. Congress has given DOE the mandate to do so.

The framework presented here suggests the central role of stakeholders in contemporary policy formulation, implementation, and evaluation. Meaningful stakeholder involvement could help ameliorate two problems related to public acceptance: legitimacy and trust. Participants would be more likely to perceive decision makers as trustworthy, and their decisions as legitimate. Considering the diverse attitudes among key stakeholders, a consensus on nuclear waste management will likely not be reached in the short run, though understanding the divergent perspectives on the front end may reduce false expectations and programmatic delays in the long-term.

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