

THE YUCCA MOUNTAIN DILEMMA

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ABSTRACT

Last year a U.S. Federal court ruled that EPA had not followed the recommendation of the National Academy of Science with regard to the 10,000 year period of regulatory compliance. As a result the Yucca Mountain Project is at yet another critical juncture. It is facing a decision to either clear the legal and political issues and move ahead or be cancelled.

If the Project is cancelled, the Nuclear Waste Policy Act (the Act) calls for the U.S. Department of Energy (DOE) to reassess the ultimate disposition of nuclear waste, and recommend an alternative approach to Congress.

If instead, the nation decides Yucca Mountain is the correct approach, then policy makers need to take definitive action to clear legal and political issues currently stalling the Project. More study and spending hundreds of millions of dollars each year to maintain the status quo is not the answer.

INTRODUCTION

This paper discusses the dilemma facing policy makers with regard to what to do with the Yucca Mountain Project. Some of the factors they will need to consider are as follows.

- Billions of dollars have been spent assessing the mountain's potential to serve as a viable geologic repository.
- The state of Nevada and environmental groups are fighting the project tooth and nail and are waging a nationwide public information campaign.
- Elected officials from states with nuclear waste want it moved.
- Citizens are frightened about nuclear in general and specifically in nuclear waste being transported through their communities.
- Nuclear utility firms are suing the government for not accepting the waste starting in 1998 and living up to contract agreements with DOE.
- Solving the waste issue is a critical ingredient in the potential for authorizing new nuclear power plants in the United States (and its potential for mitigating global warming).
- If the Project is cancelled what viable alternatives exist that are better than retrievable geologic disposal?
- Doing nothing will leave the problem to next generations, but may allow the development of new technology to mitigate long term radiotoxicity.

- Leaving the waste where it is poses unique security, safety, environmental and custody issues.

Rationale for Geologic Disposal and Yucca Mountain

After years of debate, noted scientists and the National Academy of Science concluded that the best and safest long term solution to high level nuclear waste management is retrievable geologic disposal. “Disposition of radioactive wastes in a deep geological repository is a sound approach as long as it progresses through a stepwise decision-making process that takes advantage of technical advances, public participation, and international cooperation.” [1]

Citizens that consume electric power from nuclear plants, and tax payers, have contributed billions of dollars to characterize and implement geologic disposal at Yucca Mountain. The author has studied and visited numerous potential disposal sites around the world. There is no perfect place, but geotechnically speaking Yucca Mountain is undoubtedly one of the best places on earth to place high level nuclear waste. But even if scientists are wrong, the Act requires the waste must be retrievable for at least 50-years, and current plans are for retrieval to be possible for hundreds of years. Finally, Yucca Mountain has been evaluated for over a decade. Billions of dollars have been spent on scientific and engineering studies. It is this author’s opinion that more than enough information has been obtained to proceed with submitting the license application to the NRC.

The Nuclear Regulatory Commission (NRC) can issue a construction license if “...there is reasonable assurance that the types and amounts of radioactive materials described in the application can be received, possessed, and disposed of in a geologic repository operations area of the design proposed without unreasonable risk to the health and safety of the public. [2] This first step does not deal with emplacement or closure of the repository, but is an essential first step in the process, and one the DOE is pursuing.

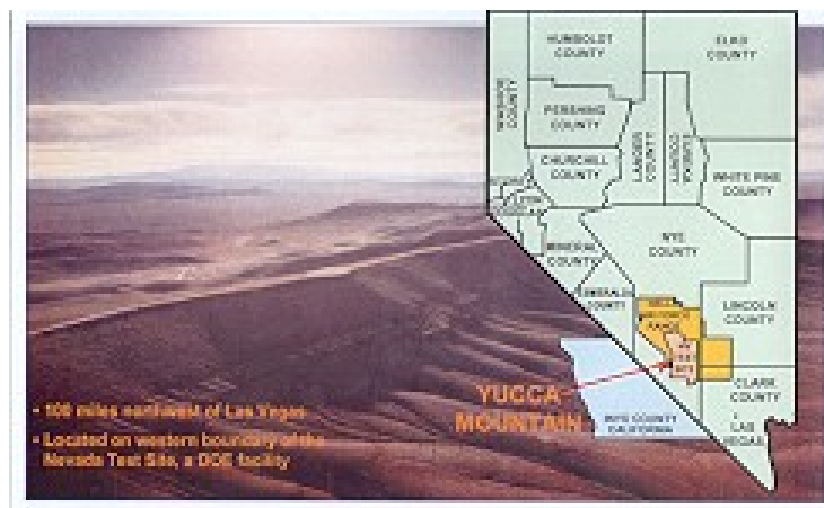


Fig. 1. Yucca Mountain site and map

Alternatives to Geologic Disposal

If the Yucca Mountain Project is cancelled, the Nuclear Waste Policy Act [3] calls for the U.S. department of Energy to reassess the issue, and recommend to Congress an alternative approach. The Act states “If the Secretary at any time determines the Yucca Mountain site to be unsuitable for development as a repository, the Secretary shall (A) terminate all site characterization activities at such site; (B) notify the Congress, the Governor and legislature of Nevada of such termination and the reasons for such termination; (C) remove any high-level radioactive waste, spent nuclear fuel, or other radioactive materials at or in such site as promptly as practicable; (D) take reasonable and necessary steps to reclaim the site and to mitigate any significant adverse environmental impacts caused by site characterization activities at such site; (E) suspend all future benefit payment under subtitle F [42 U.S.C. 10173 et seq.] with respect to such site; and report to Congress not later than 6 months after such determination the Secretary’s recommendations for further action to assure the safe, permanent disposal of spent nuclear fuel and high-level radioactive waste, including the need for legislative authority.”

Studies conducted decades ago by scientists around the world, starting in the 1950’s, included ways to manage highly radioactive materials accumulating at power plants and other sites to mitigate the long term health, safety, and environmental risks. [4] A variety of options were considered, including

- Leaving it where it is
- Disposing of it in various ways
 - Sub-seabed disposal
 - Very deep-hole disposal
 - Space disposal
 - Ice-sheet disposal
 - Rock melt disposal
 - Island geologic disposal
 - Deep-well injection disposal
 - Deep geologic disposal
- Making it safer through advanced technologies



Fig. 2. Waste management alternatives [4]

Reprocessing spent nuclear fuel (SNF) and high level waste (HLW), discontinued in the United States, was considered an alternative for reducing the amount of waste, but does not appreciably reduce its long term radiotoxicity. Transmutation partitioning technologies were also considered to transmute the very long-lived wastes into less radioactive or shorter-lived products, but only modest research and development has been carried out over the years, so the technology has not been commercially demonstrated. [5]

More recently, the alternative of leaving the waste where it is at power plants and DOE facilities seems to be favored by many environmental groups [6]. Converting Yucca Mountain to a long term storage program has been discussed, as well as extending retrievability beyond the 50-years mandated in the Act. Storing the waste for 50-60 years in “Interim Hardened On-Site Storage” (HOSS) is advocated by Dr. Arjun Makhijani, author of the plan and president of the Institute for Energy and Environmental Research. [7] Shooting it to the moon is even being suggested. [8]

In March 1999, the House of Lords published a report documenting a study of waste management alternatives in the United Kingdom. [6] The study revisited the options of geological disposal, indefinite storage, seabed disposal, sub-seabed disposal, subduction zones, ice sheets, ejection into space, partitioning and nuclear transmutation, and Synroc. The report concluded “Of the many methods for the long-term management of nuclear wastes that have been suggested and studied world-wide, only two are now being advocated (see Chapter 3). We found that the majority view from the scientific and technical community is that wastes should be emplaced in deep geological repositories. The minority view, held particularly by members of environmental pressure groups, is that wastes should be stored on or near the ground surface indefinitely, while a research and development programme is conducted to find the best means to manage them in the longer term.”

In Canada a UN expert has been hired to evaluate options for its waste management program. Ms. Dowdeswell’s specific assignment is to explore three potential solutions: Deep geological disposal, central storage, and continued storage at existing sites. Dowdeswell said she is not far

enough into her reading to map out a plan for further research but remains open to other options. [9]

Leaving high level waste and spent nuclear fuel where it is at over 100-nuclear power plants and DOE facilities sounds like the easy way out of coming to grips with this dilemma. But, there are serious considerations to leaving the waste at existing power plants indefinitely. First, if it is assumed that all the existing plants will shut down after their license extensions expire, the pools and dry storage facilities will not be supported by profit making entities. Therefore the security, safety and environmental protection of the facilities will not receive the attention necessary to provide public confidence. Then it is likely the federal government will be forced to take on the ownership and responsibility for the waste at all those sites.

An author at Colorado University expressed concern about long term storage. “Security of storage facilities is a major issue as SNF contains uranium and plutonium that could be processed to build nuclear weapons and HLW could be used by terrorists to build a so-called “dirty bomb.” Even though adequate security can be maintained at the present, it is highly questionable whether institutional mechanisms that can maintain security and replaced aging facilities will still be in place in hundreds or thousands of years. In light of this fact, many officials in national disposal programs believe that surface storage is only an interim solution and that permanent disposal in a geologic repository should be accomplished”. [10]

Late in 2004 Mathew L. Wald, a reporter for the New York Times, stated “The Yucca Mountain Nuclear Waste Repository is stalled and may never open. Its time to adopt a surer, short-term plan for storing highly radioactive material – and bet that our grandchildren will find better things to do with it.” [20] Leaving the problem to our grandchildren is exactly what Congress tried to avoid by enacting the Nuclear Waste Policy Act. This article is not technical factual, and mimics much of the state of Nevada’s positions, but does express the emotional concerns of many in the country.

Alternative Geologic Disposal Options

When Yucca Mountain was selected as the only site for characterization, per the Act amendment of 1987, work was discontinued on a number of other sites across the nation in varying geologic media. If the Project is cancelled, consideration could again be given to some of those sites in DOE’s recommendation to Congress. However, it is very unlikely that the politicians from those other regions would allow that to happen. In fact when Nevada was selected, it was partially because of pressure from the delegations from Texas and Washington. That is not to say that the geology, hydrology and remote setting of Yucca Mountain were not superior to the other sites, but politics played a very important role in the decision.

Ironically, the dryness of the Yucca Mountain site has resulted in technical difficulty in evaluating its performance. Essentially all other potential repository sites around the world are in saturated (wet) rock, and the design of waste packages and the engineered barrier for that environment is in many ways more predictable than the pseudo dryness of Yucca Mountain. As an example, the repository design in Finland, which is for disposal in salt water below sea level in granite, uses copper-spheroidal iron waste packages. Their packages will be subjected to a

reducing wet environment and have been designed accordingly. [11] At Yucca Mountain, even though it is in dry unsaturated volcanic tuff, the uncertainty of the hydrologic conditions for the next 10,000 years has led to a very expensive design which has to contemplate wet and dry (oxidizing) conditions.

The WIPP site in Carlsbad, New Mexico has been successfully licensed and is operating safely. There has been discussion about using it for high level as well as transuranic waste. The principle is good, but the politics of the situation are questionable, and like Nevada would require the Congress to take action to make the approach palatable to New Mexico and its citizens. They have already done their part to solve a serious national environmental problem. Nevada has not. [12]

International repositories have been proposed in Russia and Australia. The promoters of this concept would propose to take nuclear waste from countries having difficulty in implementing their national programs by moving the waste out of sight and out of mind. Essentially all countries require their nuclear waste to be disposed of or otherwise dealt with within the country, so it is doubtful any of these proposals will see the light of day, especially in the United States. But there are countries with small amounts of waste that would benefit from joint programs with other countries, particularly those in the European Union. The objections to international transportation of the waste would of course be a serious consideration. [13]

Public Confidence and Politics

The key to proceeding responsibly with Yucca Mountain, or waste management programs around the developed world, is public confidence. People are frightened about anything nuclear after Chernobyl and Three Mile Island, and after the media blitz by anti nuclear groups. The truth is that our citizens face many serious risks in our daily lives, and those posed by nuclear power generation or waste transportation or disposal are very low. Michael J.W. Hines of Harvard [14] is quoted as saying “Some people are scared of nuclear power, the resulting nuclear waste, and the possibility of both meltdowns and terrorist attacks on a plant. These concerns are legitimate but less terrifying and less likely than inevitable environmental pollution and health problems from fossil fuels.

Meltdowns are far less likely due to reforms after the Three Mile Island incident—a partial meltdown in 1979. When properly managed, nuclear waste can be contained and stored safely for millennia. Some countries, such as France, have already made nuclear power the cornerstone of their electricity production.

There is, and always has been, a potential for terrorist attacks against the nuclear industry. While hefty reactor shielding mitigates the danger of an attack, a breach could release deadly levels of radioactivity to plant employees and those nearby. But the problem is the existence of terrorism, not of nuclear power. Equal or greater dangers are posed by attacks on large dams, poisoning open-air watersheds or attacking our society’s vulnerable dependence on computer, electricity, and phone networks. To be free from terrorism, we would have to sacrifice modernity itself.

If anything, building a waste containment facility deep in Yucca Mountain would remove tons of nuclear waste from several temporary surface storage facilities around the country. These facilities are an easier target than the small amounts of waste hidden on trains or trucks crossing

to Nevada. Also, the radioactivity of nuclear waste is so reduced before transport that radiation released from the much-feared truck or rail accident would not endanger anyone who simply walked away from the accident.” [14]

The national Parent Teachers Association has passed a resolution expressing its views about nuclear waste transportation and Yucca Mountain. An excerpt follows which is representative of many public groups in the United States. [15] “Government estimates are that more than 123 million people live near the potential highway routes, and 106 million live in counties along potential rail routes. Up to 77,000 tons of nuclear waste will go to the site. Of particular concern to National PTA is the health and safety of children who live in these communities. Unanswered questions include:

- How will the government ensure the safety of children living near those routes?
- What are the health risks to children who attend schools near the proposed routes, some of which could have several shipments passing through daily?
- What plans does the government have to ensure the personnel in schools, and response teams in those areas near shipping routes, have evacuation plans?
- Would there be federal funding to train educators and school administrators to prepare for a response to a high-level radioactive nuclear waste accident emergency?
- When routes are selected, will the number of nearby schools factor into the decision?

National PTA recommended that a federally initiated public awareness campaign to inform communities about transportation routes and safety plans be fully developed and activated before Congress approves the project.” [15]

The source of the fear of things nuclear is aptly stated in a Nuclear Energy Agency (NEA) document. “...radioactive waste has given rise to more public concern than most other types of toxic waste that also require adequate management and disposal policies. The public does not necessarily share the high level of confidence of the scientific and technical community in the long-term safety of nuclear waste management. The inevitable uncertainties that arise in dealing with projections over thousands of years lead to reservations about committing to a course of action whose consequences cannot be fully assessed.” [16]

Yucca Mountain has been a whipping boy for Nevada politicians for over a decade. It is a discredit to our political system that such an impasse has continued for so many years. The blame lies in many circles, but our Congress is certainly at the top of the list for the way it foisted the project on the state. But, Nevada has had an opportunity to work with the rest of the country to help solve this important environmental problem, but has chosen to wage a campaign to discredit the project and even impugn the motives and ethics of well intentioned individuals associated with the program. [17]

CONCLUSIONS

Proceeding responsibly with the Yucca Mountain Project is necessary because the nuclear waste is piling up at nuclear power plants and DOE facilities, and a permanent solution to its safe management is paramount. No matter how many in the country deplore anything nuclear, the waste from existing facilities will not just disappear, and it will not remain safe where it is for

decades to come. Like all our other environmental problems this one needs to be dealt with in a rational manner. [18]

Delays are costing the public billions of dollars. A policy question for our elected officials is whether doing nothing and/or continuing to let the project languish for years to come is a better alternative than taking decisive action to either facilitate its success or terminate it to stop the bleeding.

Last year a U.S. Federal court ruled that EPA had not followed the recommendation of the National Academy of Science with regard to the 10,000 year period of regulatory compliance. This turns out to be another delay, and possibly a death knell for the Yucca Mountain Project. Designing a facility for 10,000 years and predicting its performance is questionable in itself, let alone some very much longer period when radioactive materials may enter the accessible environment. What are three possible solutions to this dilemma?

- Congress passes legislation to confirm the legitimacy of the 10,000 year period, and mandates the repository stay open for an extended period of time, say 200 years, before a decision to close or retrieve the waste is made; or
- Congress changes the Yucca Mountain project to a long term storage program and funds research and development of advanced technologies for the destruction and/or reuse of long lived radioisotopes; or
- The Administration terminates the program, re-evaluates alternatives for the final disposition of high level nuclear waste, including the implications for leaving it at power plants indefinitely, and recommends a new course of action to Congress.

The scientific evidence and opinion of scientists and policy makers has not changed since the 1950's with regard to the choice of deep retrievable geologic disposal as the best long term waste management option. None of the other options, including doing nothing and leaving the waste where it is, would be superior to it when public and worker safety, security, environmental impact, cost and availability of technology are the yard sticks. If research and development of transmutation partitioning technologies results in commercially available technologies, they could be implemented at Yucca Mountain or any other geologic repository.

The time has come for definitive action by the Congress to facilitate completion of the Project. Congress needs to find a way to reach an accommodation with the state of Nevada and end the years of impasse. A similar situation from our past is Congressional legislation that authorized the North Slope Oil Pipeline as the final and only means of bridging the irresolvable gap between adversaries and the needs of the public as a whole.

A more comprehensive and aggressive government funded public awareness campaign should be initiated to inform the public and elected officials across the nation concerning the transportation and management of nuclear waste.

Lastly, policy makers need to revisit the management structure and funding mechanisms of the Yucca Mountain Project to assure it succeeds as a large industrial project. [19]

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