

# contents

MANAGING EDITOR  
Barbara Ferkiss

ASSOCIATE EDITORS  
Jane Scully  
Joy O'Rourke

ASSISTANT EDITOR  
Rae Nelson

GRAPHICS  
Jane Rogers

PRODUCTION SUPERVISOR  
Naomi Rogers

DESIGN CONSULTANT  
Susan Neighbors

BUSINESS MANAGER  
Barbara Marney

ADVERTISING MANAGER  
James Ingraham

CIRCULATION MANAGER  
Page Minshew

PUBLISHER  
Cornelius W. Vahle Jr.

EDITORIAL COORDINATOR  
Louise M. Dudley

Editorial and Circulation Offices:  
4000 Albemarle Street, N.W.  
Washington, D.C. 20016  
Telephone: 202-362-6445

Copyright ©1980 Helen Dwight Reid  
Educational Foundation

Second class postage paid at Washington, D.C.

POSTMASTER: Send address changes to  
*Environment*, Room 500, 4000 Albemarle  
Street, N.W., Washington, D.C. 20016.

ENVIRONMENT (ISSN 0013-9157) is published monthly except bimonthly January/February and July/August by the Helen Dwight Reid Educational Foundation in cooperation with the Scientists' Institute for Public Information. Subscription rates are: Individuals, \$14.00; Institutions, \$22.00 a year; Foreign subscriptions, add \$4.00; Newsstand, \$2.00. All foreign subscriptions must be paid in U.S. dollars. Please allow six weeks for shipment of first copy.

The views expressed in "Overview" and in the articles in this issue are those of the authors and not necessarily those of the editors or publisher.

**ENVIRONMENT**

Volume 22, Number 3  
April 1980

## OVERVIEW

2

**UNIONS** John Yolton (p. 2)  
**ECOLOGY** Russell W. Peterson (p. 3)  
**CITIES** Michele Tingling (p. 5)  
**INDUSTRY** Joseph L. Ling (p. 42)  
**LAW** Ross Sandler (p. 43)

## THE UNFINISHED AGENDA

6

**Denis Hayes**

On this tenth anniversary of the first Earth Day, the national coordinator of the event which opened an era of environmental awareness recounts the accomplishments of the past ten years and reviews some of the problems still awaiting remedies. He concludes that the achievements of the 1970s make the unfinished agenda for Earth Day '80 all the more challenging—because the environmental decisions of the new decade require recognition of other real, and sometimes conflicting, social concerns.

## HELPING THE PUBLIC DECIDE

14

**Nancy E. Abrams and Joel R. Primack**

Public participation in decisions about complex technological and scientific problems, such as radioactive waste disposal, is frequently ineffective because the wrong questions are asked of the wrong people. The model proposed here—"critical review and public assessment"—would encourage participation of a variety of publics in the review process at the stages most appropriate for their own special interests and expertise. The authors suggest that the outcome would be a high quality technical plan enjoying widespread public understanding and support.

## A NEW LOOK AT SMALL POWER PLANTS: II. THE ENVIRONMENTAL EFFECTS

25

**David B. Champion and Michael D. Williams**

Small coal-burning power plants are not only more economical than large plants but offer some significant environmental advantages as well. Although the cumulative impact of the smaller power plants might equal that of one large plant, the impact is spread over a larger area and can be more easily absorbed by the environment.

## FARMING ON THE URBAN FRINGE

33

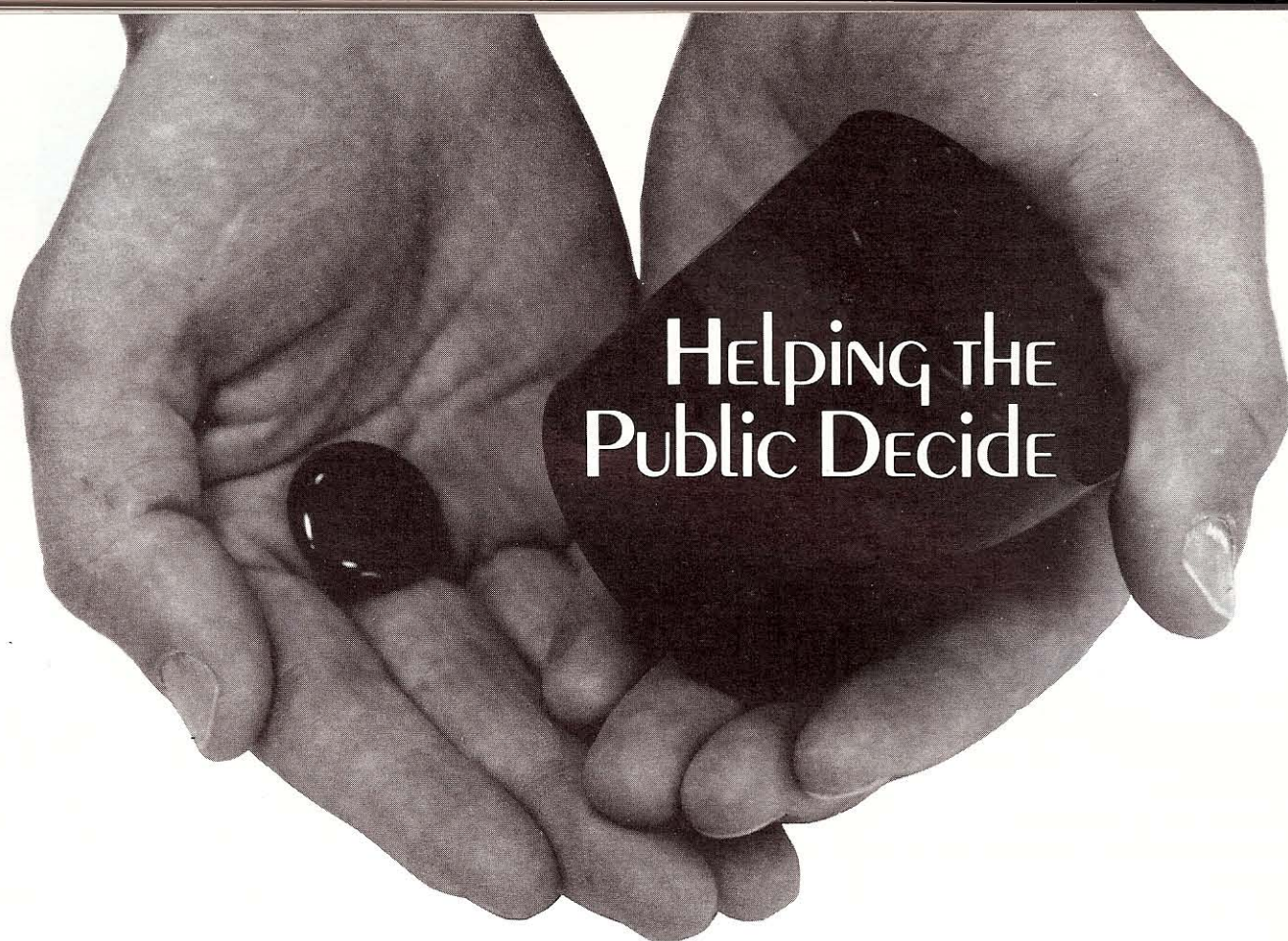
**Robert E. Coughlin**

The continuing loss of our best farmlands to urban sprawl portends a serious problem. Although the construction of new urban areas is the most dramatic and irreversible effect of such spillover, a shift to different types of farming and the premature idling of large areas are the first, and often fatal, steps in the ultimate development sequence. Various public programs to save farmlands and to maintain farming as an economically viable undertaking are now being implemented in many fringe areas where development pressures are already moderate to strong.

## SPECTRUM

21

**ABOUT THE COVER:** The Earth Day '80 logo, created by David Root, symbolizes the need for people to join together to improve the environment.



## The Case of Radioactive Waste Management

BY NANCY E. ABRAMS

AND

JOEL R. PRIMACK

---

**NANCY E. ABRAMS** is a lawyer specializing in developing new procedures for democratic resolution of technological problems. She has worked for the Congressional Office of Technology Assessment and has served as a consultant to the Swedish government. **JOEL R. PRIMACK** is Associate Professor of Physics at the University of California, Santa Cruz, and has written extensively on nuclear energy and other issues of technology policy. He has been a consultant to environmental groups and to the Nuclear Regulatory Commission.

---

POWERFUL INDIVIDUALS OR GROUPS affected by government decisions have always demanded and achieved influence in making those decisions. Now that large numbers of ordinary citizens in democracies such as the United States are educated and the mass media inform and connect them, they too are capable of becoming organized and therefore powerful when the right issues arise. The increase in the number of vocal interests is making government more difficult, but it may also lead to better considered and fairer decisions.

Public participation in decision making serves two basic functions: first, it adds to the legitimacy and public acceptance of government decisions; and, secondly, what the public contributes—an outside perspective, unusual kinds of expertise, a longer-range view than most elected officials can afford, and on occasion basic moral demands—may actually lead to a better decision. This latter function is less recognized than the former by the government's own decision makers and experts, but there is no doubt that, at least in some cases, input from the public has saved us from some technological Vietnams, for example, the anti-ballistic missile system and the SST.

Government difficulty in winning public acceptance of nuclear power, combined with public frustration with existing procedures in this area, has led to various proposals for new forums and procedures that would permit more public input. But one cannot develop intelligent procedures in the abstract, even on a particular problem such as nuclear waste disposal, without first determining the nature of the issues for which the procedure is supposed to produce legitimate and wise decisions. As long as the framing of the questions is unexamined, the strong possibility exists that public participation appears to be difficult to obtain primarily

The caption which accompanies this Department of Energy photograph states that "nuclear waste can be immobilized for handling or disposal" in the form shown—25 percent high-level waste mixed with 75 percent glass. The small object on the left is said to represent the annual quantity of high-level waste glass which would be generated per person served exclusively by nuclear power plants; the large piece on the right represents a person's lifetime share. However, several important points are not mentioned. First, if there were actually nuclear waste within these pieces of glass, no one would be holding them in his bare hands. Also, the glassifying or "vitrification" process is being considered only for disposal of wastes which have been reprocessed, not for disposal of unprocessed spent fuel rods. Yet U.S. policy has explicitly rejected reprocessing because of its proliferation implications. Additionally, it has not been proved that nuclear wastes can in fact be successfully disposed of in vitrified form. To the contrary, it has been shown that this type of glass, when subjected to the pressure it would receive if buried in salt, together with the effects of the heat and radioactivity within it and the brine around it, would disintegrate in about two weeks (see note 16).

because it is being sought on the least appropriate questions. We would argue that this is true in the case of nuclear waste disposal, based on the following considerations.

Public workshops and hearings sponsored by the Environmental Protection Administration (EPA), the Department of Energy (DOE), and the Nuclear Regulatory Commission (NRC) as well as NRC licensing experience indicate that these agencies permit public participation either too early, when plans are extremely vague, or too late, when the public is presented with a *fait accompli*, and also that the agencies have not thought through which of their decisions are the ones on which public participation is most essential or most feasible. The resulting confusion of issues makes most current public participation attempts frustrating and nonproductive.

Identifying the major decisions which must be made in nuclear waste management is a prerequisite to determining *which* of those decisions require public input and *who* constitutes the "public" in each case. This has never been done by the federal agencies.

The controversy we are seeing today is not simply over the choice among various possible methods of nuclear waste disposal; it also involves serious doubt, if not suspicion, about the government's real intentions in handling the whole problem. It would be highly desirable for the government to present as soon as possible a complete tentative plan for nuclear waste disposal. This plan should then be broadly discussed and criticized through government-funded studies by outsiders. Such a procedure would help to establish the main issues for public debate and thus facilitate informed and effective public participation. In this article we propose a new model for doing this—"critical review and public assessment," a two-tiered approach to public participation.

There have been attempts to develop "public participation mechanisms" but, with respect to the nuclear waste issue, these have been so premature that their use would prove not only worthless but diversionary. The public cannot respond to an enormous, vague technical question submitted to it directly. Members of the public have neither the expertise nor the patience. If government is serious about involving the public, it must first seek *and fund* expert comment and analysis from interested and independent experts on everything that could go wrong with a plan and allow this stage of criticism to establish the real issues and trade-offs for the public. It is well documented that again and again in public controversies over technologies it has been independent scientists who first effectively raised the issues which public activists came to understand and took over from there.<sup>1</sup>

### Federal Agencies and the Public

The Environmental Protection Agency, the Nuclear Regulatory Commission, and the Department of Energy apparently believe public input on the nuclear waste disposal issue to be appropriate only as guidance on the most general issues before any real decisions have been made or as a challenge to a fully developed plan in a formal hearing. In other words, they do not know how to integrate public participation into an ongoing decision-making process where strong public input could really make a difference.

*If the EPA addresses unplanned events in its environmental protection criteria, what would be an appropriate and effective approach? What aspects of the disposal process and of the unplanned events should be addressed?*

This was the first question participants at EPA's Albuquerque workshop on radioactive waste were supposed to consider. How they were supposed to know what "unplanned events" were, if EPA did not, is unclear.

*Can and/or should environmental radiation protection criteria be established on a generic basis addressing all forms and types of radioactive wastes if possible?*<sup>2</sup>

This was the opener at EPA's Reston (Virginia) workshop. A few of the prepared papers dealt with questions like these, but a reading of the public comments shows one after another person expressing basically fear—fear that human beings will not handle radioactive waste with the care it demands, fear that the future of the earth is in danger—and ending with plaintive pleas to EPA to "take my statement into account." According to one participant at the Denver workshop, lack of travel funds meant that only the most dedicated antinuclear activists and the well-heeled nuclear industry representatives (who comprised about two-thirds of those attending) came, with a consequent polarization of all discussions and a premium placed on scoring points. Despite successes in getting some of their views reflected in the workshop proceedings, many antinuclear participants wondered what it was all for. Some demanded assurances on the record that they would be listened to.

NRC also held a series of workshops under specific instructions in their 1979 authorization act<sup>3</sup> that they prepare a report for Congress by March 1979 on the advisability of awarding grants to the states to fund development of "review capability," as they called it, and to make recommendations on better methods of participation by the states in the siting, licensing, and development of federal nuclear waste facilities. State officials and legislators thus made up the vast majority of participants at these workshops.

According to NRC's report,<sup>4</sup> a consensus was clear among the state representatives that states should have "consultation and concurrence" with federal authorities at every stage, but no ideas emerged as to exactly how this would be done. Another view on which the states all agreed was that NRC's preliminary site suitability criteria were far too vague to discuss usefully. The NRC report's recommendations to Congress, with the benefit of state input at four workshops, were basically that "a (federal-state) planning council be established" (as recommended already by the Interagency Review Group in their report to the President<sup>5</sup>), a review capability [of states] be established," and "measures be taken to involve the states."<sup>6</sup>

The main subject of discussion in the report, and apparently a central NRC concern, is how to proceed with siting a federal waste dump if state concurrence cannot be obtained voluntarily. Many arguments are provided to justify a federal right to proceed "in the national interest," creating a reasonable doubt in the mind of the reader as to the seriousness of NRC's concern with genuine state involvement. In NRC's own words, the purpose of state involvement is twofold: it serves as a "channel for informing the states," and "it enables federal decision makers to solicit and receive a more or less authoritative expression from policy-making officials of the states with respect to those matters which are of direct concern to them."<sup>7</sup> In other words, state participation is basically for information exchange, not a sharing of power.

The IRG report also discusses the "state veto" issue but, while determining that a recommendation for or against a state veto would be premature, it concludes that "consultation and concurrence" would be more in the interests of the states than a state veto right. Both these rationalizations miss the point that a "veto" need not be over the flat question of siting or not siting but could be over part of the issue—namely, the acceptability of incentives offered for siting and of the criteria according to which the facility is guaranteed by contract to be built. Only by separating out the specific issues can one move beyond the standard legalistic approach of each party attempting to preserve its rights for a future dispute.

DOE's draft Environmental Impact Statement (EIS) on "Management of Commercially Generated Radioactive Waste"<sup>8</sup> weighs about seven pounds. It gives no indication what DOE plans to do; instead, options within options are all duly presented. DOE has held several public hearings around the country to elicit the public's reactions to its EIS, but the San Francisco hearing<sup>9</sup> was not even conducted by DOE's own employees. Instead, some outside consultants with unspecified, if any, connections to DOE policy making had been hired to take care of this apparent nuisance of a task.

EPA, NRC, and DOE discuss generalities and numberless options, presumably in the hope that somehow a solution will emerge. Their jurisdictions and missions are limited in such a way that no one of them is in a position to take charge or even to take an overview of the whole process. This contributes to public confusion because it is impossible to tell what solution is emerging, if any, or who is responsible and, consequently, where one's efforts and concern should be focused. As the NRC itself says:

*One reason that State participation at the present time may be poorly focused is that there is no effective way to determine exactly what the Federal policies and programs consist of. To a large extent, this may reflect the fact that activities at the Federal level are themselves still in the process of being worked out and, further, that the participation of several Federal agencies creates inevitable problems of coordination.<sup>10</sup>*

Without sorting out this admitted confusion, the agencies would like to "involve the public," as if they could help clarify matters. But involving more people in a confused effort merely magnifies the confusion; it also creates ill feelings. The "State Planning Council" proposed by the IRG will have the same problem. It is supposed to develop "criteria for evaluating proposed nuclear waste management activities."<sup>11</sup> Meanwhile, DOE determines "site selection criteria"; NRC determines "site suitability criteria";<sup>12</sup> and EPA determines "environmental protection criteria."<sup>13</sup> Since development of criteria is the area most in need of public participation, something basic must be done to give the public half a chance to participate.

## The "Public"

Before discussing public participation further, it is important to define "public." Of course, the public is not a monolith with a single point of view. For our purposes the public is composed of all the people outside the federal agencies and the nuclear industry (representatives of the nuclear industry have never lacked channels through which they can and do influence government decision making). All individuals or groups with a contribution to make to the national debate or to a local debate on radioactive waste management are considered to be legitimate spokespersons for the public, even if they do not represent anyone else.

Peter Montague has pointed out that there are two major unrepresented interests in the radwaste controversy: the uninformed and the unborn.<sup>14</sup> It is important to consider these groups, to be sure, because they are the largest in number, yet the least likely to be heard from. But there is another unrepresented group far easier to reach, whose input could be of great value: the informed and concerned public. This last category of the informed, concerned, and uninfluential includes:

- people who oppose nuclear energy anytime, anywhere;
- people who oppose nuclear powerplants near their homes;
- people like the authors of the Kemeny Report, who have no objections to nuclear power in principle but insist that, if it is used, it must be made much safer;
- labor organizations mostly concerned with jobs;
- nuclear proponents outside the nuclear industry;
- businesspeople, especially those concerned about the relationship between nuclear power and the national economy, or between nuclear power and their local economy;
- public interest scientists, lawyers, economists, energy analysts, and other independent experts;
- civil liberties advocates;
- environmental organizations;
- foreign policy experts or others concerned about the relationship between nuclear energy and proliferation;
- state officials concerned about addi-

tional responsibilities nuclear facilities may place upon them (such as transportation monitoring, evacuation planning);

- and other concerned persons.

All these groups should be thought of as the "public" in the discussion which follows.

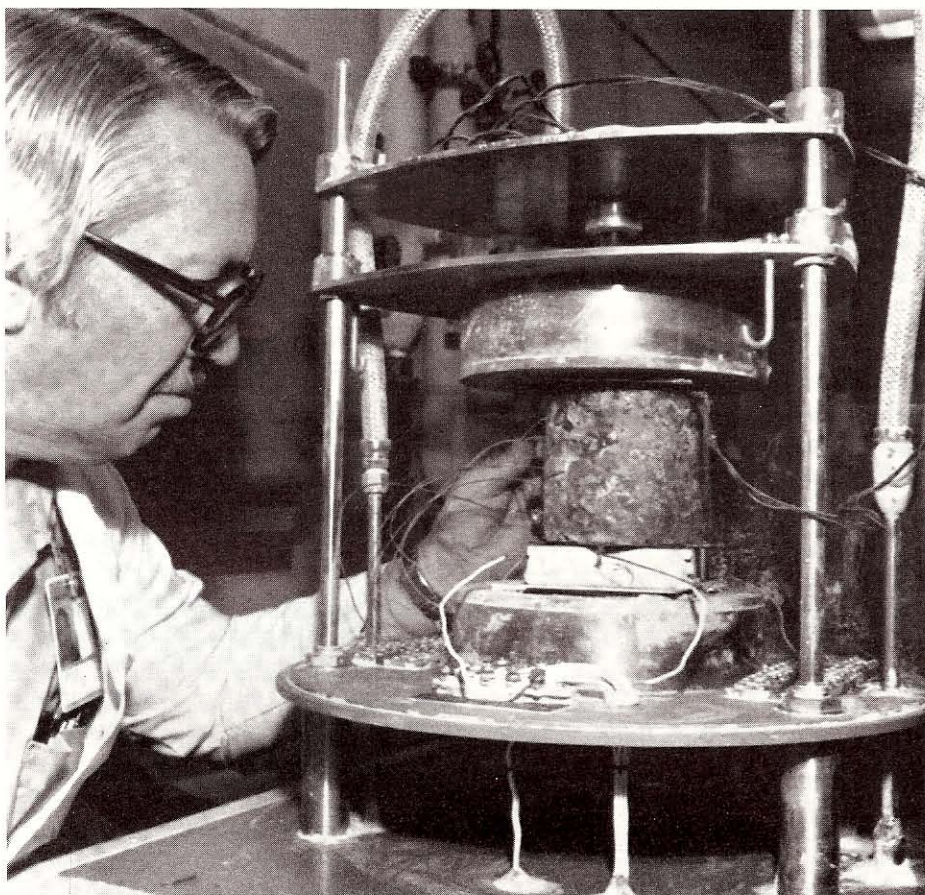
## The Crucial Decisions

### *Criteria the Program Must Meet*

**Short-term safety.** Short term safety may turn out to be the most important question of all. How much safety will we require in the transportation, handling, interim storage, and burial operations of the spent fuels and other waste forms? Most attention has been paid to the long-range effects of nuclear waste because frontiers of science are more interesting than such mundane issues as how to get the waste safely off a truck. But these are not only the chief concerns of workers and unions; they are precisely the concerns of greatest importance to the people living in the region of the site and will also be the first public test of the competence of the entire operation. Transportation, handling, and burial operations could become to nuclear waste disposal what the waste disposal issue has become to nuclear power: the "trivial" but recalcitrant engineering problem that threatens to undermine the whole venture.

**Long-term safety.** How safe should the disposal facility be in relation to people living nearby, people who will live there in the future, and the environment?

**Design specifications.** How much radioactivity can be released in various forms, both before burial and after? What degree of certainty will be required? Salt, for example, might really work as a storage medium. But there are so many uncertainties about it that it just might not. We do not have the necessary scientific knowledge now to predict with assurance the fate of canisters, glass, or other physical barriers, water flow, etc., and therefore cannot do *realistic* calculations. The usual engineering approach in such circumstances is to do "conservative" computer simulations (use conservative values for parameters), although



Sandia Laboratories

A Sandia Laboratories researcher readies a salt cylinder for testing at temperatures of 700°F in order to obtain information needed to calculate the behavior of salt at high heat. Salt has long been the "preferred" geologic storage medium for final disposal of processed radioactive waste, but many uncertainties remain.

the computer simulations themselves are of uncertain validity because the whole approach might be wrong. The real question is, thus, how much scientific understanding will we demand before proceeding.

How much scientific verification of the procedure will we require? How much hydrologic, seismic, and other geologic data and understanding? How much certainty about the long-term behavior of the physical barriers, the sorption of various radioactive elements by the rock? Will we require that all relevant tests be performed at the actual site? Must waterflow rates be measured on-site? This is an extremely important question.

If it were decided that everything must be done very conservatively, then DOE, when they thought they had a site, would have to drill each exploratory hole as if they were starting the real construction, since it is not possible to drill a lot of test holes without ruining a site.

Yet in beginning measurements in these holes they would have to be open to the possibility of having to abandon the site as inadequate. The price of such an approach could be enormous, both financially and in delay, but this is precisely the kind of decision that needs public input—from a public that understands the trade-offs. This is not a scientific decision.

How reliable or robust should the technology be? In other words, if the technical designers forget to take some parameter into account or careless workers mess up some aspect of construction, will it still work reasonably well? Is it failsafe, like the Italian dessert, appropriately called "Il Diplomatico," whose recipe says:

*You can put in a little less rum or a little more chocolate, add or subtract an egg, and you'll still come up with a successful and delicious cake. It's practically fool-proof.*<sup>15</sup>

Nuclear technology is not known for its

robustness. Nuclear power plants are so complicated that they are out of service much of the time for one cause or another, and it gets harder to service them as they grow older and become increasingly contaminated with radioactivity. Can we afford a temperamental nuclear waste disposal technology?

*Time and cost.* Despite all protestations that safety comes first, time and cost are the major trade-offs in all decisions about waste disposal. How soon do we demand that final disposal operations begin? How much are we willing to spend on the whole venture, now and in the future?

### **Geologic Medium**

Salt has been the "preferred" geologic storage medium for over 20 years, and DOE inherited the idea with so much momentum behind it because no alternatives were seriously studied until recently. The particular public whose input is badly needed on this decision is independent scientists.

### **Technology**

Given a choice of geologic medium, there are still many decisions to be made about technologies. Should the waste be left in the form of fuel rods, or should it be physically or chemically reprocessed? Should reprocessed waste be combined with glass or ceramics; and, if so, with what dilution and in which chemical form?<sup>16</sup> What materials should the waste be encased in? How many layers and which metals? Should the waste forms be surrounded by something which will still be there in thousands of years when the long-lived isotopes like plutonium come out, to be sure they emerge with the proper valence to be sorbed by the surrounding rock and not dissolve in groundwater? The decisions made under "Criteria" above are crucial for guidance on such questions and, if there has been substantial and meaningful public input into the decisions about criteria, then there may be no need to involve the general public in this kind of technical choice. The need to involve public interest scientists and other outside experts remains, however.

### **Management**

How should the waste program be set up? Should a federal agency manage it

---

**Often public participation in decision making appears difficult to obtain because it is sought on the least appropriate questions. One cannot develop intelligent procedures without first determining the nature of the issues for which the procedure is supposed to produce decisions.**

---

directly? Should it be managed by a private corporation? A public corporation?<sup>17</sup> This is a valid question for public participation by management experts, knowledgeable businesspeople, and public interest lawyers, among others. And it should be discussed with the recognition that the short-term and the long-term tasks involved in nuclear waste disposal present very different management problems which might best be handled by different schemes.

### **Right to Negotiate**

Who will negotiate for the potential victims? As the NRC Report puts it:

*A State may have sound economic motivation for welcoming the location of nuclear power reactors within its boundaries; the incentive for accepting high-level wastes, on the other hand, is hardly so clear.*<sup>18</sup>

It is admittedly a no-win proposition, involving unknown risks but no conceivable gain; therefore the government will have the choice of either negotiating incentives to encourage a region to accept siting of a nuclear waste repository or of forcing it to do so by a near-totalitarian exercise of power. The IRG and the NRC, as mentioned earlier, are clearly concerned about what will happen if "consultation" does not lead to "concurrence," so it is probably safe to assume that at least an attempt at negotiation will be made.

The local people—and exactly what constitutes "local" will have to be determined case by case—should have a strong say in who represents them in these negotiations. It should not be automatically assumed that officials elected for entirely different reasons, such as mayors or governors—officials who may never have taken any public positions on nuclear issues—should represent the public

in such a capacity. Probably no one would want to be represented by an official like the mayor of Carlsbad, New Mexico, who was quoted in the *International Herald Tribune* in 1978 as saying about the Waste Isolation Pilot Project, which was to have been built in Carlsbad. "Well, I guess it'll be good for the economy if it doesn't kill us all."

NRC has already discussed the issue of incentives with state representatives in its workshops, and apparently Western states oppose "special incentives" while Central and Eastern states want them. However, all states have agreed that the federal government should pay what they call "compensation for the direct and indirect costs of repository siting."<sup>19</sup> When DOE finally points the finger, "indirect costs" may very well be indistinguishable from "special incentives."

Suppose, for the sake of argument, that a negotiating team agreed, in a region that did not want a nuclear waste facility, that they would accept such a facility if the government promised to fulfill certain publicly determined criteria (of safety, etc.); to guarantee full property insurance (no Price-Anderson type arrangements), with strict liability and a 100-year statute of limitations; to provide parks, a civic center, a library, assurance of gasoline supplies, and other benefits.

It would still be extremely important, regardless of the method by which the negotiating team was selected, that the public concerned also approve the contract, just as most labor unions require membership approval of contracts. This approval could take the form of a referendum where the choices were simply "yes" or "no"—possibly with a required two-thirds vote. This is probably the only issue of those we have discussed where the public should not only have its say but should actually make the decision.

### **Legal Issues**

Should sanctions be specified in advance for gross incompetence in managing the wastes? How? Imposing sanctions would require independent monitoring of performance and is related to the question of management. What would the appropriate remedies be?

Another concern is, who will protect the dangerous materials during transport and while they are collected at the site? Since siting cannot be near a big population center, it will have to be in a rural, relatively quiet area of the country which is not accustomed to a large police presence and the kind of security arrangements which may be necessary. Local police, furthermore, will be too few in number and not trained to handle these matters alone. What kinds of civil liberties problems are posed by the possibility of a federal police force and surveillance to avert terrorist or other attempts at sabotage or theft? These are matters for public debate.

#### **Continuing Public Input**

Finally, but perhaps most fundamentally, the question arises: How much public participation does the public want? The federal government should not look for a single "final solution" to the public participation problem. This, above all other problems, is not one which could be solved "if only we had enough information." For example, would the region around a site want a local nuclear waste board to monitor activities at the site, or would they rather leave it to the federal experts? Some areas probably would want such a board, like a school board or a police supervisory board, that would not only monitor but keep the whole process open, especially to the media. Other regions might prefer to leave matters to the experts, but the *region in question* should have the choice. People in a given region may even want different things at different times because more participation will always be sought at times when trust in the main actors is low. Rather than trying to establish a single policy on public participation, therefore, the federal government should recognize by law the right of regions in which a site is proposed or constructed to determine the extent of participation in the waste management program that they consider to be necessary. They should also have the right to review their decision periodically.

#### **One Plan Is Better than a Thousand Options**

The number of important decisions to be made in nuclear waste management

---

**Identifying the major decisions which must be made in nuclear waste management is a prerequisite to determining which of those decisions require public input and who constitutes the "public" in each case. This has never been done by the federal agencies.**

---

is large, and it is always dangerous to make such interconnected decisions in a vacuum, each separate from the others. The confusion among the agencies, and between the agencies and the public, has created a situation where we will be lucky if there even is a conscious decision made on each of the questions discussed above. The fundamental flaw in the process is that *no one sees the big picture*. There is a solution, however.

In Sweden in 1977 a law was passed preventing utilities from starting up new nuclear power plants until they had shown that a safe plan for nuclear waste disposal existed. With five operating reactors and two newly completed reactors ready to go into operation, the Swedish utilities formed a study group called KBS ("Nuclear Fuel Safety" in Swedish) which in one year put together a detailed plan for nuclear waste disposal. This was not the plan which *would* necessarily be used, since actual waste disposal was not within the power of the utilities to control; it was instead an existence proof—a plan to show that a safe plan could be devised. The Swedish government then had the plan reviewed by about 25 Swedish and 25 foreign organizations. In addition, the government had its own Energy Commission, a politically appointed body with limited lifespan, perform an extraordinary technical review according to a new procedure called "scientific mediation," which Nancy Abrams and Steve Berry had developed a year earlier.<sup>20</sup>

The KBS Report laid out a complete scenario: fuel rods would be removed from reactors, stored in a central facility in Sweden, then shipped to France for reprocessing, including vitrification (conversion to glass) of the high-level liquid waste. The vitrified blocks would then be returned to Sweden, stored for

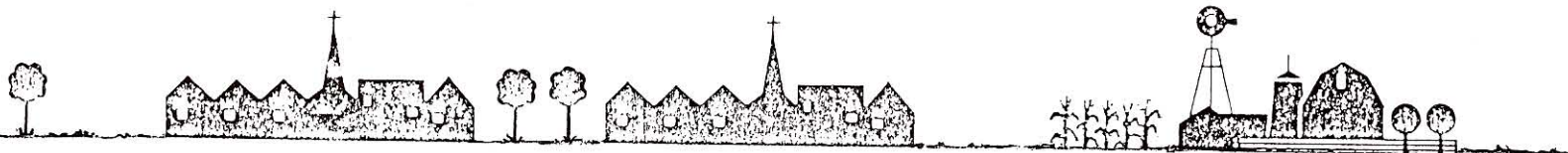
30 years in a middle-term facility which was described in detail, then encased in various layers of metals and buried 500 meters deep in tunnels cut into solid granite and irrigated for cooling until the depository was ready to be closed; it would then be sealed with a bentonite clay and quartz-sand mixture. Computer models were used to predict the long-range behavior of the waste form, the containers, the groundwater movements, and so forth.

There were enormous problems with such a complex plan. Many were discovered by the various reviewers. They might never have been foreseen given the piecemeal planning now going on in the United States. Furthermore, during the entire period since 1977, this plan and a subsequent one proposed for disposal of unprocessed spent fuel have been central topics of public controversy and political debate at the highest levels of government in Sweden.

The enormous value of preparing the KBS Report and having it reviewed independently by so many organizations and individuals was that Sweden got a real sense of the big picture. Ironically, the United States, with the biggest collection of nuclear waste in the world, has not even attempted an exercise on the scale of the Swedish effort. It should and it can.

A single overall nuclear waste management and disposal plan should be designed, including a complete scenario for the fuel rods from the reactor to the waste forms that will exist thousands of years from now. The scenario should be understandable and visualizable, not a list of options. However, unlike the KBS Report, it should also contain an explanation of the reasons behind the main technological choices in the scenario and upfront, unvarnished worst-case analyses.

This plan, representing the best thinking of its makers, should be published and open for criticism. Numerous independent critical reviews funded by the government would ensure that the plan would become a focus of national and international scientific interest as well as of public debate. It is always easier to rewrite a draft than to start from scratch, and this plan would be the nation's first draft.



## NOTES

1. Metropolitan areas as defined in 1975.
2. Daniel R. Vining, Jr., T. Plaut, and K. Bieri, "Urban Encroachment in Prime Agricultural Land in the United States," *International Regional Science Review* 2, no. 2 (1977): 143-156. Quality of land for agricultural uses is commonly expressed in terms of soil capability classes; "prime" agricultural land consists of Classes I and II, the soils best suited for cropland.
3. Thomas Plaut, *Urban Growth and Agricultural Decline Problems and Policies*, Bureau of Business Research, University of Texas, Austin, 1978.
4. Soil Conservation Service, *Potential Croplands Study*, U. S. Department of Agriculture, Washington, D. C., 1975.
5. *Ibid.*
6. See note 3 above.
7. Calvin Beale, *The Revival of Population Growth in Nonmetropolitan America*, Report ERS-605, Economic Research Service, U. S. Department of Agriculture, Washington, D. C., 1976; Daniel R. Vining, Jr., and Ann Strauss, *A Demonstration That Current Deconcentration Population Trends Are a Clean Break with Past Trends*, Discussion Paper Series No. 90, Regional Science Research Institute, Philadelphia, 1976.
8. David E. Berry, "Effects of Urbanization on Agricultural Activities," *Growth and Change* 9, no. 3 (1978): 2-8.
9. Howard Conklin and Richard Dymaza, *Maintaining Viable Agriculture in Areas of Urban Expansion*, New York State Office of Planning Services, Albany, 1972.
10. Robert E. Coughlin and David E. Berry, *Saving the Garden: The Preservation of Farmland and Other Environmentally Valuable Land*, preliminary report to National Science Foundation, Regional Science Research Institute, Philadelphia, 1977.
11. Ernest Leonardo and Robert E. Coughlin, *The Farmer's Perception of Problems Caused by Nearby Urbanization: A Report on Five Field Studies*, working paper, Regional Science Research Institute, Philadelphia, 1977.
12. James H. Brown and Neal A. Roberts, *Land into Cities: The Land Market on the Urban Fringe*, Department of City and Regional Planning, Harvard University, Cambridge, 1978.
13. Personal communications with Daniel Rose, Assistant Professor of Landscape Architecture and Regional Planning, University of Pennsylvania.
14. David E. Berry, "The Sensitivity of Dairying to Urbanization," *Professional Geographer* 31, no. 2 (1979): 170-176.
15. See note 8 above.
16. D. Cummins, *Effect of Urban Expansion on Dairying in the Lake States: 1949-69*, Agricultural Economics Report No. 196, Economic Research Service, U. S. Department of Agriculture, Washington, D. C., 1970.
17. John Fraser Hart, "Loss and Abandonment of Cleared Farmland in the Eastern United States," *Annals of the Association of American Geographers*, 58 (1968): 417-440.
18. See note 10 above.
19. *Ibid.*
20. Robert E. Coughlin and Thomas Plaut, "Less-than-Fee Acquisition for the Preservation of Open Space: Does It Work?" *Journal of the American Institute of Planners* 44 (1978): 452-462.
21. Robert E. Coughlin, *The Public's Interest in the Preservation of Farmland*, paper presented at the Northeast Agricultural Leadership Assembly, Cherry Hill, New Jersey, March 21, 1979.
22. Peter W. Amato, "Wisconsin Hopes a New Law Will Preserve Its Farms," *Planning* 45, no. 1 (1979): 10-12.

## Helping the Public Decide

(continued from page 20)

battles inevitable in such a forum. At a deeper level, however, intervention does not seek to challenge the decision-making process, which is itself essentially flawed. Since an agency decision, as explained earlier in this article, is frequently a *fait accompli* by the time of intervention, there is no real opportunity for intervenors to do anything but create delay. Consequently, they are regarded by both their industrial opponents and the agency before which they appear as obstructionists.

"Critical review and public assessment" can be seen as an alternative strategy to intervention, a strategy which challenges the decision-making process but which, ironically, may be less objectionable to the agencies and industry for several reasons. First, money paid out by the relevant agency (or possibly through a separate agency set up specifically for

this purpose) would go directly for constructive critical reviews, not to hire lawyers. Second, scientists representing many points of view would be funded, not just environmentalists. Third, raising new technical issues or problems, so difficult in agency hearings, would be encouraged as one of the main goals of the entire process. Finally, the use of "critical review and public assessment" would, in a relatively short time, substantially increase the number of scientists who contribute to public issues generally, broadening the base of the public-interest science movement with beneficial results across the board for technology politics.

## The Need for Public Participation

The legitimacy that public participation can lend to decision making on nuclear waste disposal is not mere sugarcoating. The alternative—the federal preemption-rush approach—may work to obtain the first dump site, but as things inevitably go wrong, mounting

public anger and distrust will prove incomparably harder to deal with thereafter. The other central purpose of public participation—improving the quality of the decision—may also turn out to be of incalculable value. The public has already saved us from several technological quagmires, and a disastrous nuclear dump could be harder to pull out of than Vietnam.

The fear of some people that public participation will lead to endless delay is based on the mistaken belief that the "public" is comprised of only those totally committed antinuclear people who are fighting the possibility of safe nuclear waste disposal on the grounds that the existence of such a technology will encourage the production of more waste and more nuclear plants. This group certainly exists and is highly vocal. However, there are many others who could understand, if real efforts were made to clarify for the public the issues and trade-offs involved, that the price of preventing development of safe nuclear waste disposal (or even of demanding such excru-

ciatingly high standards of safety and conservatism as to put off such development indefinitely) is an increased probability over time that the wastes will never be disposed of properly. Instead, as the public loses interest in the issue, the problem will be inherited by lower and lower levels of bureaucracy as the wastes themselves age, leak, and become more dangerous. Like the other toxic wastes that litter the countryside, nuclear waste, once the national attention shifts, will become just another kind of garbage, to be taken care of whenever someone has the time.

Public participation need not cause interminable delay. To the contrary, if no waste disposal technology is developed in the next few years, delay—the traditional tool of the environmentalists—may well be intentionally appropriated by the pro-nuclear forces, who understand the difficulty of safe nuclear waste disposal and would like to put it off till no watchful eye remains. This was the approach before environmentalists got the public interested, and there is every reason to expect that this will be the approach again if environmentalists and the public lose interest.

## NOTES

1. Joel Primack and Frank von Hippel, *Advice and Dissent: Scientists in the Political Arena*, Basic Books, 1974; New American Library, 1976.

2. *Proceedings: A Workshop of Policy and Technical Issues Pertinent to the Development of Environmental Protection Criteria for Radioactive Wastes*, Albuquerque, New Mexico, April 12-14, 1977, U.S. EPA, Office of Radiation Programs; *Proceedings: A Workshop on Issues Pertinent to the Development of Environmental Protection Criteria for Radioactive Wastes*, Reston, Virginia, February 3-5, 1977, U.S. EPA, Office of Radiation Programs; *Proceedings of a Public Forum on Environmental Protection Criteria for Radioactive Wastes*, March 30-April 1, 1978, Denver, Colorado, U.S. EPA, Office of Radiation Programs.

3. Sec. 14(b) P.L. 95-601.

4. *Means for Improving State Participation in the Siting, Licensing and Development of Federal Nuclear Waste Facilities: A Report to Congress*, U.S. NRC, Office of State Programs, March 1979 (NUREG-0539). Hereafter called NRC Report.

5. *Report to the President by the Interagency Review Group on Nuclear Waste Management*, March 1979 (TID-29442), pp. 93-95. Hereafter called IRG Report.

6. NRC Report, p. 27.

7. NRC Report, p. 15.

8. *Draft Environmental Impact Statement, Management of Commercially Generated Radioactive Waste*, Vols. 1-2, April 1979, Department of Energy, (DOE/EIS-0046-D).

9. Nancy Abrams testified at this hearing.

10. NRC Report, p. 15.

11. IRG Report, p. 90.

12. NRC Report, pp. 6-7.

13. EPA, Preface to Albuquerque workshop proceedings.

14. Peter Montague, "Representing the Unrepresented in Radioactive Waste Management Decisions," unpublished paper presented to the AAAS Symposium on Radioactive Waste Management, Houston, Texas, January 1979.

15. Marcella Hazan, *The Classic Italian Cook Book*, Knopf, 1976, p. 436.

16. Richard A. Kerr, "Nuclear Waste Disposal: Alternatives to Solidification in Glass Proposed," *Science* 204, 289 (April 20, 1979).

17. Mason Willich and Richard Lester, *Radioactive Wastes Management and Regulation*, Free Press, 1977.

18. NRC Report, p. 3.

19. NRC Report, p. 10.

20. Nancy E. Abrams and R. Stephen Berry, "Mediation: A Better Alternative to the Science Court," *Bulletin of the Atomic Scientists*, April 1977.

Scientific mediation is a procedure for advising government agencies on the technical aspects of a policy question when scientists are apparently in disagreement on the scientific questions. Very briefly, two or more scientists, one representing each main technical viewpoint, are brought together and, with the help of a mediator, they write a joint paper explaining their areas of agreement, their areas of disagreement, and the reasons why they disagree on each point. The focus of the effort is on illuminating their grounds of disagreement rather than on arriving at consensus.

A more complete account of how scientific mediation was used in Sweden appears in Nancy Abrams, "Nuclear Politics in Sweden," *Environment*, May 1979. Nancy Abrams served as a consultant to the Swedish Energy Commission during the entire review.

21. Judy Hurley of the Center for Non-Violence, Santa Cruz, California (and a participant at the EPA Denver workshop on radioactive waste criteria) has suggested that some of the grants given to outside scientists to review the EPRI plan should be for scientists who will work with a citizens group, explain the plan to them, and perform with them a review in which the technical aspects are not isolated from value questions (personal communication).

22. The idea of involving both a public interest group and a small citizens' committee in this way was suggested by Harriet Barlow, Institute for Local Self-Reliance, Washington, D.C. (personal communication).

## Overview — Cities

(continued from page 5)

Now, my perception of this intruder movement was that it was a non-people phenomenon that detracted energy, resources, and support from the civil rights/human rights movement, which had become too dangerous and uncomfortable for many. It seemed typical of a white elitist movement that the primary concerns articulated, at least as I heard them, were for areas where people were not, rather than where people were.

I left college angrier than ever but determined to continue fighting, in whatever arena presented itself, for change in general conditions that I considered to be intolerable. I went to work at the

National Urban League on a health project; health seemed to be a niche that needed activists and encompassed many of the ills that needed curing. Then I became involved in the education field, and discovered another set of needs that were still unmet—in education also there was room for activism and energy. From education, communications was a logical next step; for in all of these areas, a prime issue was lack of resources and lack of control. In each case, minorities and poor persons were victims who were unable to participate in developing solutions to their problems. And imposed solutions never worked—they were always too little too late.

After wandering through other areas with a growing sense of frustration at not being able to pull these concerns (and the advocates thereof) under one workable umbrella, I returned to the

National Urban League to work on a project called the Community Urban Environment program. I probably would not have gone by choice, but it seemed a preferable alternative to unemployment and I took it.

From considerable soul searching, a question arose: why did I feel that environmental concerns excluded me when the concept of environment was an all-inclusive umbrella? The definition of environment is "the sum total of external influences on an organism," and that seemed to me to include poverty, deteriorating housing, poor health, inadequate education and health care, and unemployment, none of which I recalled being considered as environmental concerns. Why not? Because these were paramount concerns of minorities and the poor, and we had not participated in defining, directing, and prioritizing