

2. What a Waste! *or* Why We Need Plan B

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Dr. Gail H. Marcus is presently an independent consultant on nuclear power technology and policy. She recently completed a three-year term as Deputy Director-General of the OECD Nuclear Energy Agency (NEA) in Paris. In this position, she was responsible for the program of work and budget for the agency. From 1999 through 2004, Dr. Marcus served as Principal Deputy Director of the Office of Nuclear Energy, Science and Technology. There she provided technical leadership for DOE's nuclear energy programs and facilities, including the development of next-generation nuclear power systems. Other responsibilities included production and distribution of isotopes for medical treatment, diagnosis and research, and oversight of DOE test and research reactors and related facilities and activities. From 1998-1999, Dr. Marcus spent a year in Japan as Visiting Professor in the Research Laboratory for Nuclear Reactors, Tokyo Institute of Technology. She conducted research on comparative nuclear regulatory policy in Japan and the United States.

Previously, Dr. Marcus had been in the US Nuclear Regulatory Commission (NRC). She served in a variety of positions including Deputy Executive Director of the Advisory Committee on Reactor Safeguards/Advisory Committee on Nuclear Waste; Director of Project Directorate III-3, providing regulatory oversight of seven nuclear power plants in the Midwest; and Director of the Advanced Reactors Project Directorate, where she was responsible for technical reviews of advanced reactor designs.

She also served as technical assistant to Commissioner Kenneth Rogers at the NRC for over four years, providing advice and recommendations on a broad range of technical and policy issues of interest to the Commission. From this position she was detailed for five months to Japan's Ministry of International Trade and Industry, where she was NRC's first assignee to Japan, studying Japan's licensing of the Advanced Boiling Water Reactor.

Prior to her service at NRC, Dr. Marcus was Assistant Chief of the Science Policy Research Division at the Congressional Research Service (1980-1985). In this position, she was responsible for policy analysis in support of Congress covering all fields of science and technology, and played a lead role in policy analysis and development for energy, nuclear power, and risk assessment and management.

Organization:

From 2001-2002, Dr. Marcus served as President of the American Nuclear Society (ANS), an 11,000 member professional society. She is a Fellow of the ANS and of the American Association for the Advancement of Science (AAAS). She is a former member of the National Research Council Committee on the Future Needs of Nuclear Engineering Education, and served three terms on the MIT Corporation Visiting Committee for the Nuclear Engineering Department. She is just completing a term as the elected Chair of the Engineering Section of AAAS.

Publication:

Dr. Marcus has authored numerous technical papers and publications. Her research interests include nuclear regulatory policy, energy technology and policy, risk assessment and management, international nuclear policy, and advanced nuclear technologies.

Education:

Dr. Marcus has an S.B. and S.M. in Physics, and an Sc.D. in Nuclear Engineering from MIT. She is the first woman to earn a doctorate in nuclear engineering in the United States.

One of the major impediments to the future of the nuclear option has long been the perception that high-level radioactive waste disposal is an intractable problem. Recently, with growing interest in new reactors to combat global warming and improve energy security, this perception has become a more serious concern. Perhaps as a result, national plans for waste disposal are receiving heightened levels of public attention in some countries. It is particularly noteworthy that this issue has been raised by both candidates during the 2008 US presidential campaign.

It is therefore important that we explore the issues involved and revisit some of the national strategies for nuclear waste disposal.

Background

Even though the volume of nuclear waste is small compared to the wastes from some other energy-producing technologies, and very small compared to wastes from many common industrial activities, the public impression is that the disposal of nuclear waste is both a big problem and an unsolvable one. The long half-lives of some of the radioisotopes in nuclear waste and recent concerns about terrorist attacks or diversion of materials have put nuclear wastes in a class by themselves in the public perception.

To date, no nation has actually completed the construction of a permanent high-level repository for wastes from commercial nuclear power plants. This situation has been cast as a failure to “solve” the waste problem, and as a reason that nuclear power is not a viable alternative to help address our future energy needs.

This widely perceived “failure” could well prove the most significant stumbling block to the anticipated nuclear renaissance. Even though it is not true that the waste problem is insoluble, and even though substantial progress is being made in some countries, most notably Sweden and Finland, these facts have gone largely unnoticed by the general public. The difficulties some of the bigger countries, such as the United States, have encountered in developing a viable approach to dealing with nuclear waste have dominated the news and colored public opinion. Sometimes “perception is reality.”

If we can't develop a robust approach to nuclear waste disposal—and more important, if we can't convince the policy makers and the public that the approach is robust—the “waste” will be more than the spent fuel rods from the nuclear power plants. All the time and money that has been spent trying to develop viable waste repositories will be wasted.

I am prompted to say, “What a waste that would be!”

Yucca Mountain

Let's look first at the primary reason for the perceived problem—Yucca Mountain. Because of the size and visibility of the U.S. nuclear program, the fate of its efforts at high-level waste disposal has been watched closely. The long and sometimes tortuous path Yucca Mountain has followed should provide a number of lessons learned, both for the United States and for other countries.

Today's problems have their roots in a decision Congress made in 1987. At that time, the United States was in the process of characterizing three sites as possible sites for a U.S. high-level waste repository. Congress narrowed the effort before the characterization of the three sites was completed and declared Yucca Mountain the sole site for future efforts. The United States had, in essence, “put all its eggs in one basket.”

This decision had two immediate effects. First, the lack of any other options created a strong appearance that the site characterization would have to result in a positive conclusion, as there was no fallback. This did not improve public confidence that the decision reached would be an objective, science-based one.

Second, the decision galvanized the State of Nevada. It is not hard to see why they regarded the Congressional action as arbitrary and unfair treatment of their State. They became a powerful and persistent opponent of the Federal Yucca Mountain Project. The ensuing 25 years have seen considerable time and money invested in a protracted political and legal battle between the State of Nevada and the Federal government. Given that there should have been another way, I am again prompted to say “What a waste!”

While the legal and political wrangling has undoubtedly diverted resources and slowed progress, technical work has continued during this period. For a long time, it appeared that the overall technical findings were positive. In fact, five years ago, when the decision on whether to proceed with the Yucca Mountain project was before Congress, I was personally convinced that the preponderance of technical evidence showed that the repository would be licensable. I was equally convinced that the political problems could be resolved.

Today, I am convinced of neither. During the intervening years, questions have been raised about the seismicity of the site and the possibility of wa-

ter infiltration in the long term. These questions have not been adequately addressed in the public arena. On the political side, no progress has been made toward reconciling the interests of the State of Nevada and the nation.

I am more and more convinced that we have passed the point where the science is the primary consideration. Even if further investigation should prove that the site unequivocally meets the technical criteria established, the long and acrimonious history has left a very difficult public acceptance environment as a legacy.

Other Experiences

Of course, I am most familiar with the details of the waste program in my own country, but in following what has been happening elsewhere, I am struck by the fact that the public concerns are similar everywhere. The United States is far from alone in experiencing public opposition to the idea of disposing of a waste product with a very long half-life. Nearly every country has experienced some degree of difficulty in finding a site for a repository that is both technically suitable and that has the support of the public, particularly the local residents in the area of the proposed site. The recent reports of leaks at the Asse site in Germany are just one more example of the degree of scrutiny these sites receive.

It is instructive to look to the countries that have had the greatest success so far. At the moment, Sweden and Finland stand out from the crowd. These two countries have chosen a staged approach to repository development that allows more time and flexibility in decision-making and increases public awareness of the implementation process. In particular, these countries have engaged the public in the site selection process to try to assure that there will be local support for a repository, and have interacted with the communities in an open and transparent way to develop a reciprocal dialogue among equals.

It should be remembered that the United States, too, has had one major success—that is, the Waste Isolation Plant Project (WIPP) site in New Mexico. While this site is not designated for the disposal of wastes from commercial nuclear power plants, it is nevertheless a repository with similar requirements for long-term storage, transportation to the site, etc. that have proved difficult for Yucca Mountain and other proposed sites. While WIPP was not without its opponents, the overall successful experience demonstrates that not every proposed repository project will end at an impasse.

“Plan B” —A Viable Backup

It is useful to explore the successes and the failures so far for lessons learned. Of course, there are limitations to relying on such “models,” because the detailed circumstances always vary. National laws and public attitudes differ; circumstances vary over time; and the details of one proposal can’t necessarily be duplicated at other sites. Nevertheless, the fact that there are several successful models suggests that the time has come to revisit Yucca Mountain and other stalled projects.

In short, what has been seriously lacking in most of the national programs that have stalled is a “Plan B,” a backup plan. It is now time for countries to develop a Plan B.

Plan B should be based on three fundamental premises:

- That a long-term repository is ultimately needed, but that the urgency to “solve” the long-term waste problem immediately has been overstated; and
- That a robust approach must explore multiple technical and siting options.
- That public acceptance is critical.

With that in mind, here are the basic elements of Plan B:

Interim storage: In the short term, the delays in bringing a repository on line are not critical. The total volume of discharged fuel generated from nuclear power plants is small and can be stored safely for decades in temporary facilities at reactor sites or other interim locations. Therefore, it is not as important to have immediate action as it is to have a viable path forward.

I say this with full understanding that countries like the United States have not successfully resolved interim storage either. In most countries, the high-level waste remains on site, and there are various reasons why some of those sites may not be desirable or feasible for waste storage for extended periods beyond the lifetime of the plants. Nevertheless, siting interim storage facilities opens up many more options than are possible for a permanent repository, and Plan B should make provisions for interim storage.

A staged approach: The development plan for a long-term project as a waste repository should be use a staged approach so that adjustments can be made as the project proceeds based on scientific

advances and operational experience.

A second site: For the United States, Plan B also should include starting now to identify and characterize at least one additional long-term site. Even if Yucca Mountain were to move forward, this would not be wasted effort, because a second repository will ultimately be needed. And if the Yucca Mountain project is terminated for any reason, the United States will have taken some steps toward an alternative. It is imperative that a different process be developed for selection of another site. The experiences of Sweden and Finland may prove useful in this regard.

Reprocessing: Furthermore, reprocessing could result in substantial changes to how Yucca Mountain, or any other site, can be used and the characteristics it needs to have. Plan B should therefore include greater consideration of how to integrate recycling and waste disposal. Other countries, including Japan and France, have already recognized the importance of this linkage.

Long-term retrievable storage: Further, options other than “permanent” disposal should be considered. Much has already been said about the case for long-term retrievable storage, particularly before reprocessing is implemented. It may well be a better approach to disposal for many reasons, and could provide greater assurance of the long-term safety of the site.

Other options: Other options for high-level nuclear waste disposal have been proposed, particularly (but not exclusively) for countries with smaller nuclear power programs. These options range from other technical solutions, such as disposing of waste in boreholes that potentially can be sited in more locations or shooting it into outer space, to regional or international waste repositories. The latter option was recently proposed by one of the U.S. presidential candidates. Some of these alternatives could be promising, but much more needs to be done to determine their viability. For alternatives like boreholes or disposal in space, the issues are both technical and economic; for an alternative like a multinational repository, the question of what country will take the waste is paramount.

Public acceptance: As the models of Sweden and Finland suggest, the public must be engaged early and openly, and measures that address their concerns must be incorporated into how the site is developed.

All these features have been talked about separately. It is time to put them together in the form of

a coherent Plan B.

In the Meantime...

For the case of Yucca Mountain, at this point, it is unclear whether the technical review of the application recently submitted to the Nuclear Regulatory Commission by the Department of Energy will continue in a new Administration. Whatever happens, an immediate, transparent, and ongoing dialogue with the public has been lacking. Such a dialogue must be started, and should cover both technical and political issues associated with the site. On the technical side, questions that have been raised about the technical suitability of the site are of concern.

It is equally important that the State of Nevada receive a fair response. The state’s view that the political process treated it unfairly should be of long-term concern to everyone. The immediate issue is nuclear waste disposal, but the principle applies to the myriad needs of society. The common good must be balanced against the interests of regions, states and individuals. None should automatically trump the others, but all must be addressed in an open and equitable way.

The development and discussion of Plan B should be part of the dialogue. Even though this may seem yet another way to slow the project, the United States may need to back up a step before it can move forward. The sooner that fact is recognized, the sooner the deadlock can be broken and progress can begin.

Conclusion

I have cast this discussion mostly in terms of Yucca Mountain. However, the principles apply more broadly. More and more countries will have to face the issue of waste disposal in the coming years. Just as in many other pioneering efforts, the “first adopters” inevitably set the stage for others, both by their successes and by their mistakes. The successes can be used, where possible, as a model; the mistakes can prove equally valuable in demonstrating what not to do.

Plan B could become an important part of a new model for the future. It has the advantage of assuring that there are both interim storage options and backup options for a long-term disposal site, it provides the basis for a process in which the public can have confidence, and it allows for adaptation to changes such as the development of reprocessing.

There are, of course, no easy answers. The Plan B I have outlined is easy to describe, but much harder to put into practice. Nevertheless, the pre-

sent approach in the US and other countries has proven faulty. A change is clearly needed, and Plan B provides the multiple options and variations that should help avoid the kind of impasse that can arise when everything depends on only one option. It is not just a way out of the deep hole Yucca Mountain has become. It is a robust approach to assure that other countries do not encounter their own Yucca Mountains.

As before, I would welcome any comments or feedback.

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